Project design document form
(Version 12.0)

BASIC INFORMATION	
Title of the project activity	Brazil NovaGerar Landfill Gas to Energy Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	11
Completion date of the PDD	11/11/2021
Project participants	• Haztec Tecnologia e Planejamento Ambiental S.A. (Brazil) • Allcot AG (Switzerland)
Host Party	Brazil
Applied methodologies and standardized baselines	ACM0001: Flaring or use of landfill gas, version 19.0;
Sectoral scopes	Sectoral Scope: 1 -Energy industries (renewable – / non-renewable sources) Sectoral Scope: 13 (waste handling and disposal)
Estimated amount of annual average GHG emission reductions	599,273

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The project activity involves investments in a gas collection system, leachate drainage system, and a future modular power generation plant at two of NovaGerar landfill sites. LFG gas is being captured and flared at the Marambaia dump site, and at the Adrianópolis sanitary landfill. The Marambaia dump site opened in 1986 and closed in February 2003 with around 700,000 tons of waste disposed at the site. The landfill called Nova Iguaçu (former name of "Andrianópolis") started operation in February 2003 and is currently disposing about 4,000 tons of municipal solid waste per day. The Adrianópolis and Marambaia sites are adjacent to each other located close to a densely populated section of the municipality of Nova Iguaçu, Rio de Janeiro, with around 800,000 inhabitants. The project consists of two phases:

1. Collection and flaring of LFG, reducing uncontrolled release of methane
2. Generation of electricity from LFG, reducing CO2 emissions associated to the use of grid electricity.

The project is entering in its third crediting period. Due to the age of the waste, the project activity will not continue extracting LFG from the Marambaia site since the landfill gas has practically been depleted. Therefore, the project for the third crediting period will focus on the gas extraction at the Adrianópolis Landfill site by installing power generation in 2019. The LFG extracted that will not be used to generate electricity will be flared (open system). The scenario existing prior the start of the project activity is the same as the baseline scenario (i.e., atmospheric release of the LFG).The operation of the Adrianópolis Landfill has been divided into 4 cells for waste disposal, named Sub-Aterro 1, Sub-Aterro 2, Sub-Aterro 3, and Sub-Aterro 4 (see figure below). At the end of 2008, the waste disposal was carried in only 2 cells (Sub-Aterro 1 and Sub-Aterro 3) although the gas extraction system was operating only in the Sub-Aterro 1. In November of 2008, the waste disposal has initiated in the Sub-Aterro 4 and the gas extraction system has extended to the Sub-Aterro 3.

Fig 1 – Disposal sites at Adrianópolis LF

The final installed capacity is expected to reach until 27.64 MW upon project completion. However, the installed capacity may vary depending on the availability of the generator equipment in the market at the time of actual implementation of the second phase.

For this crediting period, estimates of GHG emission reductions are:

- Annual average GHG emission reduction: 599,273 tCO_2e

- Total estimated GHG emission reductions: 4,194,914 tCO_2e

Social and environmental benefits:
The project will improve local health and the environment. Contaminated leachate and surface run-off from existing dumpsites are affecting ground and surface water quality. The uncontrolled release of landfill gas (LFG) is similarly impacting the environment and leading to risks of explosions in uncontrolled open dumpsites. With the operation of the NovaGerar Landfills (NGLF), environmental health risks and the potential for explosions are greatly reduced. The project will also have a limited, but positive impact on local employment through the recruitment of staff for day-to-day operation of the landfill facilities.

The project is helping the Host Country fulfill its goal of promoting sustainable development. Specifically, the project:

- Increases employment opportunities in the area where the project is located;
- Uses clean and efficient technologies;
- Acts as a clean technology demonstration project;
- Optimizes the use of natural resources, avoids uncontrolled waste management.

A.2. Location of project activity

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Host Party:
- Brazil

Region/State/Province:
- Rio de Janeiro

City/Town/Community:
- Nova Iguaçu

Physical/Geographical location:
- The landfill is located at approximately 10 Kilometers from the center of Nova Iguaçu city, province of Rio de Janeiro, Brazil. Precipitation in the area is over 1,000 mm per year and annual average temperature is around 23°C. The site, which is located at coordinates Latitude 22.666667; Longitude: 43.466667, is shown on figure below.

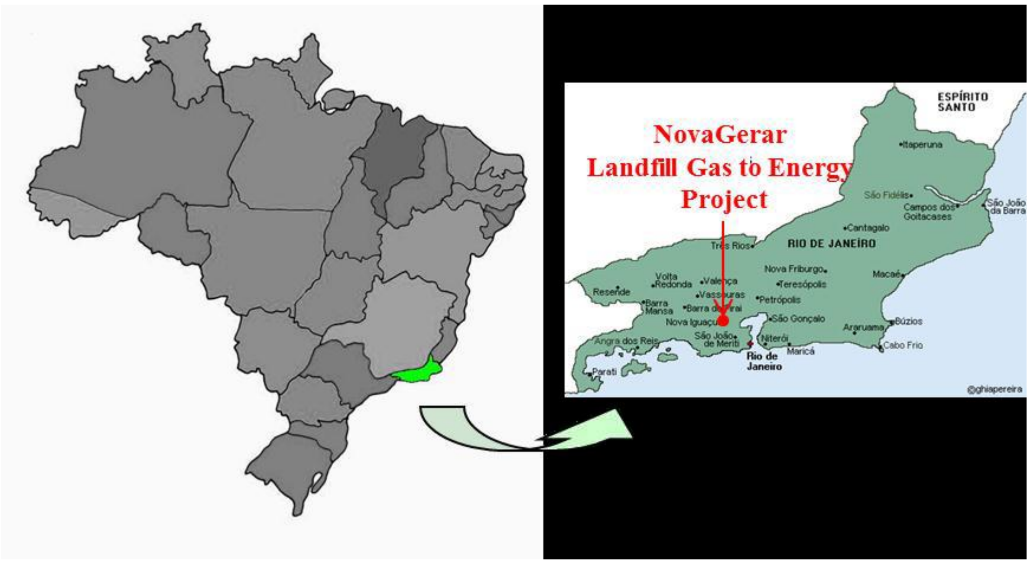

Figure 1 - Location of the NovaGerar landfill gas to energy project

A.3. Technologies/measures

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The project consists of a LFG collecting system, LFG pre-treatment system, open flaring system, electricity generation system and grid connection system. First, the landfill gas is collected, and then through a network composed of transportation pipes, the landfill gas reaches the pre-treatment system, in which the moisture is removed. The open flare has been used since the start of the operations (period required to test the volume and quality of the gas prior to energy generation) and it will be used when the volume of gas exceeds the capacity of the power generation system or when the power generation system is down (e.g., maintenance, breakdown).

The implementation and operation of the project activity consists in:

Landfill gas collection system:
State-of-the-art gas collection technology includes the items listed below. The transmission line of Adrianópolis from the gas extraction wells to the power generation / flare complex is shown on Figure 2.

- Vertical wells used to extract gas and leachate;
- Horizontal wells used to extract gas;
- Optimal well spacing for maximum gas collection whilst minimizing costs;
- Wellheads designed for gas measurements;
- Blowers;
- Condensate extraction and storage systems designed at strategic low points throughout the gas system; and
- Pipeline collection system to connect the LFG collected with the electricity generation and flaring systems.

Figure 2. Example of transmission pipeline in the project activity

The landfill has been covered by clay to prevent the biogas to come out through the landfill surface. The LFG collection efficiency (95%[1]) has been considered in the calculations of the emission reductions ex-ante.

[1]Source: According to project's LFG network collection technical specification

Landfill gas pre-treatment system:
Once the landfill gas is collected and transported through pipes, the landfill gas reaches the pre-treatment system (demister), in which the moisture of landfill gas is removed.

Open flaring system:
The open flare selected is designed to operate continuously and safely destroy the biogas generated by solid waste.

The flaring system ensures the combustion of LFG (e.g., maintenance, breakdown or when the volume of gas exceeds the capacity of the power generation system). The flare system includes the items listed below.

- Open flare with controlled combustion system;
- Blower system used to direct gas for flaring;
- Equipment to ensure continuous monitoring of, flow and burn detection; and
- Security restarts system, in cases the system shuts down.

The flare system, with a capacity to process 7,500 Nm^3/h of LFG and will achieve destruction efficiency of 50%[2]. For the ex-ante estimates of the emission reductions, and for conservative reasons, 50% flare efficiency has been considered. The average lifetime of the equipment of the system is between 15 to 20 years[3].

The landfill gas flaring system is maintained in accordance with manufacturer's recommended specifications on schedule and procedures in order to ensure the safety and environmental soundness of the operations. The project personnel involved in the operations and monitoring receives a comprehensive training on equipment, maintenance and monitoring from the equipment supplier.

Figure 3. Example of flare system – Adrianópolis Landfill/Brazil

[2] Open flare manufacturer technical data

[3] Ibid

Electricity generation system and grid connection system

The power generation system will be comprised of around 27.64 MW. The electricity generated by the Project will be exported to the interconnect national electricity grid. The configuration of the equipment will be chosen in accordance with the availability of the generation equipment on the market at the time of actual implementation of the second phase.

This kind of technology is still not widely applied in Brazil. Very few landfills have already installed equipment for the collection and generation electricity through LFG.

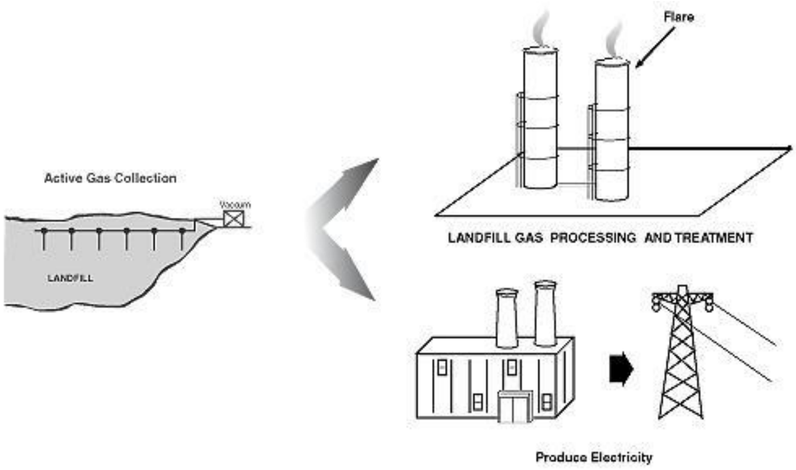

Figure 4 – Power generation diagram

The forecast installed capacity and electricity generated by the project activity are present below:

Real Implemented due to PRC				PDD registered before PRC	PDD registered before PRC with increased capacity by 20 per cent
Year*	**Net capacity (MWe)[1]**	**Number of group generators**	**Net electricity generated in the plant (MWh)[4]**	**Net electricity generated in the plant (MWh)**	**Net electricity generated in the plant (MWh)[5]**
2018	0.00	0	0	16,980	0
2019**	16.93	12	102,811	33,960	40,752
2020	21.93	16	176,754	33,960	40,752
2021	24.78	18	199,739	33,960	40,752
2022	27.64	20	222,724	33,960	40,752
2023	27.64	20	222,724	33,960	40,752
2024	27.64	20	222,724	33,960	40,752
2025***	27.64	20	111,362	16,980	20,376

[1] Definition of Net capacity: is the maximum capacity at the plant minus the amount of electricity that is consumed by the plant;

[4] Real implemented but not used in CERs calculation, due to paragraph 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the capacity specified in the originally registered PDD (before PRC)

[5] Values from PDD registered before PRC with increased capacity by 20 per cent, due to paragraph 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the capacity specified in the originally registered PDD (before PRC)

Note: As highlighted in Section A.2, the final equipment that will be chosen (as well as the final installed capacity) may vary depending on the availability of the generation equipment on the market at the time of actual implementation of the second phase.
* From 01/07/2018 to 30/06/2025
**In 2019, the electricity generation will be from April to December (275 days)
***In 2025, the electricity generation will be from January to December (6 months)

The lifetime of the equipment is 20 years and it was based on market standard specifications[6].

Monitoring system:
The process will be controlled by an electrical control system equipped with a Programmable Logical Controller (PLC). All details related to monitoring of CDM project are provided in section B.7. of this PDD.

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 (host)	Haztec Tecnologia e Planejamento Ambiental S.A.	No
Switzerland	Allcot AG	Yes

A.5. Public funding of project activity

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There is no Annex I public funding involved in the Project Activity

A.6. History of project activity

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The proposed CDM project activity is not a project activity that has been deregistered, nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA);

A.7. Debundling

>>
Not applicable.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

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- Large-scale Consolidated Methodology ACM0001: “Flaring or use of landfill gas” (Version 19.0)[7];

[6] The document was made available to DOE in validation visit.

[7] https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M

- TOOL02 Methodological tool: “Combined tool to identify the baseline scenario and demonstrate additionality” (Version 07.0)[8];
- TOOL03 Methodological tool: “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (Version 03.0)[9].
- TOOL04 Methodological tool: “Emissions from solid waste disposal sites” (Version 08.0)[10];
- TOOL05 Methodological tool: “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (Version 03.0)[11];
- TOOL06 Methodological tool: “Project emissions from flaring” (Version 03.0)[12];
- TOOL08 Methodological tool: “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 03.0)[13];
- TOOL09 Methodological tool: “Determining the baseline efficiency of thermal or electric energy generation systems” (Version 02.0)[14];
- TOOL10 Methodological Tool: “Tool to determine the remaining lifetime of equipment” (Version 01)[15];
- TOOL12 Methodological tool: “Project and leakage emissions from transportation of freight” (Version 01.1.0)[16];
- TOOL07 Methodological tool: “Tool to calculate the emission factor for an electricity system” (Version 07.0)[17];
- TOOL11 Methodological Tool: “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 03.0.1)[18];
- TOOL32 Methodological tool: “Positive lists of technologies” (Version 01.0)[19]

B.2. Applicability of methodologies and standardized baselines

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The methodology ACM0001 is applicable for project activities that comprise one of the following scenarios:

- The captured gas is flared; and/or
- The captured gas is used to produce energy (e.g. electricity/thermal energy);

<u>The methodology ACM0001: “Flaring or use of landfill gas” is applicable to project activities which:</u>

“...

a) *Install a new LFG capture system in a new or existing SWDS where no LFG capture system was installed prior to the implementation of the project activity; or*
b) *Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:*
    i) *The captured LFG was vented or flared and not used prior to the implementation of the project activity; and*

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8 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

9 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

10 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.0.pdf

11 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

12 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v3.0.pdf

13 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf

14 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v2.0.pdf

15 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

16 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf

17 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

18 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

19 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-32-v1.pdf

- *ii) In the case of an existing active LFG capture system for which the amount of LFG can not 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;*
- *iv) Supplying compressed/liquefied LFG to consumers using trucks;*
- *v) Supplying the LFG to consumers through a dedicated pipeline;*

d) *Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.*

Justification: - Part 1
The methodology **is applicable** because it has been made an investment into an existing LFG capture system to increase the recovery rate (collection efficiency) and change the use of the captured LFG (also electricity generation). The captured LFG was only vented and not used prior to the implementation of the project activity.

In the project activity, the LFG is flared and will generate electricity.

