Gold Standard for the Global Goals

TEMPLATE

KEY PROJECT INFORMATION & PROJECT DESIGN DOCUMENT (PDD)

PUBLICATION DATE **29.06.2023**

VERSION **v.1.5**

RELATED SUPPORT

- TEMPLATE GUIDE Key Project Information & Project Design Document

This document contains the following Sections

KEY PROJECT INFORMATION

GS ID of Project	11728
Title of Project	Manaus Landfill Gas Project
Time of First Submission Date	12/09/2022[1]
Date of Design Certification	07/06/2023[2]
Version number of the PDD	14
Completion date of version	10/03/2024
Project Developer	Conestoga-Rovers Engenharia Ltda
Project Representative	João Sprovieri (BENG)
Project Participants and any communities involved	Conestoga-Rovers Engenharia Ltda
Host Country (ies)	Brazil
Activity Requirements applied	☐ Community Service Activity ☒ Renewable Energy ☐ Land-Use and Forests Activity Requirements/Risks & Capacities ☐ N/A
Scale of the project activity	☐ Micro scale ☐ Small Scale ☒ Large Scale
Other Requirements applied	N/A
Methodology (ies) applied and version number	ACM0001: Flaring or use of landfill gas (version 19.0)
Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A
Project Cycle:	☐ Regular

[1] This is the date project documentation was first submitted for preliminary review. For retroactive projects, this must take place within 1 year of the project start date (5 years for LUF projects)
[2] The date of Design Certification is the last day of the 4week Design Review period, even if the design review is concluded after this date.

☒ Retroactive

Land-use & Forest Key Project Information[3]

Not applicable

Table 1 – Estimated Sustainable Development Contributions

Sustainable Development Goals Targeted	SDG Impact (defined in B.6.)	Estimated Annual Average	Units or Products
13 Climate Action (mandatory)	Yearly emission reductions	474,911 tCO2e/year	
5 Gender Equality	Quantity of women in managerial positions	At least one woman in leadership and decision-making positions by showing signed company functional organizational chart in the determined year.	
7 Affordable and clean energy	Amount of electricity generated using LFG by the project activity in year y	Yearly estimated 56,807 MWh of electricity generation	
8 Decent Work and Economic Growth	Total jobs generated as a result of the project.	At least one onsite employee in the determined year.	

SECTION A. DESCRIPTION OF PROJECT

A.1 Purpose and general description of project

>>

The Manaus Landfill Gas Project has been developed at the Manaus Landfill (Site), originally called the Aterro Municipal de Manaus. The Site has received non-hazardous solid municipal, industrial, commercial, institutional, and some agricultural wastes for approximately 38 years. Landfills normally emit carbon dioxide (CO_2) and methane (CH_4) into the atmosphere, with these compounds being generated by the anaerobic

[3] Please refer to 0 for detailed information on LUF projects

decomposition of the above-noted wastes placed at the project site. Prior to the implementation of the Project, the Manaus landfill was basically a landfill with minimal control of surface water and leachate and no control of landfill gas (LFG). The lifetime of the project activity is expected to be 25 years based on technical study[4].

The Site is situated in the city of Manaus, the capital of the vast state of Amazonas, located in the northwestern Brazil, and is a major departure point for the surrounding Amazon Rainforest. Just east of the city, the Negro River converges with the Solimões, tributaries form the Amazon River, the longest and biggest (in terms of volume) river in the world.

Despite its natural riches, the state of Amazonas has serious poverty problems, revealing one of the worst social indices and the highest rates of violence. Around 45% of its population lives in poverty (US$5,50/day) and around 14% in extreme poverty (US$1.90/day) – Manaus stands in the first position in terms of the poverty index in Brazil. The state of Amazonas has the third highest informal employment rate of Brazil - meaning unregistered workers with no labor rights or benefits, often working in precarious and dangerous conditions - representing around 57% of the occupied population.

The purpose of the project activity is to collect landfill gas (LFG) at the Manaus Landfill and to combust the extracted LFG over a seven year-period, using a high efficient enclosed flare, thereby generating electricity and reducing greenhouse gas emissions (GHG). During the third crediting period, the project is expected to reduce 474,911 tCO_2e/year and 1,424,733 tCO_2e during the whole period (3 years).

The project involved the construction of a LFG collection system consisting of horizontal trenches and vertical LFG extraction wells, centrifugal blower(s), and all other

[4] Based on Article from VOL. 39, NO. 19, 2005 / ENVIRONMENTAL SCIENCE & TECHNOLOGY "Landfill-Gas-to-Energy Projects: Analysis of Net Private and Social Benefits", Department of Civil and Environmental Engineering. Carnegie Mellon University. Evidence sent to DOE

supporting mechanical and electrical subsystems and appurtenances necessary to collect the LFG.

The LFG collected from the site is combusted in an enclosed LFG flare with full process controls and instrumentation installed and operating. The state-of-the-art flare is capable of providing sufficient temperature and retention time of the extracted LFG for complete destruction of hydrocarbons.

Conestoga-Rovers & Associates (CRA), former name of Conestoga-Rovers Engenharia Ltda (CRE), started design activities in late 2005 and construction works started in October 2008. The project was ready for commissioning in July 2009. According to the completeness check, the official registration date was on July 8th, 2011.

A.1.1. Eligibility of the project under Gold Standard

>>

The project meets the eligibility criteria as per section 3.1.1 of GS4GG Principles & Requirements, as follows:

(a) *Types of project*: This activity is eligible for Gold Standard and is consistent with Renewable Energy Activity (REA) projects requirements. According to RENEWABLE ENERGY ACTIVITY REQUIREMENTS:
3. Project activity using Biogas (landfill gas and biogas from agro-processing, wastewater and other residues):
3.1.1 Methane recovery project activities shall be eligible for emission reductions from both methane avoidance (including from the flared biogas fraction) and non-renewable fuel substitution as long as evidence is provided on time for validation to demonstrate that the system was designed in a way to at least make use of some of the biogas recovered for the delivery of energy services (e.g. electricity, heat).

The proposed project consists of capturing the biogas generated by the landfill for subsequent use or flaring.

(b) *Location of Project*: the proposed project activity is located in the North region of Brazil.

(c) *Project area, boundary and scale*: The description of the project area, boundary and its scale are detailed in the next sections. Specific requirements related to CSA projects are discussed below in this section.

(d) *Host country requirements*: The project complies with all local regulation. All the necessary permits to operate were issued by the local authority.

(e) *Contact details*: Contact details are provided in Appendix 2 of this document. Legal aspects related to the project and/or its products and resources are discussed in the next section.

(f) *Legal ownership*: Please refer to section A.1.2 for details.

(g) *Other rights*: Please refer to section A.1.2 for details.

(h) *ODA assistance*: The project does not benefit from any fund deriving from an ODA assistance.

The project participants clarifies that: *(i)* the project is only registered within the CDM under the UNFCCC and participants are aware of all GS rules established aiming at preventing double counting; *(ii)* Brazil has not implemented any cap and trade system to date; *(iii)* the project area does not overlaps with any other emission reduction project activity; and, (iv) the project has all the necessary permits to operate, including, but not limited to, environmental permit and DNA authorization.

A.1.2. Legal ownership of products generated by the project and legal rights to alter use of resources required to service the project

>>

The operator of the landfill is Tumpex - Empresa Amazonense de Coleta de Lixo Ltda. This company has managed and operated the landfill since 1989. However, everything that concerns the landfill biogas is the responsibility of Conestoga-Rovers Engenharia Ltda., as established in the contract between Tumpex - Empresa Amazonense de Coleta de Lixo Ltda. and Conestoga-Rovers Engenharia Ltda., signed on November 21, 2005. Besides, there is a protocol of intentions between Conestoga-Rovers Engenharia Ltda., Tumpex - Empresa Amazonense de Coleta de Lixo Ltda., signed on July 25th, 2008. This protocol establishes the partnership between the companies to implement the necessary actions for the capture and burning of the gas at the Manaus Landfill with the objective of selling the carbon credits generated by the project in the international market.

A.2 Location of project

>>

The project activity takes places in Manaus Landfill, located in the city of Manaus, capital of Amazonas state, at the geographical coordinates 2º57'29.92''S and 60º00'54.74''W. The project site is located at Km 19 of Highway AM-010. The Manaus Landfill covers 60 hectares (ha) area and the current waste filling area has 41 ha, with available space for continued filling.

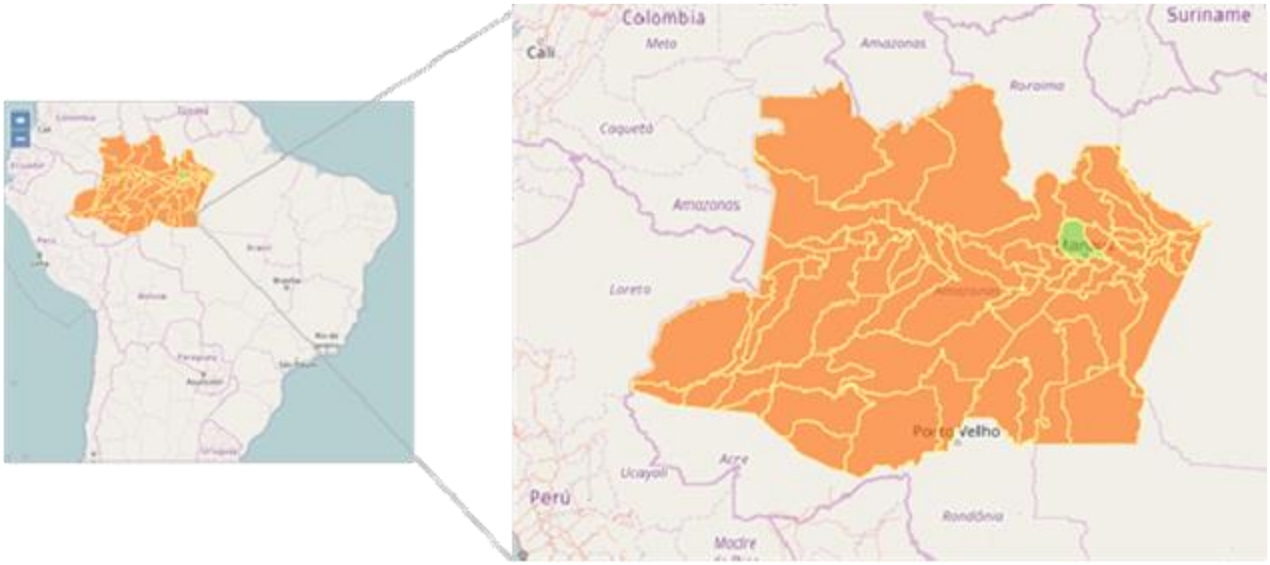


Figure 1 – Geographical position of Manaus city, Brazil.

Source: IBGE, Cid@des[1].

Figure 2 – Aerial view of Manaus Landfill.

A.3 Technologies and/or measures

>>

The Manaus Landfill Gas Project has been developed at the Manaus Landfill (Site), originally called the Aterro Municipal de Manaus. The Site has received non-hazardous solid municipal, industrial, commercial, institutional, and some agricultural wastes for approximately 38 years. Landfills normally emit carbon dioxide (CO_2) and methane (CH_4) into the atmosphere, with these compounds being generated by the anaerobic decomposition of the above-noted wastes placed at the project site. Prior to the implementation of the Project, the Manaus landfill was basically a landfill with has minimal control of surface water and leachate and no control of landfill gas (LFG).

The purpose of the project activity is to collect landfill gas (LFG) at the Manaus Landfill and to combust the extracted LFG over a seven year-period, using a high efficient enclosed flare, thereby generating electricity and reducing greenhouse gas emissions (GHG).

The project involved the construction of a LFG collection system consisting of horizontal trenches and vertical LFG extraction wells, centrifugal blower(s), and all other supporting mechanical and electrical subsystems and appurtenances necessary to collect the LFG.

The LFG collected from the site is combusted in an enclosed LFG flare with full process controls and instrumentation installed and operating. The state-of-the-art flare is capable of providing sufficient temperature and retention time of the extracted LFG for complete destruction of hydrocarbons.

Conestoga-Rovers & Associates (CRA), company name before current Conestoga-Rovers Engenharia Ltda (CRE), started design activities in late 2005 and construction works started in October 2008.

The project was ready for commissioning in July 2009. Accordingly, to the completeness check, the official registration date was on July 8th, 2011.

As there is no legal requirement to capture LFG in landfill sites in Brazil, the baseline scenario is LFG release to the atmosphere. This is also the scenario prior to the project implementation. Therefore, the Project Participants need some incentive to make investment in a LFG recovery and destruction system at the Manaus Landfill.

The baseline scenario is LFG release to the atmosphere and a landfill without any legal requirement to capture this LFG. This is also the scenario prior to the project

implementation. Therefore, an extra-incentive is needed for CRE to make additional investment and install an appropriate facility to properly burn the methane produced at the project site.

a) Collecting System

Following concrete examples from other LFG projects in the world, the Project involved the installation of horizontal collecting system and vertical wells to avoid the emission of methane to the atmosphere. An example of configuration used is presented in **Figure 3** below:

Figure 1 – Example of horizontal collection system (trench).

The horizontal collecting system and vertical wells were implemented due to the project activity only. Usually, the horizontal colleting systems are made of Polyvinyl Chloride (PVC) or High-Density Polyethylene (HDPE), due to the flexibility and the corrosion resistance.

The horizontal collecting system and vertical wells are connected to the transmission pipeline. This pipeline transports the LFG to the manifolds or gas regulation stations. The manifold is designed to regulate the concentration of the gas (methane, oxygen and others).

Figure 2 – Gas Regulation Station.

b) Transmission Pipeline

The transmission pipeline is the last step of the collecting system. It transports the collected LFG to the flare station. The transmission pipeline might be connected to all manifolds or gas regulation stations around the landfill.

Figure 3 – Example of transmission pipelines.

The collecting pipeline and the transmission pipeline are both usually in HDPE, because this material can support high pressures and is flexible. The transmission pipeline is finally connected to the flare station. A common practice all over the world is to use HDPE, which is more flexible and more resistant to high pressure, if compared to metal or concrete equipment. The disadvantage is represented by the high cost involved.

c) Blowering System

The blowering system is responsible to give negative pressure to the landfill, blowing the gas to the pipeline. The blower dimensioning depends on the final use of the gas (flare, boiler, electricity).

In order to preserve the operation of the blowers, a dewatering system is installed to remove the condensate. This equipment is a single knock-out dewatering component.

Figure 4 – Blower system

d) Flare System

The destruction of the methane content in the LFG collected is made via enclosed flares, in order to ensure high methane destruction (minimum 98%).
Basically, the flare is constructed using refractory material, a gas inlet, dampers to control the air inlet, an ignition spark, flame viewer and points to sample collection, as presented in the pictures below:

Figure 5 – Detail of Enclosed Flare.

e) Biogas Generator (CHP300)

The biogas generator was installed at Manaus Landfill Gas Project on May 26, 2019. The generator CHP300 use biogas as fuel to generate electricity only to supply biogas plant demand.

For the correct operation of the generator, it is necessary to ensure the supply of fuel at the required flow and pressure. Biogas must be clean, free from moisture, contaminants and impurities. The composition of biogas can vary according to the production process. Differences in methane content are reflected in a fuel with greater or lesser calorific value.

Figure 8– Detail of Biogas Generator

Model	CHP300
Manufactures	CHP Brasil
Fuel	Biogas about 55 to 75% CH4 74 Nm³/h
Continuous Power	170kW

Among the parameters monitored by the control system are:

- Coolant temperature
- Lubricating oil pressure
- Inlet temperature
- Quality of the air / fuel mixture
- Overload

Figure 9– Detail of Biogas Generator

f) Power Generation

The power generation system will be comprise of around 12 engines - 1.6 MW each[5]. The electricity generated by the Project will supply Manaus Electricity Grid, which is interconnected with the National Interconnected System ("SIN" from the Portuguese *Sistema Interligado Nacional*) since July 2013[6].

This kind of technology is still not widely applied in Brazil. Very few landfills have already installed equipment for LFG collection and flaring, even more considering enclosed flares as it is the case of the project activity. Therefore, the company needed engineers and other specialists with experience in this area to advice the company while implementing the project. These professionals also received trainings for the operation and maintenance of the facilities.
Technology was manufactured abroad, and therefore, technology transfer occurred from countries with strict environmental legislative requirements and environmentally sound technologies.

A.4 Scale of the project

>>
Large-scale, using ACM0001 v19.0.

A.5 Funding sources of project

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

[5] Estimated to start on 01/06/2026. However, conditions to implement the LFG electricity generation plant may vary according to regulatory and market availability conditions. Electricity sales were not performed until the present moment (Renewal of 3rd Crediting Period) since the LFG electricity generation and exporting plant has not been implemented yet and therefore not able to export electricity to the grid.

[6] Information available in the ONS Annual Report of 2013: <http://ons.org.br/sites/multimidia/Documentos%20Compartilhados/relatorios%20anuais/2013/HTML/01-00-destaques.html>.

SECTION B. APPLICATION OF APPROVED GOLD STANDARD METHODOLOGY (IES) AND/OR DEMONSTRATION OF SDG CONTRIBUTIONS

B.1. Reference of approved methodology (ies)

>>

The project activity applies ACM0001 methodology "Flaring or use of landfill gas" (Version 19.0[7]).

ACM0001 also refers to the following methodological tools:

- TOOL02-Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)[8];
- TOOL 03-Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 03)[9];
- TOOL 04-Emissions from solid waste disposal sites (Version 08.1)[10];
- TOOL 05-Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)[11];
- TOOL 06-Project emissions from flaring (Version 04.0)[12];
- TOOL 07-Tool to calculate the emission factor for an electricity system (Version 07.0)[13]
- TOOL08- Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 03.0)[14];
- TOOL09- Determine the baseline efficiency of thermal or electric energy generation systems (Version 03.0)[15];
- TOOL10-Tool to determine the remaining lifetime of equipment (Version 01)[16];

[7] https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M
[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-v8.1.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-v4.0.pdf
[13] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
[14] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf
[15] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v3.0.pdf
[16] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

- TOOL11-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)[17];
- TOOL12-Project and leakage emissions from transportation of freight (Version 01.1.0)[18];

Since this PDD refers to the third crediting period of Manaus project, the "Tool for the demonstration and assessment of additionality" and the "Combined tool to identify the baseline scenario and demonstrate additionality" are not applicable.
The tool "Project and leakage emissions from transportation of freight" is also not applied to Manaus project, since there are no GHG emissions from transportation of freight in the project boundary.

B.2. Applicability of methodology (ies)

>>
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);

The methodology ACM0001: "Flaring or use of landfill gas" is applicable to project activities which:

"...

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

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

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

(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is

[17] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf
[18] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf

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 will be 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 partially flared in open flares and not used prior to the implementation of the project activity.

In the project activity, the LFG will be 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. A declaration letter issued by the PP has been made available to the DOE.

"...

