Monitoring report form for CDM project activity
(Version 07.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	Oeste de Caucaia Landfill Project Activity	
UNFCCC reference number of the project activity	10261	
Version number of the PDD applicable to this monitoring report	4	
Version number of this monitoring report	1	
Completion date of this monitoring report	12/03/2021	
Monitoring period number	3	
Duration of this monitoring period	24/09/2020 – 31/12/2020	
Monitoring report number for this monitoring period	Not applicable	
Project participants	GNR Fortaleza Valorização de Biogás Ltda.	
Host Party	Brazil	
Applied methodologies and standardized baselines	ACM0001: Flaring or use of landfill gas	
Sectoral scopes	13: Waste handling and disposal	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	77,019 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	156,846 tCO_2e[1]	

[1] Calculated using the PDD estimation of emission reductions to be achieved in 2020 (579,856 tCO_2e) times the number of days in this monitoring period for this year (99 days) divided by the number of days in the year (366 days).

SECTION A. Description of project activity

A.1. General description of project activity

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The primary objective of the Oeste de Caucaia Landfill Project Activity is to prevent greenhouse gases emissions by the Oeste de Caucaia Landfill through the capture, purification and injection of the landfill gas into a distribution grid, displacing the use of natural gas. The Oeste de Caucaia - Ecofor landfill is a municipal solid waste (MSW) disposal site located in Caucaia, Brazil.

The landfill is owned by the municipality of Caucaia and is operated since 2003 by ECOFOR under a 20-year concession. A passive LFG capture system was operational before the implementation of the CDM Project Activity. GNR Fortaleza Valorização de Biogás Ltda. is the project activity implementer. Applying the state-of-the-art on LFG capture technology, a collecting system was installed to avoid the free emission of methane to the atmosphere. A detailed description of the equipment is provided in Section B.1.

The captured LFG is sent to the upgrading facility before being injected to the natural gas distribution grid of CEGÁS – Companhia de Gás do Ceará (local natural gas supplier). CEGÁS will receive the upgraded gas from Oeste de Caucaia Landfill Project through a natural gas distribution grid, therefore mixing it with natural gas. This type of project, *i.e.*, landfill gas upgrading to natural gas and injection into a natural gas distribution grid is not usual in Brazil.

This monitoring report covers the period from 24/09/2020 to 31/12/2020. Currently, only the first phase of the project – which consists of a processing capacity of LFG equivalent to 7,500 Nm^3/h - has been implemented.

The total emission reductions achieved during this monitored period is **77,019 tCO2e.**

A.2. Location of project activity

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The Oeste de Caucaia Landfill is located is located in the municipality of Caucaia, Ceará state, north-eastern region of Brazil (Figure 1). The geographic coordinates (Figure 2) of the site where the project has been implemented are:

Latitude: 3°47'20.29"South
Longitude: 38°40'24.99"West

Figure 1 - Caucaia location (Source: http://pt.wikipedia.org)

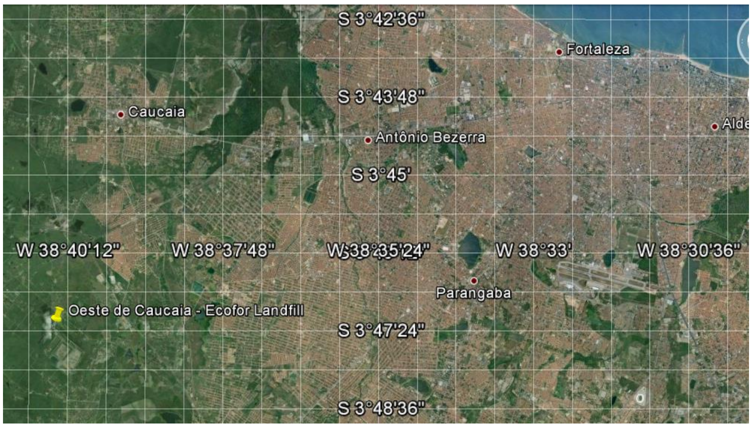

Figure 2 - Oeste de Caucaia Landfill location (Source: adapted from Google Earth)

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil	Private entity – GNR Fortaleza Valorização de Biogás Ltda.	No

This monitoring report was developed and reviewed by:

Consultancy	Project Proponent (Project Participant)
BENG	GNR Fortaleza Valorização de Biogás Ltda
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A.4. References to applied methodologies and standardized baselines

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Oeste de Caucaia Landfill Project Activity applies the ACM0001 methodology – "Flaring or use of landfill gas"[2] (version 15.0.0) and the following methodological tools:

- TOOL06 - "Project emissions from flaring" (version 02.0.0)[3];
- TOOL05 - "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01)[4];
- TOOL07 - "Tool to calculate the emission factor for an electricity system" (version 4.0)[5];
- TOOL03 - "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (version 02)[6];
- TOOL04 - "Emissions from solid waste disposal sites" (version 07.0)[7];

[2] Available at: <https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M>. Accessed on: 06/10/2020.

[3] Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v3.0.pdf/history_view>. Accessed on: 06/10/2020.

[4] Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf/history_view>. Accessed on: 06/10/2020.

[5] Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf/history_view>. Accessed on: 06/10/2020.

[6] Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf/history_view>. Accessed on: 06/10/2020.

- TOOL02 - “Combined tool to identify the baseline scenario and demonstrate additionality” (version 05.0.0)[8];
- TOOL08 - “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0)[9];
- TOOL09 - “Tool to determine the baseline efficiency of thermal or electric energy generation systems” (version 01)[10];
- TOOL10 - “Tool to determine the remaining lifetime of equipment” (version 01)[11];
- TOOL12 - “Project and leakage emissions from transportation of freight” (version 01.1.0)[12];
- 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)[13].

The “Tool to determine the baseline efficiency of thermal or electric energy generation systems”, “Tool to determine the remaining lifetime of equipment” and the methodological tool “Project and leakage emissions from transportation of freight” are not applicable to the project activity, and therefore are not used. Similarly, the methodological tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” was not used since the PDD corresponds to the first crediting period of the proposed CDM Project Activity.

A.5. Crediting period type and duration

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Renewable
The crediting period corresponding to the monitoring period covered in this monitoring report goes from 22/04/2016 to 22/04/2023.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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As per the registered PDD, Oeste de Caucaia Landfill Project Activity was implemented in phases. To date only the phase I has been operational.

In summary, the technology applied by the project consists of:

- Gas extraction wells with wellhead flow control and monitoring;
- A wellfield gas conveyance system (“laterals” and “header”);
- A Gas Station and an upgrading gas facility;
- A flaring system; and,
- A pipeline to inject the upgraded gas into the natural gas distribution grid.