Moreover, the amount of organic waste will be the same in the project activity as well as in the absence of the project activity.

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

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

b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln;
- *i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or*
- *ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary.*

This methodology is not applicable:

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 melting furnace;

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

..."

Justification: - Part 2
According to Section B.4 and B.5, the methodology is applicable because:
- The most plausible baseline scenario is release the LFG to atmosphere from the SWDS, and;
- The electricity would be generated in the grid.

Moreover, there is neither a combination with other approved methodologies nor change in management of the landfill due to the project activity (e.g. addition of liquids, pre-treating waste or changing the shape of the landfill to increase the Methane Correction Factor).

Justification: - Part 3
The methodology is applicable since the most recent Urban Solid Waste Diagnosis from Institute for Applied Economic Research (IPEA) has been published in 2012. According to Table 18, 100% of the Nova Iguaçu area municipal solid waste is disposed in landfills/open dumps and 0% is managed by other methods. Thus, it is possible to state that recycling percentage in the project activity area is negligible.

<u>The "Combined tool to identify the baseline scenario and demonstrate additionality" is applicable to project activities where:</u>

"…
All potential alternatives 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:

- *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.*

…"

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.

Justification:
The tool is **applicable** because the Step 1 of the "Combined tool to identify the baseline scenario and demonstrate additionality" presented in section B.4, demonstrates that all alternative scenarios identified are realistic and credible to the project activity.

<u>The "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" </u>is **applicable** due to the consideration of an "Alternative approach for project and/or leakage emissions", using Option B3 from tool to calculate "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (TOOL05). In the particular case of the project activity, project emissions from consumption of electricity will be determined by calculating the CO2 emissions from diesel fuel combustion in the captive power plant. As stated in TOOL05, these emissions should be calculated using the latest approved version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". This option provides an accurate estimate since all the power generated by the captive power plant is consumed by the proposed CDM project activity. Diesel will be used in backup diesel group generators in absence of electricity from the grid. The applicability condition of the methodological tool is thus met.

<u>The tool "Emissions from solid waste disposal sites" </u>is **applicable** to the project activity because the CDM project activity mitigates methane emissions from a specific existing SWDS (Application A).

<u>The tool to calculate "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" </u>is **applicable** to the project activity following one out of the three scenarios below applied to the sources of electricity consumption:

- Scenario A: 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;

- Scenario B: 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;
- Scenario C: 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.

As for the monitoring of the amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated:

a) Scenario I: Electricity is supplied to the grid;
b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or
c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.

Justification:
The tool is applicable according to Scenario A and Scenario B stated above since the project activity includes electricity consumption from the grid when electricity generated by the LFG power plant is not operational and electricity consumption from the diesel generators when electricity from the grid is not available.

Also, Scenario I is applicable since the project activity includes electricity generation to the grid.

The tool "Project emissions from flaring" is **applicable** to the project activity since the project activity uses open and/or enclosed flares and project participant documents the same in the PDD including the type of flare used in the project activity. Tool is applicable to the flaring of flammable greenhouse gases where:

- Methane is the component with the highest concentration in the flammable residual gas; and
- 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 flares used in the project site operate according to the specifications provided by the manufacturer.

Justification:
Since methane is the component with the highest concentration in the flammable residual gas from waste anaerobic degradation generating LFG and flares used in the project site operate according to the specifications provided by the manufacturer, the tool is available.

The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is **applicable** to the project activity because the applicable methodology (ACM0001) demands measuring flow and composition of residual and exhaust gases for the determination of baseline and project emissions.

The "Tool to determine the baseline efficiency of thermal or electric energy generation systems" is **not applicable** to the project activity since there is no thermal or electric energy generation in the baseline scenario. Also, the project activity does not involve the improvement of the energy efficiency through retrofits or replacement of the existing system by a new system.

The "Tool to determine the remaining lifetime of equipment" is **not applicable** since the project activity do not involve the replacement of existing equipment with new equipment or retrofit of existing equipment as part of energy efficiency improvement activities.

The "Project and leakage emissions from transportation of freight" is **not applicable** since the project activity do not involve the transportation of freight.

The "Tool to calculate the emission factor for an electricity system" is **applicable** since the project activity demands electricity that is provided by the grid. This tool is also referred to in the "Tool to calculate project and/or leakage emissions from electricity consumption and monitoring of electricity generation" 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.

The "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" is **applicable** to the project activity since it is required to assess the continued validity of the baseline at the renewal of a crediting period.

The "Positive lists of technologies" is **not applicable** to the project activity since the LFG is used to generate electricity in one or several power plants with a total nameplate capacity that is higher than 10 MW.

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 landfill site.	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative
		CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity
	Emissions from electricity generation	CO_2	Yes	Major emission source if power generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from heat generation	CO2	No	No heat generation in the project activity
		CH4	No	Excluded for simplification. This is conservative
		N2O	No	Excluded for simplification. This is conservative
	Emissions from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	No use of natural gas in the project activity
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	No	May be a minor emission source. Only for diesel that will be used in backup diesel group generators in absence of electricity from the grid.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from electricity consumption due to the project activity	CO_2	Yes	May be an important emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from flaring	CO_2	No	Emissions are considered negligible
		CH_4	Yes	May be an important emission source
		N_2O	No	Emissions are considered negligible
	Emissions from distribution of LFG using trucks and dedicated pipelines	CO_2	No	No existence of distribution of LFG using trucks and dedicated pipelines
		CH_4	No	No existence of distribution of LFG using trucks and dedicated pipelines
		N_2O	No	Emissions are considered negligible

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

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

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

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

(d) Heat generation equipment or sources which are supplying heat in the baseline that is displaced by heat generated by captured LFG in the project activity; and (not applicable)

(e) The transportation of the compressed/liquefied LFG from the biogas processing facility to consumers. (not applicable)

The flow diagram is presented below:

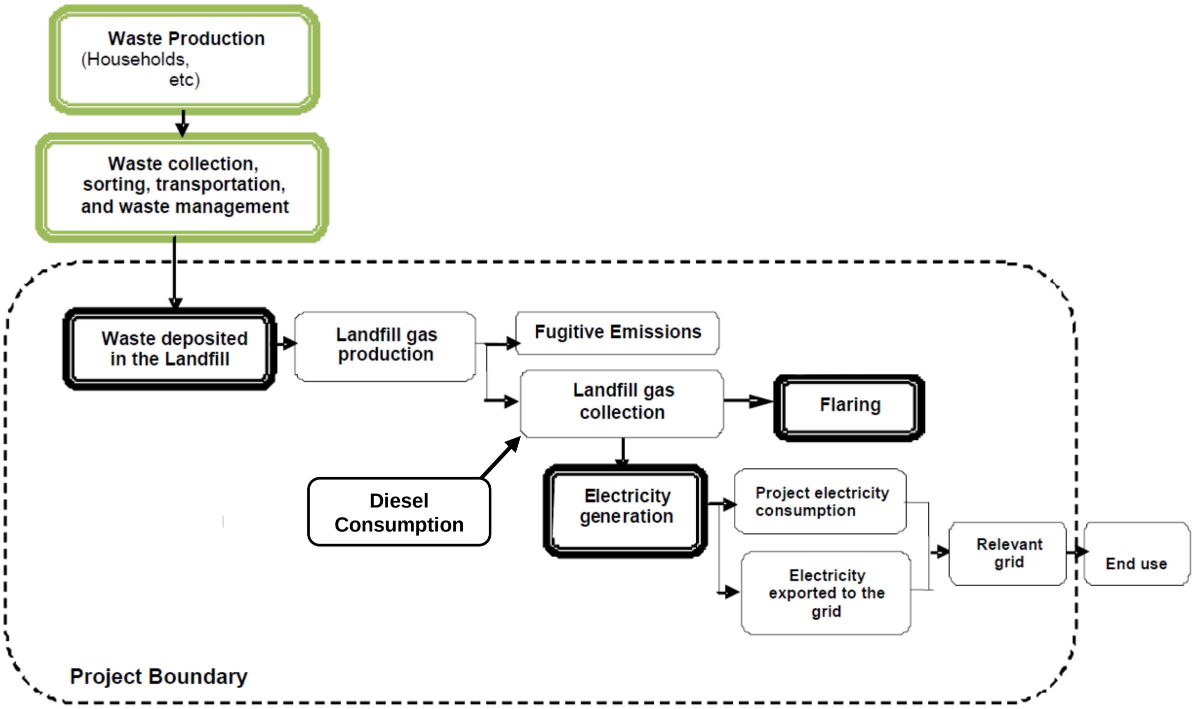

Figure 5 – Flow diagram project boundary

B.4. Establishment and description of baseline scenario

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The methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" has been used to assess the continued validity of the baseline considering the renewal of the crediting period.

The stepwise procedure of the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period are as follows:

Step 1: Assess the validity of the current baseline for the next crediting period

In order to assess the continued validity of the baseline, changes in the relevant national and/or sectorial regulations between the crediting periods have to be examined at the renewal of the crediting period. If at the start of the project activity, the project activity was not mandated by regulations, but at the time of renewal of the crediting period regulations are in place that enforce the practice or norms or technologies that are used by the project activity, the new regulation (formulated after the registration of the project activity) has to be examined to determine if it applies to existing project or not.

The baseline scenario does not have to be updated for the third crediting period as no new regulations requiring capture and combustion or use of LFG are in place.

The “Procedures for the renewal of the crediting period of a registered CDM project activity” approved by the CDM Executive Board require assessing the impact of new relevant national and/or sectorial policies and circumstances on the baseline.

Prior to the implementation of the project activity the landfill gas is being released to atmosphere and electricity is being generated in existing and/or new grid-connected power plants, other than the project activity power plant.

Thus, the baseline remains the same as defined in the 1st crediting period and required regulations.

The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectorial policies

At the start of the project activity in 2004, the Brazilian legislation did not require landfills to capture and/or flare and/or use the LFG. After the registration of the project activity in 18/11/2004, the project participant, in order to assess if the current baseline complies with all relevant mandatory national and/or sectorial policies which have come into effect after the submission of the project activity for validation, has verified that the current baseline complies with all applicable laws and regulations.

The baseline scenario for the project activity is identified using step 1 of the ‘Combined tool to identify the baseline scenario and demonstrate additionality”, as agreed in ACM0001 “Flaring or use of landfill gas”.

Step 1.2: Assess the impact of circumstances

There is no impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

This sub-step is not applicable since the baseline scenario of the project activity is the business as usual (BAU) scenario (passive venting system).
Also, in the baseline scenario, electricity is being generated in existing and/or new grid-connected power plants, other than the project activity power plant.

Step 1.4: Assessment of the validity of the data and parameters

Considering the applied methodology at the project activity registration “AM0003 - Simplified financial analysis for landfill gas capture projects” has changed to consolidated methodology ACM0001 and all related applicable tools some ex-ante parameters published by IPCC have been updated accordingly.

According to the “Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period”, where any data and parameter used and not monitored during the crediting period are not valid anymore they should be updated following the Step 2 as follows:

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The baseline emissions for the third crediting period have been updated, without reassessing the baseline scenario, based on the latest approved version of the methodology ACM0001. This update was applied in the context of the sectorial policies and circumstances that are applicable at the time of requesting for renewal of the crediting period, which has not changed as to affect the project.

Step 2.2: Update the data and parameters

All parameters regarding the grid emission factor calculation have been updated for the 3rd crediting period ($EF_{grid,OM,y}$ is ex-post monitored and $EF_{grid,BM,y}$ is ex-ante monitored[20], thus $EF_{grid,CM,y}$ is ex post monitored).

The baseline scenario for the project activity is identified using step 1 of the 'Combined tool to identify the baseline scenario and demonstrate additionality", as agreed in ACM0001 "Flaring or use of landfill gas".

Other parameters have been updated for the 3rd crediting period, according to the list below:

- LFG collection efficiency (95%);
- GWP_{CH4} (From 20 t CO_2e/t CH_4 to 25 t CO_2e/t CH_4);
- Electricity plant installed capacity (27.64 MW)[21];
- TDL_y - Average technical transmission and distribution losses for the electricity (16%).

Realistic and credible alternatives to the project activity that can be part of the baseline scenario are defined through the following sub-steps:

STEP 0: Demonstration that a proposed project activity is the First-of-its-kind.

This step is not applied because the proposed project activity is not the First-of-its-kind.
Even with the Post-Registration Changes related to the increment of electricity generation plant installed capacity (From 4.245 MW to 27.636 MW), the baseline remains the same as from the 2nd crediting period and not being defined as a new baseline for the 3rd crediting period.

Outcome of Step 0: The proposed project activity is not the First-of-its-kind.

Step 1: Identification of alternative scenarios

This Step serves to identify all alternative scenarios to the proposed CDM project activity(s) which can be the baseline scenario.

The project participants will monitor all relevant policies and circumstances at the beginning of each crediting period and adjust the baseline accordingly.

Step 1a: Define alternative scenarios to the proposed CDM project activity

The identified alternatives for the destruction of LFG in the absence of the project activity are:

LFG1	The project activity implemented without being registered as a CDM project activity (i.e. capture, and flaring andor use of LFG);
LFG2	Release of the LFG to atmosphere Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons

Thus, the remaining real alternatives for the destruction of LFG are LFG1, LFG2.

[20] According to STEP 5, option 1 of Tool to calculate the emission factor for an electricity system.

[21] According to para 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the capacity specified in the originally registered PDD (before PRC)

The EIA (Environmental Impact Assessment) does not cover recycling, treatment or incineration of organic waste, alternatives LFG3, LFG4 and LFG5 should not be considered.

For electricity generation, the realistic and credible alternatives are:

E1	Electricity generation from LFG, undertaken without being registered as CDM project activity;
E3	Electricity generation in existing and/or new grid-connected power plants.;

In the absence of project activity, no captive electricity consumption would be necessary. Thus, the alternative scenario E2 should not be considered.

According to the project activity configuration, there will be no heat generation. Therefore, all alternative scenarios addressing these possibilities should not be considered.

Thus, the remaining real alternatives to the project activity are E1 and E3.

The combinations of the project activity compose the following scenarios:

Scenarios		Comments
1	LFG1 + E1	Possible
2	LFG1 + E3	Possible
3	LFG2 + E1	This alternative is not plausible because to generate electricity in the project activity, it is necessary to implement the capture, flaring and use of LFG.
4	LFG2 + E3	Possible

Outcome of Step 1a: Three realistic and credible alternative scenarios to the project activity were identified:

- Scenario 1 (LFG1 + E1);
- Scenario 2 (LFG1 + E3);
- Scenario 4 (LFG2 + E3);

Step 1b: Consistency with mandatory applicable laws and regulations

All alternative scenarios identified in Step *1a* comply with all applicable laws and regulations. Brazil's New National Solid Waste Policy (NSWP),[22] ratified by the President on 02/08/2010 after 19 years under discussion. The NSWP does not request the LFG capture and/or flare and there is not forecast to approve any regulation or policy in the next years with this requirement. The laws and regulations applicable for the electricity generation component are law 8987/95 and law 9074/95[23].

The scenario 4 which is, a continuation of the current situation of the landfill (baseline scenario) represents the business as usual practice for the project site as well as for most of the landfills in Brazil.