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

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

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

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

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

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

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

This methodology is not applicable:

(e) 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;

(f) 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 released the LFG to atmosphere from the SWDS, and;
- In the project activity, the LFG is used to generate electricity which in the absence of the project activity, the electricity would be generated in the grid by a mix of sources (including fossil fuels plants which composes of Brazilian Interconnected Electrical System - SIN)

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).

The applicable scenarios are (a) and (b). Scenarios (c) and (d) are not applicable for the project activity.

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

The tool to calculate "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" 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, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer;
- 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 consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or
- 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 consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the 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.

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 enclosed and/or open 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 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.

LFG use equipment was not in operation prior to the implementation of the project activity.

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 methodological tool "Determining 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 methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" is **applicable** since demonstration of additionality using investment analysis was used at the time of the project registration.

The methodological tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" is **applicable** due to the use of fossil fuel consumption by the project activity.

B.3. Project boundary

>>

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Emissions from decomposition of waste at the SWDS site	CO_2	Yes	The major source of emissions in the baseline.
		CH_4	No	N2O emission are small compared to CH4 emissions from SWDS. This is conservative.
		N_2O	No	CO2 emissions from decomposition of organic waste are not accounted since the CO2 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	There is no heat generation in the project activity.
		CH4	No	There is no heat generation in the project activity.
		N2O	No	There is no heat generation in the project activity.
	Emissions from the use of natural gas	CO2	No	There is no use of natural gas in the project activity.
		CH4	No	There is no use of natural gas in the project activity.
		N2O	No	There is no use of natural gas in the project activity.
Project scenario	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	Yes	May be an important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from electricity	CO_2	Yes	May be an important emission source.

consumption due to the project activity	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	There is no distribution of LFG using trucks in the project activity
	CH_4	No	There is no distribution of LFG using trucks in the project activity
	N_2O	No	There is no distribution of LFG using trucks in the project activity

According to the ACM0001 methodology, the project boundary includes the site where the LFG is captured (Manaus Landfill) and:

a) Sites where the LFG is flared or used (e.g. flare, power plant, boiler, air heater, glass melting furnace, kiln or natural gas distribution network or biogas processing facility);
In the case of the proposed CDM Project Activity, the site where the LFG is flared/used consists of the collection system, biogas upgrading facility, gas station facilities (including flaring).

b) Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity to the project baseline that is displaced by electricity generated by captured LFG in the project activity;
All the power generation sources connected to the Brazilian National Grid are included in the project boundary once electricity from the grid will be consumed by the LFG plant. On May 26th, 2008, the Brazilian Designated Authority published Resolution #817 defining the Brazilian Interconnected Grid as a single system covering all five geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence, this is the configuration of the national grid that is to be considered.

The figure below is a simplified representation of the project boundary:

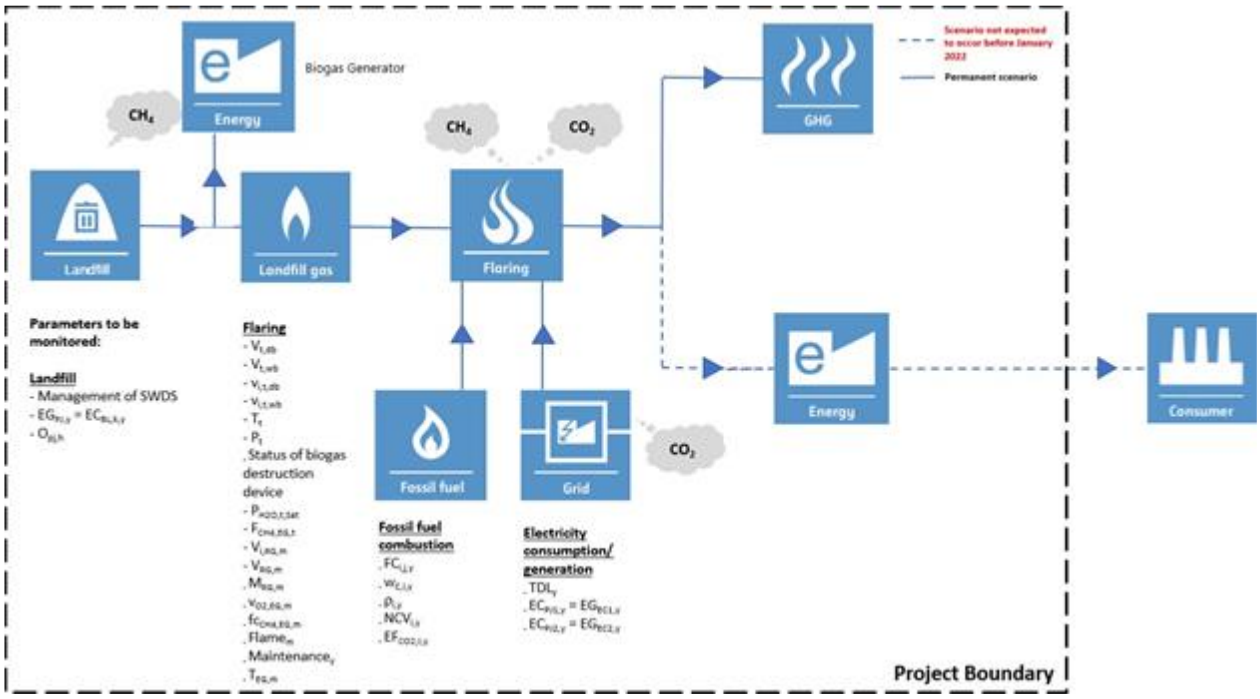


Figure 10 – Simplified diagram of the Project Boundary[19]

As the installed biogas generator has very low capacity, the PP decided not to monitor it, since the cost of monitoring would be greater than the savings on the electricity bill.[20]

B.4. Establishment and description of baseline scenario

>>

Since the project installed capacity is higher than 10MW, it shall apply "Combined tool to identify the baseline scenario and demonstrate additionality", while defining baseline scenarios for LFG, electricity and heat. In the case of the project activity, the following baseline scenarios apply:

> LFG2: Atmospheric release of the LFG or capture of LFG in an managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

[19] Some of the icons used to illustrate the project boundary were adapted from the CDM Methodology Booklet available at: http://cdm.unfccc.int/methodologies/documentation/meth_booklet.pdf.

[20] costs of purchasing monitoring, calibration and maintenance equipment.

E3: Electricity generation in existing and/or new grid-connected power plants. No heat generation is involved in the project activity.

According to the CDM Project Standard for Project Activities:

To demonstrate the validity of the original baseline or its update, project participants are not required to re-assess the baseline scenario. Instead, project participants shall assess the GHG emission reductions that would have resulted from that scenario.

The project participants shall assess and incorporate the impact of national and/or sectoral policies and circumstances, existing at the time of requesting the renewal of the crediting period, on the current baseline GHG emissions, without reassessing the baseline scenario".

According to the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period", the following steps were taken:

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

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

In Brazil, there are no policies regarding mandatory LFG capture or destruction requirements neither local environmental regulations nor policies which promote the productive use of LFG.

In the beginning of 2010, the Política Nacional de Resíduos Sólidos (National Solid Waste Policy), under discussion since 2000, was approved. One of the scopes of this policy is to enforce the adequate environmental final destination of the solid waste. However, the Policy does not foresee either the obligation of landfill gas destruction or the promotion of the landfill gas use such as those for the production of renewable energy and processing of organic waste[21].

Concerning energetic use of the landfill gas, the PROINFA – Programa de Incentivo a Fontes Alternativas was created in 2002, in order to incentive the use of renewable sources to generate electricity. The goal of the program was to generate 3,300 MW of renewable energy, divided in three groups: wind-energy (1,100 MW), small-hydro power plants (1,100 MW) and biomass (1,100 MW, including bagasse, wood, solid

[21] LEI 12305/2010 – National Solid Waste Policy . Available at: < https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm. >

waste, rice husk, etc.). Despite of achieving the goals, no landfill-gas-to-energy project was implemented. The calls for PROINFA were closed in 2003, before the beginning of the Manaus Landfill Project Activity's operation and investment decision.

The following table presents an analysis of the compliance of the alternatives listed previously with the local/national regulation.

Alternative	Compliance with Local / National Policies	Observations
LFG1: Project Activity undertaken without being registered as a CDM Project Activity	Yes	-
LFG2: Continuation of the landfill operation and LFG atmospheric release (Business as Usual – BAU scenario) or partial LFG capture and destruction trough flaring to comply with regulations or contractual requirements, or to address safety and odour concerns, or for other reasons.	Yes	As stated before, there is no current law or contractual requirements to capture/destroy/use the LFG nor enforcing the supply of natural gas

The delineation considered for the project is Manaus Electricity Grid, which is interconnected with the National Interconnected System ("SIN" from the Portuguese Sistema Interligado Nacional) since July 2013[22]. In this third crediting period, the delineation for CO2 emission factor calculation purposes is SIN following the Brazilian DNA delineation.

Therefore, the current baseline complies with national and sectoral policies which have come into effect after the submission of the project for registration and are applicable at the time of requesting renewal of the crediting period. The current baseline complies all requirements from:

[22] It is important to highlight that Manaus Electricity Grid was already interconnected with the National Interconnected System by the time it has renewed its 2nd Crediting Period. Thus, no changes has been identified in the national grid between the 2nd and the 3rd Crediting Periods.

- The National Electric System Operator ("ONS" from the Portuguese Operador Nacional do Sistema Elétrico);
- The Electricity Regulatory Agency ("ANEEL" from the Portuguese Agência Nacional de Energia Elétrica);
- The Mines and Energy Ministry ("MME" from the Portuguese Ministério de Minas e Energia);
- The Chamber of Electrical Energy Commercialization ("CCEE" from the Portuguese
- Câmara de Comercialização de Energia Elétrica);
- The Amazonas Environmental Agency ("IPAAM" from the Portuguese Instituto de Proteção Ambiental do Estado do Amazonas);
- The CDM Executive Board.

Since circumstances related to the calculation of the emission factor of the grid have changed, information related to baseline emission factor calculation was reviewed in this third crediting period (see sections B.6.1 and B.6.3).

Step 1.2: Assess the impact of circumstances

As mentioned above, the applied values for CO2 emission factor of the grid have slightly changed and, therefore, it was reviewed in this PDD. The operating, build and combined margin CO2 emission factor of the grid for the second crediting periods is presented below:

Estimated Operating, Build and Combined CO2 emission factor of Manaus project during the first crediting period.

Crediting period	$EF_{OM,y}$ (tCO_2/MWh)	$EF_{BM,y}$ (tCO_2/MWh)	$EF_{CM,y}$ (tCO_2/MWh)
Second	0.4979	0.1581	0.2430

Source: Registered PDD

The CO2 EF of the grid reflects the GHG emissions of existing and the prospective power plants connected to the electricity system. In the case of Brazil, it possesses a large share of hydroelectricity and, for this reason, it presents a low CO2 emission factor of the grid when comparing to other countries. However, during the years when an atypical short rainy season is observed, the generation of electricity by the thermal power plants fueled with fossil fuels rises.

While analyzing methods and source of data, there are no difference between crediting periods in respect to the CO2 EF calculation is the delineation of the grid. At the time of the renewal of the 3rd crediting period, the Brazilian DNA made public available data EFOM,y and EFBM,y parameters – used to calculate the EFCM,y. Therefore, delineation and data from the Brazilian DNA were used for Manaus project.

Furthermore, the weights established in the CO2 EF tool also remined unchanged for the 3rd Crediting Period. Detailed description of methods applied for the calculation of emission reductions are presented in sections B.6.1 and B.6.3.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) is technically possible

Not applicable since Project Activity was a greenfield project and investments were made to make possible its implementation and operation.

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

Considering the applied methodology at the project activity registration ACM0001 version 18 has changed to consolidated methodology ACM0001 version 19 and all related applicable tools some ex-ante parameters published by IPCC have been updated accordingly.

According to the methodological tool "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. More details for the updated baseline emissions for the third crediting period can be seen in section B.6.

Step 2.2: Update the data and parameters

All parameters regarding the baseline emissions calculation have been updated for the 3rd crediting period. Further information can be seen in section B.6.

B.5. Demonstration of additionality

The demonstration of additionality is not applicable for the renewal of the crediting period of a registered CDM project activity. The whole assessment and demonstration of additionality for the given registered CDM project activity is included in the latest version of the PDD valid for the 1st 7- year renewable crediting period.

The following table shows the timeline of the Project showing that the CDM benefits were taken into account when deciding to implement it.

Implementation timeline of the Project

Key Events	Date
PDD submitted to SGS for validation	2 December 2005
PDD in Global Stakeholder Consultation (GSC) for the first time	07 December 2005 to 06 January 2006
PDD public comments availability closes	6 January 2006
SGS issues validation report	29 May 2006
Host country approval submitted	2 June 2006
CRA signed a contract (including CDM consideration) with Tumpex (landfill operator), Manaus City Hall and Enterpa to develop the proposed project (starting date of the project activity).	25 July 2008
Construction works started	October 2008
CRA notifies SGS of revised PDD submittal for new validation	5 November 2008
CRA develops revised PDD and submits to SGS for validation	4 December 2008
PDD in GSC for the second time	21 January 2009 to 19 February 2009
PDD public comments availability closes	19 February 2009
PDD in GSC for the third time	26 May 2010 to 24 June 2010

As can be seen from the Table above, several actions were taken at an early stage, indicating that consideration of applying for CDM was taken seriously well before the final investment decision was made.

The additionality of the project activity will be demonstrated and assessed using the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity

The identified alternatives for the disposal of the waste in the absence of the project activity include:

LFG1 – The project activity (capture of landfill gas and power generation) undertaken without being registered as a CDM project activity;

LFG2 – Atmospheric release of the landfill gas;

For power generation, the realistic and credible alternatives include

- P1 – Power generated from landfill gas undertaken without being registered as CDM project activity;
- P6 – Existing and/or new grid-connected power plants;

The only remaining real alternatives to the project activity are LFG1, LFG2, P1 and P6.

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

Sub-step 1b. Consistency with mandatory laws and regulations:

In Brazil, there is no regulation or policy that obliges the landfill operator to burn the LFG generated in the landfill. In documents below, there is no regulation or obligation about burning LFG in landfill. Following below the source of this statement:

Documents	Elaborated by	Reference
Solid Waste Integrated Management	Ministry of Environment and Ministry of Cities	http://www.ibam.org.br/publique/media/01-girs.pdf
SNIS	Ministry of Cities	SNIS: Secretaria Nacional de Informações sobre Saneamento Sistema Nacional de Informações sobre Saneamento: diagnóstico do manejo de resíduos sólidos urbanos, page II.281 http://www.pmss.gov.br/snis/PaginaCarrega.php?EWRErterterTERTer=80

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

Step2. Investment analysis

Sub-step2a. Determine appropriate analysis method

As the proposed project activity will generate financial benefits other than CDM related income, the Option III is chosen.

Sub-step2b. – Option III. Apply benchmark analysis

For the purpose of assessing the financial/economic attractiveness, the most appropriate financial indicator for the decision context is the Internal Rate of Return (IRR).

The benchmark parameter used for this comparison was the government bond rates increased by a suitable risk premium, calculated as follows:

Benchmark calculation method

Benchmark real terms	
A	Brazilian Government Bond Rate NTN-B, maturity 2024 (maturity similar to the project lifetime, real terms)
B	Market Risk Premium (S&P 500 - T-Bonds)
C	Unlevered Beta (in lack of open companies with the same risk profile)
D = A + B x C	Benchmark - Real Terms

The government bond rate chosen in the Brazilian Bond NTN-B 15082024, with a similar tenor of the project activity. The yield is based on the inflation rate (IPCA - Indice Nacional de Preços ao Consumidor Amplo) increased by a fixed rate at the moment of the acquisition[23]. The fixed rate used for the benchmark calculation was based on 3 years prior to the project investment decision (i.e. 2005, 2006 and 2007[24]), resulting in 7.9%. The inflation rate was not considered in this analysis, as the investment analysis is done in real terms.

In order to calculate this spread, the project participants used the risk premium calculated by the average historical difference between the US T-bonds and the S&P 500. This would result in a Market risk premium of 6.42%.[25]

To estimate the risk in investing in a power generation project, the project participants should consider also the beta of companies with the same risk profile (such as public held companies with the same portfolio). However, there is no other company with a comparable portfolio to CRE listed in a stock exchange. Therefore, the project proponents considered the beta of all utilities (0.63).[26] This approach is

[23] http://www.tesouro.fazenda.gov.br/tesouro_direto/consulta_titulos/consultatitulos.asp
[24] http://www.tesouro.fazenda.gov.br/tesouro_direto/historico.asp
[25] http://www.stern.nyu.edu/~adamodar/pc/datasets/histretSP.xls
[26] http://www.stern.nyu.edu/~adamodar/pc/archives/betas07.xls

deemed conservative as most of those companies operates with widely known technologies, less risky than LFG to energy projects. With these input data, the benchmark calculated follows:

Benchmark value

Benchmark real terms		
A	Brazilian Government Bond Rate NTN-B, maturity 2024 (maturity similar to the project lifetime, real terms)	7.90%
B	Market Risk Premium (S&P 500 - T-Bonds)	6.42%
C	Unlevered Beta (in lack of open companies with the same risk profile)	0.63
D = A + B x C	Benchmark - Real Terms[7]	11.94%

[27]

Sub-step 2c. Calculation and comparison of financial indicators

The following assumptions were taken for the purpose of the calculation of the financial indicator:

Main assumptions

[27] It was not considered the currency risk. Consequently, this benchmark calculation is deemed conservative

	Parameter	Value	Unit	Reference
Assumptions	Asset's Life time	25	Years	Tool to determine the remaining lifetime of equipment (EB 50 - Annex 15, page 4)
	Installed capacity for each engine	1.6	MW	gas engine technical data.pdf
	Total installed capacity	19.2	MW	-
	Load factor	99.06%	%	Parasitic Losses and Load Factor april 08.pdf
	Exchange Rate	1.57	R$/US$	"Banco Central do Brasil" on 25/07/2008 (http://www4.bcb.gov.br/?TXCONVERSAO)
	Electricity price	156.78	R$/MWh	notatcnicamanaus276_31_08.pdf, page 8, table III-A, Breitener (Jaraqui).
	Price per MW installed	2,637,433.98	US$/MWinstalled	LFG Utilization System.pdf
	Power plant operation cost	26.36	US$/MWh	Agreement and Proposal for operation and maintenance services.pdf
	Tax (PIS)	1.65%	%	Contribution to the Social Integration Program and Civil Service Asset Formation Program – PIS/PASEP (http://www.receita.fazenda.gov.br/principal/Ingles/SistemaTributarioBR/Taxes.htm)
	Tax (Confins)	7.60%	%	COFINS - Contribution to Social Security Financing (http://www.receita.fazenda.gov.br/principal/Ingles/SistemaTributarioBR/Taxes.htm)
	Tax (IRPJ)	15%	%	Art. 541. (http://www.receita.fazenda.gov.br/Legislacao/rir/L2Parte3.htm)
	Tax (IRPJ additional)	10%	%	Art. 542. (http://www.receita.fazenda.gov.br/Legislacao/rir/L2Parte3.htm)
	Tax (CSLL)	9%	%	(Social contribution on net profit) Art. 3o - II (http://www.planalto.gov.br/ccivil_03/LEIS/L7689.htm)
	Contingency	5%	%	"Landfill Full Cost Accounting Guide" (5% Contingency Factor.pdf) http://www.mfe.govt.nz/publications/waste/landfill-full-cost-accounting-guide-mar04/html/page7.html

Note: The documents above were made available to DOE in validation visit.

