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	El Molle – Landfill gas (LFG) capture project	
UNFCCC reference number of the project activity	0170	
Version number of the PDD applicable to this monitoring report	8	
Version number of this monitoring report	12	
Completion date of this monitoring report	27/05/2020	
Monitoring period number	10th monitoring period	
Duration of this monitoring period	From 01/01/2019 to 30/06/2019	
Monitoring report number for this monitoring period	1st	
Project participants	Gestión Integral de Residuos S.p.A. First Climate (Switzerland) AG	
Host Party	Chile	
Applied methodologies and standardized baselines	ACM0001: Flaring or use of landfill gas, version 18.0;	
Sectoral scopes	Sectoral Scope: 1 (Energy) Sectoral Scope: 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
	-	32,932 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	96,047[1] tCO_2e	

[1]Calculated using the PDD estimation for 2019 (188,911) multiplied by the number of days in the monitoring period (181) and divided by number of days in the year (365).

SECTION A. Description of project activity

A.1. General description of project activity

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El Molle landfill is an existing and operational landfill site. It is located 7 km far from Valparaiso city. The landfill site is suitable for municipal solid waste management and it is the most important landfill in the region. The landfill site belongs to the Valparaiso Municipality and was given under a 20 years public concession to **Gestión Integral de Residuos SpA (GIRSpA)**[2]

The purpose of the El Molle landfill project is the installation of a highly efficient landfill gas collection system and an electricity generation plant through LFG. This involves investments in a gas collection system, airtight covering of the landfill, flaring equipment and a LFG electricity generation plant with 4.5 MW (3 x 1.5 MW) installed capacity.

The main equipment currently installed in this project activity are:

- 2 blower;
- Several collection wells, manifolds and transmission pipelines;

See section B.1. for further details on the technology employed.

At the initial stage of the project (1st Crediting Period), no electricity was generated from the collected LFG. This was due to the high investment costs in power generation equipment and grid connection and the current low price of electricity. Another reason is the relatively low power capacity (4.5 MW) that can be installed, and the uncertainty and variation in the actual production of biogas.

Currently the project has implemented the LFG electricity generation plant with 4.5 MW (3 x 1.5 MW) installed capacity. The commissioning date considering Group generators are below:

- Group generator 1: 12/01/2016
- Group generator 2: 12/01/2016
- Group generator 3: 12/01/2016

The landfill gas was collected only through a passive system, with no systematic and monitored collection system. Therefore, an extra-incentive was needed to make additional investments and enhance its landfill gas collection rate and install appropriate facilities to properly combust the methane produced at the site by using group generators and also producing electricity.

The total emission reductions achieved in this period is **32,932 tCO2e.**

A.2. Location of project activity

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Host Party:

- Chile

Region/State/Province:

- Region V: So called Región de Valparaíso.

City/Town/Community:

- Between the “Puchuncaví” community to the north and the “Rocas de Santo Domingo”, community to the South.

[2] The former entity legal name Gestión Integral de Residuos S.A. (GIRSA) has changed to Gestión Integral de Residuos SpA (GIRSpA), according to the deed of modification Rep. N° 1636/2015. made available to the DOE. Thus, it is the same Project Participant entity.

Physical/Geographical location:

- El Molle landfill is located in Sector Camino La Pólvora, 7 km NE of Valparaiso city serving the cities presented below:

District	Population Served
Valparaiso	296,655
Viña del Mar	334,248
Concon	42,152
Quilpue	168,070
Limache	45,27
San Antonio	87,675
El Tabo	8,203
El Quisco	11,329
Cartagena	17,029
Algarrobo	8,601

Geographically, the site is referred to the following coordinates:

Coordinates	
UTM (x,y)	**Geographic (long, lat)**
Limited to the North by	
(19S 254,251.85W, 6,336,801.82S)	(W 71.63, S 33.07)
(19S 254,591.09W, 6,336,429.51S)	(W 71.62, S 33.08)
Limited to the South by	
(19S 253,489.66W, 6,334,875.88S)	(W 71.64, S 33.09)
(19S 253,489.66W, 6,334,880.56S)	(W 71.64, S 33.09)

In the following figure, the physical location of El Molle landfill site is shown:

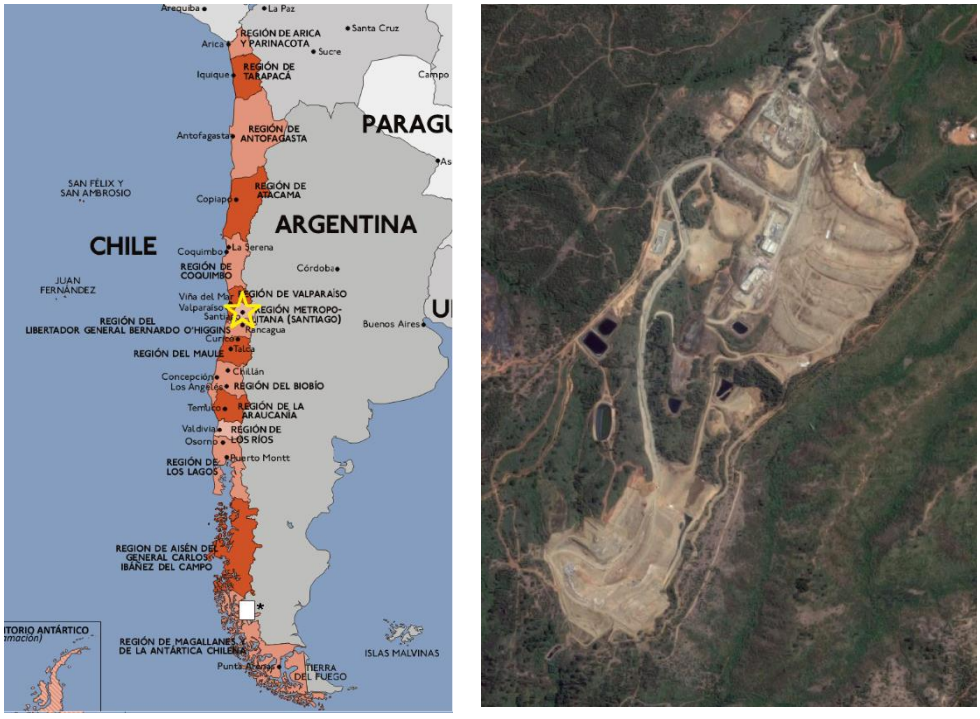

Figure 1 - El Molle Landfill site

El Molle landfill receives 1,200 tones of MSW per day average. To the date, it accumulate 4,820,000 tones of MSW and it expect to receive up to 7,035,000 tones until 2021. The landfill has a surface of 96 hectares in total and the capacity has been calculated in 3,972,600 m3 of domestic solid wastes and similar debris.

The landfill is divided in five cells. Three out of the five cells (Old Cell and Cell I and Cell II) were totally filled and capped by GIRSpA S.A in 2013. Then, GIRSpA S.A started to fill Cell III using the best available techniques of landfilling at the host country by successions of layers of waste covered with layers of filling material (a mix of sand, silt, clay and organic 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)
Chile (host)	Gestión Integral de Residuos S.p.A.	No
Switzerland	First Climate (Switzerland) AG	No

This monitoring report was developed and reviewed by:

Consultancy	Project Proponent (Project Participant)
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Francisco Santo francisco.santo@beng.eng.br	

A.4. References to applied methodologies and standardized baselines

A.5.

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The applied methodology is ACM0001 - Flaring or use of landfill gas, version 18.0.
Tools to which the methodology refers are the following:

- Large-scale Consolidated Methodology ACM0001: “Flaring or use of landfill gas” (Version 18.0)[3];
- TOOL03 Methodological tool: “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (Version 03.0)[4].
- TOOL04 Methodological tool: “Emissions from solid waste disposal sites” (Version 08.0)[5];
- TOOL05 Methodological tool: “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (Version 03.0)[6];

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

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

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

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

- TOOL06 Methodological tool: Project emissions from flaring (Version 02.0.0); [7]
- TOOL08 Methodological tool: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0)[8];
- TOOL09 Methodological tool: "Determining the baseline efficiency of thermal or electric energy generation systems" (Version 02.0)[9];
- TOOL10 Methodological Tool: "Tool to determine the remaining lifetime of equipment" (Version 01)[10];
- TOOL12 Methodological tool: "Project and leakage emissions from transportation of freight" (Version 01.1.0)[11];
- TOOL07 Methodological tool: Tool to calculate the emission factor for an electricity system (Version 06.0); [12];

A.6. Crediting period type and duration

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The renewable crediting period is from 15/12/2013 to 14/12/2020 (2nd Crediting Period).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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El Molle – Landfill gas (LFG) capture project started its commissioning on 19/02/2006[13] and operated until 31/12/2012, by means of flaring LFG only.