The project participant will monitor all relevant policies and circumstances at the beginning of each crediting period and adjust the baseline accordingly.

Outcome of Step 1b: Three realistic and credible alternative scenarios to the project activity are in compliance with mandatory legislation and regulations. The alternatives scenarios remain the same:

- Scenario 1 (LFG1 + E1);
- Scenario 2 (LFG1 + E3);
- Scenario 4 (LFG2 + E3);

[22] http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm

[23] http://www.aneel.gov.br/area.cfm?idArea=43

B.5. Demonstration of additionality

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The additionality of the project activity will be demonstrated and assessed using the "Combined tool to identify the baseline scenario and demonstrate additionality".

The Step *0*, *1a* and *1b* are described above in section B.4.

Step 2: Barrier analysis

This step serves to identify barriers and to assess which alternative scenarios are prevented by these barriers as per the latest approved version of the "Guidelines for objective demonstration and assessment of barriers". The following Sub-steps are applied:

Sub-step 2a: Identify barriers that would prevent the implementation of alternative scenarios

- **Investment barrier:** The implementation of the Scenario 2 (collection and destruction of LFG in open flares + electricity generation in existing and/or new grid-connected power plants) requires a very high amount of investment from such project components:
  - Collection system;
  - Biogas transport pipe system;
  - Blower System;
  - Flare System;
  - LFG Station (edifications).

In Brazil, flaring LFG in open flares does not generate any revenues and has only expenditures. Therefore, the high investment regarding project components described above is not feasible in the economical point of view.

Outcome of Step 2a: the identified barrier (investment barrier) as described above prevents the scenario 2. However, the identified barrier does not prevent the occurrence of the other scenarios (scenarios 1 and 4).

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

As the investment in Scenario 2 does not generate any revenues and has only expenditures for the PP, this scenario is not economical/financial attractive.

Outcome of Step 2b: The two realistic and credible alternative scenarios to the project activity are:

- Scenario 1 (LFG1 + E1);
- Scenario 4 (LFG2 + E3);

Step3. Investment analysis

Sub-step3a. Determine appropriate analysis method

As the proposed project activity will generate financial benefits other than CDM related income, the Option III is chosen. This option is appropriated because the baseline does not require investment, as per "Guidelines on the assessment of investment analysis", paragraph 19.

Sub-step3b. – Option III. Apply benchmark analysis

The alternative LFG 1 (equivalent to P1) (proposed project without CDM revenues) is evaluated by applying a benchmark analysis. The likelihood that this project would be developed without CDM revenues, as opposed to the continuation of business as usual activity (LFG2 in combination with P6), is evaluated by comparing its project internal rate of return (IRR) with the benchmark rate of return available to investors in Brazil.

In order to conduct the benchmark analysis, an evaluation of the project's cash-flow and its internal rate of return (IRR) (without CDM financial incentives) is undertaken. The benchmark analysis is undertaken by using a discount rate of 15.0% according to registered PDD of 2004.

All values of financial parameters are reported below[24]:

- Investment analysis is conducted over a period of 21 years (until 2025) based on the expected lifetime of the project activity[25,26]
- Taxes on sales[27]. The taxes are IPI, ICMS, PIS and COFINS, respectively:
  - IPI (Tax on Manufactured Products): 5.00%
  - ICMS (The Tax on Circulation of Goods and Transportation and Communication Services): 12.00%
  - PIS (Profit Participation Contribution): 1.00%
  - COFINS (Social Security Financing Contribution): 0.65%
- Discount rate: 15.0% (original cash flow).
- Exchange rate used for the investment analysis: 3.97 BRL/EUR[28].
- Generation capacity: maximum generation capacity is 16.93 MW. Units in service will be the following:
  - 2019: 12 units X 1.411 MW, total 16.93 MW
- Electricity price: 170.00 R$/MWh[29].
- Generation of electricity in 2019 will be 111,751 MWh
- Generation of electricity in 2020-2024 will be 148,324 MWh
- Generation of electricity in 2025 (1^{st} semester, up to 30/06/2025) will be 74,162 MWh
- Investment in group motor including engines, construction of the plant, connection, etc[30]:
  - Year 2019: R$ 29,219,200.00
- Operation and Maintenance[31]:
  - O&M electricity system: 25,000 R$/month (fixed) and 100 R$/MWh.
  - O&M LFG system costs: 0.0291 R$/$m^3_{LFG}$.

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[24] All data used in for the financial analysis are the latest available information when preparing the financial analysis.

[25] Project defined as biogas capture, generation of electricity and/or gas flaring.

[26] Lifetime of equipment, Source: spec ZTOF JZ.pdf

[27]Source: Brazilian Tax office (Ministerio da Fazenda)

[28] Source: Brazilian Central Bank.

[29] Based on commercial proposal.

[30] Source: Commercial quotations (detailed in the Financial analysis Excel spreadsheet).

[31] Source: Commercial quotations (detailed in the Financial analysis Excel spreadsheet).

Sub-step 3c. Calculation and comparison of financial indicators

<u>Alternative Scenario 1:</u> The scenario 1 is the project activity (capture and flare of LFG and power generation) undertaken without being registered as a CDM project activity.

		0	1	2	3	4	5	6	7	8	9	10	11
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Electricity Component													
Installed capacity		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Electricity production	24 hours 365 days	0	0	0	0	0	0	0	0	0	0	0	0
Tariff	$ 170,00 / MWh												
Gross Revenues		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Royalty Munic.	10%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Taxes	18,65%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Royalty owner Marambaia	(7,884 MWh) 10%	$0	$0	($98.129)	($98.129)	($98.129)	($98.129)	($98.129)	($98.129)	($98.129)	($98.129)	($98.129)	($98.129)
- Rent land Marambaia	$1.333 / month	$0	($16.000)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)
- NPL's Base Cost	$36,00 / MWh	$0	($16.000)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)
- % NPL	25%	$0	($16.000)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)
ERs Component													
O&M electricity costs		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M LFG costs		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Capex (12 engines)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Consolidation													
Taxable Income to NovaGerar		$0	($16.000)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)
Net Income (- Income tax)	34%	$0	($16.000)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)
Cashflow - Working Capita		$0	($16.000)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)	($114.129)
NPV Total	15%	($8.236.372)											

		12	13	14	15	16	17	18	19	20	21	22
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Electricity Component												
Installed capacity		0,00	0,00	0,00	0,00	16,93	16,93	16,93	16,93	16,93	16,93	16,93
Electricity production	24 hours 365 days	0	0	0	0	111.751	148.324	148.324	148.324	148.324	148.324	74.162
Tariff	$ 170,00 / MWh											
Gross Revenues		$0	$0	$0	$0	$18.997.704	$25.215.134	$25.215.134	$25.215.134	$25.215.134	$25.215.134	$12.607.567
- Royalty Munic.	10%	$0	$0	$0	$0	$17.097.934	$22.693.621	$22.693.621	$22.693.621	$22.693.621	$22.693.621	$11.346.810
- Taxes	18,65%	$0	$0	$0	$0	$13.909.169	$18.461.261	$18.461.261	$18.461.261	$18.461.261	$18.461.261	$9.230.630
- Royalty owner Marambaia	(7,884 MWh) 10%	($98.129)	($98.129)	($98.129)	($98.129)	$13.811.040	$18.363.132	$18.363.132	$18.363.132	$18.363.132	$18.363.132	$9.132.502
- Rent land Marambaia	$1.333 / month	($114.129)	($114.129)	($114.129)	($114.129)	$13.795.040	$18.347.132	$18.347.132	$18.347.132	$18.347.132	$18.347.132	$9.116.502
- NPL's Base Cost	$36,00 / MWh	($114.129)	($114.129)	($114.129)	($114.129)	$9.771.997	$13.007.457	$13.007.457	$13.007.457	$13.007.457	$13.007.457	$6.446.664
- % NPL	25%	($114.129)	($114.129)	($114.129)	($114.129)	$7.328.998	$9.755.592	$9.755.592	$9.755.592	$9.755.592	$9.755.592	$4.834.998
ERs Component												
O&M electricity costs		$0	$0	$0	$0	($10.507.138)	($13.945.837)	($13.945.837)	($13.945.837)	($13.945.837)	($13.945.837)	($6.972.919)
O&M LFG costs		$0	$0	$0	$0	($2.373.216)	($3.149.905)	($3.149.905)	($3.149.905)	($3.149.905)	($3.149.905)	($1.574.952)
Total O&M		$0	$0	$0	$0	($12.880.354)	($17.095.742)	($17.095.742)	($17.095.742)	($17.095.742)	($17.095.742)	($8.547.871)
- Capex (12 engines)		$0	$0	$0	$0	($29.219.200)	$0	$0	$0	$0	$0	$0
Consolidation												
Taxable Income to NovaGerar		($114.129)	($114.129)	($114.129)	($114.129)	($34.770.556)	($7.340.150)	($7.340.150)	($7.340.150)	($7.340.150)	($7.340.150)	($3.712.873)
Net Income (- Income tax)	34%	($114.129)	($114.129)	($114.129)	($114.129)	($34.770.556)	($7.340.150)	($7.340.150)	($7.340.150)	($7.340.150)	($7.340.150)	($3.712.873)
Cashflow - Working Capita		($114.129)	($114.129)	($114.129)	($114.129)	($35.425.105)	($7.554.366)	($7.340.150)	($7.340.150)	($6.905.767)	($7.340.150)	($3.712.873)

Alternative Scenario 4

The alternative scenario 4 (atmospheric release of the landfill gas) is the continuation of the current practice, which is in compliance with all applicable regulations and policies; and was deemed the most plausible alternative to the project activity. As explained above, the **alternative scenario 4** does not generate any revenues, but only expenditures.

Therefore, the NPV = 0.

Sub-step 3d. Sensitivity analysis

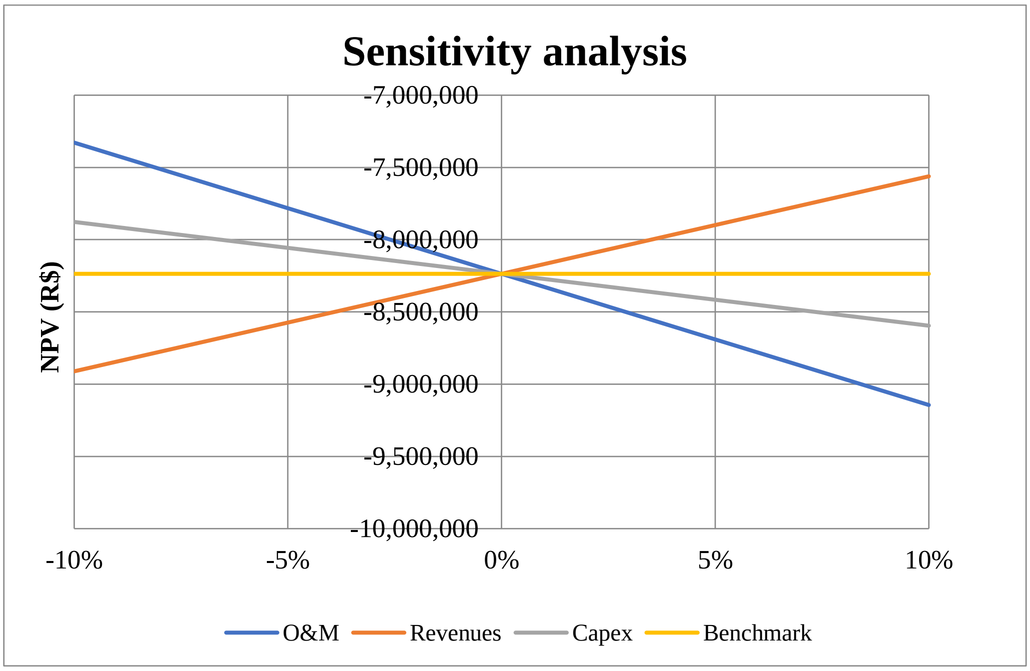
The sensitivity analysis was performed varying the electricity tariff (revenues), the capital expenses (CapEx) and operational and maintenance costs (O&M) for the alternative scenarios 1 and 4. All parameters ranging from -10% to +10%, as the result presented below:

Parameters	Variation	Sumary	
		10%	-10%
O&M		-9.144.359	-7.328.386
Revenues		-7.561.489	-8.911.255
Capex		-8.595.460	-7.877.284
Benchmark		-8.236.372	-8.236.372

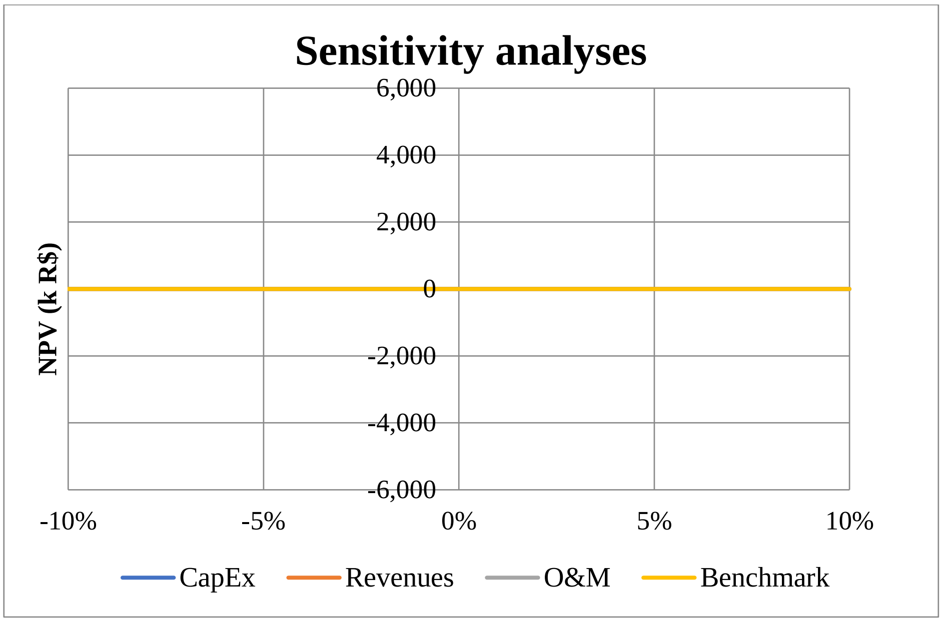
As presented above, the project Net Present Values are always less than or equal to zero in all sensitivity analyses.

The figures below show the sensitivity analysis for the three alternative scenarios (1 and 4).

Scenario 1 - Sensitivity analysis



Scenario 4 - Sensitivity analysis



Breakeven point

To ensure the additionality of this project activity, the project proponents varied the three identified parameters (CapEx, Revenues and O&M) until each of them reached the benchmark (i.e. NPV=0). The results are presented below for each alternative (alternative scenarios 1 and 4) and the spreadsheet was provided to the audit team:

Parameter	Breakeven point	
	Alternative Scenario 1	Alternative Scenario 4[32]
Capex variation until reach the benchmark (%)	-302.06%	0
Revenue until the benchmark (%)	174.0%	0
O&M variation until the benchmark (%)	-113.9%	0

Capital Expenditures (CapEx) – To reach the benchmark, the Capital Expenditures should be reduced in the **scenario alternative 1** in 302.06%. This result is unlikely. Consequently, this scenario is unrealistic.