For the project alternative: LFG1 – The project activity (capture of landfill gas and power generation) undertaken without being registered as a CDM project activity, the estimated project cash flow is present below:

	YEAR	0	1	2	3	4	5	6
		2008	2009	2010	2011	2012	2013	2014
Electricity dispatched (MWh)			0	0	0	40,823	54,707	68,591
Electricity price (USD/MWh)			99.86	99.86	99.86	99.86	99.86	99.86
Gross Revenues			-	-	-	4,076,554	5,463,034	6,849,513
PIS/Cofins	9.25%		-	-	-	(377,081.29)	(505,330.63)	(633,579.98)
Net revenues			-	-	-	3,699,473.20	4,957,703.26	6,215,933.31
O&M		0	(1,500,610.00)	(1,500,610.00)	(1,500,610.00)	(2,653,474.78)	(3,037,763.04)	(3,422,051.30)
Variable costs			(82,883.69)	(82,883.69)	(82,883.69)			
Total Costs			(1,583,493.69)	(1,583,493.69)	(1,583,493.69)	(2,653,474.78)	(3,037,763.04)	(3,422,051.30)
Gross Margin			(1,583,493.69)	(1,583,493.69)	(1,583,493.69)	1,045,998.42	1,919,940.21	2,793,882.01
SG&A								
EBITDA			(1,583,493.69)	(1,583,493.69)	(1,583,493.69)	1,045,998.42	1,919,940.21	2,793,882.01
Depreciation			(627,056.43)	(705,255.18)	(783,453.93)	(2,726,728.10)	(3,248,015.76)	(3,769,303.42)
EBIT			(2,210,550.12)	(2,288,748.87)	(2,366,947.62)	(1,680,729.68)	(1,328,075.55)	(975,421.41)
Income Taxes (IRPJ+CSLL)	34.00%		-	-	-	-	-	-
NET EARNINGS			(2,210,550.12)	(2,288,748.87)	(2,366,947.62)	(1,680,729.68)	(1,328,075.55)	(975,421.41)
CAPEX		(6,270,564.27)	(781,988)	(781,988)	(19,432,742)	(5,212,877)	(5,212,877)	(5,212,877)
Depreciation			627,056.43	705,255.18	783,453.93	2,726,728.10	3,248,015.76	3,769,303.42
Account Receivable (35 days)			-	-	-	(390,902.49)	(573,852.56)	(656,802.64)
Account payable (30 days)			130,150.17	130,150.17	130,150.17	218,093.82	249,679.15	281,264.49
Working Capital			130,150.17	130,150.17	130,150.17	(172,808.67)	(274,173.41)	(375,538.15)
+/- Working Capital increase			130,150.17	-	-	(302,958.83)	(101,364.74)	(101,364.74)
FCF		**(6,270,564.27)**	**(2,235,331.03)**	**(2,365,481.19)**	**(21,016,235.45)**	**(4,469,837.00)**	**(3,394,301.11)**	**(2,520,359.32)**

IRR	4.29%
Benchmark	11.94%
NPV	(20,530,849.37)

7	8	9	10	11	12	13	14	15	16
2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
82,475	96,360	110,244	124,128	138,012	151,897	165,781	165,781	165,781	165,781
99.86	99.86	99.86	99.86	99.86	99.86	99.86	99.86	99.86	99.86
8,235,993	9,622,472	11,008,951	12,395,431	13,781,910	15,168,390	16,554,869	16,554,869	16,554,869	16,554,869
(761,829.32)	(890,078.67)	(1,018,328.01)	(1,146,577.36)	(1,274,826.70)	(1,403,076.04)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)
7,474,163.36	8,732,393.41	9,990,623.47	11,248,853.52	12,507,083.57	13,765,313.62	15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67
(3,806,339.56)	(4,190,627.82)	(4,574,916.08)	(4,959,204.34)	(5,343,492.60)	(5,727,780.86)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)
(3,806,339.56)	(4,190,627.82)	(4,574,916.08)	(4,959,204.34)	(5,343,492.60)	(5,727,780.86)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)
3,667,823.80	4,541,765.59	5,415,707.38	6,289,649.17	7,163,590.97	8,037,532.76	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55
3,667,823.80	4,541,765.59	5,415,707.38	6,289,649.17	7,163,590.97	8,037,532.76	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55
(4,290,591.08)	(4,811,878.74)	(5,333,166.39)	(5,854,454.05)	(5,748,685.28)	(6,191,774.19)	(6,634,863.10)	(4,769,787.68)	(4,326,698.77)	(3,883,609.86)
(622,767.28)	(270,113.15)	82,540.99	435,195.12	1,414,905.68	1,845,758.56	2,276,611.45	4,141,686.87	4,584,775.78	5,027,864.69
-	-	(28,063.94)	(147,966.34)	(481,067.93)	(627,557.91)	(774,047.89)	(1,408,173.54)	(1,558,823.77)	(1,709,473.99)
(622,767.28)	(270,113.15)	54,477.05	287,228.78	933,837.75	1,218,200.65	1,502,563.56	2,733,513.34	3,025,952.02	3,318,390.70
(5,212,877)	(5,212,877)	(5,212,877)	(5,212,877)	(5,212,877)	(5,212,877)	(781,988)	(781,988)	(781,988)	(781,988)
4,290,591.08	4,811,878.74	5,333,166.39	5,854,454.05	5,748,685.28	6,191,774.19	6,634,863.10	4,769,787.68	4,326,698.77	3,883,609.86
(789,752.72)	(922,702.80)	(1,055,652.88)	(1,188,602.96)	(1,321,553.04)	(1,454,503.12)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)
312,849.83	344,435.16	376,020.50	407,605.84	439,191.17	470,776.51	502,361.85	502,361.85	502,361.85	502,361.85
(476,902.90)	(578,267.64)	(679,632.38)	(780,997.12)	(882,361.87)	(983,726.61)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)
(101,364.74)	(101,364.74)	(101,364.74)	(101,364.74)	(101,364.74)	(101,364.74)	(101,364.74)	-	-	-
(1,646,417.53)	**(772,475.74)**	**73,402.12**	**827,441.51**	**1,368,281.71**	**2,095,733.52**	**7,254,074.41**	**6,721,313.51**	**6,570,663.28**	**6,420,013.05**

17	18	19	20	21	22	23	24	25
2025	2026	2027	2028	2029	2030	2031	2032	2033
165,781	165,781	165,781	165,781	165,781	165,781	165,781	165,781	165,781
99.86	99.86	99.86	99.86	99.86	99.86	99.86	99.86	99.86
16,554,869	16,554,869	16,554,869	16,554,869	16,554,869	16,554,869	16,554,869	16,554,869	16,554,869
(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)	(1,531,325.39)
15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67	15,023,543.67
(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)
(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)	(6,112,069.13)
8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55
8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55	8,911,474.55
(3,440,520.95)	(2,997,432.04)	(2,554,343.13)	(2,111,254.23)	(1,668,165.32)	(1,225,076.41)	(781,987.50)	(781,987.50)	(781,987.50)
5,470,953.60	5,914,042.51	6,357,131.42	6,800,220.32	7,243,309.23	7,686,398.14	8,129,487.05	8,129,487.05	8,129,487.05
(1,860,124.22)	(2,010,774.45)	(2,161,424.68)	(2,312,074.91)	(2,462,725.14)	(2,613,375.37)	(2,764,025.60)	(2,764,025.60)	(2,764,025.60)
3,610,829.37	3,903,268.05	4,195,706.73	4,488,145.41	4,780,584.09	5,073,022.77	5,365,461.45	5,365,461.45	5,365,461.45
(781,988)	(781,988)	(781,988)	(781,988)	(781,988)	(781,988)	(781,988)	(781,988)	(781,988)
3,440,520.95	2,997,432.04	2,554,343.13	2,111,254.23	1,668,165.32	1,225,076.41	781,987.50	781,987.50	781,987.50
(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)	(1,587,453.20)
502,361.85	502,361.85	502,361.85	502,361.85	502,361.85	502,361.85	502,361.85	502,361.85	502,361.85
(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)	(1,085,091.35)
-	-	-	-	-	-	-	-	1,085,091.35
6,269,362.83	**6,118,712.60**	**5,968,062.37**	**5,817,412.14**	**5,666,761.91**	**5,516,111.68**	**5,365,461.45**	**5,365,461.45**	**6,450,552.80**

The capital expenses estimated includes the power generation plant and the landfill gas extraction system. As presented above, the Project IRR is 4.29%. Consequently, this scenario is not deemed attractive by the project participants.

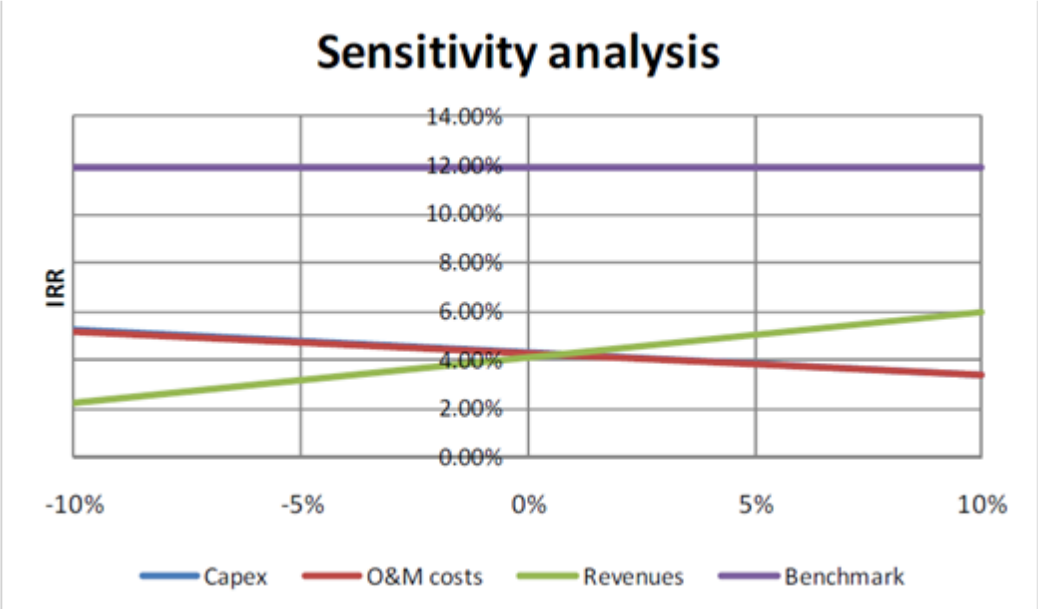
The second alternative (LFG2) is the continuation of the current practice, which is in compliance with all applicable regulations and policies, and was deemed the most plausible alternative to the project activity.

Sub-step 2d. Sensitivity analysis

The sensitivity analysis was performed varying the electricity tariff (income), the capital expenses and operational expenses. All parameters ranging from -10% to +10%, as the result presented below:

Sensitivity analysis

	Variation	IRR
CapEx	-10%	5.27%
	10%	3.38%
O&M	-10%	5.17%
	10%	3.36%
Revenues	-10%	2.28%
	10%	6.00%
Base Case	0%	4.29%



As presented above, even if the best scenario is applied, the project IRR is lower than the chosen benchmark.

To ensure the additionality of this project, the project proponents varied the three identified parameters (CapEx, O&M and Revenues) until each of them reached the benchmark. The results are presented below and the spreadsheet was provided to the audit team:

Capital Expenditures (CapEx) – To reach the benchmark, the Capital Expenditures should be reduced in 56%. This result is extremely unlikely to happen in the future, as this reduction is too large for any kind of project which has a reliable investment estimate (such as Manaus Landfill Gas Project) and as usually the CapEx increases during the project implementation.

O&M – Also, to reach the benchmark, the O&M shall be reduced in 99%. This means that PPs should receive and not pay to operate the project. Consequently, this scenario is unreal.

Revenues – this value should be increased in 55% to reach the benchmark. This means that the electricity tariff should reach BRL 243.37, deemed unrealistic as this value is far superior to the average values from the latest electricity sale auction in this subsystem.[28] Also, the second way to increase the revenue is by increasing the electricity generation. The system, as well as the number of gensets to be installed is deemed accurate by the project developers. Some adjustments might occur, but is

[28] Eletrobras Amazonas Energia (http://www.amazonasenergia.gov.br)

really not expected to have a variation of 55% in the number of gensets or in the LFG generation. Thus, the PP deemed this situation to be unlikely to happen in the future.

As could be noted, this project lacks of financial attractiveness by giving an IRR without the CER revenue below the selected benchmark.

Thus, it seems reasonable to conclude that the project activity is unlikely to be the most financially attractive scenario.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Based on the documents below:

- SNIS (2007) - Secretaria Nacional de Informações sobre Saneamento Sistema Nacional de Informações sobre Saneamento: diagnóstico do manejo de resíduos sólidos urbanos[29];
- Brazilian Greenhouse Gases Emissions Inventory Report for Waste Sector[30] and;
- Brazilian Country Profile for waste sector by Methane to Markets[31].
- Understanding methane emissions from passive systems in landfills in Brazil[32].

There are no similar activities[33] like the proposed project activity in Brazil, because all of the landfills that are developing capture and destruction of the LFG, are being developed as CDM project activities. The table below shows the landfill projects implemented or underway in Brazil.

[29] Ministry of the Cities (http://www.pmss.gov.br/snis/PaginaCarrega.php?EWRErterterTERTer=80)
[30] Ministry of Science and Technology (http://www.mct.gov.br/index.php/content/view/21465.html), page 45
[31] Methane to Markets (http://www.methanetomarkets.org/documents/landfills_cap_brazil.pdf), page 2
[32] Source: MAGALHÃES, G.HC.; ALVES, J.W.S.; SANTO FILHO. F.; COSTA, R.M.; KELSON. M. Understanding methane emissions from passive systems in landfills in Brazil. São Paulo, Brasil, 2010. Page 2. http://homologa.ambiente.sp.gov.br/biogas/docs/artigos_dissertacoes/magalhaes_alves_santofilho_costa_kelson.pdf
[33] The "Tool for the demonstration and assessment of additionality" –states: "Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis"

Project Title	Status	Source
NovaGerar Landfill Gas to Energy Project	Registered on 18/11/2004	http://cdm.unfccc.int/Projects/DB/DNV-CUK1095236970.6/view
Salvador da Bahia Landfill Gas Management Project	Registered on 15/08/2005	http://cdm.unfccc.int/Projects/DB/DNV-CUK1117823353.4/view
Onyx Landfill Gas Recovery Project – Trèmembé, Brazil	Registered on 24/11/2005	http://cdm.unfccc.int/Projects/DB/DNV-CUK1126082019.35/view
Brazil MARCA Landfill Gas to Energy Project	Registered on 23/01/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1132565688.17/view
Bandeirantes Landfill Gas to Energy Project (BLFGE)	Registered on 20/02/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1134130255.56/view
ESTRE's Paulínia Landfill Gas Project (EPLGP)	Registered on 03/03/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1134989999.25/view
Caieiras landfill gas emission reduction	Registered on 09/03/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/view
Landfill Gas to Energy Project at Lara Landfill, Mauá, Brazil	Registered on 15/05/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1138957573.9/view
São João Landfill Gas to Energy Project (SJ)	Registered on 02/07/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1145141778.29/view
Project Anaconda	Registered on 15/12/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1155134946.56/view
Central de Resíduos do Recreio Landfill Gas Project	Registered on 31/12/2006	http://cdm.unfccc.int/Projects/DB/DNV-CUK1158844635.31/view
Canabrava Landfill Gas Project	Registered on 08/04/2007	http://cdm.unfccc.int/Projects/DB/SGS-UKL1169669649.47/view
Aurá Landfill Gas Project	Registered on 30/04/2007	http://cdm.unfccc.int/Projects/DB/SGS-UKL1169639070.69/view
Quitaúna Landfill Gas Project (QLGP)	Registered on 27/05/2007	http://cdm.unfccc.int/Projects/DB/DNV-CUK1169931302.54/view
ESTRE Itapevi Landfill Gas Project (EILGP)	Registered on 17/09/2007	http://cdm.unfccc.int/Projects/DB/DNV-CUK1169886803.63/view
URBAM/ARAUNA - Landfill Gas Project (UALGP)	Registered on 14/10/2007	http://cdm.unfccc.int/Projects/DB/DNV-CUK1185017358.24/view
Embralixo/Araúna - Bragança Landfill Gas Project (EABLGP)	Registered on 15/10/2007	http://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/view
Alto-Tiete landfill gas capture project	Registered on 29/05/2008	http://cdm.unfccc.int/Projects/DB/RWTUV1204280292.23/view
Probiogas - JP-João Pessoa Landfill Gas Project	Registered on 30/01/2008	http://cdm.unfccc.int/Projects/DB/SGS-UKL1181685608.94/view
ESTRE Pedreira Landfill Gás Project (EPLGP)	Registered on 12/02/2008	http://cdm.unfccc.int/Projects/DB/DNV-CUK1179394615.79/view
SANTECH – Saneamento & Tecnologia Ambiental Ltda. – SANTEC Resíduos landfill gas emission reduction Project Activity	Registered on 19/02/2009	http://cdm.unfccc.int/Projects/DB/TUEV-SUED1214902532.06/view
Terrestre Ambiental Landfill Gás Project	Registered on 06/05/2008	http://cdm.unfccc.int/Projects/DB/DNV-CUK1179391286.32/view
CTRVV Landfill emission reduction project	Registered on 28/05/2008	http://cdm.unfccc.int/Projects/DB/SGS-UKL1198775230.25/view
Feira de Santana Landfill Gas Project	Registered on 12/08/2008	http://cdm.unfccc.int/Projects/DB/DNV-CUK1203743009.45/view
Proactiva Tijuquinhas Landfill Gas Capture and Flaring project	Registered on 13/08/2008	http://cdm.unfccc.int/Projects/DB/DNV-CUK1200058130.23/view
Natal Landfill Gas Recovery Project	Validation	http://cdm.unfccc.int/Projects/Validation/DB/K82DG9XUKVQ8IGUYJZMLMYLPQRAL1S/view.html
Projeto de Gas de Aterro TECIPAR – PROGAT	Validation	http://cdm.unfccc.int/Projects/Validation/DB/O7LXRYICDY6UWTAIEGYKIZXMEM2SMQ/view.html
Marilia/Arauna Landfill Gas Project	Validation	http://cdm.unfccc.int/Projects/Validation/DB/FQBM6GP50MLPJPM39192IFGG9T783RA/view.html
Laguna Landfill Methane Flaring	Validation	http://cdm.unfccc.int/Projects/Validation/DB/ZYNYNR7MAYN1HUBX6W98F7BWLMWOH4/view.html
Gramacho Landfill Gas Project	Validation	http://cdm.unfccc.int/Projects/Validation/DB/IOJKHC9RUXNKFXMF0G8V87YS4BV4UU/view.html
Exploitation of the biogas from Controlled Landfill in Solid Waste Management Central-CTRS/BR.040	Validation	http://cdm.unfccc.int/Projects/Validation/DB/MOYBL8JBAF6YGLLMXD0Q4FWLGPF9M7/view.html
Embralixo/Araúna - Bragança Landfill Gas Project (EABLGP)	Validation	http://cdm.unfccc.int/Projects/Validation/DB/BLH87CY04LN8PYLXEF6VS7X0PX8O60/view.html
Corpus/Araúna – Landfill Biogas Project.	Validation	http://cdm.unfccc.int/Projects/Validation/DB/XRCDRQ6VTVP6B8NFCCTH92OZI9D6B7/view.html
CGR Guatapará landfill Project	Validation	http://cdm.unfccc.int/Projects/Validation/DB/0RXYM30S4G1B0J9KBZ81WGM9CWL93L/view.html
CTR Candeias Sanitary Landfill	Validation	http://cdm.unfccc.int/Projects/Validation/DB/N6QEYV2VTTLSA6IHMB5246U3ONLXAA3/view.html

Summarizing, there are no landfill projects in Brazil burning LFG without CDM revenues.