Collecting System

The Oeste de Caucaia Landfill Project involved the perforation of new vertical wells as well as the installation of wellheads on top of them to collect the LFG emitted directly to the atmosphere in the baseline. An example of wellhead and the detail of its construction are shown in Figure 3.

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7 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.0.pdf/history_view>. Accessed on: 06/10/2020.
8 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf/history_view>. Accessed on: 06/10/2020.
9 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf/history_view>. Accessed on: 06/10/2020.
10 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v3.0.pdf/history_view>. Accessed on: 06/10/2020.
11 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf/history_view>. Accessed on: 06/10/2020.
12 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf/history_view>. Accessed on: 06/10/2020.
13 Available at: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf/history_view>. Accessed on: 06/10/2020.

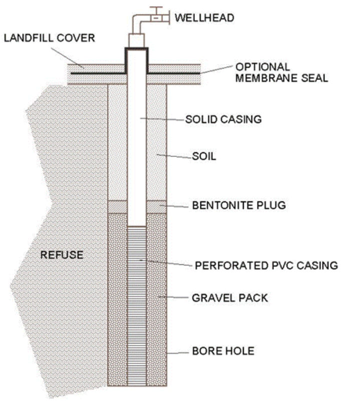

Figure 3 – Internal detail of a well and wellhead (source: USEPA, 1996[14])

New wells have been drilled in order to guarantee the efficiency of the controlled drainage of the landfill as well as of the LFG collection. Phase 1 involved the installation of 22 vertical wells and 64 horizontal extraction wells[15].

Flow-control and monitoring wellheads are employed at every gas extraction well, to allow precise regulation/adjustment of the gas flow at each well. Gas quality monitoring and flow adjustment is important to ensure that the system is "balanced" (i.e. gas extraction matches gas production so that atmospheric air is not introduced into the landfill).

A network of LFG header piping connects the horizontal collectors and vertical extraction wells, and direct the LFG to the LFG processing plant or (if the plant is down or there is excess LFG) the blower and flaring station for methane destruction.

The collection system became operational in 10/12/2015[16].

Gas Station and Upgrading gas facility

The Gas Station is the facility where the gas is suctioned from the landfill and where the gas receives the proper treatment, depending on the final use of the gas. Usually, the Gas Station is composed by blowers and condensate knock-outs. The project has 2 blowers, with a capacity of 5,000Nm³/hour each (Table 1).

Table 1 – Technical specification of the blowers.

Blowers (SP-203/204)	# of Units	2
	Manufacturer	Jonh Zink
	Model	12604
	Serial number	0514110-37597 0514109-37597
	Maximum capacity	5365 Nm³/h

Prior to the injection of the landfill gas to the natural gas distribution grid, it is treated in the upgrading facility, where most of the non-methane gases are removed from the stream. The project activity processing capacity is 7,500 Nm³/h (Phase I is operational).

14 USEPA – United States Environmental Agency; *Turning a Liability into an Asset: a Landfill Gas-to-Energy Project Development Handbook*; LMOP – Landfill Methane Outreach Program, 1996

15 In accordance with the gas capture project by Landtec, in a corporate presentation of provided by project owner

16 In accordance with in accordance with the environmental permit SEMACE No. 70/2015 which authorized the entry into operation of the system.

Flare System

Whenever LFG exceeds the processing capacity of the purification plant or the plant is not operational the gas is sent to the flaring system. The project has one open flare, with a capacity of 8,200 Nm^3/hour (Table 2). In order to ensure safety and, depending on the project performance, two more flares may be installed at the project site.

Table 2 – Technical specification of the flare.

Flare	Manufacturer		John Zink
	Type		Elevated Flare
	Commissioning date		10/12/2015
	Model		ZEF 16’’X45’
	Serial number		BF – 9149501
	Year of manufacturing		2014
	Nominal gas flow	LFG	8,200 Nm^3/h
		Upgraded LFG	4,100 Nm^3/h
	Minimum methane content	LFG	50 - 60%
		Upgraded LFG	97%
	Lowest operation temperature		100 ºF

The flare system became operational in 12/2015[17].

Upgraded gas pipeline

The upgraded gas is transported to the injection point through a pipeline. Within the landfill area the gas is collected using a *Flex Steel* pipeline. From the landfill border until CEGÁS pipeline (consumer), a *Carbon Steel* pipeline is used. This technology reduces the environmental impacts observed in a conventional mechanical construction once less machines are used during its construction.

Gas pipeline became fully operational in 12/2017, when CEGAS started to distribute the upgraded biogas produced by the project.

Most of this monitoring period the system has been in normal operation. There were a few days with significant down period and those were listed in a separate spreadsheet and have no impact on the methodology applicability. In addition to that, the National Agency of Petroleum, Natural Gas and Biofuels (ANP) also oversees the delivery of gas from the plant to CEGAS. In this way, plant shutdown events are also reported to the agency. The reports forwarded to the ANP were made available to the DOE during the project verification.

This monitoring report refers to the first monitoring period of the project. Therefore, no CERs have been issued.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

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[17] In accordance with in accordance with the environmental permit SEMACE No. 70/2015 which authorized the entry into operation of the system.

Three deviations from the registered monitoring plan are requested during this monitoring period. The requests are detailed below.

Deviation 1

In the registered monitoring plan described in the PDD, the parameter $v_{i,t,db}$ (volumetric fraction of greenhouse gas CH4 in the LFG), which is applied on calculation of project and baseline emissions, is continuously measured by a gas analyser (on dry basis), and it is aggregated hourly (at least). This equipment has two sensors that measures both the methane fraction in the LFG in the inlet of the plant and the methane fraction in the biomethane produced by the plant. This procedure is also in line with “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0) applied to Project “Oeste de Caucaia Landfill Project Activity”.
Nevertheless, as informed by project owner, the gas analyser sensor responsible for reading the methane fraction in the LFG was not operational from 24/09/2020 (00h:00min) to 30/09/2020 (23h:59 min) and the parameter could not be monitored in accordance with monitoring plan. However, the methane fraction in the biomethane was correctly measured during this period.
According to CDM project standard for project activities, version 02.0, paragraph 231, CDM validation and verification standard for project activities, version 02.0, paragraph 283 and in order to apply conservative assumptions or discount factors to the calculations to the extent required to ensure that emission reductions will not be overestimated as a result of the temporary deviation for the requested monitoring period, the conservative procedure will be elaborated as follows:

- A temporary deviation is proposed in order to provide this parameter using an alternative method. This parameter was calculated during this period, based on the amount of biomethane sold to consumer (CEGAS) - data from CEGAS reports and project activity supervisory system monitored data, and its respective fraction of methane - data from project activity supervisory system.
- The calculation of methane fraction in the LFG obtained from the amount of biomethane sold to CEGAS is coherent, once it is assumed that the amount of methane is not modified during the process of biogas upgrading. The increase of the volumetric fraction of methane in the outlet gas occurs only due to the removal of other gases from its original composition, such as N_2, CO_2 and H_2S, or rather, the purification process leads to an increase in the methane concentration in the final product
- This assumption was based on the design operation of “Oeste de Caucaia Landfill Project Activity”, which is illustrated by Figure 4, where it is possible to verify that the collected LFG that is directed to gas meter [D] passes through the upgrading process [C] and then it is sold to CEGAS [A] and injected in the natural gas pipeline.