Revenues – Theses values should be increased in the **scenario alternative 1** in 174.0%. This scenario is extremely unlikely to happen in the future based on the average electricity auction price results was 140.29 BRL/MWh (lower than 170 BRL/MWh of the electricity price of the project activity) according to historical auction data from Brazilian Electricity Regulatory Agency (ANEEL)[33]. Therefore, this scenario is unrealistic.

O&M – Also, to reach the benchmark, the O&M shall be reduced in the scenario alternative 1 in 113.9%. Thus, the PPs deemed this situation to be unlikely to happen in the future since the O&M always increase. Consequently, this scenario is unrealistic.

[32] As in this alternative there are no revenues or expenditures, the NPV is zero. Thus, it is not possible to carry out the breakeven point.

[33] https://www.aneel.gov.br/resultados-de-leiloes (*Regulated Contracting Market - ACR*)

Outcome of Step 3

A short list raking the alternative scenarios of the project activity is presented below according to the best NPV (financial indicator), taking into account the results of the sensitivity analyses.

Alternatives	Results
Scenario 4	Best scenario
Scenario 1	Worst scenario

As a result, the sensitivity analysis was conclusive, and the most financially attractive alternative is scenario 4.

Therefore, it seems reasonable to conclude that the alternative scenario 1 is unlikely to be the most financially attractive scenario.

Step 4. Common practice analysis

According to “Guidelines on common practice”, the common practice analysis establishes the following items below:

- **Applicable geographical area:** Brazil is the largest country in South America and the world's fifth largest country in the world. Therefore, the entire host country (Brazil) is considered suitable for this analysis;
- **Measure:** The project activity covers methane destruction;
- **Output:** the service delivers by the project is electricity in the grid (MWh);
- **Technology:** the technology used in the project is electricity generation through biogas combustion in group generators.

The common practice analysis consists of the following steps:

Step 1: *Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.*

The installed capacity of the project is 27.64 MW. Then, the output range of the project activity is from 13.82 to 41.45 MW.

Step 2: *In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities shall not be included in this step.*

The list with all plants is in Annex 3, item 4. The total of the plants is 65. Then, N_{all} = 65.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

The technology of the project activity is electricity generation through biogas. All projects in Brazil which generates electricity through biogas are registered CDM Projects and therefore, there is no project with the same technologies as the project activity.

Then, N_{diff} = 65 or $N_{all} = N_{diff}$.

Step 4: Calculate factor F=1-Ndiff/Nall representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

$$F = 1 - \left(\frac{N_{diff}}{N_{all}}\right)$$

$$F = 1 - \left(\frac{65}{65}\right)$$

Therefore, F = 0 and N_{all} - N_{diff} = 0.

According to Guidelines on common practice: "*the proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and Nall-Ndiff is greater than 3".*

Outcome of common practice analysis.

The project activity is not a common practice because the factor F = 0 and the N_{all} - N_{diff} = 0.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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Baseline emission calculation

The baseline emission was calculated according to the following formula:

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$$

Where:

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

As the project flares LFG and generate electricity, the $BE_{HG,y} = 0$ and $BE_{NG,y} = 0$.

Therefore, $BE_y = BE_{CH4,y} + BE_{EC,y}$

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

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

Where:

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

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

During the crediting period, the $\mathbf{F_{CH4,PJ,y}}$ will be determined as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y}$$

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year y (tCH_4/yr)
$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year y (t CH_4/yr)
$F_{CH4,EL,y}$	=	Amount of methane in the LFG which is used for electricity generation in year y (t CH_4/yr)
$F_{CH4,HG,y}$		Amount of methane in the LFG which is used for heat generation in year y (t CH_4/yr)
$F_{CH4,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network and/or dedicated pipeline and/or to the trucks in year y (t CH_4/yr)

As the project flares LFG, generate electricity, the $F_{CH4,HG,y} = 0$ and $F_{CH4,NG,y.} = 0$. Thus, the equation is:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y}$$

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

The following requirements apply:

(a) As per the gaseous stream tool, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detectors records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices. The destruction efficiency of the least efficient among the destruction devices shall be used as the destruction efficiency for all destruction devices monitored by this flow meter. If there are any periods for which one or more destruction devices are not operational, paragraph 5 (a) and (b) of the Appendix of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" tool shall be followed;

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

(c) The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations (3) or (17) in the tool);

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

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

The amount of methane destroyed by flaring ($F_{CH4,flared,y}$) will be determined as follows:

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

Where:

$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year y (t CH_4/yr)

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

$F_{CH4,sent\_flare,y}$ will be determined directly using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", applying the requirements described below. The tool shall be applied to the gaseous stream flowing in the LFG delivery pipeline to each flare.

According to "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" the following options will be considered for the present project activity:

- Option A (Volume flow in dry basis and volumetric fraction in dry basis) when the temperature of the gaseous stream is less than 60ºC (333.15 K) at the flow measurement point

  And

- Option B (Volume flow in wet basis and volumetric fraction in dry basis) when the temperature of the gaseous stream is higher than 60ºC (333.15 K) at the flow measurement point.

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. The demonstration will be made as following:

- Demonstrate that the temperature of the gaseous stream (T_t) is less than 60ºC (333.15 K) at the flow measurement point.

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

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t}$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t}$$

Where:

$F_{i,t}$	= Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$	= Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$v_{i,t,db}$	= Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m^3 gas *i*/m^3 dry gas)
$\rho_{i,t}$	= Density of greenhouse gas i in the gaseous stream in time interval *t* (kg gas *i*/m^3 gas *i*)
P_t	= Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i	= Molecular mass of greenhouse gas *i* (kg/kmol)
R_u	= Universal ideal gases constant (8,314 Pa.m^3/kmol.K)
T_t	= Temperature of the gaseous stream in time interval *t* (K)

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 option B should be applied instead.

Option B

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

$$V_{t,tb} = V_{t,wb}/(1 + v_{H2O,t,db})$$

Where:

$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$V_{t,wb}$ = Volumetric flow of the gaseous stream in time interval *t* on a wet basis (m^3 wet gas/h)
$v_{H2O,t,db}$ = Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m^3 H_2O/m^3 dry gas)

The volumetric fraction of H_2O in time interval *t* on a dry basis ($v_{H2O,t,db}$) is estimated according to following equation.

$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$

Where:

$v_{H2O,t,db}$ = Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m^3 H_2O/m^3 dry gas)
$m_{H2O,t,db}$ = Absolute humidity in the gaseous stream in time interval *t* on a dry basis (kg H_2O/kg dry gas)
$MM_{t,db}$ = Molecular mass of the gaseous stream in time interval *t* on a dry basis (kg dry gas/kmol dry gas)
MM_{H2O} = Molecular mass of H_2O (kg H_2O/kmol H_2O)

The absolute humidity of the gaseous stream (mH_2O,t,db) will be determined using Option 2 (simplified calculation without measurement of the moisture content):

*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[34].

Concerning the project activity, the conservative situation will be 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 the following equation.

$$m_{H2O,t,db,Sat} = \frac{p_{H2O,t,Sat} * MM_{H2O}}{(P_t - p_{H2O,t,Sat}) * MM_{t,db}}$$

Where:

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

[34] An assumption that the gaseous stream is saturated is conservative for the situation that the mass flow of greenhouse gas *i* is underestimated (applicable for calculating baseline emissions). Conversely, an assumption that the gas stream is dry is conservative for the situation that the greenhouse gas *i* is overestimated (applicable for calculating project emissions).

(kg dry gas/kmol dry gas)

Parameter $MM_{t,db}$ is estimated using the following equation.

$$MM_{t,db} = \sum_{k} (\nu_{k,t,db} * MM_k)$$

Where:

$MM_{t,db}$	= Molecular mass of the gaseous stream in time interval *t* on a dry basis (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 (m³ gas k/m³ dry gas)
MM_k	= Molecular mass of gas *k* (kg/kmol)
k	= All gases, except H_2O, contained in the gaseous stream (e.g. N_2 and CH_4,). 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, in the case of the project activity, the volumetric fraction of the methane that is a greenhouse gas and 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.

$PE_{flare,y}$ shall 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.

To determine the project emissions from flaring gases was used the tool "Project emissions from flaring". 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.

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 the following parameter:

Parameter	SI Unit	Description
$F_{CH4,m}$	kg	Mass flow of methane in the residual gaseous stream in the minute 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;
- CH4 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.

The option chosen for the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" by the project participant is option A. However, during the project operational monitoring, If not demonstrated that the temperature of the gaseous stream (T_t) is less than 60ºC (dry basis), then

the flow measurement should be assumed to be on a wet basis and the option B should be applied instead.

Step 2: Determination of flare efficiency

According to “Project emissions from flaring”, the flare efficiency will be calculated as follows:

<u>Open flare</u>

In the case of open flares, the flare efficiency in the minute *m* ($\eta_{flare,m}$) is 50% when the flame is detected in the minute *m* ($Flame_m$), otherwise $\eta_{flare,m}$ is 0%.

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:

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3}$$

Where:

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane valid for the commitment period (tCO_2e/tCH_4)
$F_{CH4,RG,m}$	=	Mass flow of methane in the residual gas in the minute *m* (kg)
$\eta_{flare,m}$	=	Flare efficiency in minute m

Table 1 – Parameters used in the Tool “Project emissions from flaring”

Parameter	Description	Value	Unit
P_{ref}	Atmospheric pressure at reference conditions	101,325	Pa
R_u	Universal ideal gas constant	0.008314472	$Pa.m^3/kmol.K$
T_{ref}	Temperature at reference conditions	273.15	K
GWP_{CH4}	Global warming potential of methane valid for the commitment period	25[35]	tCO_2/tCH_4
$\rho_{CH4,n}$	Density of methane at reference conditions	0.716	kg/m^3

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:

$$F_{CH4,PJ,y} = \eta_{PJ} \times BE_{CH4,SWDS,y} / GWP_{CH4}$$

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (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* (tCO_2e/yr)
η_{PJ}	=	Efficiency of the LFG capture system that will be installed in the project activity

[35] Value for the 2nd commitment period updated according to COP/MOP decisions

GWP_{CH4}	=	Global warming potential of CH_4 (tCO_2e/tCH_4)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool “Emissions from solid waste disposal sites”. The calculation of $BE_{CH4,SWDS,y}$, applying application A, according the tool is:

$$BE_{CH4,SWDS,} = \varphi_y \cdot (1-f_y) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1-e^{-k_j})$$

Where:

$BE_{CH4,SWDS,y}$	=	Baseline, project or leakage methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (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)
φ_y	=	Model correction factor to account for model uncertainties for year y
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
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

According to ACM0001 methodology, the parameter f_y in the methodological tool “Emissions from solid waste disposal sites” shall be assigned a value of 0 (zero) because the amount of LFG that would have been captured and destroyed is already accounted for in equation 2 of this methodology. Also, according to ACM0001 methodology, the parameter X begins with the year that the SWDS started receiving wastes (2010). For this reason, the parameter f_y and X will not be monitored.

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

In the baseline there are no regulatory or contractual requirements, or to address safety and odour concerns to capture and destroy LFG. Thus, the case of the project activity for determining methane captured and destroyed in the baseline is **Case 3** because there is existing LFG capture system (passive system), however there is no requirement to destroy methane. In this case:

In this situation:

$F_{CH4,BL,y} = F_{CH4,BL,sys,y}$

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

$F_{CH4,BL,sys,y} = 20\% \times F_{CH4,PJ,y}$; or

$F_{CH4,BL,y} = 20\% \times F_{CH4,PJ,y}$

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

$$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EL,k,y} \times (1 + TDL_{k,y})$$

Where:

$BE_{EC,y}$	=	Baseline emissions from electricity generation in year *y* (tCO2/yr)
$EC_{BL,k,y} = EG_{PJ,y}$	=	Net amount of electricity generated using LFG in year y (MWh/yr)
$EF_{EL,k,y}$[36]	=	Emission factor for electricity generation for source *k* in year *y* (tCO_2/MWh)
$TDL_{k,y}$	=	Average technical transmission and distribution losses for providing electricity to source *k* in year *y*.

The baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) shall be calculated using the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".

Emission Factor calculation

The project emissions derived from fossil fuels used for electricity consumption from grid connected power plants are estimated and guided using the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". The combined margin emission factor was calculated by the "Tool to calculate the emission factor for an electricity system", as follows:

Step 1. Identify the relevant electric power system

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.

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 Brazilian DNA published an official delineation of the project electricity system in Brazil, considering a national interconnected system.[37]

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

Option I: Only 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.

Step 3. Select a method to determined the operating margin (OM)

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[36] According to the "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*", $EF_{EL,k,y} = EF_{grid,CM,y}$

[37] According to Brazilian DNA Resolution n.8 published on 26/05/2008.

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or
d) Average OM.

The Brazilian DNA is responsible for calculating the OM emission factor in Brazil. It uses the method c) Dispatch data analysis OM.

For the dispatch data analysis OM, it is necessary to use the year in which the project activity displaces grid electricity and to 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 ($EF_{grid,OM\text{-}DD,y}$) is determined based on the power units that are actually dispatched at the margin during each hour h where the project is displacing electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM\text{-}DD,y}$.

The emission factor is calculated as follows:

$$EF_{grid,OM-DD,y} = \frac{\sum_{h} EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

$EF_{grid,OM\text{-}DD,y}$	=	Dispatch data analysis operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{PJ,h}$	=	Electricity displaced by the project activity in hour *h* m of year *y* (MWh)
$EF_{EL,DD,h}$	=	CO_2 emission factor for power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh)
$EG_{PJ,y}$	=	Total electricity displaced by the project activity in year *y* (MWh)
h	=	hours in year y in which the project activity is displacing grid electricity
y	=	Year in which the project activity is displacing grid electricity

The $EF_{grid,OM,2018}$ is displayed on the Brazilian DNA website, for the year 2018

$EF_{grid,OM,2018}$ =0.5390 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.

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.

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, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y ($t\ CO_2/MWh$)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y ($t\ CO_2/MWh$)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

The $EF_{grid,BM,2010}$ is displayed on the Brazilian DNA website, for the year 2010

$EF_{grid,BM,2010} = 0.1404\ tCO_2/MWh$[38]

Step 6. Calculate the combined margin emissions factor

The option a) weighted average CM was used to calculate the combined margin (CM).

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

The default weights are as follows: $w_{OM} = 0.25$ and $w_{BM} = 0.75$, fixed for the third crediting period. That gives:

$$EF_{2018} = (0.5390 \times 0.25) + (0.1404 \times 0.75) = 0.2401\ tCO_2/MWh$$[39]

The build margin CO_2 emission factors will be ex-ante.

The operating margin CO_2 emission factors will be ex-post.

Therefore, the combined margin CO_2 emission factor will be ex-post.

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[38] According to STEP 5, option 1 of Tool to calculate the emission factor for an electricity system

[39] The source of the data is from Brazilian DNA. The link is http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html

Project emissions:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y}$$

Where:

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

The parameter $PE_{DT,y}$ is not used in the calculation of project emissions since there is no distribution of compressed/liquefied LFG using trucks in the project activity.