From 01/01/2013 to 12/01/2016, the plant was decommissioned and thus not operational. The recommissioning of the project plant occurred on 13/01/2016.

During this monitoring period, the project has operated with two blowers and three group generators destroying the LFG collected in only one landfill site.

Blower 1	Year	2016
	Manufacturer	Continental Industries
	Model	077A1.07
	Serial number	1577A076
	Maximum capacity	2500 Nm³/h
Blower 2	Year	2016
	Manufacturer	Continental Industries
	Model	077A1.07
	Serial number	1577A077
	Maximum capacity	2500 Nm³/h

Table 1 –Technical details of equipment installed at Project Activity

The system has installed group generators, to supply electricity for the project internal consumption and electricity export to the grid. The specification of these equipment is presented in the table below:

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf

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

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

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

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

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

[13] According to 1st CP PDD.

Group Generator 1	Manufacturer	CATERPILLAR
	Group Generator Model	CG170-16
	Serial Number Group Generator	1438176
	Group Generator installed capacity	1.560 kW
	Year GG	2014

Group Generator 2	Manufacturer	CATERPILLAR
	Group Generator Model	CG170-16
	Serial Number Group Generator	1438177
	Group Generator installed capacity	1.560 kW
	Year GG	2014

Group Generator 3	Manufacturer	CATERPILLAR
	Group Generator Model	CG170-16
	Serial Number Group Generator	1438178
	Group Generator installed capacity	1.560 kW
	Year GG	2014

Table 2 – Group Generators specifications

The plant also counts with diesel generators in order to provide electricity during power outages from the grid:

Diesel Generator	Manufacturer	CATERPILLAR
	Group Generator Model	CG170-16
	Serial Number Group Generator	1438178
	Group Generator installed capacity	1.560 kW
	Year GG	2014

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.

B.2. Post-registration changes

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

>>
Not applicable

B.2.2. Corrections

>>
Not applicable

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

>>
Not applicable

B.2.4. Inclusion of monitoring plan

>>
Not applicable.

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

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Changes that have been approved by the Board as applicable from the period prior to this monitoring period:

The revised PDD includes permanent changes from registered monitoring plan prior approved by the Board (PRC-0170-002)

Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change - issuance track) as applicable from this monitoring period:

The proposed permanent change to the registered monitoring plan is applied to parameter "Operation of the equipment that consumes the LFG" ($O_{pj,h}$). In the registered PDD it states that the "Measuring/reading/recording frequency" is once per minute. However in the ACM0001, version 18.0, applied for this project activity, states that the "Monitoring frequency" is hourly. Thus, the permanent change involves setting the measuring/reading/recording frequency as "hourly".

B.2.6. Changes to project design

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Changes to Project Design, PDD version 12, post-registration changes reference number PRC-0170-002:

1) Inclusion of electricity generation plant installed capacity 4.5 MW. The plant was installed in 2016. It is important to highlight that this PRC does not impact negatively the methodology application, nor the project additionality and scale.

2) Legal name change from Gestión Integral de Residuos S.A (GIRSA) to Gestión Integral de Residuos SpA (GIRSpA). This change has been approved by the EB on 04/05/2018.

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

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Not applicable.