Sub-step 4b. Discuss any similar options that are occurring:

Not applicable. There are no similar options to the proposed project activity not being developed as a CDM project activity.

Conclusion:

Since all the criteria of the "Tool for the demonstration and assessment of additionality" 5.2 are satisfied, the proposed project activity is additional.

	YEAR	0	1	2	3	4	5	6
		2008	2009	2010	2011	2012	2013	2014
Electricity dispatched (MWh)			0	0	0	40.823	54.707	68.591
Electricity price (USD/MWh)			99,86	99,86	99,86	99,86	99,86	99,86
Gross Revenues			-	-	-	4.076.554	5.463.034	6.849.513
PIS/Cofins	9,25%		-	-	-	(377.081,29)	(505.330,63)	(633.579,98)
Net revenues			-	-	-	3.699.473,20	4.957.703,26	6.215.933,31
Savings from electricity bills due to 170kWh from biogas generator								
O&M		0	(1.500.610,00)	(1.500.610,00)	(1.500.610,00)	(2.653.474,78)	(3.037.763,04)	(3.422.051,30)
Variable costs			(82.883,69)	(82.883,69)	(82.883,69)			
Total Costs			(1.583.493,69)	(1.583.493,69)	(1.583.493,69)	(2.653.474,78)	(3.037.763,04)	(3.422.051,30)
Gross Margin			(1.583.493,69)	(1.583.493,69)	(1.583.493,69)	1.045.998,42	1.919.940,21	2.793.882,01
SG&A								
EBITDA			(1.583.493,69)	(1.583.493,69)	(1.583.493,69)	1.045.998,42	1.919.940,21	2.793.882,01
Depreciation			(627.056,43)	(705.255,18)	(783.453,93)	(2.726.728,10)	(3.248.015,76)	(3.769.303,42)
EBIT			(2.210.550,12)	(2.288.748,87)	(2.366.947,62)	(1.680.729,68)	(1.328.075,55)	(975.421,41)
Income Taxes (IRPJ+CSLL)	34,00%		-	-	-	-	-	-
NET EARNINGS			(2.210.550,12)	(2.288.748,87)	(2.366.947,62)	(1.680.729,68)	(1.328.075,55)	(975.421,41)
CAPEX		(6.270.564)	(781.988)	(781.988)	(19.432.742)	(5.212.877)	(5.212.877)	(5.212.877)
Depreciation			627.056,43	705.255,18	783.453,93	2.726.728,10	3.248.015,76	3.769.303,42
Account Receivable (35 days)			-	-	-	(390.902,49)	(523.852,56)	(656.802,64)
Account payable (30 days)			130.150,17	130.150,17	130.150,17	218.093,82	249.679,15	281.264,49
Working Capital			130.150,17	130.150,17	130.150,17	(172.808,67)	(274.173,41)	(375.538,15)
+/- Working Capital increase			130.150,17	-	-	(302.958,83)	(101.364,74)	(101.364,74)
FCF		**(6.270.564,27)**	**(2.235.331,03)**	**(2.365.481,19)**	**(21.016.235,45)**	**(4.469.837,00)**	**(3.394.301,11)**	**(2.520.359,32)**

IRR	4,37%
Benchmark	11,94%
NPV	(20.386.219,64)

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
82.475	96.360	110.244	124.128	138.012	151.897	165.781	165.781	165.781	165.781
99,86	99,86	99,86	99,86	99,86	99,86	99,86	99,86	99,86	99,86
8.235.993	9.622.472	11.008.951	12.395.431	13.781.910	15.168.390	16.554.869	16.554.869	16.554.869	16.554.869
(761.829,32)	(890.078,67)	(1.018.328,01)	(1.146.577,36)	(1.274.826,70)	(1.403.076,04)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)
7.474.163,36	8.732.393,41	9.990.623,47	11.248.853,52	12.507.083,57	13.765.313,62	15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67
				64.801,07	105.722,33	105.722,33	105.722,33	105.722,33	105.722,33
(3.806.339,56)	(4.190.627,82)	(4.574.916,08)	(4.959.204,34)	(5.343.492,60)	(5.727.780,86)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)
(3.806.339,56)	(4.190.627,82)	(4.574.916,08)	(4.959.204,34)	(5.278.691,53)	(5.622.058,53)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)
3.667.823,80	4.541.765,59	5.415.707,38	6.289.649,17	7.228.392,04	8.143.255,09	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88
3.667.823,80	4.541.765,59	5.415.707,38	6.289.649,17	7.228.392,04	8.143.255,09	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88
(4.290.591,08)	(4.811.878,74)	(5.333.166,39)	(5.854.454,05)	(5.748.685,28)	(6.191.774,19)	(6.634.863,10)	(4.769.787,68)	(4.326.698,77)	(3.883.609,86)
(622.767,28)	(270.113,15)	82.540,99	435.195,12	1.479.706,75	1.951.480,89	2.382.333,78	4.247.409,20	4.690.498,11	5.133.587,02
-	-	(28.063,94)	(147.966,34)	(503.100,30)	(663.503,50)	(809.993,48)	(1.444.119,13)	(1.594.769,36)	(1.745.419,59)
(622.767,28)	(270.113,15)	54.477,05	287.228,78	976.606,46	1.287.977,39	1.572.340,29	2.803.290,07	3.095.728,75	3.388.167,43
(5.212.877)	(5.212.877)	(5.212.877)	(5.212.877)	(5.212.877)	(5.212.877)	(781.988)	(781.988)	(781.988)	(781.988)
4.290.591,08	4.811.878,74	5.333.166,39	5.854.454,05	5.748.685,28	6.191.774,19	6.634.863,10	4.769.787,68	4.326.698,77	3.883.609,86
(789.752,72)	(922.702,80)	(1.055.652,88)	(1.188.602,96)	(1.321.553,04)	(1.454.503,12)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)
312.849,83	344.435,16	376.020,50	407.605,84	433.865,06	462.087,00	493.672,34	493.672,34	493.672,34	493.672,34
(476.902,90)	(578.267,64)	(679.632,38)	(780.997,12)	(887.687,98)	(992.416,12)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)
(101.364,74)	(101.364,74)	(101.364,74)	(101.364,74)	(106.690,86)	(104.728,13)	(101.364,74)	-	-	-
(1.646.417,53)	**(772.475,74)**	**73.402,12**	**827.441,51**	**1.405.724,30**	**2.162.146,87**	**7.323.851,15**	**6.791.090,25**	**6.640.440,02**	**6.489.789,79**

2025	2026	2027	2028	2029	2030	2031	2032	2033
165.781	165.781	165.781	165.781	165.781	165.781	165.781	165.781	165.781
99,86	99,86	99,86	99,86	99,86	99,86	99,86	99,86	99,86
16.554.869	16.554.869	16.554.869	16.554.869	16.554.869	16.554.869	16.554.869	16.554.869	16.554.869
(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)	(1.531.325,39)
15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67	15.023.543,67
105.722,33	105.722,33	105.722,33	105.722,33	105.722,33	105.722,33	105.722,33	105.722,33	105.722,33
(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)	(6.112.069,13)
(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)	(6.006.346,80)
9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88
9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88	9.017.196,88
(3.440.520,95)	(2.997.432,04)	(2.554.343,13)	(2.111.254,23)	(1.668.165,32)	(1.225.076,41)	(781.987,50)	(781.987,50)	(781.987,50)
5.576.675,93	6.019.764,84	6.462.853,75	6.905.942,65	7.349.031,56	7.792.120,47	8.235.209,38	8.235.209,38	8.235.209,38
(1.896.069,82)	(2.046.720,04)	(2.197.370,27)	(2.348.020,50)	(2.498.670,73)	(2.649.320,96)	(2.799.971,19)	(2.799.971,19)	(2.799.971,19)
3.680.606,11	3.973.044,79	4.265.483,47	4.557.922,15	4.850.360,83	5.142.799,51	5.435.238,19	5.435.238,19	5.435.238,19
(781.988)	(781.988)	(781.988)	(781.988)	(781.988)	(781.988)	(781.988)	(781.988)	(781.988)
3.440.520,95	2.997.432,04	2.554.343,13	2.111.254,23	1.668.165,32	1.225.076,41	781.987,50	781.987,50	781.987,50
(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)	(1.587.453,20)
493.672,34	493.672,34	493.672,34	493.672,34	493.672,34	493.672,34	493.672,34	493.672,34	493.672,34
(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)	(1.093.780,86)
-	-	-	-	-	-	-	-	1.093.780,86
6.339.139,56	**6.188.489,33**	**6.037.839,11**	**5.887.188,88**	**5.736.538,65**	**5.585.888,42**	**5.435.238,19**	**5.435.238,19**	**6.529.019,05**

B.5.1 Prior Consideration

>>

The project asked for prior consideration under the original standard as part of registration procedure.

B.5.2 Ongoing Financial Need

>>

The PDD carries out a financial analysis of the project, which concludes that it would not be attractive without the revenue from the sale of carbon credits.

The project's activity is not considered common practice, because in Brazil there is no obligation to burn biogas in landfills, as is the case with the Manaus project.

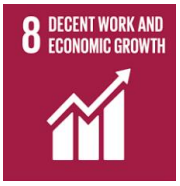
A signed company statement detailing project history and cashflow has been provided to VVB. In summary, the document approaches the following information:

- Since the beginning of Manaus Landfill Gas Project ("Manaus Project") until today, the sale of the carbon credits have been the only source of income of the Project. Considering that (i) in Brazil it is not mandatory for the landfills to burn biogas; and (ii) its implementation and maintenance results in great financial and technical liabilities, as they depend on continued investments and qualified professionals, Manaus Project would definitely not be feasible without such funds.
- The installed generator do not perform electricity sales. The generator CHP300 uses biogas as fuel to generate electricity only to supply biogas plant demand.
- Electricity sales were not performed until the present moment (Renewal of 3rd Crediting Period) since the LFG electricity generation and exporting plant has not been implemented yet and therefore not able to export electricity to the grid.
- Whereas the income of credit carbon sale have been the sole Manaus Project's revenue, its cash flow was directly and seriously affected during the time when it was not able to sell carbon credits (between 2021 and 2022, when the UNFCCC suspended the certifications and Manaus Project was still in the process to obtain its registration with Gold Standard).
- The periods when the company was able to sell the carbon credits for a reasonable price, Manaus Project presented great development, since enabled investments in both structure and manpower, resulting in bigger reduction of CO^2 emissions, and consequently, more generation of carbon credits.

- Manaus Project fits perfectly with the concept of "ongoing financial need" and Gold Standard principles, because in this case, the carbon credits are not just important, but essential for the Project's continuity.
- Cashflow showing period from 2020 to 2023 shows negative accumulated results for 2020, 2021 and 2022. Therefore, only 2023 reveals to have positive project results, based on Project Revenues from Carbon Credits against Project Expanses.

B.6. Sustainable Development Goals (SDG) outcomes

Relevant Target/Indicator for each of the five SDGs

Sustainable Development Goals Targeted	Most relevant SDG Target	SDG Impact (Proposed or SDG Indicator)
	7.2: By 2030, increase substantially the share of renewable energy in the global energy mix	Monitored Indicator: Amount of electricity generated using LFG by the project activity in year y
	13.2: Integrate climate change measures into national policies, strategies and planning	Monitored Indicator: Yearly emission reductions
	5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	Monitored Indicator: Quantity of women in managerial positions. Based on at least one woman in leadership and decision-making positions by showing signed company functional organizational chart in the determined year.
	8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	Monitored Indicator: Total jobs generated as a result of the project. Based on project onsite employees Social Records.

B.6.1 Explanation of methodological choices/approaches for estimating the SDG Impact

>>

For SDG 13:

Baseline Emissions

Baseline emissions for the proposed project activity are determined according to the following equation:

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

Where:

BE_y	=	Baseline emissions in year y (tCO_2e/yr)
BECH4,y	=	Baseline emissions of methane from the SWDS in year y (tCO_2e/yr)
BEEC,y	=	Baseline emissions associated with electricity generation in year y (tCO_2e/yr)
BEHG,y	=	Baseline emissions associated with heat generation in year y (tCO_2e/yr)
BENG,y	=	Baseline emissions associated with natural gas use in year y (tCO_2e/yr)

Baseline emissions associated with heat generation in year *y* ($BE_{HG,y}$) and natural gas use in year *y* ($BE_{NG,y}$) are not applicable to the proposed project activity.

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

Baseline emissions of methane from the SWDS are determined based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account[34].

[34] $OX_{top\text{-}layer}$ is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not

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

Equation 2

Where:

BE_{CH4y}	=	Baseline emissions of LFG from the SWDS in year y (tCO_2e/yr)
OX_{top_layer}	=	Fraction of methane in the LFG that would be oxidized in the top layer of theSWDS in the baseline (dimensionless)
$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activityin year y (tCH_4/yr)
$F_{CH4,BJ,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year y(tCH_4/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (tCO_2e/tCH_4)

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

During the crediting period, FCH4,PJ,y is to be determined as the sum of the quantities of methane flared and forwarded to electricity generation, considering the following equation:

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

Equation 3

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activityin year y (tCH_4/yr)

pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool "*Emissions from solid waste disposal sites*". In addition to this effect, the installation of a LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was considered to be very small, as the operators of the SWDS have in most cases an incentive tomain a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption

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

As the project only flares LFG and generates electricity, then $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ equals to 0 (zero).

$F_{CH4,EL,y}$ 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:

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

Where:

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

$F_{CH4,sent\_flare,y}$ will be determined directly using the "*Tool to determine the mass flow of a greenhousegas in a gaseous stream*", applying the requirements described below.

According to "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*" thefollowing 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 measurementpoint.

Option A

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

(a) Measure the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H2O/m3 dry gas; or

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

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

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t}$$ Equation 1

With:

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t}$$ Equation 2

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 (m³ 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 (m³ gas *i*/m³ dry gas)
$\rho i_{,t}$	=	Density of greenhouse gas i in the gaseous stream in time interval *t* (kg gas *i*/m³ 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.m³/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:

$$V_{t,tb} = V_{t,wb}/(1+v_{H2O,t,db}) \quad \text{Equation 3}$$

Where:

$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m³ dry gas/h)
$V_{t,wb}$	=	Volumetric flow of the gaseous stream in time interval *t* on a wet basis (m³ wet gas/h)
$V_{H2O,t,db}$	=	Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m³ H_2O/m³ 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.

$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}} \quad \text{Equation 4}$$

Where:

$V_{H2O,t,db}$	=	Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m³ H_2O/m³ 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 ($m_{H2O,t,db}$) 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[35].
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:

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

Equation 5

Where:

$m_{H2O,t,db,sat}$	=	Saturation absolute humidity in time interval *t* on a dry basis (kg H_2O/kg dry gas)
$\rho_{H2O,t,Sat}$	=	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 (kg dry gas/kmol dry gas)

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

[35] 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).

$$MM_{t,db} = \sum_{k} (v_{k,t,db} * MM_{k}) \qquad \text{Equation 6}$$

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 (m^3 gas k/m^3 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.

Project Emissions from flaring:

$PE_{flare,y}$ 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.

Enclosed flare has been installed in the project activity to increase the destruction efficiency. Those flares reach 98% (minimum)[36] of methane destruction efficiency.

To determine the project emissions from flaring gases the methodological tool "*Project emissions from flaring*" was used. The project emissions calculation procedure is given in the following steps:

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

[36] In accordance with the Manufacturer's specification.

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	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;
- CH_4 is the greenhouse gas i for which the mass flow should be determined;
- The simplification offered for calculating the molecular mass of the gaseous stream is valid; 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

Enclosed flare

In the case of enclosed flares, project participants may choose between the following two options to determine the flare efficiency for minute m ($n_{flare,m}$).

Option A: Apply a default value for flare efficiency;

Option B: Measure the flare efficiency.

The Project Participant has chosen Option B. However, in case of flare failure, Option A (default) will be used.
In the present project activity the flare efficiency for minute *m* ($\eta_{flare,m}$) will be determined by Option B.2 of the methodological tool "*Project emissions from flaring*", where the flare efficiency is measured in each minute. Both options are described below:
For enclosed flares that are defined as low height flares, which is the case of the project activity, the flare efficiency in the minute m ($n_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Option A. For example, the default value applied should be 80%, rather than 90%, and if for example the measured value was 99%, then the value to be used shall correspond to 89%.

Option A: Default value

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

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

(2) The flame is detected in minute m ($Flame_m$).

Otherwise $n_{flare,m}$ is 0%.

Option B: Measured flare efficiency

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

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

(2) The flame is detected in minute *m* ($Flame_m$); and

Otherwise $n_{flare,m}$ is 0%.
In applying Option B, the project participants may choose to determine $n_{flare,calc,m}$ using either Option B.1 or Option B.2. Under Option B.1 the measurement is conducted by an accredited entity on a biannual basis and under Option B.2 the flare efficiency is

measured in each minute. For the case of the project activity, the option B.2 has been chosen.