Since there is no supply of LFG to consumers through a dedicated pipeline, $PE_{SP,y}$ = 0

Calculation of $PE_{EC,y}$ – project emission from consumption of electricity

According to "*Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"*, the project emission from consumption of electricity will be from two sources:

- $PE_{EC1,y}$ - Grid (Brazilian interconnected electric system);
- $PE_{EC2,y}$ - Diesel generator(s) (off-grid captive power plant)

Thus,

$$PE_{EC,y} = PE_{EC1,y} + PE_{EC2,y}$$

$PE_{EC1,y}$ - Project emission from electricity consumption from the grid

As electricity will be consumed from the grid, the option A1 of the scenario A was chosen, as follows:

Option A1: 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" ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$).

Thus, the project emission is calculated as following:

$$PE_{EC1,y} = EC_{PJ1,y} \times EF_{grid,CM,y} \times (1 + TDL_y)$$

Where:

$EC_{PJ1,y}$	= quantity of electricity consumed from the grid by the project activity during the year y (MWh);
$EF_{grid,CM,y}$	= the emission factor for the grid in year y (tCO_2/MWh);
TDL_y	= average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.

$PE_{EC2,y}$ - Project emission from electricity consumption from an off-grid captive power plant (diesel generator(s))

As electricity will be consumed from diesel generators (off-grid captive power plant), an alternative approach for project and/or leakage emissions was adopted and the Option B3 was chosen because in the particular case of the project activity, project emissions from consumption of electricity will be determined by calculating the CO2 emissions from diesel fuel combustion in the captive power plant. As stated in TOOL05, these emissions should be calculated using the latest approved version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". This option provides an accurate estimate since all the power generated by the captive power plant is consumed by the proposed CDM project activity.

Then,

$$PE_{EC2,y} = PE_{FC,j,y}$$

Calculation of $PE_{FC,y}$ – project emission from consumption of fossil fuel

Project emissions from fossil fuel combustion ($PE_{FC,j,y}$) are calculated following "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*". For this project, Diesel Oil is used in diesel generators when electricity from the grid is not available, thus these emissions are calculated below:

For fuel Diesel Oil for diesel generators:

$$PE_{FC,j,y} = FC_{i,j,y} * COEF_{i,y}$$

Where:

$FC_{i,j,y}$ is the quantity of fossil fuel *i* (Diesel Oil) combusted in process *j* (diesel generators) during year *y* (m^3)

$COEF_{i,y}$ is the CO_2 emission coefficient of the Diesel Oil (tCO_2/m^3 fuel)

Due to data availability, $COEF_{i,y}$ is calculated following Option B of the tool:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2i,y}$$

Where:

$NCV_{i,y}$ Is the weighted average net calorific value of the fuel type *i* (Diesel Oil) in year *y* (GJ/m^3)

$EF_{CO2i,y}$ Is the weighted average CO_2 emission factor of fuel type *i* (Diesel Oil) in year *y* (tCO_2/GJ)

Leakage:

In accordance with the ACM0001, no leakage effects need to be accounted.

Emission Reduction

Emission reductions are calculated as follows:

$$ER_y = BE_y – PE_y,$$

Where:

ER_y = Emission reductions in year y (tCO_2e/yr);

BE_y = Baseline emissions in year y (tCO_2e/yr);

PE_y = Project emissions in year y (tCO_2e/yr);

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2 /MWh
Description	Build margin emission factor of the Brazilian grid
Source of data	Calculations based on parameters described above.
Value(s) applied	0.1404
Choice of data or measurement methods and procedures	The build margin emission factor has been defined by the Brazilian DNA
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	All data and parameters to determine the grid electricity emission factor, as required by the "Tool to calculate the emission factor for an electricity system", were included in the monitoring plan. For more details, see Annex 3.

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"
Value(s) applied	0.1
Choice of data or measurement methods and procedures	Default value used, according to ACM0001
Purpose of data	Calculation of baseline emission
Additional comment	Applicable to Step A

Data/Parameter	GWP_{CH4}
Data unit	t CO_2e/t CH_4
Description	Global warming potential of CH_4
Source of data	IPCC
Value(s) applied	25. Updated for the 2nd commitment period according to COP/MOP decisions[40]
Choice of data or measurement methods and procedures	Default value used, according to IPCC Fourth Assessment Report: Climate Change 2007, item 2.10.2: Direct Global Warming Potentials, Table 2.14
Purpose of data	Calculation of baseline emission
Additional comment	-

Data/Parameter	R_u
Data unit	Pa.m^3/kmol.K
Description	Universal ideal gas constant

[40] IPCC Fourth Assessment Report: Climate Change 2007, item 2.10.2: Direct Global Warming Potentials, Table 2.14, available at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html , accessed on 11/02/2015 and in accordance with EB69, Annex 3 and decision 4/CMP.7, available at: http://cdm.unfccc.int/Reference/Standards/meth/reg_stan02.pdf , accessed on 11/02/2015.

Source of data	Methodological tool "Project emissions from flaring"
Value(s) applied	0.008314472
Choice of data or measurement methods and procedures	Default value used, according to Methodological tool "Project emissions from flaring", table 1: Constants used in equations
Purpose of data	Calculation of baseline emission
Additional comment	-

Data/Parameter	**Waste composition**
Data unit	%
Description	Waste composition
Source of data	landfill internal studies
Value(s) applied	(see table below)
Choice of data or measurement methods and procedures	Internal Report
Purpose of data	Calculation of baseline emission
Additional comment	Used for projection of methane avoidance

Composition of waste	
A) Wood and wood products	0.00%
B) Pulp, paper and cardboard (other than sludge)	16.10%
C) Food, food waste, beverages and tobacco (other than sludge)	48.68%
D) Textiles	4.90%
E) Garden, yard and park waste	0.00%
F) Glass, plastic, metal, other inert waste	30.32%
TOTAL	0.00%

Data/Parameter	$\mathbf{P_{ref}}$
Data unit	Pa
Description	Atmospheric pressure at reference conditions
Source of data	Tool "Project emissions from flaring"
Value(s) applied	101,325
Choice of data or measurement methods and procedures	Default value extracted from Tool "Project emissions from flaring"
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	$\mathbf{T_{ref}}$
Data unit	K
Description	Temperature at reference conditions
Source of data	Tool "Project emissions from flaring"
Value(s) applied	273.15
Choice of data or measurement methods and procedures	Default value extracted from Tool "Project emissions from flaring"
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	η_{PJ}
Data unit	Dimensionless
Description	Efficiency of the LFG capture system that is installed in the project activity
Source of data	Technical specifications of the LFG capture system installed
Value(s) applied	95%
Choice of data or measurement methods and procedures	Based on project's technical specification
Purpose of data	Calculation of baseline emission
Additional comment	-

Data/Parameter	$\varphi_{default}$
Data unit	-
Description	Default value for the model correction factor to account for model uncertainties
Source of data	Tool “Emissions from solid waste disposal sites”
Value(s) applied	0.75
Choice of data or measurement methods and procedures	According to “Emissions from solid waste disposal sites”, the *Application A* was used because the landfill is an existing solid waste disposal site and in the project activity the methane emissions are being mitigated by capturing and flaring the methane (ACM0001).
Purpose of data	Calculation of baseline emission
Additional comment	-

Data/Parameter	**OX**
Data unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.1
Choice of data or measurement methods and procedures	Default value used according to “Emissions from solid waste disposal sites”
Purpose of data	Calculation of baseline emission
Additional comment	When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce CO_2. The oxidation factor represents the proportion of methane that is oxidized to CO_2.This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS.

Data/Parameter	**F**
Data unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5

Choice of data or measurement methods and procedures	Default value used according to “Emissions from solid waste disposal sites”
Purpose of data	Calculation of baseline emission
Additional comment	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide

Data/Parameter	$DOC_{f,default}$
Data unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or measurement methods and procedures	The default value was used for type Application A). according to “Emissions from solid waste disposal sites”
Purpose of data	Calculation of baseline emission
Additional comment	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. This default value can be used for Application A.

Data/Parameter	$MCF_{default}$
Data unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1.0
Choice of data or measurement methods and procedures	The project activity is an anaerobic managed solid waste disposal site with 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 is include: (i) cover material; (ii) mechanical compacting and (iii) leveling of the waste;
Purpose of data	Calculation of baseline emission
Additional comment	-

Data/Parameter	DOC_j
Data unit	-
Description	Fraction of degradable organic carbon in the waste type j (weight fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value(s) applied	(see table below)

Waste type j	DOCj (% 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%

Choice of data or measurement methods and procedures	IPCC default value for municipal solid waste (MSW) disposal site is applied.
Purpose of data	Calculation of baseline emission
Additional comment	-

<table>
<tr><td>Data/Parameter</td><td>k_j</td></tr>
<tr><td>Data unit</td><td>-</td></tr>
<tr><td>Description</td><td>Decay rate for waste type j</td></tr>
<tr><td>Source of data</td><td>2006 IPCC Guidelines for National Greenhouse Gas Inventories</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th colspan="2" rowspan="2">Waste type j</th><th>Tropical (MAT > 20 °C)</th></tr>
<tr><th>Wet (MAP > 1,000mm)</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden 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>0.4</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>IPCC default value for anaerobic managed solid waste disposal site is applied.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>MM_i</td></tr>
<tr><td>Data unit</td><td>kg/kmol</td></tr>
<tr><td>Description</td><td>Molecular mass of greenhouse gas i</td></tr>
<tr><td>Source of data</td><td>Tool to determine the mass flow of a greenhouse gas in a gaseous stream</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Compound</th><th>Structure</th><th>Molecular mass (kg/kmol)</th></tr>
<tr><td>Methane</td><td>CH_4</td><td>16.04</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>According to “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

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

Value(s) applied	Compound / Structure / Molecular mass (kg/kmol): Nitrogen / N_2 / 28.01
Choice of data or measurement methods and procedures	According to "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$\mathbf{MM_{H2O}}$
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
Value(s) applied	18.0152
Choice of data or measurement methods and procedures	According to "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

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Emission reduction

Baseline emission calculation

The total of methane generation at the site has been estimated based on the waste tonnage of the landfill using the first order decay model presented in the *"Emissions from solid waste disposal sites"* and considering the following equation as mentioned previously.

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

The assumptions used to calculate $\mathbf{F_{CH4,PJ,y}}$ are:

- Methane content in LFG = 50% (default value);
- LFG collection efficiency = 50%: (Based on Data / Parameter table 6 from ACM0001 version 19.0, default value of 50% was used.);
- Density of methane = 0.716 kg/m^3 (as per tool "Project emissions from flaring*").*

The landfill gas collection and utilization system will capture only a portion of the generated landfill gas. Thus, an default value of 50% LFG collection efficiency was applied to the estimate of LFG produced, under assumption that generated LFG is composed of 50% methane.

The ex-ante estimation of the $F_{CH4,PJ,y}$ is presented below:

$$F_{CH4,PJ,y} = \eta_{PJ} \times \frac{BE_{CH4,SWDS,y}}{GWP_{CH4}}$$

Where:

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

The table below illustrates the ex-ante estimation of $F_{CH4,PJ,y}$ by the project activity during the crediting period.

Table 2 - Ex-ante estimation of $F_{CH4,PJ,y}$

Year*	$F_{CH4,PJ,y}$ (tCH_4/yr)
2018	16,465
2019	34,078
2020	35,051
2021	35,895
2022	36,637
2023	37,300
2024	28,973
2025	11,561

*From 01/07/2018 to 30/06/2025

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

$F_{CH4,BL,y} = 20\% \times F_{CH4,PJ,y}$

Table 3 - Ex-ante estimation of $F_{CH4,BL,y}$

Year*	$F_{CH4,BL,y}$ (tCH_4/yr)
2018	3,293
2019	6,816
2020	7,010
2021	7,179
2022	7,327
2023	7,460
2024	5,795
2025	2,312

*Since 01/07/2018 until 30/06/2025

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

The equation of the $BE_{CH4,y}$ is:

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

Where the OX_{top_layer} = 0.1 (default value) and $F_{CH4,PJ,y}$ and $F_{CH4,BL,y}$ are calculated above. The results are presented below:

Table 4 - Baseline emissions of methane from the SWDS ($BE_{CH4,y}$)

Year*	$BE_{CH4,y}$ (tCO_2/year)
2018	288,130
2019	596,358
2020	613,400
2021	628,154
2022	641,148
2023	652,754
2024	507,024
2025	202,321

*Since 01/07/2018 until 30/06/2025

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

The ex-ante calculation is:

$$BE_{EC,y} = EC_{BL,k,y} \times EF_{grid,CM,y} \times (1+TDL_y)$$

As explained above, the $EF_{grid,CM,y}$ = 0.2401 tCO_2/MWh

Table 5 - Baseline emissions associated with electricity generation ($BE_{EC,y}$)

Year*	$EC_{BL,k,y}$ (MWh/yr)[41]	$BE_{EC,y}$ (tCO_2/yr)
2018	16.980	4.728
2019	33.960	9.457
2020	33.960	9.457
2021	33.960	9.457
2022	33.960	9.457
2023	33.960	9.457
2024	33.960	9.457
2025	16.980	4.728

*Since 01/07/2018 until 30/06/2025

The equation of the baseline emission calculation is:

$$BE_y = BE_{CH4,y} + BE_{EC,y}$$

[41] Values from PDD registered before PRC with increased capacity by 20 per cent, due to paragraph 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the capacity specified in the originally registered PDD (before PRC)

The result is:

Table 6 - baseline emission calculation

Year*	$BE_{CH4,y}$ (tCO_2/year)	$BE_{EC,y}$ (tCO_2/yr)	BE_y (tCO_2/yr)
2018	288.130	4.728	292.859
2019	596.358	9.457	605.815
2020	613.400	9.457	622.857
2021	628.154	9.457	637.611
2022	641.148	9.457	650.605
2023	652.754	9.457	662.210
2024	507.024	9.457	516.481
2025	202.321	4.728	207.050

*Since 01/07/2018 until 30/06/2025

1. **Project emission**

$$PE_y = PE_{EC,y} + PE_{FC,y}$$

Where:

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

There is no consumption of fossil fuels due to the project activity for purpose other than electricity generation, in year y (tCO2/yr), therefore PEFC,y = 0

Thus,

$$PEy = PE_{EC,y}$$

Calculation of $PE_{EC,y}$ – project emission from consumption of electricity

The project emission from consumption of electricity is:

$$PE_{EC,y} = PE_{EC1,y} + PE_{EC2,y}$$

Where:

$PE_{EC1,y}$ - Project emission from the grid

In the option A1 of the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", states that a value of the combined margin emission factor ($EF_{grid,CM,y}$) may be used as the emission factor ($EF_{ELj/k/l,y}$) Therefore a value of 0.2401 tCO_2/MWh will be used.

Finally the technical transmission and distribution losses ($TDL_{j,y}$) value has been assumed to be 16%, according to World Bank Database – 2014.[42] Table below summarizes the project emissions resulting from electrical consumption in the plant.