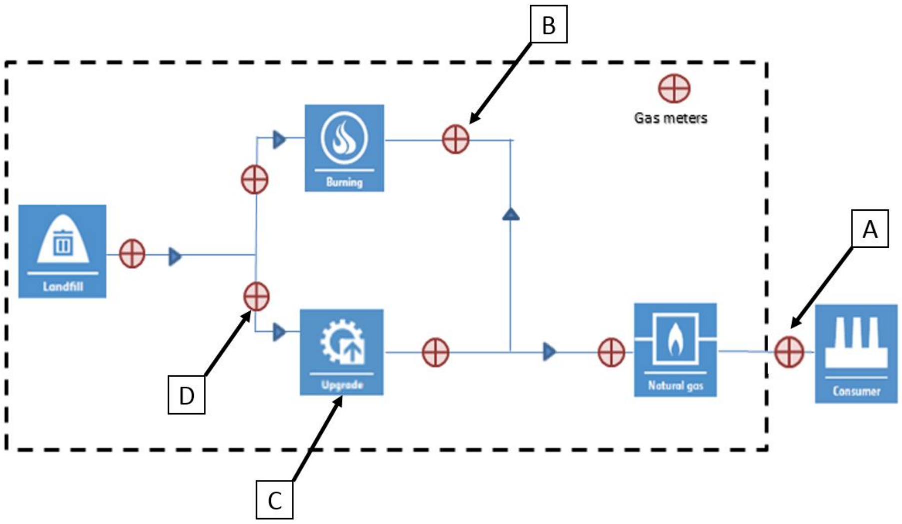

Figure 4 – Monitoring equipment of the project activity.

- The formula applied on calculation of volumetric fraction of greenhouse gas CH_4 in the LFG (vi,t,db) is described bellow:

$$vi,t,db\_LFG = \frac{Vt,db\_biomethane \times vi,t,db\_biomethane}{Vt,db\_LFG}$$

vi,t,db_LFG	[Calculated]	=	Volumetric fraction of greenhouse gas CH_4 in the LFG in time interval t on a dry basis (%)
$Vt,db\_biomethane$	[A] + [B]	=	Volumetric flow of the gaseous stream Biomethane in time interval t on a dry basis (Nm^3/h)
$vi,t,db\_biomethane$	[C]	=	Volumetric fraction of greenhouse gas CH_4 in the Biomethane in time interval t on a dry basis (%)
Vt,db_LFG	[D]	=	Volumetric flow of the gaseous stream LFG in time interval t on a dry basis (Nm^3/h)

The deviation described above considers only the methane content of the product that is delivered to CEGÁS. Thus, the "*Volumetric fraction of greenhouse gas CH_4 in the LFG*" is calculated as the ratio between the "*Total Methane Flow at the end of the Biomethane process*" and the "*Flow of LFG sent to the Biomethane process*":

$$\text{“Volumetric fraction of greenhouse gas CH4 in the LFG”} = A/D$$

Nevertheless, some methane loss may occur during the purification process. Adding the process losses to the calculated value would represent a higher value in the "LFG flow sent to Biomethane process" [D].Thus, the estimate presented is conservative since it does not add the methane losses in the biogas purification process to the result of methane concentration in biogas.

Deviation 2

From the entire monitoring period, the parameter “Flame detection of flare in the minute m” ($Flame_m$) was not implemented for the flare line and thus, not registered not the supervisory system.
According to CDM project standard for project activities, version 02.0, paragraph 231, CDM validation and verification standard for project activities, version 02.0, paragraph 283 and in order

to apply conservative assumptions or discount factors to the calculations to the extent required to ensure that emission reductions will not be overestimated as a result of the temporary deviation for the requested monitoring period, the conservative procedure will be elaborated as follows:

- It has been demonstrated that the flare is equipped with valves on the input gas line that close automatically if the device becomes non- operational. Thus, if LFG flow is registered for the flare line, then the LFG flow is combusted by this destruction device.
- As per flare operational description provided by manufacturer, the gas flows to the pilot device and a spark is generated to ignite the pilot flame and the automatic mode attempts to light the pilot three times.
- At the end of these attempts, if pilot flame is not ignited, “Pilot Failure” lamp will be illuminated and the operator will have to press the reset push-button to restart the unit.
- Upon proving the pilot flame, the automatic block valve is opened and the gas blower is started allowing gas flow to the flare.

The deviation described above is conservative, because it could be demonstrated, according to the manufacturer’s specifications, that although the parameter was not formally recorded, the gas flow is automatically blocked by the system when the flame is not lit. In other words, if any flow is registered, the flame is on.

Deviation 3

In the registered monitoring plan described in the PDD, the parameter Tt (Temperature of the gaseous stream in time interval t), which is applied on calculation of project and baseline emissions, is continuously measured by temperature sensor meter, and it is aggregated hourly (at least). This procedure is also in line with “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (Version 02.0.0) applied to Project “Oeste de Caucaia Landfill Project Activity”.
Nevertheless, as informed by project owner, the temperature sensor meter that should provide the measurement was not operational during the period between 24/09/2020 (00h:00min) to 26/11/2020 (16h:37 min) and the parameter could not be monitored in accordance with monitoring plan.
According to CDM project standard for project activities, version 02.0, paragraph 231, CDM validation and verification standard for project activities, version 02.0, paragraph 283 and in order to apply conservative assumptions or discount factors to the calculations to the extent required to ensure that emission reductions will not be overestimated as a result of the temporary deviation for the requested monitoring period, the conservative procedure will be elaborated as follows:

- As stated in the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, it is necessary to demonstrate that the gaseous stream is dry or wet by demonstrating that the temperature of the gaseous stream (Tt) is less than 60°C (dry basis) or higher than 60°C (wet basis) at the flow measurement point.
- For the deviation period, since it was not possible to demonstrate if the gaseous stream is dry or wet, it was conservatively adopted a temperature of 78°C (wet basis, being above the highest LFG temperature registered during the entire monitoring period) and thus, converting the measured volumetric flow from wet basis to dry basis, as defined in Option B of the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”.

The deviation described above is conservative because the gas flow rate was actually adjusted and considered the highest temperature measured in the periods when the equipment was in operation. Furthermore, the deviation was applied to only four out of the thirty-four months included in the current monitoring report.