Option B.2: Measurement of the flare efficiency in each minute

The calculated flare efficiency $\eta_{flare,calc,m}$ is determined based on monitoring the methane content in the exhaust gas, the residual gas, and the air used in the combustion process during the minute *m* in a year *y* ($\eta_{flare,calc,y}$), as follows:

$$\eta_{flare,calc,m} = 1 - \frac{F_{CH4,EG,m}}{F_{CH4,RG,m}}$$ Equation 7

Where:

$\eta_{flare,calc,m}$	=	Flare efficiency in the minute *m*
$F_{CH4,EG,m}$	=	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the minute *m* (kg)
$F_{CH4,RG,m}$	=	Mass flow of methane in the residual gas on a dry basis at reference conditions in the minute *m* (kg)

$F_{CH4,RG,m}$ is calculated according to Step 1.

$F_{CH4,EG,m}$ is determined according to Steps 2.1 – 2.4:

Step 2.1: Determine the methane mass flow in the exhaust gas on a dry basis

The mass flow of methane in the exhaust gas is determined based on the volumetric flow of the exhaust gas and the measured concentration of methane in the exhaust gas, as follows:

$$F_{CH4,EG,m} = V_{EG,m} \times fc_{CH4,EG,m} \times 10^{-6}$$ **Equation 8**

Where:

$F_{CH4,EG,m}$	=	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the minute *m* (kg)
$V_{EG,m}$	=	Volumetric flow of the exhaust gas of the flare on a dry basis at reference conditions in minute *m* (m^3)
$fc_{CH4,EG,m}$	=	Concentration of methane in the exhaust gas of the flare on a dry basis at

reference conditions in minute *m* (mg/m^3)

Step 2.2: Determine the volumetric flow of the exhaust gas ($V_{EG,m}$)

Determine the average volume flow of the exhaust gas in minute *m* based on a stoichiometric calculation of the combustion process. This depends on the chemical composition of the residual gas, the amount of air supplied to combust it and the composition of the exhaust gas. It is calculated as follows:

$$V_{EG,m} = Q_{EG,m} \times M_{RG,m} \quad \textbf{Equation 9}$$

Where:

$V_{EG,m}$	=	Volumetric flow of the exhaust gas on a dry basis at reference conditions in minute *m* (m^3)
$Q_{EG,m}$	=	Volume of the exhaust gas on a dry basis at reference conditions per kilogram of residual gas on a dry basis at reference conditions in minute *m* (m^3 exhaust gas/kg residual gas)
$M_{RG,m}$	=	Mass flow of the residual gas on a dry basis at reference conditions in the minute *m* (kg)

Step 2.3: Determine the mass flow of the residual gas ($M_{RG,m}$)

Project participants may select to monitor the mass flow of the residual gas in minute m directly (see monitored parameter $M_{RG,m}$) or, according to the procedure given in this step, calculate $M_{RG,m}$ based on the volumetric flow and the density of the residual gas. The density of the residual gas is determined based on the volumetric fraction of all components in the gas.

$$M_{RG,m} = \rho_{RG,ref,m} \times V_{RG,m} \quad \textbf{Equation 10}$$

Where:

$M_{RG,m}$	=	Mass flow of the residual gas on a dry basis at reference conditions in minute *m* (kg)
$\rho_{RG,ref,m}$	=	Density of the residual gas at reference conditions in minute *m* (kg/m^3)

$V_{RG,m}$	=	Volumetric flow of the residual gas on a dry basis at reference conditions in the minute *m* (m^3)

and

$$\rho_{RG,ref,m} = \frac{P_{ref}}{\frac{R_u}{MM_{RG,m}} \times T_{ref}}$$ **Equation 11**

Where:

$\rho_{RG,ref,m}$	=	Density of the residual gas at reference conditions in minute *m* (kg/m^3)
P_{ref}	=	Atmospheric pressure at reference conditions (Pa)
R_u	=	Universal ideal gas constant ($Pa.m^3/kmol.K$)
$MM_{RG,m}$	=	Molecular mass of the residual gas in minute *m* (kg/kmol)
T_{ref}	=	Temperature at reference conditions (K)

Use the equation below to calculate $MM_{RG,m}$. When applying this equation, project participants may choose to either a) use the measured volumetric fraction of each component *i* of the residual gas, or b) as a simplification, measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N_2). The same equation applies, irrespective of which option is selected.

$$MM_{RG,m} = \sum_i (v_{i,RG,m} \times MM_i)$$ **Equation 12**

Where:

$MM_{RG,m}$	=	Molecular mass of the residual gas in minute *m* (kg/kmol)
MM_i	=	Molecular mass of residual gas component *i* (kg/kmol)
$V_{i,RG,m}$	=	Volumetric fraction of component i in the residual gas on a dry basis at reference conditions in the hour *h*
i	=	Components of the residual gas. If Option (a) is selected to measure the volumetric fraction, then i = CH_4, CO, CO_2, O_2, H_2, H_2S, NH_3, N_2 or if Option (b) is selected then i = CH_4 and N_2

Step 2.4: Determine the volume of the exhaust gas on a dry basis at reference conditions per kilogram of residual gas ($Q_{EG,m}$)

$Q_{ECO2,EG,m}$ shall be determined as follows:

$$Q_{EG,m} = Q_{CO_2,EG,m} + Q_{O_2,EG,m} + Q_{N_2,EG,m}$$ **Equation 13**

Where:

$Q_{EG,m}$	=	Volume of the exhaust gas on a dry basis per kg of residual gas on a dry basis at reference conditions in the minute *m* (m^3/kg residual gas)
$Q_{CO2,EG,m}$	=	Quantity of CO_2 volume in the exhaust gas per kg of residual gas on a dry basis at reference conditions in the minute *m* (m^3/kg residual gas)
$Q_{N2,EG,m}$	=	Quantity of N_2 volume in the exhaust gas per kg of residual gas on a dry basis at reference conditions in the minute *m* (m_3/kg residual gas)
$Q_{O2,EG,m}$	=	Quantity of O_2 volume in the exhaust gas per kg of residual gas on a dry basis at reference conditions in the minute *m* (m^3/kg residual gas)

with

$$Q_{O_2,EG,m} = n_{O2,EG,m} \times VM_{ref}$$ **Equation 14**

Where:

$Q_{O2,EG,m}$	=	Quantity of O_2 volume in the exhaust gas per kg of residual gas on a dry basis at reference conditions in the minute *m* (m^3/kg residual gas)
$n_{O2,EG,m}$	=	Quantity of O_2 (moles) in the exhaust gas per kg of residual gas flared on a dry basis at reference conditions in minute m (kmol/kg residual gas)
VM_{ref}	=	Volume of one mole of any ideal gas at reference temperature and pressure (m^3/kmol)

$$Q_{N2,EG,m} = VM_{ref} \times \left\{ \frac{MF_{N,RG,m}}{2 \times AM_N} + \left(\frac{1 - v_{O2,air}}{v_{O_2,air}} \right) \times \left[F_{O2,RG,m} + n_{O2,EG,m} \right] \right\}$$ **Equation 15**

Where:

$Q_{N2,EG,m}$	=	Quantity of N_2 (volume) in the exhaust gas per kg of residual gas on a dry basis at reference conditions in the minute m (m3/kg residual gas)
VM_{ref}	=	Volume of one mole of any ideal gas at reference temperature and pressure (m^3/kmol)
$MF_{N,RG,m}$	=	Mass fraction of nitrogen in the residual gas in the minute *m*
AM_N	=	Atomic mass of nitrogen (kg/kmol)
$V_{O2,air}$	=	Volumetric fraction of O_2 in air
$F_{O2,RG,m}$	=	Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in minute *m* (kmol/kg residual gas)
$n_{O2,EG,m}$	=	Quantity of O_2 (moles) in the exhaust gas per kg of residual gas flared on a dry basis at reference conditions in minute *m* (kmol/kg residual gas)

$$Q_{CO_2,EG,m} = \frac{MF_{C,RG,m}}{AM_C} \times VM_{ref}$$ **Equation 16**

Where:

$Q_{CO2,EG,m}$	=	Quantity of CO_2 volume in the exhaust gas per kg of residual gas on a dry basis at reference conditions in the minute *m* (m^3/kg residual gas)
$MF_{C,RG,m}$	=	Mass fraction of carbon in the residual gas in the minute *m*
AM_C	=	Atomic mass of carbon (kg/kmol)
VM_{ref}	=	Volume of one mole of any ideal gas at reference temperature and pressure (m^3/kmol)

$$n_{O2,EG,m} = \frac{v_{O_2,EG,m}}{\left(1-(v_{O_2,EG,m}/v_{O_2,air})\right)} \cdot \left[\frac{MF_{C,RG,m}}{AM_C} + \frac{MF_{N,RG,m}}{2 \times AM_N} + \left(\frac{1-v_{O_2,air}}{v_{O_2,air}}\right) \times F_{O2,RG,m}\right]$$ **Equation 17**

Where:

$n_{CO2,EG,m}$	=	Quantity of O_2 (moles) in the exhaust gas per kg of residual gas flared on a dry basis at reference conditions in minute *m* (kmol/kg residual gas)
$V_{O2,EG,m}$	=	Volumetric fraction of O_2 in the exhaust gas on a dry basis at reference conditions in the minute *m*
$V_{O2,air}$	=	Volumetric fraction of O_2 in the air
$MF_{C,RG,m}$	=	Mass fraction of carbon in the residual gas in the minute *m*
AM_C	=	Atomic mass of carbon (kg/kmol)
$MF_{N,RG,m}$	=	Mass fraction of nitrogen in the residual gas in the minute *m*
AM_N	=	Atomic mass of nitrogen (kg/kmol)
$F_{02,RG,m}$	=	Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in minute *m* (kmol/kg residual gas)

$$F_{O2,RG,m} = \frac{MF_{C,RG,m}}{AM_C} + \frac{MF_{H,RG,m}}{4AM_H} - \frac{MF_{O,RG,m}}{2AM_O}$$ **Equation 18**

Where:

$F_{02,RG,m}$	=	Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in minute *m* (kmol/kg residual gas)
$MF_{C,RG,m}$	=	Mass fraction of carbon in the residual gas in the minute *m*
AM_C	=	Atomic mass of carbon (kg/kmol)
$MF_{O,RG,m}$	=	Mass fraction of oxygen in the residual gas in the minute *m*
AM_O	=	Atomic mass of oxygen (kg/kmol)
$MF_{H,RG,m}$	=	Mass fraction of hydrogen in the residual gas in the minute *m*
AM_H	=	Atomic mass of hydrogen (kg/kmol)

Determine the mass fractions of carbon, hydrogen, oxygen and nitrogen in the residual gas, using the volumetric fraction of component i in the residual gas and applying the equation below. In applying this equation, the project participants may choose to either a) use the measured volumetric fraction of each component i of the residual gas, or (b) as a simplification, measure the volumetric fraction of methane

and consider the difference to 100% as being nitrogen (N_2). The same equation applies, irrespective of which option is selected.

$$MF_{j,RG,m} = \frac{\sum_i v_{i,RG,m} \times AM_j \times NA_{j,i}}{MM_{RG,m}}$$ Equation 19

Where:

$MF_{j,RG,m}$	=	Mass fraction of element *j* in the residual gas in the minute *m*
$V_{i,RG,m}$	=	Volumetric fraction of component *i* in the residual gas on a dry basis in the minute *m*
AM_j	=	Atomic mass of element *j* (kg/kmol)
$NA_{i,i}$	=	Number of atoms of element *j* in component *i*
$MM_{RG,m}$	=	Molecular mass of the residual gas in minute *m* (kg/kmol)
j	=	Elements C, O, H and N
i	=	Component of residual gas. If Option (a) is selected to measure the volumetric fraction, then i = CH_4, CO, CO_2, O_2, H_2, H_2S, NH_3, N_2 or if Option (b) is selected then i= CH_4 and N_2

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:

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3}$$ Equation 20

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*

Parameters used in the tool "*Project emissions from flaring*"

Parameter	Description	Value	Unit
MM_{CH4}	Molecular mass of methane	16.04	kg/kmol
MM_{CO}	Molecular mass of carbon monoxide	28.01	kg/kmol
MM_{CO2}	Molecular mass of carbon dioxide	44.01	kg/kmol
MM_{O2}	Molecular mass of oxygen	32.00	kg/kmol
MM_{H2}	Molecular mass of hydrogen	2.02	kg/kmol
MM_{N2}	Molecular mass of nitrogen	28.02	kg/kmol
AM_C	Atomic mass of carbon	12.00	kg/kmol (g/mol)
AM_H	Atomic mass of hydrogen	1.01	kg/kmol (g/mol)
AM_O	Atomic mass of oxygen	16.00	kg/kmol (g/mol)
AM_N	Atomic mass of nitrogen	14.00	kg/kmol (g/mol)
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 references conditions	273.15	K
GWP_{CH4}	Global warming potential of methane valid for the second commitment period	28[37]	tCO_2/tCH_4
$\rho_{CH4,n}$	Density of methane at references conditions	0.716	Kg/m^3

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

[37] updated as per Applicability of Global Warming Potential for Gold Standard for the Global Goals Projects available at https://globalgoals.goldstandard.org/standards/RU-2020-PR-V1.2-GWP-values.pdf.

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:

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

Equation 21

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)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool "*Emissions from solid waste disposal sites*". The calculation of $BE_{CH4,SWDS,y}$ according the tool is:

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

Equation 22

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* (tCO_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)
$Wj_{,x}$	=	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 (1986). For this reason, the parameter f_y and *X* will not be monitored.

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

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

Cases for determining methane captured and destroyed in the baseline.

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

Requirement to destroy methane

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

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

In the particular case of the Manaus landfill, as per the project design and licensing requirements, no LFG is to be destroyed by combustion in LFG venting drains in order to address odors or safety concerns. Direct venting of LFG through LFG venting drains (with no combustion) is enough to prevent dangerous accumulation of LFG in the inner section of the landfill.

Therefore, Case 2 and Case 4 are not applicable for the determination of $F_{CH4,BL,y}$.

Existing LFG capture and destruction system

Non-Existence of LFG capture and destruction system at the Manaus landfill: By taking into account the definitions of "LFG capture system" and "existing LFG capture system" as per ACM0001[38], it is thus assumed that there is a LFG capture system at the Manaus landfill. While combustion of LFG is not a practice, no destruction of methane occurs. Thus, it is assumed that there is no LFG capture and destruction

[38] As per ACM0001, "LFG capture system" is defined as follows: *A system to capture LFG. The system may be passive, active or a combination of both active and passive components. Passive systems capture LFG by means of natural pressure, concentration, and density gradients. Active systems use mechanical equipment to capture LFG by providing pressure gradients. Captured LFG can be vented, flared or used.*

Also, "Existing LFG capture system" is defined as follows: *a system that has been in operation in the last calendar year prior to the start of the operation of the project activity*.

system at the Manaus landfill. Therefore, Case 3 is not applicable either. Thus, the only remaining and applicable case for the project activity is Case 1 (Requirement to destroy methane = No; Existing LFG capture and destruction system = No).
No LFG capture and destruction system would be implemented in the absence of the project (baseline scenario) at the Manaus landfill.
Thus, as per ACM0001 in this situation:
$F_{CH4,BL,y} = 0$

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

Baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) shall be calculated by applying applicable guidance of the tool "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*". When applying this methodological tool:

- The electricity sources *k* in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and
- $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year *y*.

This Tool declares:

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

Specifically for baseline emissions, we have:

$$BE_{EC,y} = \sum_{j} EC_{BL,k,y} * EF_{EL,k,y} * (1 + TDL_{k,y})$$

Equation 23

Where:

$BE_{EC,y}$	=	Baseline emissions associated with electricity generation (in tCO_2/yr)
$EC_{BL,k,y}$	=	Net amount of electricity generated using LFG in year *y* (in MWh)
$EF_{EL,k,y}$	=	Emission factor for electricity generation for source *k* in year y (in tCO_2/MWh)

$TDL_{k,y}$	=	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
k	=	Sources of electricity generated identified in the selection of the most plausible baseline scenario

Project participant choose Option A.1 of the tool "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*" for determining $EF_{EL,k,y}$. thus according to the option chosen we:

> *"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 ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$)".*

More details about the emission factor calculation are presented in the Appendix 4.

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

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

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

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

Finally:

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

Equation 24

Project emissions

Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y}$$ **Equation 25**

Where:

PE_y	=	Project emissions in year *y* (in tCO_2/yr)
$PE_{EC,y}$	=	Emissions from consumption of electricity due to the project activity in year *y* (in tCO_2/yr)
$PE_{FC,y}$	=	Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (in tCO_2/yr)
$PE_{DT,y}$	=	Emissions from the distribution of compressed/liquefied LFG using trucks, in year y (tCO_2/yr)
$PE_{SP,y}$	=	Emissions from the supply of LFG to consumers through a dedicated pipeline, in year *y* (tCO_2/yr)

The parameters $PE_{DT,y}$ and $PE_{SP,y}$ are not used in the calculation of project emissions since there is no distribution of compressed/liquefied LFG using trucks and supply of LFG to consumers through a dedicated pipeline in the project activity.
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 three sources:

- *Scenario A:* $PE_{EC1,y}$ – Electricity consumption from the grid;
- *Scenario B:* $PE_{EC2,y}$ – Electricity consumption from an off-grid captive power plant;
- *Scenario C*: $PE_{EC2,y}$ – Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s).

In the case of the project activity, electricity consumption from the grid and diesel generators are used in the project. Since the captive power plant (diesel generator) is not connected to the electricity grid, scenarios A and B apply.
Thus,

$$PE_{EC,y} = PE_{EC1,y} + PE_{EC2,y} \quad \textbf{Equation 26}$$

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

$$PE_{EC1,y} = EC_{PJ1,y} \times EF_{grid,CM,y} \times (1 + TDL_y) \quad \textbf{Equation 27}$$

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 is consumed from diesel generators (off-grid captive power plant), a conservative approach was adopted and the option B2 of the scenario B was chosen since "*electricity consumption source is a project or leakage electricity consumption source*". Therefore, the value used will be 1.3 tCO_2/MWh for project emission from diesel generator(s).

$$PE_{EC2,y} = EC_{PJ2,y} \times EF_{diesel\_generator,y} \times (1 + TDL_y) \quad \textbf{Equation 28}$$

Where:

$EC_{PJ2,y}$	=	Quantity of electricity consumed from diesel generator by the project activity during the year *y* (MWh)
$EF_{diesel\_generator,y}$	=	The emission factor for the diesel generator 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

$PE_{FC,y}$ - Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation

Considering that Manaus project activity have a consumption of fossil fuels due to the project activity, for purpose other than electricity generation, such as LPG to flare ignition, the project emissions has to be accounted and monitored.
According to the *"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"*, CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y} \qquad \textbf{Equation 29}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr)
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year y (mass or volume unit/yr)
$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type *i*, as follows:

Option A: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type *i*, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = w_{c,i,y} \times 44/12$ **Equation 30**
If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = w_{c,i,y} \times \rho_{i,y} \times 44/12$ **Equation 31**

Where:

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* (tCO_2/mass or volume unit)
$w_{Ci,y}$	=	Is the weighted average mass fraction of carbon in fuel type *i* in year *y* (tC/mass unit of the fuel)

$\rho_{i,y}$	=	Is the weighted average density of fuel type *i* in year *y* (mass unit/volume unit of the fuel)
i	=	Are the fuel types combusted in process *j* during the year *y*

Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad \textbf{Equation 32}$$

Where:

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{co2,i,y}$	=	Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B of the Tool since the necessary data for Option A is not available.