Table 7 - Electricity consumption from the grid resulting due to project activity

Year*	**Electricity consumption from the grid** (MWh/year)	**$PE_{el,grid}$ (tCO_2/year)**
2018	1,377	384
2019	679	190
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0

*Since 01/07/2018 until 30/06/2025

It is important to notice, it is considered that in standard operation the electricity of LFG plant will be supplied by of the LFG electricity power plant. As a result, in principle, there is no electrical consumption from the grid by the LFG plant and if there will be, it will be monitored.

$PE_{EC2,y}$ - Project emission from diesel generator(s)

Since an alternative approach for project and/or leakage emissions was adopted and the Option B3 of TOOL05 was chosen, then:

$$PE_{EC2,y} = PE_{FC,j,y}$$

$PE_{FC,j,y}$ is calculated below.

Calculation of $PE_{FC,y}$ – project emission from consumption of fossil fuel

The project emission from consumption of fossil fuel is:

$$PE_{FC,j,y} = FC_{i,j,y} \times COEF_{i,y}$$

Where:

$FC_{i,j,y}$ is the quantity of fossil fuel *i* (Diesel Oil) combusted in process *j* (diesel generators) during year *y* (m^3)

$COEF_{i,y}$ is the CO_2 emission coefficient of the Diesel Oil (tCO_2/ m^3 fuel)

Due to data availability, $COEF_{i,y}$ is calculated following Option B of the tool:

$COEF_{i,y} = NCV_{i,y} * EF_{CO2i,y}$

Where

$NCV_{i,y}$ Is the weighted average net calorific value of the fuel type *i* (Diesel Oil) in year *y* (GJ/ m^3)

$EF_{CO2i,y}$ Is the weighted average CO_2 emission factor of fuel type *i* (Diesel Oil) in year *y* (tCO_2/GJ)

[42] World Bank Database (15.775% for 2014 is the most recent data. It was adopted 16%). Source: https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?end=2014&locations=BR&start=1971&view=chart

Table 8 - Electricity consumption from the grid resulting due to project activity

Year*	$FC_{i,j,y}$ (m^3/year)	$PE_{fc,y} = PE_{EC2,y}$ (tCO_2/year)
2018	0	0
2019	0	0
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0

*Since 01/07/2018 until 30/06/2025

Fossil fuel consumption from diesel generators is monitored, however considered as negligible for ex-ante calculation.

2. Leakage:

No leakage effects need to be accounted under methodology ACM0001.

3. Emission reduction

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO_2e/yr);
BE_y	=	Baseline emissions in year y (tCO_2e/yr);
PE_y	=	Project emissions in year y (tCO_2e/yr);

B.6.4. Summary of ex ante estimates of emission reductions
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Year*	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2018	292,859	384	0	292,475
2019	605,815	190	0	605,625
2020	622,857	0	0	622,857
2021	637,611	0	0	637,611
2022	650,605	0	0	650,605
2023	662,210	0	0	662,210
2024	516,481	0	0	516,481
2025	207,050	0	0	207,050
Total	292,859	384	0	292,475
Total number of crediting years	**7**			
Annual average over the crediting period	**599,355**	**82**	**0**	**599,273**

*Since 01/07/2018 until 30/06/2025

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Baseline, project and/or leakage emission from electricity consumption and monitoring of electricity generation

Data/Parameter	$\mathbf{EF_{grid,CM,y}}$
Data unit	tCO_2 /MWh
Description	CO_2 emission factor of the Brazilian grid electricity during the year y
Source of data	Calculations based on parameters described above.
Value(s) applied	0.2401
Measurement methods and procedures	The emission factor is calculated ex-post, as the weighted average of the dispatch data analysis OM (Operating Margin) and the BM (Build margin), as described in B.6.3.
Monitoring frequency	Annual
QA/QC procedures	Apply procedures in the "Tool to calculate the emission factor for an electricity system"
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	All data and parameters to determine the grid electricity emission factor, as required by the "Tool to calculate the emission factor for an electricity system" were included in the monitoring plan. For more details, see Annex 3.

Data/Parameter	$\mathbf{EF_{grid,OM,y}}$
Data unit	tCO_2 /MWh
Description	Operating margin emission factor of the Brazilian grid
Source of data	Calculations based on parameters described above.
Value(s) applied	0.5390

Measurement methods and procedures	The operating margin emission factor is calculated ex-post, as described in B.6.3.
Monitoring frequency	Annual
QA/QC procedures	Apply procedures in the “Tool to calculate the emission factor for an electricity system”
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	All data and parameters to determine the grid electricity emission factor, as required by the “Tool to calculate the emission factor for an electricity system” were included in the monitoring plan. For more details, see Annex 3.

Data/Parameter	**TDL_y**
Data unit	-
Description	Average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site.
Source of data	World Bank Database
Value(s) applied	16%[43]
Measurement methods and procedures	For (a): *TDLj/k/l,y* should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation
Monitoring frequency	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years
QA/QC procedures	-
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	The data was based on World Bank Database - 2014.[44]

Data/Parameter	**$EC_{PJ1,y} = EG_{EC1,y}$**
Data unit	MWh/y
Description	Quantity of electricity consumed from the grid by the project activity during the year y;
Source of data	Measurement from Project participants.
Value(s) applied	

Year	$EC_{PJ1,y}$ (MWh/year)
2018	1,377
2019	679
2020	0
2021	0
2022	0
2023	0
2024	0
2025	0

[43] World Bank Database (15.775% for 2014 is the most recent data. It was adopted 16%). Source: https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?end=2014&locations=BR&start=1971&view=chart

[44] World Bank Database (15.775% for 2014 is the most recent data. It was adopted 16%). Source: https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?end=2014&locations=BR&start=1971&view=chart

Measurement methods and procedures	Continuously measured by electricity meters for the grid electricity consumption as per the “Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” and methodology ACM0001.
Monitoring frequency	Continuously
QA/QC procedures	As per the “Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	The data will be archived throughout the crediting period and two years thereafter.

Tool to calculate project or leakage CO2 emissions from fossil fuel combustion

Data / Parameter	$NCV_{fuel,y}$
Unit	GJ per mass (GJ/ton)
Description	Weighted average net calorific value of fossil fuel i in year y
Source of data	Regional or national default values
Value(s) applied	46.71 for diesel
Measurement methods and procedures	Measurements should be undertaken in line with national or international fuel standards. Monitoring frequency: Review appropriateness of the values annually
Monitoring frequency	Continuously
QA/QC procedures	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	The value was based on Brazilian Database. The data will be archived throughout the crediting period and two years thereafter

Data / Parameter	$EF_{CO2,Diesel,y}$
Unit	tCO2/GJ
Description	Weighted average CO_2 emission factor of fuel type j (Diesel Oil) year y
Source of data	IPCC 2006
Value(s) applied	0.0843 (Diesel Oil)
Measurement methods and procedures	Measurements should be undertaken in line with national or international fuel standards. Monitoring frequency: Review appropriateness of the values annually
Monitoring frequency	Continuously
QA/QC procedures	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	-

Data/Parameter	$FC_{i,j,y}$
Data unit	m^3/year
Description	Quantity of fossil fuels of type i (Diesel Oil) in process j (diesel generators) during the year y

Source of data	Project Developer
Value(s) applied	0 (since diesel generator will only consume fossil fuel when electricity from the grid is not available)
Measurement methods and procedures	A volumetric meter is employed to measure the fossil fuel consumption continuously
Monitoring frequency	Continuously
QA/QC procedures	The metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	The data will be archived throughout the crediting period and two years thereafter. Diesel generator will only consume fossil fuel when electricity from the grid is not available. Thus, ex-ante estimative for fuel consumption is defined as zero.

ACM0001: Flaring or use of landfill gas

Data/Parameter	**Management of SWDS**
Data unit	-
Description	Management of SWDS
Source of data	Use different sources of data: - Original design of the landfill; - Technical specifications for the management of the SWDS; - Local or national regulations
Value(s) applied	-
Measurement methods and procedures	Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Monitoring frequency	Annually
QA/QC procedures	-
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	-

Data/Parameter	$\mathbf{EG_{PJ,y} = EC_{BL,k,y}}$
Data unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year y
Source of data	Electricity meter
Value(s) applied	40,752 in 2024[45]
Measurement methods and procedures	Monitor net electricity generation by the project activity using LFG
Monitoring frequency	Continuous
QA/QC procedures	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company.
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comment	This parameter is required for calculating baseline emissions associated with electricity generation ($BE_{EC,y}$) using the “Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”

[45] Values from PDD registered before PRC with increased capacity by 20 per cent, due to paragraph 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the capacity specified in the originally registered PDD (before PRC)

Data/Parameter	$O_{pj,h}$
Data unit	-
Description	Operation of the equipment that consumes the LFG
Source of data	Measurements by Project participant using a device integrated with the operational software at the landfill gas plant.
Value(s) applied	n/a
Measurement methods and procedures	For each equipment unit j using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: (a) Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; (b) Flame. Flame detection system is used to ensure that the equipment is in operation; (c) Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnances. This option is not applicable to brick kilns. Opj,h=0 when: (a) One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute); (b) Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); (c) No products are generated in the hour h. Otherwise, Opj,h=1
Monitoring frequency	Once per minute
QA/QC procedures	The calibration of this equipment is not applicable since it is a device integrated with the operational software at the landfill gas plant.
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	For open flares is only possible to detect the flame to ensure if the equipment is in operation or not.

Tool to determine the mass flow of a greenhouse gas in a gaseous stream

Data/Parameter	$V_{t,db}$
Data unit	m³ /h
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis
Source of data	Measurements by Project participants using a flow meter(s)
Value(s) applied	n/a
Measurement methods and procedures	The volumetric flow rate of the residual gas which is sent to each individual flare, LFG engines in the hour h will be measured by the installed flow meters with digital recordable electronic signal, according to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, the measurement option in the project activity will be: • Option (A) dry basis: when the temperature of gaseous stream is lower than 60ºC (333.15 K) at the flow measurement point; • Option (B) wet basis: when the temperature of gaseous stream is higher than 60o C (333.15 K) at the flow measurement point;
Monitoring frequency	Continuous recorded and hourly aggregated
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. The calibration frequency of this monitoring equipment should be in accordance with manufacturer’s specifications.
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
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” is applied for the determination of $F_{CH4,flared,y}$, $F_{CH4,EL,y}$

Data/Parameter	$V_{t,wb}$
Data unit	m³/h
Description	Volumetric flow of the gaseous stream in time interval t on a wet basis
Source of data	Measurements by Project participants using a flow meter
Value(s) applied	n/a
Measurement methods and procedures	The volumetric flow rate of the residual gas which is sent to each individual flare, LFG engines in the hour h will be measured by the installed flow meters with digital recordable electronic signal, according to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, the measurement option in the project activity will be: • Option (A) dry basis: when the temperature of gaseous stream is lower than 60ºC (333.15 K) at the flow measurement point; • Option (B) wet basis: when the temperature of gaseous stream is higher than 60º C (333.15 K) at the flow measurement point;
Monitoring frequency	Continuous recorded and hourly aggregated
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. The calibration frequency of this monitoring equipment should be in accordance with manufacturer’s specifications.
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	This parameter will be monitored only in case Options B or C of the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” is applied for the determination of $F_{CH4,flared,y}$, $F_{CH4,EL,y}$

Data/Parameter	$v_{i,t,db}$
Data unit	m^3 gas i/m^3 dry gas
Description	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis
Source of data	Measurements by Project participants using gas analyzer
Value(s) applied	Approximately 50%
Measurement methods and procedures	Continuous gas analyzer operating in dry basis. Volumetric flow measurement should always refer to the actual pressure and temperature.
Monitoring frequency	Continuous recorded and hourly aggregated
QA/QC procedures	Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	This parameter will be monitored only in case Option A of the tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” is applied for the determination of $F_{CH4,flared,y}$, $F_{CH4,EL,y}$

Data/Parameter	$v_{i,t,wb}$
Data unit	m^3 gas i/m^3 dry gas
Description	Volumetric fraction of greenhouse gas i in a time interval t on a wet basis
Source of data	Measurements by Project participants using gas analyzer
Value(s) applied	Approximately 50%
Measurement methods and procedures	Calculated based on the dry basis analysis plus water concentration measurement or continuous in-situ analyzers if not specified in the underlying methodology
Monitoring frequency	Continuous recorded and hourly aggregated
QA/QC procedures	Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	This parameter may be monitored only in case Option B of the tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” is applied for the determination of $F_{CH4,flared,y}$, $F_{CH4,EL,y}$

Data/Parameter	T_t
Data unit	K
Description	Temperature of the gaseous stream in time interval t
Source of data	Measurements by Project participant using a temperature meter
Value(s) applied	n/a
Measurement methods and procedures	Thermoresistance with digital recordable electronic signal will be used. The accuracy and uncertainty of the monitoring instrument will be in accordance with manufacturer specifications.
Monitoring frequency	Continuous
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. The calibration frequency of this monitoring equipment should be according to the manufacturer’s specifications
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency). However, if the applicability condition related to the gaseous stream flow temperature being below 60ºC is adopted, this parameter must be monitored continuously to assure the applicability condition is met.

Data/Parameter	P_t
Data unit	Pa
Description	Pressure of the gaseous stream in time interval t
Source of data	Measurements by Project participant using a pressure meter
Value(s) applied	n/a
Measurement methods and procedures	Instruments with recordable electronic signal (analogical or digital) will be used. Examples include pressure transducers, etc. The accuracy and uncertainty of the monitoring instrument will be in accordance with manufacturer specifications.
Monitoring frequency	Continuous
QA/QC procedures	Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated according manufacturer recommendation. In case the pressure meter is not a capacitive or resistive pressure transducer, the calibration frequency of this monitoring equipment should be according to the manufacturer's specifications.
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency)

Data/Parameter	**Status of biogas destruction device**
Data unit	-
Description	Operational status of biogas destruction devices
Source of data	Provided by project participants
Value(s) applied	n/a
Measurement methods and procedures	Monitoring and documenting may be undertaken by recording the energy production from methane captured or the operation of the flare by means of a flame detector to demonstrate the actual destruction of methane, unless a different method is specified in the underlying methodology/tool. Emission reductions will not accrue for periods in which the destruction device is not operational.
Monitoring frequency	Continuous
QA/QC procedures	-
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	For Flame detector devices refer to the methodological tool "Project emissions from flaring"

Data/Parameter	$P_{H2O,t,Sat}$
Data unit	Pa
Description	Saturation pressure of H_2O at temperature Tt in time interval t
Source of data	Provided by project participants
Value(s) applied	n/a
Measurement methods and procedures	This parameter is solely a function of the gaseous stream temperature Tt and can be found at reference [1] for a total pressure equal to 101,325 Pa
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment	[1] Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4º Edition 1994, John Wiley & Sons, Inc.

Methodological tool "Project emissions from flaring"

Data/Parameter	**$Flame_m$**
Data unit	Flame on or Flame off
Description	Flame detection of flare in the minute m
Source of data	Project Participant
Value(s) applied	-
Measurement methods and procedures	Measurements by project participants using a continuous ultraviolet flame detector
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 and project emissions when the flame is on[46].
Additional comment	-

Data/Parameter	**$Maintenance_y$**
Data unit	Calendar dates
Description	Maintenance events completed in year y
Source of data	Project participants
Value(s) applied	-
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	Daily
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 and project emissions when the flame is on[47].
Additional comment	Monitoring of this parameter is required for the case of flares. 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

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The monitoring plan will be done according to the methodology ACM0001, the applicable tools, as well as per the CDM project standard. Details are available in section B.7.1 above. The monitoring equipment locations are presented in the picture below:

[46] When the flame is off, neither baseline nor project emissions occurs since the LFG is not combusted and instead released to the atmosphere.