B.2.2. Corrections

>>
Not applicable. This section is intentionally left blank.

B.2.3. Changes to the start date of the crediting period

>>
Not applicable. This section is intentionally left blank.

B.2.4. Inclusion of monitoring plan

>>
Not applicable. This section is intentionally left blank.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

>>
Not applicable. This section is intentionally left blank.

B.2.6. Changes to project design

>>
Not applicable. This section is intentionally left blank.

B.2.7. Changes specific to afforestation or reforestation project activity

>>
Not applicable. This section is intentionally left blank.

SECTION C. Description of monitoring system

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The monitoring of project activity followed the requirements established in ACM0001 and referred tools. All data monitored was made available at the time of the verification and will be archived electronically for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

The project is equipped with meters which collect the following data:

(i) Landfill gas (LFG) sent to flare;
(ii) LFG sent to the upgrading system;
(iii) Biomethane resulted from upgrading process; and,
(iv) Biomethane which does not reach the required parameters to be delivered to the NG distribution system and, for this reason, is flared.

Since the flow meters already measures the volumetric flow rate of the residual gas at normal conditions, the parameters Temperature of the landfill gas (T) and Pressure of the landfill gas (P) have not been measured for normalizing purposes.

The below table presents the main technical characteristics of the monitoring equipment.

Table 3 – Technical specification of the monitoring equipment.

Type	Manufacturer	Model	Serial number	Range
LFG Flow inlet to Biomethane	ABB	FMT500-IG	V14224-002961	0 - 24,000 Nm^3/h
LFG Flow inlet direct to Flare	ABB	FMT500-IG	V14224-002969	1 - 24,000 Nm^3/h
Biomethane Flow inlet return to Flare	ABB	FMT500-IG	V14224-002962	2 - 24,000 Nm^3/h
LFG Temperature	WARME	WTT-6001	TI.3244	0 - 80ºC
LFG Pressure	ROSEMOUNT	3051	2593163	0 - 500 mbar

Methane Fraction in LFG	ABB	PGC-1000	T170268182	0-100%

However, whenever for a certain period a delay in the calibration of measuring equipment was observed, the procedures defined in paragraph 369 of the CDM validation and verification standard for project activities were adopted. The errors and uncertainties applied in the relevant monitoring period are presented in a separate calibration spreadsheet.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

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The following ex ante parameters, which are listed in the registered PDD, were not used in this monitoring period in order to calculate the emission reductions by the project activity and, therefore, are not presented in the tables below:

- Total amount of waste disposed in a SWDS in year x (W_x)
- Efficiency of the LFG capture system that will be installed in the project activity (η_{PJ})
- Default value for model correction factor to account for model uncertainties ($\varphi_{default}$)
- 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 (f_y)
- Oxidation factor (reflecting the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste)) (OX)
- Fraction of methane in the SWDS gas (volume fraction) (F)
- Default value for the fraction of degradable organic carbon in MSW that decomposes in the SWDS ($DOC_{f,default}$)
- Methane correction factor ($MCF_{default}$)
- Fraction of degradable organic carbon in the waste type j (weight fraction) (DOC_j)
- Decay rate for the waste type j (k_j)
- Amount of fuel type i consumed by power plant/unit m, k or n (or in the project electricity system in case of $FC_{i,y}$) in year y or hour h ($FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$)
- CO_2 emission factor of fossil fuel type i used in power unit m in year y ($EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$)
- Net electricity generated by power plant/unit m or k in year y ($EG_{m,y}$ and $EG_{k,y}$)
- Average net energy conversion efficiency of power unit m in year y ($\eta_{m,y}$)

ACM0001

Data/Parameter	OX_{top_layer}
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool “Emissions from solid waste disposal sites”
Value(s) applied	0.1
Choice of data or measurement methods and procedures	As per the applicable tool

Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Applicable to section 5.4.1. of the registered PDD (baseline emissions of methane from the SWDS, $BE_{CH4,y}$)

Data/Parameter	GWP_{CH4}
Unit	t_{CO2e}/t_{CH4}
Description	Global Warming Potential of CH_4
Source of data	IPCC
Value(s) applied	25 for the second commitment period. Shall be updated according to any future COP/MOP decisions
Choice of data or measurement methods and procedures	As per the applicable methodology
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	NCV_{CH4}
Unit	TJ/t_{CH4}
Description	Net calorific value of methane at reference conditions
Source of data	Technical literature
Value(s) applied	0.0504
Choice of data or measurement methods and procedures	As per the applicable methodology
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

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

Data/Parameter	R_u
Unit	$Pa.m^3/kmol.K$
Description	Universal ideal gases constant
Source of data	As per the applicable tool
Value(s) applied	8,314
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	MM_i
Unit	kg/kmol
Description	Molecular mass of greenhouse gas *i*
Source of data	Tool
Value(s) applied	16.04 (for methane)
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	MM_k
Unit	kg/kmol
Description	Molecular mass of gas *k* *(k = N_2)*
Source of data	As per the tool
Value(s) applied	28.01
Choice of data or measurement methods and procedures	According to ACM0001, the simplification offered in the tool for calculating the molecular mass of the gaseous stream ($MM_{t,db}$) is valid. Thus, the volumetric fraction of the greenhouse gas (CH_4) is considered and the difference to 100% is considered as pure nitrogen.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	MM_{H2O}
Unit	kg/kmol
Description	Molecular mass of water
Source of data	As per the tool
Value(s) applied	18.0152
Choice of data or measurement methods and procedures	According to “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	P_n
Unit	Pa
Description	Total pressure at normal conditions
Source of data	As per the tool
Value(s) applied	101,325
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline and project emissions
Additional comments	-

Data/Parameter	T_n
Unit	K
Description	Temperature at normal conditions
Source of data	As per the tool
Value(s) applied	273.15
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline and project emissions
Additional comments	-

“Tool to calculate the emission factor for an electricity system”

Data/Parameter	$EF_{grid,OM-adj,y}$
Unit	tCO_2/MWh
Description	Simple adjusted operating margin CO_2 emission factor in year *y*

Source of data	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value(s) applied	0.3612
Choice of data or measurement methods and procedures	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Purpose of data/parameter	Calculation of the project emissions due to electricity consumption
Additional comments	For methodological choices details, please refer to section E.6.1. of the registered PDD

Data/Parameter	$EF_{BM,2013}$
Unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year *y*
Source of data	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value(s) applied	0.2850
Choice of data or measurement methods and procedures	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Purpose of data/parameter	Calculation of the project emissions due to electricity consumption
Additional comments	For methodological choices details, please refer to section E.6.1. of the registered PDD

D.2. Data and parameters monitored

The following monitored parameters, listed in the registered PDD, will not be used in this monitoring period and thus not presented in the tables below since have been not used in the calculation of emission reductions:

- Volumetric fraction of greenhouse gas *i* in a time interval *t* on a wet basis ($v_{i,t,wb}$);
- Quantity of fuel type *i* combusted in process *j* during the year y ($FC_{i,j,y}$), when *i* corresponds to any fossil fuel used to generate electricity since electricity consumed by the plant is from the grid;
- Weighted average net calorific value of fuel type *i* in year *y* ($NCV_{,i,y}$), when *i* corresponds to any fossil fuel used to generate electricity since electricity consumed by the plant is from the grid;
- Weighted average CO_2 emission factor of fuel type *i* in year *y* ($EF_{CO2,i,y}$), when *i* corresponds to any fossil fuel used to generate electricity since electricity consumed by the plant is from the grid;

ACM0001

Data/Parameter	Management of SWDS
Unit	-
Description	Management of SWDS
Measured/calculated/ default	-
Source of data	- Environmental Impact Assessment - Environmental Permits: LO Nº081/2016 and its renewal request; and, LO Nº 76/2020, issued on 15/09/2020, valid through 14/06/2026
Value(s) of monitored parameter	-

Monitoring equipment	-
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	-
QA/QC procedures	Project participants referred to the original design of the landfill (as described in the Environmental Impact Assessment) and compared to the latest issued environmental permits to ensure that management of the landfill has not changed aiming at increasing methane generation after the implementation of the project activity.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	$Op_{j,h}$
Unit	-
Description	Operation of the equipment that consumes the LFG
Measured/calculated/ default	In the context of the proposed project activity, equipment unit *j* using *the LFG* consists of the LFG upgrading facility and a flare. Hence, the following parameters are to be used to ensure that the plant is operating in hour *h*: *For the LFG upgrading facility* • Products generated. Monitor the generation of upgraded LFG which is sold to the consumer. This information was cross-checked against data from the supervisory system; *For the flaring system* • Flame. Flame detection system is used to ensure that the equipment is in operation; $Op_{j,h}$=0 when: • No products are generated in the hour h • Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); Otherwise, $Op_{j,h}$=1
Source of data	Project Participants
Value(s) of monitored parameter	The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.
Monitoring equipment	-
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	Not applicable
QA/QC procedures	Valve directing the product to CEGAS network and flame detectors are subject to a regular maintenance and testing regime to ensure equipment is functioning well.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This is monitored to ensure methane destruction is claimed for methane used in the upgrading LFG facility when it is operational

Data/Parameter	$EG_{EC,y}$
Unit	MWh
Description	Amount of electricity consumed by the project activity in year y
Measured/calculated/ default	Measured
Source of data	Electricity meters

Value(s) of monitored parameter	<table><tr><th>Month</th><th>Electricity consumed (MWh)</th></tr><tr><td>September[18]</td><td>-</td></tr><tr><td>October</td><td>1,222.20</td></tr><tr><td>November</td><td>1,106.58</td></tr><tr><td>December</td><td>1,153.15</td></tr><tr><td>TOTAL</td><td>3,481.93</td></tr></table>
Monitoring equipment	From 4/09/2020 until 31/12/2020 Manufacturer: SCHNEIDER Model: ION8650 Serial Number: MW-1709A919-02 Accuracy class: C/D Meter calibration and maintenance under the responsibility of the local electricity distribution company. Calibrated on 18/02/2018, valid for 5 years.
Measuring/reading/recording frequency	Continuously, aggregated at least annually
Calculation method (if applicable)	-
QA/QC procedures	Electricity meter will be subject to regular maintenance and testing to ensure accuracy. The calibration periodicity will be in accordance with the manufacturer recommendation. The accuracy of the equipment, as per the manufacturer specification is 0,2% (Accuracy class 0,2%).
Purpose of data/parameter	Calculation of project emissions
Additional comments	This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process *t* ($PE_{EC,y}$) using the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*". In accordance with ACM0001, this parameter is equivalent to $EC_{PJ,k,y}$ in the tool.

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

Data/Parameter	$V_{t,db}$
Unit	m³ dry gas/h
Description	Volumetric flow of the gaseous stream in time interval *t* on a dry basis
Measured/calculated/ default	Measured
Source of data	Onsite measurements
Value(s) of monitored parameter	The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.
Monitoring equipment	Avalable in a separate calibration spreadsheet
Measuring/reading/recording frequency	Continuous, aggregated at least hourly.
Calculation method (if applicable)	-
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 specification.
Purpose of data/parameter	Calculation of baseline and project emissions
Additional comments	This parameter will be monitored in Option A

[18] Total electricity from the grid consumed by the Project Activity was accounted as Project emissions in the previous verification.

Data/Parameter	$V_{t,wb}$
Unit	m³ wet gas/h
Description	Volumetric flow of the gaseous stream in time interval *t* on a wet basis
Measured/calculated/ default	Measured
Source of data	Onsite measurements
Value(s) of monitored parameter	The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.
Monitoring equipment	Avalable in a separate calibration spreadsheet
Measuring/reading/recording frequency	Continuous, aggregated at least hourly.
Calculation method (if applicable)	-
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 specification.
Purpose of data/parameter	Calculation of baseline and project emissions
Additional comments	This parameter is monitored in Option B and C.

<table>
<tr><td>Data/Parameter</td><td>$V_{i,t,db}$</td></tr>
<tr><td>Unit</td><td>m³ gas i/m³ dry gas</td></tr>
<tr><td>Description</td><td>Volumetric fraction of greenhouse gas i in time interval t on a dry basis</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Onsite measurement</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th>Instrument</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial number</th><th>Starting period</th><th>Finishing period</th><th>Calibration frequency</th><th>Date of Calibration</th><th>Validity</th></tr>
<tr><td>Methane Fraction in LFG</td><td>Ecometano - GNR</td><td>ABB</td><td>PGC-1000</td><td>T170268182</td><td>24/09/2020
14/10/2020</td><td>13/10/2020
31/12/2020</td><td>6 months</td><td>11/08/2020
14/10/2020</td><td>10/02/2021
13/04/2021</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous, aggregated at least hourly.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>-</td></tr>
<tr><td>QA/QC procedures</td><td>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.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of baseline and project emissions</td></tr>
<tr><td>Additional comments</td><td>This parameter will be monitored in Option A and B.</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$V_{i,t,wb}$</td></tr>
<tr><td>Unit</td><td>m³ gas i/m³ wet gas</td></tr>
<tr><td>Description</td><td>Volumetric fraction of greenhouse gas i in a time interval t on a wet basis</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Onsite measurement</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th>Instrument</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial number</th><th>Starting period</th><th>Finishing period</th><th>Calibration frequency</th><th>Date of Calibration</th><th>Validity</th></tr>
<tr><td>Methane Fraction in LFG</td><td>Ecometano - GNR</td><td>ABB</td><td>PGC-1000</td><td>T170268182</td><td>24/09/2020
14/10/2020</td><td>13/10/2020
31/12/2020</td><td>6 months</td><td>11/08/2020
14/10/2020</td><td>10/02/2021
13/04/2021</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous, aggregated at least hourly.</td></tr>
</table>

Calculation method (if applicable)	-
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/parameter	Calculation of baseline and project emissions
Additional comments	This parameter will be monitored in Options C and may be monitored in Option A.