Leakage

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

Emission Reduction

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{Equation 33}$$

Where:

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

For SDG 7:

The baseline for the project is the generation of electricity in the national grid which contains fossil fuel based electricity plants. The project will export renewable electricity to the grid, avoiding the dispatch of the same amount of electricity from fossil-fuel based power plants in the Brazilian National Grid. The project is expected to generate 56,807 MWh of clean energy per year. The measurement method consists in continuous measurements by electricity meters for the grid electricity consumption.

For SDG 5:

The project contributes to the increase of the quantity of women in managerial positions by presenting at least one woman in project leadership and decision-making positions by showing signed company functional organizational chart every year.

For SDG 8:

The project contributes to the SDG target 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. Based on project onsite employees Social Records. This is achieved by showing the number of onsite employee.

For Safeguarding Principle 3:

The project activity contributes to avoid community exposure to increased health risks and shall not adversely affect the health of the workers and the community. The project provides Labour Health Assistance to its employees and counts with valid operational licence issued by the Local Environmental Agency. This is achieved by showing the number of Labour Health Reports and project Environmental Permits.

For Safeguarding Principle 6.1:

The project developer does not complicit in any form of forced or compulsory labour. All employees offering their services on a voluntary basis and are free to quit the services at any time without a menace or penalty. The project participants are committed to apply safe and healthy working conditions during all phases of the project. All employees of the project are protected by the Consolidation of Labour Laws. This is achieved by showing the number of onsite employee.

B.6.2 Data and parameters fixed ex ante

>>

ACM0001: Flaring or use of landfill gas

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	OX_{top_layer}
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in thebaseline
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	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	η_{PJ}
Unit	Dimensionless
Description	Efficiency of the LFG capture system that is be installed in the project activity
Source of data	Flare manufacturer and company which has been responsible for assemblyand testing of the equipment at the landfill site
Value(s) applied	80%
Choice of data or Measurement methods and procedures	Based on the active LFG capture system installed in the project activity.
Purpose of data	Calculation of baseline emission

Additional comment	-

Project emissions from flaring

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	GWP_{CH4}
Unit	tCO_2e/tCH_4
Description	Global warming potential of CH_4
Source of data	IPCC
Value(s) applied	28 updated as per Applicability of Global Warming Potential for Gold Standard for the Global Goals Projects available at https://globalgoals.goldstandard.org/standards/RU-2020-PR-V1.2-GWP-values.pdf .
Choice of data or Measurement methods and procedures	Default value used, according to IPCC Fourth Assessment Report: ClimateChange 2007, item 2.10.2: Direct Global Warming Potentials, Table 2.14
Purpose of data	Calculation of baseline emission
Additional comment	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	$SPEC_{flare}$
Unit	Temperature - °C Flow rate - Nm^3/h Maintenance schedule - number of days
Description	Manufacturer's flare specifications for temperature, flow rate and maintenance schedule
Source of data	Flare manufacturer
Value(s) applied	-

Choice of data or Measurement methods and procedures	<table><tr><td>Flare model</td><td>ZTOF® Enclosed – John Zink</td></tr><tr><td>Minimum flare temperature</td><td>760 ºC</td></tr><tr><td>Maximum flare temperature</td><td>982 ºC</td></tr><tr><td>Minimum and maximum inlet flow rate</td><td>Minimum flow: 858 Nm³/h Maximum flow: 5,150 Nm³/h</td></tr><tr><td>Maximum duration in days between maintenance events</td><td>N/A[39]</td></tr></table>
Purpose of data	Calculation of project emissions
Additional comment	-

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

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	R_u
Unit	$Pa.m^3/kmol.K$
Description	Universal ideal gas constant
Source of data	Methodological "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*"
Value(s) applied	8,314
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	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	MM_i
Unit	kg/kmol
Description	Molecular mass of greenhouse gas *i*
Source of data	*"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"*

Value(s) applied	<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>
Choice of data or Measurement methods and procedures	According to "*Tool to determine the mass flow of a greenhouse gas in agaseous stream*"
Purpose of data	Calculation of baseline emissions
Additional comment	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	MM_k
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	<table><tr><th>Compound</th><th>Structure</th><th>Molecular mass (kg/kmol)</th></tr><tr><td>Nitrogen</td><td>N_2</td><td>28.01</td></tr></table>
Choice of data or Measurement methods and procedures	According to "*Tool to determine the mass flow of a greenhouse gas in agaseous stream*"
Purpose of data	Calculation of baseline emissions
Additional comment	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	MM_{H2O}
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 agaseous stream*"
Purpose of data	Calculation of baseline emissions
Additional comment	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	P_{ref}
Unit	Pa
Description	Atmospheric pressure at reference conditions
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value(s) applied	101,325
Choice of data or Measurement methods and procedures	Default value extracted from "*Tool to determine the mass flow of a greenhousegas in a gaseous stream*"
Purpose of data	Calculation of project emissions
Additional comment	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	T_{ref}
Unit	K
Description	Temperature at reference conditions

Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value(s) applied	273.15
Choice of data or Measurement methods and procedures	Default value extracted from *"Tool to determine the mass flow of a greenhousegas in a gaseous stream"*
Purpose of data	Calculation of project emissions
Additional comment	-

Emissions from solid waste disposal sites

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	$\varphi_{default}$
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 wasused 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	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	OX
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 Tool *"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.

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	F
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 Tool *"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

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	$DOC_{f,default}$
Unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW thatdecomposes 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 Tool *"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 beused for Application A.

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	$MCF_{default}$
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) levelling of the waste.
Purpose of data	Calculation of baseline emission
Additional comment	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	DOC_j
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	

Waste type j	DOCj (% wet waste)
Wood and wood products	43%
Pulp, paper and carboard (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	-

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	k_j
Unit	1/yr
Description	Decay rate for waste type *j*
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories

Value(s) applied	<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>0.40</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default value for anaerobic managed solid waste disposal site is applied.
Purpose of data	Calculation of baseline emissions
Additional comment	Used for projection of methane avoidance. The Brazil's climate database was provided by EMBRAPA, and historical data from 1961 to 1990 for the municipality of Manaus was used.

Relevant SDG Indicator	SDG 13.2.1
Data/parameter	Waste composition
Unit	%
Description	Waste composition
Source of data	Landfill internal data
Value(s) applied	<table><tr><th colspan="2">Composition of the waste</th></tr><tr><td>A) Wood and wood products</td><td>0.50%</td></tr><tr><td>B) Pulp, paper and carboard (other than sludge)</td><td>20.81%</td></tr><tr><td>C) Food, food waste, beverages and tobacco (other than sludge)</td><td>25.04%</td></tr><tr><td>D) Textiles</td><td>0.00%</td></tr><tr><td>E) Garden, yard and park waste</td><td>0.00%</td></tr></table>

	F) Glass, plastic, metal, other inert waste	53.66%
	TOTAL	**100%**
Choice of data or Measurement methods and procedures	Available from Study ANALYSIS OF THE GRAVIMETRIC COMPOSITION OF URBAN SOLID WASTE FROM THE CITY OF MANAUS –AM 2023 https://ojs.focopublicacoes.com.br/foco/article/view/2247/1419	
Purpose of data	Calculation of baseline emission	
Additional comment	Used for projection of methane avoidance	

Tool to calculate the emission factor for an electricity system

Relevant SDG Indicator	SDG 13.2.1 SDG 7
Data/parameter	$EF_{grid,BM,2016}$
Unit	tCO_2/MWh
Description	Build margin emission factor for the grid in year y
Source of data	Brazilian DNA. Available at: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao
Value(s) applied	0.1581 (*ex ante* estimate for year 2016)
Choice of data or Measurement methods and procedures	The ex-ante calculation vintage of this parameter was chosen as per theprocedures of the "*Tool to calculate the emission factor for an electricitysystem*".
Purpose of data	Calculation of project emissions
Additional comment	According to Option 1 of the Tool, EFOM should remain the same as the one used in the 2nd crediting period

Relevant SDG Indicator	SDG 13.2.1 SDG 7
Data/parameter	$EF_{grid,OM-dis,y}$ **(2022)**

Unit	tCO_2/MWh
Description	Dispatch data analysis operating margin CO_2 emission factor in year *y*
Source of data	Brazilian DNA. Available at: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao
Value(s) applied	0.4068 (latest data available 2022)
Choice of data or Measurement methods and procedures	The ex-ante calculation vintage of this parameter was chosen as per theprocedures of the "*Tool to calculate the emission factor for an electricitysystem*".
Purpose of data	Calculation of project emissions
Additional comment	-

B.6.3 Ex ante estimation of SDG Impact

>>

Emission reduction (SDG 13 and SDG 07)

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 $F_{CH4,PJ,y}$ are:

- Methane content in LFG = 50% (default value);
- LFG collection efficiency = 80% (Based on estimation of methane generation in the Manaus landfill);
- Density of methane = 0.716 kg/m^3 (as per tool "*Project emissions from flaring*").

The landfill gas collection and utilization system captures only a portion of the generated landfill gas. Thus, an estimate of 80% LFG collection 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:

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

Equation 34

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 third crediting period.

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

Year	$F_{CH4,PJ,y}$ (tCH_4/yr)
From 08/07/2023	8,949
2024	18,483
2025	18,517
Until 07/07/2026	8,098

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

As discussed in the Section B.6.1 of this PDD, $F_{CH4,BL,y} = 0$.

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

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

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH4}$$ Equation 35

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:

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

Year	$BE_{CH4,y}$ (tCO_2/yr)
From 08/07/2023	225,507
2024	465,760
2025	466,631
Until 07/07/2026	204,058

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

The ex-ante calculation is:

$$BE_{EC,y} = \sum_{j} EC_{BL,k,y} * EF_{EL,k,y} * (1 + TDL_{k,y})$$ Equation 36

As explained above, $feel_{j/k/l,y} = EF_{grid,CM,y}$. Thus, the $EF_{grid,CM,y} = 0.2202$ tCO_2/MWh.

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

Year	$EC_{BL,k,y}$ (MWh/yr)	$BE_{EC,y}$ (tCO_2/yr)
From 08/07/2023	26,529	4,937
2024	68,591	12,764
2025	82,475	15,347
Until 07/07/2026	49,632	9,236

The equation of the baseline emission calculation is:

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

Equation 37

The result is:

Total baseline emissions of the project activity.

Year	$BE_{CH4,y}$ (tCO_2/yr)	$BE_{EC,y}$ (tCO_2/yr)	BE_y (tCO_2/yr)
From 08/07/2023	225,507	4,937	230,443
2024	465,760	12,764	478,524
2025	466,631	15,347	481,978
Until 07/07/2026	204,058	9,236	213,294

Emission Factor calculation

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

As mentioned above the average $EF_{OM\ dispatch,\ 2022}$ is 0.4068 tCO_2/MWh and the $EF_{grid,BM,2016}$ is 0.1581 tCO_2/MWh.

Considering the Option 1[39] was chosen for the proposed project in the first crediting period, or the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

[39] Source TOOL07 v7: 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

Calculate the combined margin emissions factor

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

EF_{2016} = 0.4068 x 0.25 + 0.1581 x 0.75 = 0.2202 tCO_2/MWh

The combined margin CO_2 emission factor will be fixed during the third crediting period.

Project Emissions

According to "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*", 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).

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

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

In the project activity, the annual electricity consumption from the grid is estimated around 830 MWh/year. However, this variable will be monitored during the whole crediting period.

In the option A1 of the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*", 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 0.2202 tCO_2/MWh will be used.

Finally the technical transmission and distribution losses ($TDL_{j,y}$) value has been assumed to be 28.6%, according to National Energy Balance 2023 for the year 2022[40]. Table below summarizes the project emissions resulting from electrical consumption in the plant.

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;

[40] National Energy Balance 2023 (base year 2022). Available at: <https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-748/topico-681/BEN_S%C3%ADntese_2023_PT.pdf>.

Electricity consumption from the grid resulting due to the project activity.

Year	$EC_{PJ1,y}$ (MWh/yr)	$PE_{EC1,y}$ (tCO_2/yr)
From 08/07/2023	402	75
2024	830	155
2025	830	155
Until 07/07/2026	428	80

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

The diesel generator consumption will be around 220 MWh/year during phase 1 (from 2018 to 2021) and for the phase 2 (from 2022 to 2025) it is no consumption of diesel by the diesel generator since the electricity will be generated through LFG in order to supply the LFG plant internal needs. The emission factor from the diesel generator(s) is 1.3 tCO_2/MWh. The following table represents the project emissions from the use of the standby generator over the crediting period. Table below presents the project emissions associated with fossil fuel combustion at the project site.

Electricity consumption from the grid resulting due to the project activity?.

Year	$EC_{PJ2,y}$ (MWh/yr)	$PE_{EC2,y}$ (tCO_2/yr)
From 08/07/2023	107	139
2024	220	286
2025	220	286
Until 07/07/2026	113	148

$PE_{FC,y}$ - Project emission from consumption of fossil fuels due to the project activity, for purpose other than electricity generation

Based on monitored values of the project activity for 2024 year of 78 kg/yr of LPG for the parameter $FC_{i,j,y}$ has been used. The emission factor is 0.00305 tCO_2/kg. The following table represents the project emissions from the use of LPG over the crediting period.

LPG consumption due to the project activity.

Year	$FC_{i,j,y}$ (mass or volume unit /yr)	$PE_{FC,y}$ (tCO_2/yr)
From 08/07/2023	38	0.115
2024	78	0.238
2025	78	0.238
Until 07/07/2026	40	0.122

Leakage

No leakage effects need to be accounted under methodology ACM0001.

Emission Reduction

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \qquad \textbf{Equation 38}$$

Where:

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

Emission reductions due the project activity.

Year	BE_y (tCO_2/yr)	PE_y (tCO_2/yr)	ER_y (tCO_2/yr)
From 08/07/2023	233,019	253	232,766
2024	485,183	522	484,661
2025	489,986	522	489,464
Until 07/07/2026	218,113	270	217,842

For SDG 5:

1 women in managerial positions

For SDG 8:

1 Project onsite employee

For SDG 7:

56,807 MWh of electricity generation per year

For SDG 13:

474,911 tCO2e per year

B.6.4 Summary of ex ante estimates of each SDG Impact

Year	Baseline estimate	Project estimate	Net benefit
08/07/2023	233,019	253	232,766
2024	485,183	522	484,661
2025	489,986	522	489,464
07/07/2026	218,113	270	217,842
Total	**1,426,302**	**1,567**	**1,424,733**
Total number of crediting years	**3**		
Annual average over the crediting period	**475,434**	**522**	**474,911**

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

Relevant SDG Indicator	SDG 7.1.1 / 7.1.2 / 7.2.1 SDG 13.2.1
Data / Parameter	TDL_y
Unit	-
Description	Average technical transmission and distribution losses in the grid in year *y* forthe voltage level at which electricity is obtained from the grid at the project site.

Source of data	National Energy Balance 2023 for the year 2022[41]
Value(s) applied	28.6%
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 figuresshould 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	Since this parameter is related to project renewable energy generation and consumption, it contributes to: • *Indicator 7.1.1: Proportion of population with access to electricity* • *Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology* • *Indicator 7.2.1: Renewable energy share in the total final energy consumption* Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a*

[41] National Energy Balance 2023 (base year 2022). Available at: <https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-748/topico-681/BEN_S%C3%ADntese_2023_PT.pdf>.

	national adaptation plan, nationally determined contribution, national communication, biennial update report or other)

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$EC_{PJ1,y} = EG_{EC1,y}$
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** / **$EC_{PJ1,y}$** From 08/07/2023 — 402 2024 — 830 2025 — 830 Until 07/07/2026 — 428
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. Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to:

	• *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 7.1.1 / 7.1.2 / 7.2.1 SDG 13.2.1
Data / Parameter	$EC_{PJ2,y} = EG_{EC2,y}$
Unit	MWh/y
Description	Quantity of electricity consumed from diesel generator by the project activity during the year y
Source of data	Measurement from Project participants.
Value(s) applied	
Measurement methods and procedures	Continuously measured by electricity meters for the diesel generators as per "*Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*" and ACM0001 methodology.
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

Year	$EC_{PJ2,y}$
From 08/07/2023	139
2024	286
2025	286
Until 07/07/2026	148

Additional comment	The data will be archived throughout the crediting period and two years thereafter. Since this parameter is related to project renewable energy generation and consumption, it contributes to: • *Indicator 7.1.1: Proportion of population with access to electricity* • *Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology* • *Indicator 7.2.1: Renewable energy share in the total final energy consumption* Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

ACM0001: Flaring or use of landfill gas

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	Management of SWDS
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	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)* The project is taking place at the current municipality discharge site thus no land change is involved.