[47] When the maintenance is being carried out, neither baseline nor project emissions occurs since the LFG is not combusted and released to the atmosphere.

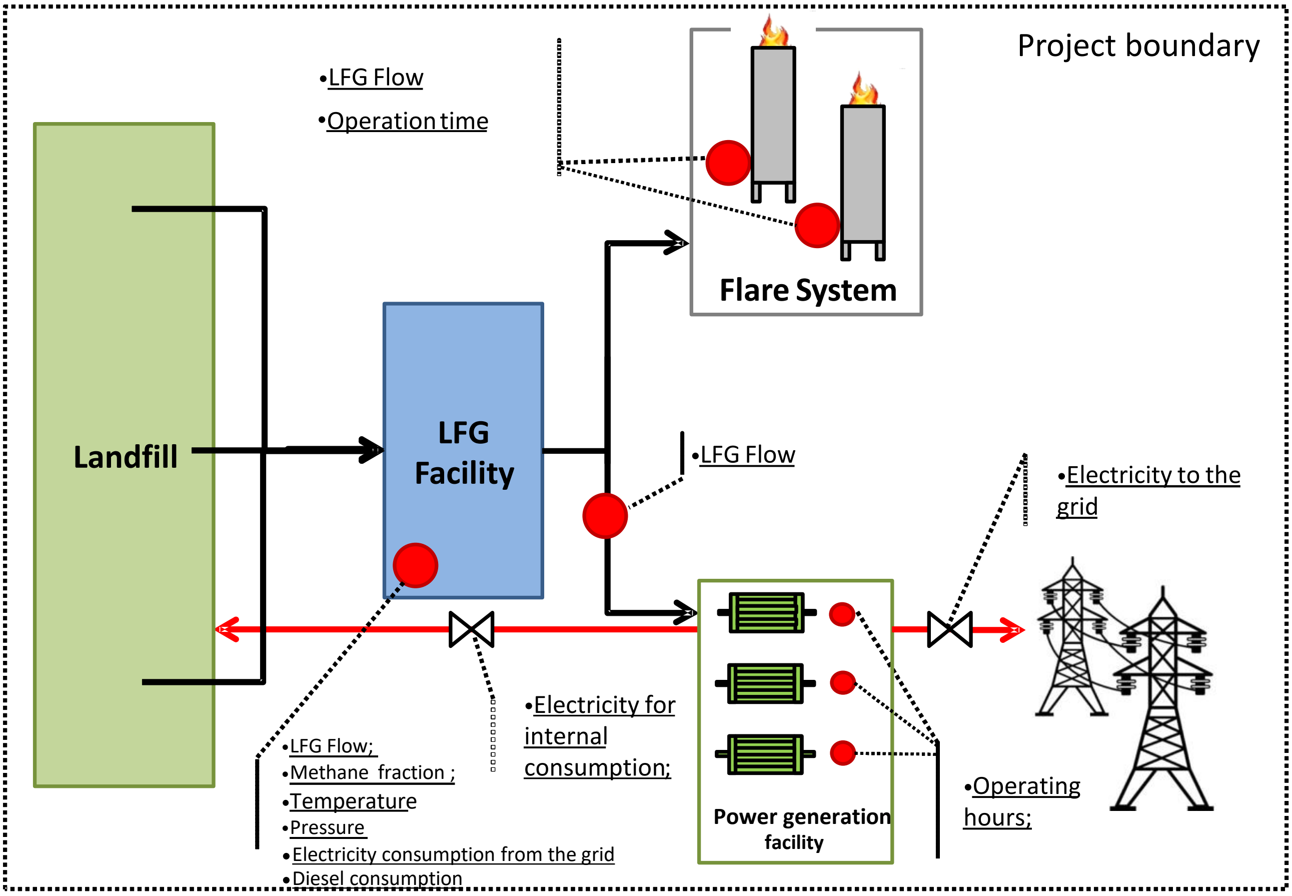

Figure 6 - Monitoring equipment locations[48]

All continuously measured parameters (LFG flow, CH_4 concentration, flare temperature, flare operating hours, engine operating hours, and engine electrical output) will be recorded electronically via a datalogger, located within the Site boundary which will have the capability to aggregate and print the collected data at the frequencies as specified above. It will be the responsibility of the Site Operator to provide all requested data logs which will be stored over the duration of the reporting period at the Site office. The data logs will be summarized into emission reduction calculations prior to each verification. This task will be completed by the project owner and reported directly to the DOE. These logs will be available at the request of the DOE in order to prove the operational integrity of the Project.

1. Introduction and Objectives

The two primary purposes of the monitoring plan are:

- To collect the necessary system data required for the determination of emissions reductions; and
- To demonstrate successful compliance with established operating and performance criteria to verify the emission reductions and generate the respective CERs.

The operational data that is collected will be used to support the periodic verification report that will be required for CER auditing. The monitoring plan discussed herein is designed to meet or exceed the UNFCCC requirements (approved monitoring methodology ACM0001).

[48] If the flare were open, only the detection of the flame will be monitored.

The routine system monitoring program required for the determination of the emission reductions is discussed in section 2 below, while the additional system data that is collected to ensure the safe, correct, and efficient operation of the LFG management system is discussed in section 3.

2. Training of monitoring personnel

Before commencement of the O&M phase, project owner will conduct a training and quality control program to ensure that good management practices are carried out and implemented by all project operating personnel in terms of record-keeping, equipment calibration, overall maintenance, and procedures for corrective action. An operations manual will be developed for the operating personnel. The procedures for filing data and calculations to be performed by the LFG utilization operator will be included in a daily log to be placed in the main control room.

3. Monitoring Work Program

The LFG monitoring program is a relatively simple, straight forward program designed to collect system operating data required to safely operate the system and for the verification of CERs. This data will be collected in real time and will provide a continuous record that is easy to monitor, review, and validate.

The following sections will outline and discuss the following key elements of the monitoring program:

- Flow measurement;
- Gas quality measurements;
- Flame detection in case of open flares;
- Electrical Consumption;
- Fossil fuel consumption
- Project electricity output;
- Regulatory requirements;
- Data records; and
- Data assessment and reporting.

3.1. Flow Measurement

According to ACM0001, one flow meter will be installed during Phase 1 (flaring) on the piping, straight before the flares.

During phase 2 (electricity generation) implementation, in order to follow ACM0001, flow meters will be installed:

- A flow meter will be installed in the piping before the power plant to measure the LFG flow utilized for electricity generation;
- and other flow meter will be either installed in each flare.

The flow of LFG collected by the system and subsequently utilized, flared are measured via individual flow measuring devices suitable for measuring the velocity and volumetric flow of a gas. One common example is an annubar. The flow measurements are taken within the piping itself, and the flow sensors are connected to transmitters that are capable of collecting and sending continuous data to a recording device such as a datalogger.

The flow sensors are calibrated according to a specified temperature and composition of the gas, thus the flow actually measured must be corrected to according to actual temperature, pressure, and composition, thus density, of the gas measured. The equipment selected will allow dynamic compensation for these parameters, normalized to a standard temperature, pressure, and gas composition. For reporting purposes, the flows are generally required to be normalized to 0°C and 1.01325 bar at standard gas composition of 50% methane and carbon dioxide each by volume.

The accuracy of a flow meter is dependent on the design of the equipment, and the specific type of sensor used. The equipment selected for the site utilizes a continuous monitoring system as defined in ACM0001, which measures and aggregates flow data approximately once every minute.

3.2. Gas Quality

The two parameters that are most pertinent to the validation of CERs, as well as the safe and efficient operation of the system are the concentration of methane and oxygen in the gas stream delivered for utilization or diverted to flaring. These two parameters are measured via a common sample line that is ran to the main collection system piping, and measured in real time by two separate sensors, one for methane and the other for oxygen, installed as per ACM0001.

Regular calibration of the equipment is especially important, as the accuracy of the methane and oxygen sensors is greatest within the expected range of the gas stream to be measured. The equipment selected for the site aggregates gas compositions approximately once every minute.

3.3. Uncombusted Methane

For open flares, the efficiency will be measured per the methodological tool “Project emissions from flaring”.

3.4. Electrical Consumption

The consumed electricity from the grid by the project activity will be continuously measured by electricity meters for the grid and diesel generators. The respective data will be electronically recorded.

Monthly electrical bills charged to the project will be monitored and considered as the actual energy consumption for the project.

3.5. Project Electricity Output

The generated electricity used for the landfill internal consumption (i.e. administration offices, truck garage, recycling plant, leachate pumps), excluding the LFG Facility electricity consumption by the project activity[49] will be continuously measured by an electricity meter and respective data will be electronically recorded. Due to paragraph 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the installed capacity specified in the originally registered PDD (before PRC).

3.6. Diesel purchased

A volumetric meter is employed to measure the fossil fuel consumption continuously. The metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records For ex-ante calculation, the value of Diesel purchased was considered zero since there is no estimation from Diesel consumption and this emission source is very small.

3.7. Regulatory Requirements

Regulatory requirements relating to LFG projects will be evaluated annually by investigating municipal, state and national regulations pertaining to LFG. This will be done through consultation with the appropriate regulatory bodies, ongoing discussion with regulators, and monitoring of publications delineating upcoming legislative changes governing landfills and LFG.

[49] There will not be claimed CERs for LFG Facility electricity consumption because the electricity consumption is a consequence of the CDM Project.

4. Data records and storage

Data collected from each of the parameter sensors is transmitted directly to an electronic database from which the CER volume calculations may be carried out, as described in section 2.1 above. A hard copy backup or reports of the data may be printed as required or recorded in Portable Document Format (PDF). Backup of the electronic data is conducted frequently, as described above.

Data monitored and required for verification and issuance are kept and archived for at least two years after the end of the final crediting period or the last issuance of CERs, whichever occurs later.

4.1. Data Assessment and Reporting

Assessment of the flow and composition data described above coupled with the operating hours of the engines/flare and engines/flare destruction efficiencies are used to determine the quantity of CERs to be generated. For electricity generation offsets, the appropriate emission factors will be applied.

The destruction efficiency of the open flares will be 50% as defined in “Project emissions from flaring”.

As discussed in Section 2.1, flow data is normalized to standard temperature, pressure, and composition for reporting purposes. The data will be compiled and assessed to produce the required quantification and validation. The periodic monitoring report will contain the data required for the verification of the CERs, and additionally may contain operational data from the collection system and flaring system described below to illustrate that the system is well maintained and operating at peak efficiency. Records of regular maintenance performed will also be a component of the annual report.

5. Related monitoring and project performance review

The project owner will conduct an additional operational monitoring of the LFG collection system to check the project performance and ensure that the system is being operated both correctly and efficiently. Periodic adjustments to the horizontal trenches and to the extraction wells/drains will be required to optimize the capture and collection systems effectiveness. LFG collection field adjustments will be made based upon a review of the trench and well performance history considered within the context of the overall LFG collection field operation in order to maximize the collection of methane balanced against minimization of any oxygen in the system that could introduce unsafe operating conditions. Monitoring at each trench and extraction well will consist of the following parameters: valve position, individual well/trench flow, individual well/trench vacuum, and composition of the gas collected, i.e., methane, carbon dioxide, and oxygen, using a portable measuring device.

6. Emergency procedures

As a precautionary measure, system is plugged to a battery-based uninterruptible power supply (UPS) to avoid data loss due to power failures. As a backup is produced and stored off-site from the main recording system, no more than 2 to 3 minutes of data at a time would ever be lost due to a system malfunction.

All data are collected and registered in data log in supervisory system. In addition, there will be developed an Emergency Plan including others types of emergencies such as fire and work accidents.

7. Calibration

All the measurement instruments will be subject to regular calibration as per manufacturer’s specifications. The regular check and calibration will be made to the operators. The plant Manager will be responsible for checking the equipment’s proper working order, as well as checking and

storing up the calibration certificates and records. Calibration certificates will be kept for all the equipment during the crediting period and two years after.

Also, for calibration, CDM project standard for project activities Version 2, paragraph 79 (d) will be used. Thus the project participants shall apply the following unless the applied methodologies, the applied standardized baselines or the other applied methodological regulatory documents state otherwise:
(d) The calibration of measuring equipment shall be carried out by an accredited person or institution;

8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

The date of completion the application of the methodology to the project activity study is 15/10/2018.

The person/entity determining the baseline is as follows:
Beng Engenharia Ltda, São Paulo, Brazil
Contact person: Mr. João Sprovieri
Mr. Francisco Santo
Email: joao.sprovieri@beng.eng.br
francisco.santo@beng.eng.br

Beng Engenharia Ltda is not a Project Participant.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>
Project starting date: 18/11/2004

C.2. Expected operational lifetime of project activity

>>
21 years and 0 months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Renewable (3 x 7 years)

C.3.2. Start date of crediting period

>>
The 3rd crediting period will start on 01/07/2018.

C.3.3. Duration of crediting period

>>
7 years and 0 months.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

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According to the National GHG Emissions Inventory conducted by CETESB in 1994, at that time Brazil had over 6,000 waste depositing sites, receiving over 60,000 tonnes of waste per day (please note this study is currently being updated). Of this amount, 76% of the total waste is disposed in 'rubbish dumps' ("lixões") with no management, gas collection, or water treatment whatsoever, and usually without any license or under no control by the environmental agencies concerned. According

to the same study, 84% of Brazil's methane emissions come from the deposition of waste in uncontrolled rubbish dumps. The remaining 24% of waste is disposed in 'controlled' landfills (as opposed to 'sanitary' landfills, as planned by the project), but these are usually highly ineffective in relation to emissions and percolate control. In the few cases where gases are collected, this is done for safety reasons (to avoid explosions), and it is often the case that the amounts effectively collected are very low, due to high levels of percolates (which are often not drained or treated, as well) blocking the drainage pipes.

By collecting and combusting landfill gas, the NovaGerar project's 'sanitary' landfills will reduce both global and local environmental effects of uncontrolled releases. The major components of landfill gas, methane and carbon dioxide, are colourless and odourless. The main global environmental concern over these compounds is the fact that they are greenhouse gases. Although the majority of landfill gas emissions are quickly diluted in the atmosphere, in confined spaces there is a risk of asphyxiation and/or toxic effects if landfill gas is present at high concentrations. Landfill gas also contains over 150 trace components that can cause other local and global environmental effects such as odour nuisances, stratospheric ozone layer depletion, and ground-level ozone creation. Through appropriate management of the Nova Iguaçu site, landfill gas will be captured and combusted, removing the risks of toxic effects on the local community and local environment.