<table>
<tr><td>Data/Parameter</td><td>$\boldsymbol{T_t}$</td></tr>
<tr><td>Unit</td><td>K</td></tr>
<tr><td>Description</td><td>Temperature of the gaseous stream in time interval t</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Onsite measurements</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th>Instrument</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial number</th><th>Starting period</th><th>Finishing period</th><th>Calibration frequency</th><th>Date of Calibration</th><th>Validity</th></tr>
<tr><td>LFG Temperature</td><td>TE 210</td><td>WARME</td><td>WTT-6001</td><td>TI.3243</td><td>24/09/2020</td><td>31/12/2020</td><td>3 years</td><td>11/11/2020</td><td>10/11/2023</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous, aggregated at least hourly.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>-</td></tr>
<tr><td>QA/QC procedures</td><td>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</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of baseline and project emissions</td></tr>
<tr><td>Additional comments</td><td>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.
Applicable to Options A and C of the tool.</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>P_t</td></tr>
<tr><td>Unit</td><td>Pa</td></tr>
<tr><td>Description</td><td>Pressure of the gaseous stream in time interval t</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Onsite measurements</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th>Instrument</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial number</th><th>Starting period</th><th>Finishing period</th><th>Calibration frequency</th><th>Date of Calibration</th><th>Validity</th></tr>
<tr><td>LFG Pressure</td><td>PIT 210</td><td>ROSEMOUNT</td><td>3051</td><td>2593164</td><td>24/09/2020</td><td>31/12/2020</td><td>3 years</td><td>04/11/2020</td><td>03/11/2023</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous, aggregated at least hourly.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>-</td></tr>
</table>

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.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	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). Applicable to Option A and C of the tool.

Data/Parameter	$P_{H2O,t,Sat}$
Unit	Pa
Description	Saturation pressure of H_2O at temperature T_t in time interval t
Measured/calculated/ default	Default
Source of data	Provided by project participants
Value(s) of monitored parameter	n/a
Monitoring equipment	-
Measuring/reading/recording frequency	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
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	[1] Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4º Edition 1994, John Wiley & Sons, Inc.

"Project emissions from flaring"

Data/Parameter	$Flame_m$
Unit	Flame on or Flame off
Description	Flame detection of flare in the minute *m*
Measured/calculated/ default	The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.
Source of data	Project participants
Value(s) of monitored parameter	The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.
Monitoring equipment	Flame detector
Measuring/reading/recording frequency	Once per minute. Detection of flame recorder as a minute that the flame was on, otherwise recorded as a minute that the flame was off
Calculation method (if applicable)	-
QA/QC procedures	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations. It will be replaced after 10,000 operating hours. The spectral range of the equipment is 190 – 270nm and its maximum sensitivity is 210 ± 10nm.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

Data/Parameter	$TDL_{project, y}$
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Measured/calculated/ default	Default
Source of data	ANEEL Report[19]
Value(s) of monitored parameter	2019: 16.02 %
Monitoring equipment	-
Measuring/reading/recording frequency	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	Official source is used. Aneel is the Brazilian electricity regulatory agency. Data from 2020 is not available yet. Hence, information from 2019 (most recent figure) is used to calculate project emissions due to electricity consumption during 2020.

"Tool to determine project emissions from fossil fuel combustion"

Data/Parameter	$FC_{i,j,y}$
Unit	kg/yr
Description	Quantity of fuel type *i* combusted in process *j* during the year y (*i* = LPG)
Measured/calculated/ default	Measured
Source of data	Sales receipt
Value(s) of monitored parameter	The CERs calculation spreadsheet includes all records of measurement data of this parameter during the considered monitoring period.
Monitoring equipment	Internal records related to LPG purchase
Measuring/reading/recording frequency	At every purchase of LPG
Calculation method (if applicable)	-
QA/QC procedures	The consistency of metered fuel consumption quantities is to 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/parameter	Calculation of project emissions
Additional comments	Conservatively, it shall be considered that all LPG purchase will be used.

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

[19] Publicly available in Portuguese at https://www.aneel.gov.br/metodologia-distribuicao/-/asset_publisher/e2INtBH4EC4e/content/perdas/654800?inheritRedirect=false&redirect=http%3A%2F%2Fwww.aneel.gov.br%2Fmetodologia-distribuicao%3Fp_p_id%3D101_INSTANCE_e2INtBH4EC4e%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-2%26p_p_col_pos%3D3%26p_p_col_count%3D4

Measured/calculated/ default	Default
Source of data	Brazilian Energy Balance 2020 Year 2019[20]
Value(s) of monitored parameter	0.0465
Monitoring equipment	-
Measuring/reading/recording frequency	Review appropriateness of values annually
Calculation method (if applicable)	-
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 ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data/parameter	Calculation of project emissions from fossil fuel consumption for the flare ignition.
Additional comments	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.

Data/Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	Weighted average CO_2 emission factor of fuel type *i* in year *y* (*i* = LPG)
Measured/calculated/ default	Default
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) of monitored parameter	0.0656
Monitoring equipment	-
Measuring/reading/recording frequency	Any future revisions of the IPCC Guidelines should be taken into account.
Calculation method (if applicable)	-
QA/QC procedures	Not applicable since IPCC default value is used.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/TJ
Description	Weighted average CO_2 emission factor of fuel type *i* in year *y* (*i* = natural gas)
Measured/calculated/ default	Default
Source of data	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

[20] Publicly available, both in English and in Portuguese, at: <https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-479/topico-528/BEN2020_sp.pdf>.

Value(s) of monitored parameter	58.3
Monitoring equipment	-
Measuring/reading/recording frequency	Any future revisions of the IPCC Guidelines should be taken into account.
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Option d) is used since the source mentioned in option a) is not available. Further the fuel considered – *i.e.* natural gas - is not liquid. Therefore, option c) could not be used. This parameter is used to determine $EF_{CO2,NG,y}$ from ACM0001. Following the procedures of the methodology, it is to be determined using the "*Tool to determine project emissions from fossil fuel combustion"*.