Relevant SDG Indicator	SDG 7.1.1 / 7.1.2 / 7.2.1 SDG 13.2.1
Data / Parameter	$EG_{PJ,y} = EC_{BL,k,y}$
Unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year y
Source of data	Electricity meter
Value(s) applied	

Year	$EG_{PJ,y}$
From 08/07/2023	26,529
2024	68,591

	<table><tr><td>2025</td><td>82,475</td></tr><tr><td>Until 07/07/2026</td><td>49,632</td></tr></table>
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*". Since this parameter is related to project renewable energy generation and consumption, it contributes to: • *Indicator 7.1.1: Proportion of population with access to electricity* • *Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology* • *Indicator 7.2.1: Renewable energy share in the total final energy consumption* Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 7.1.1 / 7.1.2 / 7.2.1 SDG 13.2.1
Data / Parameter	$O_{pj,h}$
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. $O_{pj,h}$ = 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, $O_{pj,h}$ = 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	Since this parameter is related to project renewable energy generation and consumption, it contributes to: • *Indicator 7.1.1: Proportion of population with access to electricity* • *Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology* • *Indicator 7.2.1: Renewable energy share in the total final energy consumption* Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

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

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$V_{t,db}$
Unit	m^3/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 $F_{CH4,flared,y}$ and $F_{CH4,EL,y}$ Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$V_{t,wb}$
Unit	m^3/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 60ºC (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 $F_{CH4,flared,y}$ and $F_{CH4,EL,y}$ Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined*

	contribution, national communication, biennial update report or other)

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$v_{i,t,db}$
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 analyser (onsite measurements)
Value(s) applied	50%
Measurement methods and procedures	Continuous gas analyser 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 $F_{CH4,flared,y}$ and $F_{CH4,EL,y}$ Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined*

	contribution, national communication, biennial update report or other)

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$v_{i,t,wb}$
Unit	m^3 gas *i*/m^3 wet 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 analyser (onsite measurements)
Value(s) applied	50%
Measurement methods and procedures	Continuous gas analyser 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 $F_{CH4,flared,y}$ and $F_{CH4,EL,y}$ Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined*

	contribution, national communication, biennial update report or other)

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	T_t
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. Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate*

	change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	P_t
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 monthly. 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) Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to:

	• *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	Status of biogas destruction device
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*" Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low*

	greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$P_{H2O,t,Sat}$
Unit	Pa
Description	Saturation pressure of H_2O at temperature T_t 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. Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Methodological tool "*Project emissions from flaring*"

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$V_{i,RG,m}$
Unit	-
Description	Volumetric fraction of component i in the residual gas on a dry basis in the minute m where i = CH4, CO, CO2, O2, H2, H2S, NH4, N2
Source of data	Measurements by project participants using a continuous gas analyser
Value(s) applied	50%
Measurement methods and procedures	Measurement may be made on either dry or wet basis. If value is made on a wet basis, then it shall be converted to dry basis for reporting
Monitoring frequency	Continuously. Values to be averaged on a minute basis
QA/QC procedures	Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard certified gas
Purpose of data	Determination of the flare efficiency
Additional comment	As a simplified approach, project participants may only measure the content CH4, CO and CO2 of the residual gas and consider the remaining part as N2. Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency (as the case of the purpose project activity) Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$V_{RG,m}$
Unit	m^3
Description	Volumetric flow of the residual gas on a dry basis at reference conditions in the minute *m*
Source of data	Measurements by project participants using a flow meter
Value(s) applied	-
Measurement methods and procedures	Instruments with recordable electronic signal (analogical or digital)
Monitoring frequency	Continuously. Values to be averaged on a minute basis
QA/QC procedures	Flow meters are to be periodically calibrated according to the manufacturer's recommendation
Purpose of data	Determination of the flare efficiency
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$M_{RG,m}$
Unit	kg
Description	Mass flow of the residual gas on a dry basis at reference conditions in the minute m

Source of data	-
Value(s) applied	-
Measurement methods and procedures	Instruments with recordable electronic signal (analogical or digital)
Monitoring frequency	Continuous, values to be averaged on a minute basis
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications
Purpose of data	Determination of the flare efficiency
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$v_{O2,EG,m}$
Unit	-
Description	Volumetric fraction of O_2 in the exhaust gas on a dry basis at reference conditions in the minute *m*
Source of data	Measurements by project participants using a continuous gas analyser
Value(s) applied	-
Measurement methods and procedures	Extractive sampling analysers with water and particulates removal devices or in situ analysers for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate

	sampling probes adequate to high temperatures level (e.g. inconel probes)
Monitoring frequency	Continuously. Values to be averaged on a minute basis
QA/QC procedures	Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard gas
Purpose of data	Determination of the flare efficiency
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$fc_{CH4,EG,m}$
Unit	mg/m^3
Description	Concentration of methane in the exhaust gas of the flare on a dry basis at reference conditions in the minute *m*
Source of data	Measurements by project participants using a continuous gas analyser
Value(s) applied	-
Measurement methods and procedures	Extractive sampling analysers with water and particulates removal devices or in situ analyser for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare in order that the sampling is of the gas after consumption has taken place (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes)

Monitoring frequency	Continuously. Values to be averaged on a minute basis
QA/QC procedures	Analysers must be periodically calibrated according to manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard gas
Purpose of data	Determination of the flare efficiency
Additional comment	Measurement instruments may read ppmv or % values. To convert from ppmv to mg/m3 simply multiply by 0.716. 1% equals 10 000 ppmv Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$Flame_m$
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 Ultra Violet 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[42].
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$Maintenance_y$
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

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

Purpose of data	Calculation of baseline and project emissions when the flame is on[43].
Additional comment	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($S_{PEC,flare}$). Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$T_{EG,m}$
Unit	ºC
Description	Temperature in the exhaust gas of the enclosed flare in minute *m*
Source of data	Measurements by project participants
Value(s) applied	-
Measurement methods and procedures	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 760ºC indicates that a significant amount of gases are still being

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

	burnt and that the flare is operating. Data will be recorded continuously and values will be averaged hourly or at a shorter time interval.
Monitoring frequency	Once per minute
QA/QC procedures	Thermocouples will be replaced or calibrated every year.
Purpose of data	(b) Calculation of project emissions or actual net GHG removals by sinks
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$FC_{i,j,y}$
Unit	kg/yr
Description	Quantity of fuel type *i* combusted in process *j* during the year *y*
Source of data	Sales of receipt
Value(s) applied	78
Measurement methods and procedures	Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of

	control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
Monitoring frequency	Continuously
QA/QC procedures	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Purpose of data	Calculation of project emissions from fossil fuel combustion in process
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$NCV_{i,y}$
Unit	GJ/kg
Description	Weighted average net calorific value of fuel type i in year y (i = LPG)

Source of data	c) Regional or national default values
Value(s) applied	0.0465
Measurement methods and procedures	-
Monitoring frequency	Review appropriateness of values annually
QA/QC procedures	Verify if the value is 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 SO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	Calculation of project emissions from fossil fuel consumption for the flare ignition.
Additional comment	Option c) is used since a liquid fuel is considered and is based on well documented reliable sources (i.e. Brazilian Energy Balance). Information used with the purpose of calculating expected emission reductions is in accordance with the values provided in 2006 IPCC Guidelines. Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	SDG 13.2.1
Data / Parameter	$EF_{CO2,I,y}$
Unit	tCO_2/GJ
Description	Weighted average CO2 emission factor of fuel type i in year y (i = LPG)

Source of data	d) IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	0.0656
Measurement methods and procedures	Not applicable since IPCC default value is used.
Monitoring frequency	Any future revisions of the IPCC Guidelines should be taken into account.
QA/QC procedures	Not applicable since IPCC default value is used.
Purpose of data	Calculation of project emissions from fossil fuel consumption for the flare ignition
Additional comment	Since this parameter is related to climate change measures in means of a development of a GHG emission reduction project activity authorized by its national Designated National Authority (DNA), it contributes to: • *Indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)*

Relevant SDG Indicator	Proposed Monitored Indicator Related to SDG Target 5
Data / Parameter	Quantity of women in managerial positions
Unit	-
Description	Refers to number of female management employees (managers) (full - time) at the organization as of the end of the reporting period.
Source of data	Project activity
Value(s) applied	1
Measurement methods and procedures	Signed functional organizational chart showing women leadership and decision-making positions
Monitoring frequency	Once per year
QA/QC procedures	-

Purpose of data	-
Additional comment	Since this parameter is related to gender equality, it contributes to: • 5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life

Relevant SDG Indicator	GSDM-I8.5.1 Safeguarding Principles 6.1
Data / Parameter	Total number of jobs.
Unit	-
Description	Refers to total jobs generated as a result of the project.
Source of data	Project participant. Based on: Project onsite employees Social Records.
Value(s) applied	1
Measurement methods and procedures	Carried out by Project Participant "The project shall disclose the following information i. Total number of employees by employment contract (permanent and temporary), by gender. ii. Total number of employees by employment type (full-time and part-time), by gender.
Monitoring frequency	Once per year
QA/QC procedures	-
Purpose of data	-
Additional comment	Since this parameter is related to Decent work and economic growth, it contributes to: • 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. Also, the company offers free health assistance to its onsite employees and their familiars. It also provide additional hazard condition bonus.

Relevant SDG Indicator	Safeguarding Principles 3
Data / Parameter	Labour Health Assistance
Unit	-
Description	Provides Labor Health Assistance to all its onsite employees
Source of data	Project participant. Based on Labour Health Reports

Value(s) applied	1
Measurement methods and procedures	-
Monitoring frequency	yearly
QA/QC procedures	-
Purpose of data	
Additional comment	Since this parameter is related to Community Health, Safety and Working Conditions, it contributes to: • Safeguarding Principle 3

Relevant SDG Indicator	Safeguarding Principles 3
Data / Parameter	Environmental Permit
Unit	-
Description	Provides Environmental Permit of the Project Activity
Source of data	Project participant. Based on valid Operational License issued by the Local Environmental Agency.
Value(s) applied	1
Measurement methods and procedures	-
Monitoring frequency	yearly
QA/QC procedures	-
Purpose of data	
Additional comment	Since this parameter is related to Community Health, Safety and Working Conditions, it contributes to: • Safeguarding Principle 3

B.7.2 Sampling plan

>>

Not applicable

B.7.3 Other elements of monitoring plan

>>

The monitoring plan is done according to the methodology ACM0001, the applicable tools, as well as per the the CDM Project Standard for Project Activities. Details are available in section B.7.1 above.

All continuously measured parameters (LFG flow, CH_4 concentration, flare temperature, flare operating hours, engine operating hours, and engine electrical output) are recorded electronically via a datalogger, located within the site boundary which have the capability to aggregate and print the collected data at the frequencies as specified above. It is the responsibility of the Site Operator to provide all requested data logs which is stored over the duration of the reporting period at the Site office. The data logs are summarized into emission reduction calculation summaries prior to each verification. This task is completed by CRE and reported directly to the DOE. These logs are available as required by 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 the 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 and used to support the periodic verification report, required CER auditing. The monitoring plan discussed herein is designed to meet or exceed the UNFCCC requirements (approved monitoring methodology ACM0001 ver. 18).

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, Conestoga-Rovers Engenharia Ltda (CRE) conducted trainings and quality control programs 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. Operation manuals are developed for the operating personnel. The

procedures for filing data and calculations to be performed by the LFG utilization operator is 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 is collected in real time and provides continuous record that is easy to monitor, review, and validate. The following sections outline and discuss the following key elements of the monitoring program:

- Flow measurement;
- Gas quality measurements;
- Uncombusted methane;
- Electrical Consumption;
- Project electricity output;
- Regulatory requirements;
- Data records; and
- Data assessment and reporting.

3.1. Flow Measurement

Following ACM0001, one flow meter was installed during Phase 1 (flaring) on the piping, straight before the flares.

The flow of LFG collected by the system and subsequently utilized or 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 allows 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, however equipment is available that will provide a minimum accuracy of +/- 2% by volume. The equipment selected for the site utilizes a continuous monitoring system as defined in ACM0001, which measures once every minute and aggregates flow data approximately once every hour.

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 run to the main collection system piping, and measured in real time by two separate sensors, one each for methane and 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. Equipment is readily available that will provide an accuracy of at least +/- 1% by volume. The equipment selected for the site aggregates gas compositions approximately once every 1 minute as per the definition of a continuous monitoring system in ACM0001.

3.3. Uncombusted Methane

The efficiency of the enclosed flares is measured in each minute per the methodological tool "*Project emissions from flaring*".

3.4. Electrical Consumption

Electricity consumption will be continuously monitored by electricity meters. Monthly electrical bills charged to the project are monitored and considered as the actual energy consumption for the project.

3.5. Project Electricity Output

The generated electricity supplied to the grid by the project activity is continuously measured by an electricity meter and respective data is electronically recorded.

3.6. LPG purchased

The mass of LPG purchased by the project developer will be continuously monitored through the invoices issued by the LPG supplier.

3.7. Diesel purchased

Quantities of diesel used for the standby generator will be continuously monitored and will be recorded via receipts and additional information is delivered from the fuel company. In case of lack of information, IPCC guidelines will be used.

3.8. Regulatory Requirements

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

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. 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 on a 2-3 minute intervals, as described above.

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 flare is a function of the internal combustion temperature and resident holding time, which are generally measured by the

flare system controller and recorded for auditing purposes. Extensive technical documentation is available that documents the destructive efficiency of the enclosed drum flares that will be used, subject to the flow rate and combustion temperature verification. Destruction efficiency will also be assessed periodically through measurement of uncombusted methane emissions.
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

CRE 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 extraction wells will be required to optimize the collection system effectiveness. LFG collection field adjustments will be made based upon a review of the 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 extraction well/trench 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, the Landtec® 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 will be collected through a Landtec® Field Analytical Unit (FAU) and will be transmitted to a Landtec® Field Server Unit (FSU), which records the data on-site and automatically sends it via a “always-on” Internet connection to an off-site server for

storage and off-site back-up. All collected data is available for viewing, report generation, and retrieval through a Web interface, the EnviroComp™ Reporting System (ECRS), which can be accessed from anywhere an Internet connection is available. The plant Manager will check daily the records. In addition, it was 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 equipments until two years after the end of the crediting period.

SECTION C. DURATION AND CREDITING PERIOD

C.1. Duration of project

C.1.1 Start date of project

>>

25/07/2008[44]

C.1.2 Expected operational lifetime of project

>>

25y and 0 months[45].

C.2. Crediting period of project

C.2.1 Start date of crediting period

>>

[44]Earliest date on which the Project Developer has committed to expenditures related to the implementation of the Project.

[45] Based on Article from VOL. 39, NO. 19, 2005 / ENVIRONMENTAL SCIENCE & TECHNOLOGY "Landfill-Gas-to-Energy Projects: Analysis of Net Private and Social Benefits", Department of Civil and Environmental Engineering. Carnegie Mellon University. Evidence sent to DOE

CDM Crediting Period[46]:

2nd CP: From 08/07/2018 until 07/07/2025 (7 years)

GS4GG Crediting Period[47]:

2nd CP: From 08/07/2018 until 07/07/2023 (5 years)

3rd CP: From 08/07/2023 until 07/07/2026 (3 years)

C.2.2 Total length of crediting period

>>

5 years and 0 months.

SECTION D. SUMMARY OF SAFEGUARDING PRINCIPLES AND GENDER SENSITIVE ASSESSMENT

D.1 Safeguarding Principles that will be monitored

A completed Safeguarding Principles Assessment is in Appendix 1, ongoing monitoring is summarised below.

PRINCIPLES	MITIGATION MEASURES ADDED TO THE MONITORING PLAN
Safeguarding Principles 6.1	Total jobs generated as a result of the project
Safeguarding Principles 3	Labor Health Assistance to all its onsite employees
Safeguarding Principles 3	Environmental Permit of the Project Activity

D.2. Assessment that project complies with GS4GG Gender Sensitive requirements

Question 1 - Explain how the project reflects the key issues and	The company has an integrated management system with guidelines on compliance with the labor and human rights policy in its operations. This internal norm foresees, among other things, commitments that ensure gender equity. All employees in

[46] Source: https://cdm.unfccc.int/Projects/DB/SGS-UKL1291802325.34/view
[47] The total crediting period cannot exceed 15 years

requirements of Gender Sensitive design and implementation as outlined in the Gender Policy?	management positions must sign a term of awareness of the company's internal policies. The company structure has few employees. However, it is possible to verify the existence of women in management positions and the non-existence of wage discrimination between men and women. It is also important to note that this system includes guidelines for internal and external company communication to ensure that all actors directly or indirectly involved in its operations are well informed about the project. In this sense, it is important to highlight the relevance of the public meeting held in the past about the implementation of the project, which was widely advertised in the community, had an effective participation of the invited actors, and counted with a significant presence of women, as reported in the Stakeholder Consultation Report.
Question 2 - Explain how the project aligns with existing country policies, strategies and best practices	Brazil is a signatory to the identified commitment, which can be verified at the following electronic address: https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=IV-8&chapter=4&clang=_en Additionally, as mentioned in the previous answer, a woman is responsible for the execution of the project, which can be seen in the organization chart of the company.
Question 3 - Is an Expert required for the Gender Safeguarding Principles & Requirements ?	The project doesn't trigger key Safeguarding Principles and Requirements adopted by the Gold Standard. Section D.1. highlights the project participant's assessment of the key questions on GS Safeguarding Principles & Requirements. The following safeguarding principles and requirements are triggered by the project.
Question 4 - Is an Expert required to assist with Gender issues at the Stakeholder Consultation?	Almost two-thirds of those present at the public consultation meeting were women representing the most diverse local stakeholders. As explained previously, no records of the meeting are available. In this sense, it is no longer possible to ascertain whether the women present made comments and how they were addressed. It should be noted, however, that the project constantly receives public visits from schools and the local community and,

	through the grievance mechanism described below, is open to receive comments at any time.

SECTION E. SUMMARY OF LOCAL STAKEHOLDER CONSULTATION

The below is a summary of the 2 step GS4GG Consultation for monitoring purposes. Please refer to the separate Stakeholder Consultation Report for a complete report on the initial consultation and stakeholder feedback round.

E.1 Summary of stakeholder mitigation measures

>>

During the Global Stakeholder Process conducted while seeking CDM registration, a comment was received trough UNFCCC platform.

Mr. Eloi Marcondes submitted the following comment:

"As in the case of other few landfill gas project activities implemented in Brazil in a public landfill, information about the tendering process for the concession of the rights to explore biogas from our public landfill by involved project participants is unclear and not transparent. While the municipal administration of some cities in Brazil where LFG capture and destruction/utilization CDM projects were implemented in public landfill (e.g. São Paulo, Rio de Janeiro) managed to take financial benefits of associated carbon revenues, the case of this landfill in Manaus in unclear. As a citizen of Manaus, I would appreciate if it could be clarified whether we citizens of Manaus will benefit from the exploration under a concession agreement of biogas in our public landfill.

I hope this is not one more example of a not transparent and fair deal between a public entity and private parties which harm the interest of the citizens like me."

The comment was answered by the company during the validation of the CDM Project Activity, as follow:

"As a result of this Project Activity, the operation in Manaus landfill was significantly improved, reducing the risk of environmental contamination and proliferation of disease-carrying animals. Also, the odor was reduced considerably and in the future the city of Manaus shall benefit from some additional electricity generation from renewable source.

The Project Activity is being implemented with private investment only."

No comments were received from the stakeholders to whom letters were sent.

The design of the project was not modified as a result of the comment received during UNFCCC GSP. As explained to the stakeholder, the company was granted a public concession and is

developed by private companies, therefore the project the developers cannot give account from municipalities earnings.

During the SFR, conducted from 28/12/2022 up to 24/03/2023, some comments from stakeholders were received, as below:

Ms. Glória Carratte (City Councilor):
"Good morning, this landfill gas project is very important for our city, bringing effective benefits around the environment around the environment, as well as for our entire population that needs improvements that come to contribute with sustainable development."

José Nelson Rosa (TUMPEX director):
"The project to capture and burn gas from the Manaus landfill, which began in 2006, has since then been fully meeting its objectives and, throughout these years, has been successful in generating carbon credits, which carbon credits, which were made available on the international market, as foreseen in the initial project. The energy generation phase is underway, with the participation of major power generators, and a power generation station has been installed.
The power generation station has been installed since 2019 on a pilot basis, which fully meets the landfill's internal needs. The installation of the landfill gas capture, along with the installed flare, has been fundamental to maintain the stability of the and, at the same time, generate additional revenue for the community."