Landfill gas electricity generators can also produce nitrogen oxides emissions that vary widely from one site to another, depending on the type of generator and the extent to which steps have been taken to minimise such emissions. Combustion of landfill gas can also result in the release of organic compounds and trace amounts of toxic materials, including mercury and dioxins, although such releases are at levels significantly lower than if the landfill gas is flared. These emissions are also viewed as significantly less harmful than the continued uncontrolled release of landfill gas. Where methane is used for electricity generation, operational practices at the landfill are improved thus contributing to sustainable development. Specifically, for landfills, sustainable means accelerating waste stabilization such that the landfill processes can be said to be largely complete within one generation (30- 50 years). This ensures that both leachate and methane are more carefully managed and controlled, and the degradation processes are accelerated. Groundwater and surface water can be contaminated by untreated leachate from landfill sites. Leachate may cause serious water pollution if not properly managed. Surface water runoff from a landfill site can also cause unacceptable sediment loads in receiving waters, while uncontrolled surface water run-on can lead to excessive generation of leachate and migration of contaminated waters off-site. With NovaGerar providing appropriate management on the site, these potential problems should be avoided. Also, there are few water impacts associated with landfill gas electricity generation plants. Unlike other power plants that rely upon water for cooling, landfill gas power plants are usually very small, and therefore pollution discharges into local lakes or streams are typically quite small.

Other potential hazards and amenity impacts minimized by appropriate management of the Nova Iguaçu landfill site include the risks of fire or explosions, landfill gas migration, dust, odour, pests, vermin, unsightliness and litter, each of which may occur on-site or off-site. The following aspects of the operation of the landfill gas to energy project have also been addressed:

- Noise – There will be some increase in noise from the site associated with energy recovery, although the engines will be housed to reduce noise emissions. The impacts are likely to be marginal given the noise typically associated with operations at the landfills.

- Visual amenity – Placement of energy recovery facilities at the landfill site will increase the visual presence of the site, however the impacts are expected to be marginal given the visual intrusion currently associated with the waste disposal operations.

Where landfill gas utilization schemes, such as the NovaGerar project, are developed in countries like Brazil, there is also an opportunity to promote best practices to improve landfill management standards, and contribute towards global sustainable development.

D.2. Environmental impact assessment

>>

An Environmental Impact Assessment (EIA-RIMA, in Brazil) was conducted as a requirement to obtain the environmental licenses to operate the Nova Iguaçu landfill. This EIA was subjected to a prolonged stakeholder consultation process which culminated in an official public hearing in 2001.

The concerns of stakeholders are recorded in the official minutes of this hearing (Ata de Reunião de Audiência Pública), kept by INEA, the environmental agency responsible.

The project developer's response to stakeholder concerns is contained in a statement of social responsibility between SA Paulista and the relevant Ministry in Brazil (Termo de Compromisso c/o Ministério Público). Among various other points, SA Paulista agreed to remediate the highly polluting Marambaia rubbish dump, which was expected to close at the end of 2001, and finally closed in August 2002.

Most recent Urban Solid Waste Diagnosis from Institute for Applied Economic Research (IPEA) has been published in 2012. According to Table 18, 100% of the Nova Iguaçu area municipal solid waste is disposed in landfills/open dumps and 0% is managed by other methods. Thus, it is possible to state that recycling percentage in the project activity area is negligible.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

For the environmental licenses and Operational permits, the State environmental agency INEA, has already conducted a public hearing in 2001, which was only focusing on the waste disposal and management facilities in Adrianópolis and not on the clean up of Marambaia. All comments have been incorporated into the executive project. The documentation is available to the public on request. The new Stakeholder Consultation Process for the NovaGerar project includes both sites, Adrianópolis and Marambaia and is being carried out by an independent organization specializing in sanitary engineering and environmental issues, Associacao Brasileira de Engenharia Sanitaria e Ambiental - ABES. The consultation process is based on meetings and interviews and will be concluded by the end of 2002.

The target groups were divided in 5 interest groups:

i. public sector representatives, including environmental agencies, municipalities, federal and state government and local universities;
ii. non-governmental organizations, including relevant local and national organizations specializing on climate change;
iii. private sector representatives (local electric power supplier and gas distributor);
iv. international climate change organization (IETA); and
v. scavengers. All scavengers, who have been working in Marambaia, were interviewed. Their socioeconomic situation was analysed with the intention to reintegrate them into the landfill operations.

In a public hearing, where the local association of the scavengers, a representative of the municipality, SA Paulista and ABES participated, the project was explained, labor rights outlined and discussed how scavengers could be legally absorbed by the concessionaire. By today, already 10 former scavengers have been legally contracted for the construction site by SA Paulista. Other interest groups have been contacted personally or by mail, where the project has been outlined and the risks and benefits explained. They have been asked for their comments or no objection regarding the technical, environmental and social issues. Up to present date, all organizations agreed with the project concept and most of them emphasize the environmental importance of the landfill when considering the precarious waste disposal situation in Brazil and in particular the Rio de Janeiro metropolitan area. Most interesting is that 50% of all contacted stakeholders recognize the project's contribution to the mitigation of the global warming impacts.

The report was concluded by the end of 2002 and made available to the public. The project sponsor announced where it could be accessed. In any case, it was available at the project sponsor's web site as well as on the site of the WB/carbon finance.

E.2. Summary of comments received

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Up to present date, all organizations have agreed with the project concept and most of them emphasized the environmental importance of the landfill when considering the precarious waste disposal situation in Brazil and in particular the Rio de Janeiro metropolitan area. Most interesting is that 50% of all contacted stakeholders recognize the project's contribution to the mitigation of the global warming impacts.

E.3. Consideration of comments received

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All comments received in the context of the environmental licensing and Operation permit process have been incorporated into the executive project. The documentation is available to the public on request. In a public hearing, where the local association of the scavengers, a representative of the municipality, SA Paulista and ABES participated, the project was explained, labour rights outlined and discussed how scavengers could be legally absorbed by the concessionaire. By today, already 10 former scavengers have been legally contracted for the construction site by SA Paulista.

The report was concluded by the end of 2002 and made available to the public. The project sponsor announced where it could be accessed. In any case, it was available at the project sponsor's web site as well as on the site of the WB/carbon finance.

SECTION F. Approval and authorization

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The letters of approval from Parties for the project activity were available at the time of submitting the PDD to the DOE for validation.

Appendix 1. Contact information of project participants

Organization name	Haztec Tecnologia e Planejamento Ambiental S.A.
Country	Brazil
Address	Rua Joaquim Palhares, 40 | 1º andar | Cidade Nova Rio de Janeiro | RJ | Cep 20260-080
Telephone	+55 (21) 3974-7722
Fax	-
E-mail	dalton.canelhas@orizonvr.com.br
Website	http://www.orizonvr.com.br
Contact person	Dalton Canelhas

Organization name	Allcot AG
Country	Switzerland
Address	Steinhauserstrasse 74 - 6300 - Zug
Telephone	+57 32 22098737
Fax	-
E-mail	all@allcot.com
Website	https://www.allcot.com/
Contact person	Alexis Leroy

Appendix 2. Affirmation regarding public funding

There is no Annex I public funding involved in the project activity.

Appendix 3. Applicability of methodologies and standardized baselines

BASELINE INFORMATION

The baseline scenario for the project activity is the uncontrolled release of landfill gas to the atmosphere and also the generation of electricity from other sources.

The table below shows the key elements used for estimate the emissions of the baseline scenario.

1. Key Parameters

Year landfilling operations started operator/historical logs	2003
Projected year for landfill closure - estimated based on current filling rate	2023
GWP for methane (UNFCCC and Kyoto Protocol decisions)	25
Methane concentration in LFG (% by volume) typical assumption for baseline scenario	50
LFG collection efficiency (%)	95
Average electricity consumption from the grid due to the project activity (MWh/year)	0
Electricity consumption from the diesel generator due to the project activity (MWh/year)	0
Combined margin emission factor for electricity displacement (tCO_2/MWh) calculated based on the Tool to calculate the emission factor for an electricity system	0.2401
Installed capacity of Power Plant (MW)	27.64
Load factor	92.00%
Operational lifetime of the project activity (years)	21
Adjustment Factor (AF)	20%

2. Waste disposal

The forecast amount of waste disposal in the landfill is presented below:

Year	Waste disposal (tonnes/yr)
2003	294,729
2004	580,695
2005	792,908
2006	565,691
2007	616,694
2008	823,198
2009	845,230
2010	932,825
2011	1,094,972
2012	748,610
2013	1,074,151
2014	1,276,403
2015	1,508,554
2016	1,429,045
2017	1,429,045

2018	1,429,045
2019	1,429,045
2020	1,429,045
2021	1,429,045
2022	1,429,045
2023	1,429,045

3. Emission factors

The table below shows the Brazilian emission factors according to determination of the Brazilian DNA. More information is available at the Brazilian DNA website[50].

Combined Margin Emission Factor (tCO_2/MWh) [8]		
3rd crediting Period		0.2401
Build Margin - 2010[1]		0.1404
Operating Margin 2018	January	0.5652
	February	0.5559
	March	0.5750
	April	0.5058
	May	0.5461
	June	0.6691
	July	0.5989
	August	0.5948
	September	0.5718
	October	0.5782
	November	0.3654
	December	0.3423
	2018	0.5390

Source: Brazilian DNA

1. According to STEP 5, option 1 of Tool

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

Not applicable

Appendix 5. Further background information on monitoring plan

The monitoring will be made as described in items B.7.1. and B.7.2.

Appendix 6. Summary report of comments received from local stakeholders

In general, the perception of the project is positive and related health benefits regarding the recovering of the landfill gas are well recognized by local stakeholders. Other concerns about the

[50] http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/arquivos/emissoes_co2/Despacho-2016.xlsx

project construction and operation are seen as solvable and not as key within their general concerns about the landfill itself.

Appendix 7. Summary of post-registration changes

A summary of the changes/updates related to PDD is presented below:

A) Post Registration changes on 20 Abr 2021 (PRC-0008-005):

1) Change to the project design regarding to electricity generation plant installed capacity increase, from 4.245 MW to 27.64 MW. Due to paragraph 241 from PS for PA´s, CERs may be claimed up to an amount calculated based on the increased installed capacity by 20 per cent of the capacity specified in the originally registered PDD (before PRC).

2) Change to project design regarding LFG collection efficiency amended from 40% to 50% (default value in accordance with ACM0001 version 19).

3) Change to project design regarding update electricity plant load factor from 91% to 92%.

4) Change to project design regarding flare type from enclosed flare to open flare, representing a decrease in the capacity of combustion efficiency and to generate CERs.

5) Change to the project design regarding inclusion of diesel generator when electricity from the grid is not available.

6) Permanent Changes in the cashflow considering amendments of key parameters:
    a. Exchange rate used for the investment analysis: 3.97 BRL/EUR;
    b. Total installed capacity: 16,93 MW, being that:
        i. 2019: 12 units X 1.411 MW, total 16.93 MW
    c. Energy price: from 48.00 R$/MWh to 170.00 R$/MWh
    d. Generation of electricity amended in:
        i. 2019: 111,751 MWh
        ii. 2020-2024: 148,324 MWh
        iii. 2025 (1st semester, up to 30/06/2025): 74,162 MWh
    e. O&M LFG costs amended will be:
        i. In 2019: R$ 2,373,215.92
        ii. From 2020 to 2024: R$ 3,149,904.77 per year
        iii. In 2025: R$ 1,574,952.38
    f. O&M electricity costs amended will be:
        i. 300,000 R$/year (fixed) and 100 R$/MWh.
    g. Investment on Electricity generation plant will be in:
        i. Year 2019: R$ 29,219,200.00
    h. Amendment in cash flow:
        i. Sheet “Schedule Engines”
        ii. Sheet “Summary - Cash Flow”
    i. Period of cash flow was extended from 2004-2023 to 2004-2025 in order to cover the whole 3rd Crediting Period. Moreover, this approach is more conservative since includes more revenues without adding any Capex.

B) Post Registration Changes from previous registered PDD (PRC):

According to Project Participant and definition of changes in CDM project standard for project activities, version 03.0:

1st PRC: "(c) Changes to the monitoring of a registered CDM project activity that have no material impact on the applicability of the applied methodologies or the other applied methodological regulatory documents, or the accuracy and completeness of the monitoring;"

- Inclusion of Option C from Methodological tool: Tool to determine the mass flow of a greenhouse gas in a gaseous stream, since gas volume flow in wet basis and gas volumetric fraction in wet basis situation can exist in the project activity. As a consequence of the Option C inclusion, fixed parameters P_n (Total pressure at normal conditions) and T_n (Temperature at normal conditions) were included.

2nd PRC: "(a) Any corrections to project information 1 of a registered clean development mechanism (CDM) project activity that do not affect the design of the project activity."

- Regarding Section A.4. Project Participant ALLCOT AG (Party involved Switzerland), at the time of renewal of crediting period, filed "Indicate if the Party involved wishes to be considered as project participant (Yes/No)" was mistakenly considered as Yes, but in fact Party Switzerland does not wishes to be considered as Project Participant. Thus, field "Indicate if the Party involved wishes to be considered as project participant" has been corrected as "No".

- Due to the complexity of the recent crediting period renewal and PRC-0008-005 processes, the project participant by mistake did not updated parameter below, according to the project operational reality:

  - The waste composition was corrected according to the data monitored by the project proponent available at the time of crediting period renewal and validation of the Project Activity but by mistake not considered in the PDD at that time.

  No significant difference can be observed with respect to the information provided in the last registered version of the PDD, but emission reductions were revised accordingly.

3rd PRC: "(d) Changes to the project design of a registered CDM project activity that do not adversely impact any of the following:
(i) The applicability and application of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents with which the project activity has been registered;
(ii) The additionality of the project activity;
(iii) The scale of the project activity."

- LFG collection efficiency has changed from 50% (according to Data / Parameter table 6 from ACM0001 version 19.0, default value) to 95% (according to project's technical specifications[51]). This change does not adversely impact the electricity generation that was estimated prior to the PRC and therefore the additionality by that fact that electricity generation was stated in the previously approved additionality financial analysis[52], under tab "Schedule Engines", cells I19 to I25, according to the calculation below:

Ex-ante yearly electricity generation (MWh)	=	Sum of the installed capacity of electricity	x	number of hours in a day (h)	x	number of days in the year (days)	x	Plant Load

[51] Technical specification Report carried out by Biotecnogás, company currently responsible for project LFG collection system continuous management. The study considered future technical plans aspects to the improvement of the collection system.

[52] Appendix 5 - Updated NovaGerar Cash Flow 2004 v2 2020 10 12 FES Rev 3.xls

generation plant (MW)	Factor (100%)[53]

Thus, it is demonstrated that collection efficiency does not impact electricity generation that was estimated prior to the PRC and therefore the additionality.

The financial analysis of the present PDD was updated by changing only the Plant Load Factor from 92% to 100%, the maximum possible valuer in order to conservatively demonstrate additionality.

These revisions neither influences the applicability of the methodology nor the additionality and scale of the project, as determined in the provisions of the applicable paragraph of the Project Standard.

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Document information

Version	*Date*	*Description*
12.0	8 October 2021	Revision to: Improve consistency with version 03.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN).
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
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.
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).

[53] Appropriate value calculated based on data provided by the electricity plant owner, where:

Load Factor (%) = Electricity generated in the plant (MWh) / Installed capacity (MW) / 8760

Version	*Date*	*Description*
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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