D.3. Implementation of sampling plan

>>

Not applicable. This section is intentionally left blank.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

>>

This section describes the methods used for the calculation of baseline emissions. As per the requirements, sample calculations for all formulae used are provided considering baseline emissions achieved by the CDM Project Activity during 10/2020.

The table below summarizes the results of baseline emissions calculated for the monitoring period.

	DEVIATION applied	BE,y	BECH4,y	BENG,y	FCH4PJ,y	FCH4BL,y	FCH4flared,y	FCH4NG,y	% CH4	FCH4 sentflare,y	Total methane for Consumer	Total methane to Flare	FCH4RG,t	PEflare,y
	(yes/no)	tCO2	tCO2	tCO2	tCH4	tCH4	tCH4	tCH4	%	tCH4	Nm³CH4	Nm³CH4	kg	tCO2
From 24/09/2020	Yes	3,911	3,350	560	191	38	0.7	191	47.3%	1.5	266,064	2,044	1,465	18
10/2020	Yes	20,728	17,758	2,970	1,015	203	4.1	1,011	58.2%	8.1	1,410,003	11,336	8,126	102
11/2020	Yes	20,962	17,961	3,001	1,026	205	4.9	1,021	58.5%	9.7	1,425,030	13,584	9,737	122
12/2020	Yes	32,724	28,043	4,680	1,602	320	9.7	1,593	58.5%	19.3	2,222,115	26,972	19,334	242

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* (t CO_2e/yr)
$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)
$BE_{EC,y}$ = Baseline emissions associated with electricity generation in year *y* (t CO_2/yr)
$BE_{HG4,y}$ = Baseline emissions associated with heat generation in year *y* (t CO_2/yr)
$BE_{NG,y}$ = Baseline emissions associated with natural gas use in year *y* (t CO_2/yr)

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

Sample calculation:

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

$BE_y = 17,758 + 2,970 = 20,728\ tCO_2e$

Baseline emissions of methane from the SWDS ($BE_{CH4,y}$) 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[21].

$$BE_{CH4,y} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH4,BL,y}\right) \quad GWP_{CH4}$$ **Equation 2**

Where,

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

Sample calculations

$BE_{CH4,y} = ((1 – OX_{top\_layer}) * F_{CH4,PJy} - F_{CH4,BLy}) * GWP_{CH4}$

$BE_{CH4,y} = ((1 – 0.1) * 1,015 – 203) * 25 = 17,758\ tCO_2e$

During the crediting period, $F_{CH4,PJ,y}$ is determined as the sum of the quantities of methane flared and forwarded to the natural gas distribution network, 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 activity in year y (tCH_4/yr)
$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year y (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 and/or to the trucks in year y (tCH_4/yr)

In the case of the project activity, $F_{CH4,HG,y}$ and $F_{CH4,EL,y}$ are zero since neither heat nor electricity will be generated using the biogas.

Sample calculations

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

$F_{CH4,PJ,y} = 4.1 + 0 + 0 + 1,011 = 1,015\ tCO_2e$

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

The determination of $F_{CH4,NG,y}$ is done using the *"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"*. Monitoring followed the requirements of the ACM0001 and "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" and considered the below options:

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

During the monitored period Options A and B were used to determine the mass flow of gases containing methane. Methodological steps applicable when this options are used are detailed below.

Option A of the Tool applies when biogas mass flow and volumetric fraction of methane measured in dry basis). While considering this option, it is necessary to demonstrate that the gaseous stream is dry by:

(a) Measuring the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H_2O/m^3 dry gas; or

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

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

Under this option, $F_{CH4,NG,y} = F_{i,t}$.

$$F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t} \quad \textbf{Equation 4}$$

And:

$$\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t} \quad \textbf{Equation 5}$$

Where:

Fi,t	=	Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h);
Vt,db	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 wet gas/h);
vi,t,db	=	Volumetric fraction of greenhouse gas *i* in the gaseous stream in time interval *t* on a dry basis (m^3 gas *i* /m^3 dry gas);
ρi,t	=	Density of greenhouse gas *i* in the gaseous stream in time interval t (kg gas *i*/m^3 gas *i*);
Pt	=	Absolute pressure of the gaseous stream in time interval *t* (Pa);
MMi	=	Molecular mass of greenhouse gas *i* (kg/kmol);
Ru	=	Universal ideal gases constant (Pa.m^3/kmol.K);
T_t	=	Temperature of the gaseous stream in time interval *t* (K).

Option B is applicable when the volume flow in wet basis and volumetric fraction in dry basis, following the demonstration criteria presented under Option A.

The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined using Equation 4 and Equation 5 used in 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:

$$V_{t,tb} = V_{t,wb}/(1 + v_{H2O,t,db}) \quad \textbf{Equation 6}$$

Where:

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

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

$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$ **Equation 7**

Where:

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

The absolute humidity of the gaseous stream ($m_{H2O,t,db}$) 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[22].

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 8**

Where:

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

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

[22] 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).

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

Equation 9

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,).

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.

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

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

Equation 10

Where,

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

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

It is important mentioning that the upgraded gas that does not reach specifications to be delivered in the NG pipeline will be flared. For the determination of biogas resulted from the upgrade system return that will be flared, one of those options and its respective requirements are applied.

Project Emissions from flaring:

Project emissions are related to the amount of methane not destroyed in the flare and are determined following the procedures of the methodological tool "*Project emissions from flaring*". The project is equipped with an open flare. In this sense, Oeste de Caucaia Landfill Project adopts the default flare efficiency. The calculation of flare efficiency will be made by the following steps:

<u>STEP 1</u>: Determination of the methane mass flow of the residual gas;

The mass flow of methane in the residual gaseous stream in the minute *m* ($F_{CH4,m}$) will be determined using the procedures set out by the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*" and the following requirements apply:

- The gaseous stream tool shall be applied to the residual gas;
- The flow of the gaseous stream shall be measured continuously;
- CH_4 is the greenhouse gas *i* for which the mass flow should be determined;

- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool); and
- The time interval *t* for which mass flow should be calculated is every minute *m*.

$F_{CH4,m}$, which is measured as the mass flow during minute *m*, shall then be used to determine the mass of methane in kilograms fed to the flare in minute *m* ($F_{CH4,RG,m}$). This parameter corresponds to $F_{CH4,sent\_flare,y}$. Therefore, the same methodological approaches apply to both parameters (Option C of the tool described above).

However, the upgraded gas, which does not reach quality specifications to be delivered into the NG pipeline, will be flared. In this case, Option A of the tool will be applied as explained above. Please refer to methodological explanations for the ex-post determination of $F_{CH4,sent\_flare,y}$ and monitoring equipment in section B.7.3.

STEP 2: Determination of flare efficiency

The Oeste de Caucaia Landfill Project installed an open flare. Therefore, in accordance with the methodological tool, the flare efficiency in the minute *m* ($\eta_{flare,m}$) is 50% when the flame is detected in minute *m* ($Flame_m$), otherwise $\eta_{flare,m}$ is 0%.