Luzia Raquel Queiroz Rodrigues Said (Secretary of State for the Environment):
"In response to correspondence about public consultation to the community, regarding the "Landfill Gas Project of Manaus", we attest to science on the subject and we inform you that this Secretary of State for the Environment -SEMA does not have has contributions and/or comments on the reports of previous public consultations from 2006 to 2010, as presented in that correspondence. In this opportunity, we place ourselves at your disposal for future activities related to the achievement of the project's objectives, contributing to the reduction of emissions of greenhouse gas (GHG) emissions and mitigating the adverse effects of climate change, and we present the contact details of the Head of the Water Resources Advisory Services - ASSHID, Mr. Maycon Douglas de Oliveira Castro, tel. 3659-1810 and e-mail protocolo@sema.am.gov.br, for additional clarifications."
Presented in a separate document "Manaus Stakeholder Consultation Report"

E.2 Final continuous input / grievance mechanism

	Method Chosen (include all known details e.g. location of book, phone number, identity of mediator)	Justification of Choice (best practice)
Continuous Input / Grievance Expression Process Book (mandatory	A Registry book is available at the s at Km 19 of Highway AM-010.	The project owner's office is publicl disclosed and opened to beneficiari
GS Contact (mandatory)	help@goldstandard.org	-
Telephone access (optional)	São Paulo office: +55 (11) 3213-4400 Manaus office: +55 (11) 3213-4400	CRE is the project owner and is available to address comments received through its institution channels.
Internet/email access (optional)	http://conestoga.com.br/sobre-a-cre/contato/	CRE is the project owner and is available to address comments received through its institution channels.
Nominated Independent Mediator (optional)	-	No mediator is assumed to be necessary since there is a close contact between the company and the local communities.
Other	Guided tours	The project frequently receives visits from the community (e.g. schools and associations). During these visits, comments can be recorded.

APPENDIX 1 - SAFEGUARDING PRINCIPLES ASSESSMENT

Complete the Assessment below and copy all Mitigation Measures for each Principle into SECTION D above. Please refer to the instructions in the Guide to Completing this Form.

Assessment Questions/ Requirements	Justification of Relevance (Yes/potentially/no)	How Project will achieve Requirements through design, management or risk mitigation.	Mitigation Measures added to the Monitoring Plan (if required)
Principle 1. Human Rights			
1. The Project Developer and the Project shall respect internationally proclaimed human rights and shall not be complicit in violence or human rights abuses of any kind as defined in the Universal Declaration of Human Rights 2. The Project shall not discriminate with regards to participation and inclusion	No	The project will export renewable electricity to the grid, avoiding the dispatch of the same amount of electricity from fossil-fuel based power plants in the Brazilian National Grid. Therefore, it provides development opportunity to all section of people proving renewable energy and better livelihood. Hence, the project positively recognizes human rights to sustainable development. Brazil adopted 'American	Not applicable

		Convention on Human Rights' 1992 and the project is bound to follow the rules and regulation of host country. Hence, the project does not violate human rights obligations adopted by the host country. The Brazilian Constitution states in its article 5 that all persons are equal before the law, without any distinction whatsoever, Brazilians and foreigners residing in the country being ensured of inviolability of the right to life, to liberty, to equality, to security and to property. Therefore, the project upholds the principles of accountability and the rule of law, participation and inclusion, and equality and non-discrimination. Brazil adopted 'American	

		Convention on Human Rights' 1992 and the project is bound to follow the rules and regulation of host country. Hence, the project does not violate human rights obligations adopted by the host country. Brazil has ratified 'International Convention on the Elimination of All Forms of Racial Discrimination :1969, the project will not discriminate with regards to its participation and inclusion.	
Principle 2. Gender Equality			
1. The Project shall not directly or indirectly lead to/contribute to adverse impacts on gender equality and/or the situation of women 2. Projects shall apply the principles of non-discrimination, equal treatment, and equal pay for equal work	No	The Citizens' Constitution declared women equal to men in all legal respects, explicitly stating in Article 5 of Title II that "men and women have equal rights and duties under the terms of this Constitution." The National Council on Women's Rights, formed in 1975, advocated	Not applicable

3. The Project shall refer to the country's national gender strategy or equivalent national commitment to aid in assessing gender risks 4. (where required) Summary of opinions and recommendations of an Expert Stakeholder(s)		successfully on behalf of including gender conscious legislation in the new constitution of 1988. As explained above the project does not contribute to discrimination against women or reinforce gender based discrimination and/or inequalities. The project respects the key gender issues and requirements of gender-sensitive design and implementation of the project (SDG#5). Brazil is a country where gender inequality is strong due to socio-cultural heritage. It is very common to see situations where men have better income than women when exercising the same employment position. The project contributes to achieve a gender equality	

		and income equivalence between men and women by adopting the better labour practices for their employees.	
2 'Gender sensitive' Mandatory Requirements:			
The Project shall complete the following gender assessment questions			
Is there a possibility that the Project might reduce or put at risk women's access to or control of resources, entitlements and benefits?	No	No. The project uses urban solid waste as resource to generate biogas and energy. Therefore, it does not put any risk to women's access or control of resources, entitlements and benefits.	Not applicable
Is there a possibility that the Project can adversely affect men and women in marginalized or vulnerable communities (e.g., potential increased burden on women or social isolation of men)?	No	No. The project uses urban solid waste as resource to generate biogas and energy. Therefore, project does not affect any marginalized or vulnerable communities.	Not applicable
Is there a possibility that the Project might not take into account gender roles and the abilities of women or men to participate in the decisions/designs of the project's	No	No. The project actually takes care the uplift of women and men. In addition, biogas being clean fuel, leads to low smoke generation	Not applicable

activities (such as lack of time, child care duties, low literacy or educational levels, or societal discrimination)?		resulting health benefits to end users.	
Does the Project take into account gender roles and the abilities of women or men to benefit from the Project's activities (e.g., Does the project criteria ensure that it includes minority groups or landless peoples)?	No	The project does not discriminate on basis of gender, caste or religion.	Not applicable
Does the Project design contribute to an increase in women's workload that adds to their care responsibilities or that prevents them from engaging in other activities?	No	No the Project was not designed to increase women´s workload nor add care responsibilities.	Not applicable
Would the Project potentially reproduce or further deepen discrimination against women based on gender, for instance, regarding their full participation in design and implementation or access to opportunities and benefits?	No	There is no place for discrimination against women in this Project. The project does not discriminate on basis of gender, caste or religion.	Not applicable
Would the Project potentially limit women's ability to use, develop and protect natural	No	The Project will not limit women´s ability regarding natural resources. The project does	Not applicable

resources, taking into account different roles and priorities of women and men in accessing and managing environmental goods and services?		not have any major impact on natural resources of the region.	
Is there a likelihood that the proposed Project would expose women and girls to further risks or hazards?	No	No the Project will not expose women and girls to further risks or hazards.	Not applicable
3.2.1. The Project shall not directly or indirectly lead to/contribute to adverse impacts on gender equality and/or the situation of women. Specifically, this shall include (not exhaustive):			
(a) Sexual harassment and/or any forms of violence against women - address the multiple risks of gender-based violence, including sexual exploitation or human trafficking.	No	The project does not involve any women workforce which may lead to sexual harassment.	Not applicable
(b) Slavery, imprisonment, physical and mental drudgery, punishment or coercion of women and girls.	No	The project does not involve any women activity which may lead to sexual harassment.	Not applicable
(c) Restriction of women's rights or access to resources (natural or economic).	No	The Project will not restrict women´s rights or access regarding natural resources. The project proponent does not discriminate on gender, caste, religion etc.	Not applicable

(d) Recognize women's ownership rights regardless of marital status - adopt project measures where possible to support to women's access to inherit and own land, homes, and other assets or natural resources.	No	Marital status is completely irrelevant to the Project. The project proponent does not discriminate on gender, caste, religion etc.	Not applicable
3.2.2 Projects shall apply the principles of nondiscrimination, equal treatment, and equal pay for equal work, specifically			
(a) Where appropriate for the implementation of a Project, paid, volunteer work or community contributions will be organized to provide the conditions for equitable participation of men and women in the identified tasks/activities.	No	Yes, the Project has equal opportunity for women and men to contribute both in volunteer and working positions	Not applicable
(b) Introduce conditions that ensure the participation of women or men in Project activities and benefits based on pregnancy, maternity/paternity leave, or marital status.	No	The project proponent has a stipulated human rights policy that takes into account participation by both men and women.	Not applicable
(c) Ensure that these conditions do not limit the access of women or men, as the case may be, to Project participation and benefits.	No	There is no limit on the access to Project participation and benefits from either of these conditions.	Not applicable

3.2.3. The Project shall refer to the country's national gender strategy or equivalent national commitment to aid in assessing gender risks.	No	The Citizens' Constitution declared women equal to men in all legal respects, explicitly stating in Article 5 of Title II that "men and women have equal rights and duties under the terms of this Constitution." The National Council on Women's Rights, formed in 1975, advocated successfully on behalf of including gender conscious legislation in the new constitution of 1988.	Not applicable
Principle 3. Community Health, Safety and Working Conditions			
1. The Project shall avoid community exposure to increased health risks and shall not adversely affect the health of the workers and the community	Potentially	The project uses urban solid waste as resource to generate biogas and energy. The project has an effective control of people and vehicles at the project site, provides Labour Health Assistance to its employees and counts with valid operational licence issued by the Local Environmental Agency.	Please see parameter "Labour Health Assistance" Please see parameter "Environmental Permit"

		Therefore, project does not affect any marginalized or vulnerable communities.	
Principle 4.1 Sites of Cultural and Historical Heritage			
Does the Project Area include sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture? >>	No	No cultural heritage is observed on the project site, thus no harm observed. The Land for the project has been approved by the local Authorities.	Not applicable
Principle 4.2 Forced Eviction and Displacement			
Does the Project require or cause the physical or economic relocation of peoples (temporary or permanent, full or partial)? >>	No	The proponent obtained licencing approval for establishing the plant. The project does not involve and is not complicit in involuntary resettlement in any way.	Not applicable
Principle 4.3 Land Tenure and Other Rights			
a. Does the Project require any change, or have any uncertainties related to land tenure arrangements and/or access rights, usage rights or land ownership? b. For Projects involving land use tenure, are there any uncertainties with regards to land	No	The project does not require any change to land tenure arrangements and/or other rights The project activity does not have any major	Not applicable

tenure, access rights, usage rights or land ownership?		impact on land use patterns.	
>>			
Principle 4.4 - Indigenous people			
Are indigenous peoples present in or within the area of influence of the Project and/or is the Project located on land/territory claimed by indigenous peoples?	No	No cultural heritage/ indigenous people are displaced due to the project.	Not applicable
>>			
Principle 5. Corruption			
1. The Project shall not involve, be complicit in or inadvertently contribute to or reinforce corruption or corrupt Projects	No	Indulgence in corruption is an illegal activity in the host country and the local labour compliance takes into account of the same.	Not applicable
Principle 6.1 Labour Rights			
1. The Project Developer shall ensure that all employment is in compliance with national labour occupational health and safety laws and with the principles and standards embodied in the ILO fundamental conventions	Potentially	The project developer does not complicit in any form of forced or compulsory labour. All employees offering their services on a voluntary basis and are free to quit the services at any time without a menace or penalty. The project	Refer to parameters "Number of employment"

2. Workers shall be able to establish and join labour organisations 3. Working agreements with all individual workers shall be documented and implemented and include: a) Working hours (must not exceed 48 hours per week on a regular basis), AND b) Duties and tasks, AND c) Remuneration (must include provision for payment of overtime), AND d) Modalities on health insurance, AND e) Modalities on termination of the contract with provision for voluntary resignation by employee, AND f) Provision for annual leave of not less than 10 days per year, not including sick		participants are committed to apply safe and healthy working conditions during all phases of the project. All employees of the project are protected by the Consolidation of Labour Laws Brazil signed the Universal Declaration of Human Rights (UDHR), adopted by the United Nations General Assembly. The project neither employs nor intends to employ child labour.	

and casual leave. 4. No child labour is allowed (Exceptions for children working on their families' property requires an opinion)			
Principle 6.2 Negative Economic Consequences			
1. Does the project cause negative economic consequences during and after project implementation?	No	The project involves in its core the solid waste management and electricity generation. Thus, the project did not cause negative economic consequences during and after project implementation	Not applicable
Principle 7.1 Emissions			
Will the Project increase greenhouse gas emissions over the Baseline Scenario?	No	The project will reduce greenhouse gas emissions and fossil fuel use compared to the baseline scenario.	Not applicable
Principle 7.2 Energy Supply			
Will the Project use energy from a local grid or power supply (i.e., not connected to a national or regional grid) or fuel resource (such as wood, biomass) that	No	The Project will supply electricity to the national electricity grid of Brazil. It may use imported electricity from the national grid when the power	Not applicable

provides for other local users?		plant is out of operation. It does not use energy from a local grid or power supply or fuel resource that provides for other local users.	
Principle 8.1 Impact on Natural Water Patterns/Flows			
Will the Project affect the natural or pre-existing pattern of watercourses, ground-water and/or the watershed(s) such as high seasonal flow variability, flooding potential, lack of aquatic connectivity or water scarcity?	No	As the project is a LFG project, there is no impact of water resources due to the project security measures such as drainage system and impermeabilizatio n.	Not applicable
Principle 8.2 Erosion and/or Water Body Instability			
a. Could the Project directly or indirectly cause additional erosion and/or water body instability or disrupt the natural pattern of erosion? b. Is the Project's area of influence susceptible to excessive erosion and/or water body instability?	No	No. This is unlikely by the project.	Not applicable
Principle 9.1 Landscape Modification and Soil			
Does the Project involve the use of land and soil for production of crops or other products?	No	The project is proposed to establish at the land which was not used for	Not applicable

		production of crops and other products for a long time.	
Principle 9.2 Vulnerability to Natural Disaster			
Will the Project be susceptible to or lead to increased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme climatic conditions?	No	The project is susceptible to decreased vulnerability to wind, earthquakes, subsidence, landslides, erosion, flooding, drought or other extreme conditions.	Not applicable
Principle 9.3 Genetic Resources			
Could the Project be negatively impacted by or involve genetically modified organisms or GMOs (e.g., contamination, collection and/or harvesting, commercial development, or take place in facilities or farms that include GMOs in their processes and production)?	No	The LFG plant does not make use of genetically modified organisms or GMOs	Not applicable
Principle 9.4 Release of pollutants			

Could the Project potentially result in the release of pollutants to the environment?	No	The project takes a precautionary approach regarding environmental challenges and is not complicit in practices contrary to the precautionary principle. The environment is protected by several Laws and Regulations in Brazil. The purpose of the "Law on Environmental Protection" is to protect the environment with principles of sustainable development and environment (by means of Environment Protection Act, 1986) . The project owner also follows necessary procedures for environmental safety at the project.	Not applicable
Principle 9.5 Hazardous and Non-hazardous Waste			
Will the Project involve the manufacture, trade, release, and/ or use of hazardous and non-hazardous chemicals and/or materials?	No	Project does not involve emission of Hazardous waste.	Not applicable

Principle 9.6 Pesticides & Fertilisers			
Will the Project involve the application of pesticides and/or fertilisers?	No	Not applicable for project activity	Not applicable
Principle 9.7 Harvesting of Forests			
Will the Project involve the harvesting of forests?	No	Not applicable for project activity	Not applicable
Principle 9.8 Food			
Does the Project modify the quantity or nutritional quality of food available such as through crop regime alteration or export or economic incentives?	No	Not applicable for project activity	Not applicable
Principle 9.9 Animal husbandry			
Will the Project involve animal husbandry?	No	Not applicable for project activity	Not applicable
Principle 9.10 High Conservation Value Areas and Critical Habitats			
Does the Project physically affect or alter largely intact or High Conservation Value (HCV) ecosystems, critical habitats, landscapes, key biodiversity areas or sites identified?	No	The environmental impact of the proposed project was considered negligible and the Environment Authority granted environmental approval for the project	Not applicable
Principle 9.11 Endangered Species			

a. Are there any endangered species identified as potentially being present within the Project boundary (including those that may route through the area)? b. Does the Project potentially impact other areas where endangered species may be present through transboundary affects?	No	No. The project does not impact other areas where endangered species may be present.	Not applicable

APPENDIX 2 - CONTACT INFORMATION OF PROJECT DEVELOPER(S)

Organization name	Conestoga-Rovers Engenharia Ltda.
Registration number with relevant authority	
Street/P.O. Box	Av. Adolfo Pinheiro, 1000 - Conj 101, 10º Andar
Building	
City	São Paulo
State/Region	SP
Postcode	04734-002
Country	Brazil
Telephone	+55 11 3213-4400
E-mail	fpileggi@craengenharia.com.br
Website	www.craengenharia.com.br
Contact person	Flavia Pileggi
Title	
Salutation	
Last name	
Middle name	
First name	
Department	
Mobile	
Direct tel.	
Personal e-mail	

APPENDIX 3 - LUF ADDITIONAL INFORMATION

Risk of change to the Project Area during Project Certification Period:	N/A
Risk of change to the Project activities during Project Certification Period:	N/A
Land-use history and current status of Project Area:	N/A
Socio-Economic history:	N/A
Forest management applied (past and future)	N/A
Forest characteristics (including main tree species planted)	N/A
Main social impacts (risks and benefits)	N/A
Main environmental impacts (risks and benefits)	N/A
Financial structure	N/A
Infrastructure (roads/houses etc):	N/A
Water bodies:	N/A
Sites with special significance for indigenous people and local communities - resulting from the Stakeholder Consultation:	N/A
Where indigenous people and local communities are situated:	N/A
Where indigenous people and local communities have legal rights, customary rights or sites with special cultural, ecological, economic, religious or spiritual significance:	N/A

APPENDIX 4 - DESIGN CHANGES

A4.1. Details of proposed or actual design change

>>

Not applicable

A4.2. Describe the impacts of design change on the following

a. Additionality

>>

Not applicable

b. Applicability of methodology and other methodological regulatory documents with which the project activity has been certified

>>

Not applicable

c. Compliance with the monitoring plan of the applied methodology

>>

Not applicable

d. Level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan

>>

Not applicable

e. Scale of the project activity

>>

Not applicable

f. Stakeholder consultation

>>

Not applicable

g. Sustainable development criteria

>>

Not applicable

h. Safeguarding assessment

>>

Not applicable

i. Compliance with applicable legislation

>>

Not applicable

j. <u>Only for LUF Projects</u>: Transparent summary of all approved changes in Project Area, Eligible Area and accompanying changes in ex-ante emissions removals.

Not applicable

Revision History

Version	Date	Remarks
1.5	29 June 2023	Editorial changes to match V2.1 of the Safeguarding Principles Requirements
1.4	21 June 2023	Editorial changes to match V2.0 of the Safeguarding Principles Requirements
1.3	14 April 2023	Integrated the design change memo as annex of the document. Editorial changes
1.2	14 October 2020	Hyperlinked section summary to enable quick access to key sections Improved clarity on Key Project Information Inclusion criteria table added Gender sensitive requirements added Prior consideration (1 yr rule) and Ongoing Financial Need added Safeguard Principles Assessment as annex and a new section to include applicable safeguards for clarity Improved Clarity on SDG contribution/SDG Impact term used throughout Clarity on Stakeholder Consultation information required Provision of an accompanying Guide to help the user understand detailed rules and requirements
1.1	24 August 2017	Updated to include section A.8 on 'gender sensitive' requirements
1.0	10 July 2017	Initial adoption