STEP 3: Calculation of project emissions from flaring

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

$$PE_{flare,y} = GWP_{CH_4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \cdot \left(1 - \eta_{flare,m}\right) \times 10^{-3}$$ **Equation 11**

Where,

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

Sample calculation

$PE_{flare,y} = GWP_{CH4} * \sum F_{CH4,RG,m} * (1 - \eta_{flare,m}).10^{-3}$

$PE_{flare,y} = 25 * 8{,}126 * (1 - 0.5).10^{-3} = 102\ tCO_2e$

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

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

$$BE_{NG,y} = 0.0504 \times F_{CH4,NG,y} \times EF_{CO2,NG,y}$$ **Equation 12**

Where,

$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year *y* ($t\ CO_2/yr$)
$EF_{CO2,NG,y}$	=	Average CO_2 emission factor of natural gas in the natural gas network or in trucks in year *y* (tCO_2/TJ)
$F_{CH4,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network or in trucks in year *y* (tCH_4/yr)

$EF_{CO2,NG,y}$ is determined using the *"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".*

Sample calculation

$BE_{NG,y} = 0.0504 * F_{CH4NG,y} * EF_{CO2,NG,y}$

$BE_{NG,y} = 0.0504 * 1{,}011 * 58.3 = 2{,}970\ tCO_2e$

Finally, the determination of the amount of methane in the LFG that would be flared in the baseline ($F_{CH4,BL,y}$) is calculated following the provisions of Case 3 of the ACM0001, as per the registered PDD. In accordance with the ACM0001 methodology, under *Case 3*, $F_{CH4,BL,y}$ = $F_{CH4,BL,sys,y}$ and the following equation applies:

$$F_{CH4,BL,sys,y} = 0.2 \times F_{CH4,PJ,y}$$ **Equation 13**

Sample calculation
$F_{CH4,BL,sys,y} = F_{CH4,BL,y} = 0.2 * F_{CH4,PJ,y}$
$F_{CH4,BL,y} = 0.2 * 1{,}015 = 203\ tCO_2e$

E.2. Calculation of project emissions or actual net removals

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This section describes the methods used for the calculation of project emissions. As per the requirements, sample calculations for all formulae used are provided considering project emissions occurring as a consequence of the implementation of the CDM Project Activity during 10/2020.

The table below summarizes the results of project emissions calculated for the monitoring period.

	DEVIATION applied	PE,y	PEEC1	PEFC,j	ECPJ1	FCi,j
	(yes/no)	tCO2	tCO2	tCO2	MWh	Kg
From 24/09/2020	Yes	0.00	0.00	0.0000	0.00	0.00
10/2020	Yes	458.15	458.15	0.0000	1222.20	0.00
11/2020	Yes	414.81	414.81	0.0000	1106.58	0.00
12/2020	Yes	432.27	432.27	0.0000	1153.15	0.00

Sources of project emissions are electricity and fossil fuel consumption, as presented in the equation below:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y}$$ **Equation 14**

Where,

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year *y* (t CO_2/yr);
$PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (t CO_2/yr);
$PE_{DT,y}$ = Emissions from the distribution of compressed/liquefied LFG using trucks, in year *y* (t CO_2/yr).

The proposed project activity will not make use of trucks to distribute compressed/liquefied LFG. On the contrary, it will inject the purified LFG directly into the natural gas distribution grid. Therefore, there are no project emissions associated with the distribution of compressed/liquefied LFG using trucks and $PE_{DT,y}$ is **zero.**

Sample calculation
$PE_y = PE_{EC,y} + PE_{FC,y}$
$PE_y = 458.15 + 0 = 458.15\ tCO_2e$

The project emissions from electricity consumption ($PE_{EC,y}$) is calculated following the procedures set out by the *"Tool to estimate the baseline, project and/or leakage emissions from electricity consumption"*. During the crediting period, electricity is purchased from the grid and is consumed for the operation of the active LFG collection system and LFG upgrading facility.

Therefore, Option **A.1** of the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption"* is used. Under this option, project emissions from consumption of

electricity from the grid are calculated based on the power consumed by the project activity and the emission factor of the grid, adjusted for transmission losses, using the following formula:

$$PE_{EC,grid,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$ **Equation 15**

Where,

$PE_{EC,grid,y}$	=	Project emissions from electricity consumption from the grid by the project activity during the year *y* (tCO_2/year);
$EC_{PJ,y}$	=	Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh)
$EF_{EL,j,,y}$	=	Emission factor for electricity generation for source *j* in year (tCO_2/MWh)
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
j	=	Sources of electricity consumption in the project

The Emission Factor for electricity consumed from the grid was determined according to the procedures of the *"Tool for calculation of emission factor for electricity systems"* and is fixed as per the registered PDD. The transmission and distribution losses were updated considering the most recent information made publicly available by ANEEL.

Sample calculation

$PE_{EC,grid,y} = EC_{PJ,y} * EF_{EL,j,,y} * (1 + TDL_{j,y})$

$PE_{EC,grid,y} = 1222.20 * 0.3231 * (1 + 16\%) = 458.15\ tCO_2e$

Emissions from consumption of fossil fuels ($PE_{FC,y}$)

Project emissions resulting from combustion of fossil fuels are related to LPG consumption for flare ignition. This source of project emission is determined in accordance with procedures of the *"Tool to calculate project or leakage emissions from fossil fuel combustion"* using the following formulae:

$PE_{FC,j,y} = SUM(FC_{i,j,y} * COEF_{i,y})$ **Equation 16**

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*

Sample calculation

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

$PE_{FC,j,y} = SUM(0 * ((0.0465*0.0656)/1000)) = 0\ tCO_2e$

E.3. Calculation of leakage emissions

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According to ACM0001 there is no need to account for leakage. Hence, $LE_y = 0\ tCO_2e$

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or	Project GHG emissions or actual net	Leakage GHG emissions	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)

				Before 01/01/2013	From 01/01/2013	Total amount
Total	78,324	1,305.2	0	0	77,019	77,019

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period ($t\ CO_2e$)	Amount estimated ex ante for this monitoring period in the PDD ($t\ CO_2e$)
77,019	156,846

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

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Calculated using the PDD estimation of emission reductions to be achieved in 2020 (579,856 tCO_2e) times the number of days in this monitoring period for this year (99 days) divided by the number of days in the year (366 days).

E.6. Remarks on increase in achieved emission reductions

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Not applicable. This section is intentionally left blank.

E.7. Remarks on scale of small-scale project activity

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Not applicable. This section is intentionally left blank.

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Document information

Version	Date	Description
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).

Version	*Date*	*Description*
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.