SECTION C. Description of monitoring system

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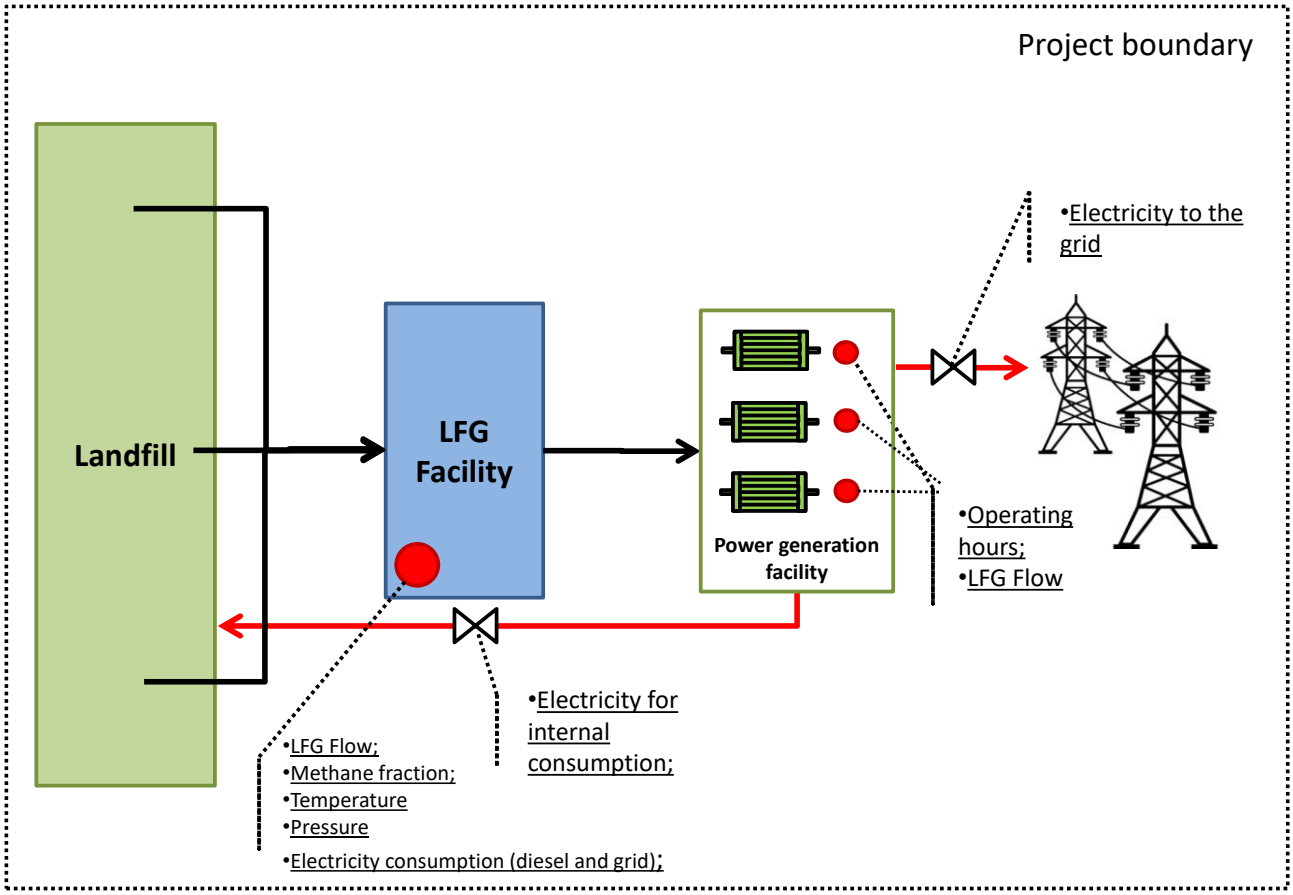
The monitoring equipment and their location are presented in below.



Considering the monitoring parameters presented in the registered PDD, it is important to highlight the current monitoring system situation for the present monitoring period:

(1) 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.

All monitoring instruments were running properly and calibrated (some period were identified with delayed calibration and the procedures defined paragraph 369 of the CDM validation and verification standard for project activities have been adopted) during this monitoring period.

Type	Manufacturer	Model	Location	Range
Flow Meter Flare[14]	FCI	ST51	Flare pipeline	0.3 to 400 sfps
Flow Meter Main line[15]	FCI	ST51	Main pipeline	0.3 to 400 sfps
Temperature meter Flare (Thermocouple)	ECIL	Type N	Flare	0 to 1480 °C
Methane content analyzer in the residual gas	Siemens	ULTRAMAT 23	Main pipeline	0 to 100% CH4
LFG temperature meter	FCI	ST51	Main pipeline	0.3 to 400 sfps
LFG Pressure meter	Honeywell	STG 73S	Main pipeline	3.5 to 0.035 bar

Table 3 – Monitoring instruments

[14] Flow meter automatically converts the flow to Nm3.

[15] Flow meter automatically converts the flow to Nm3.

All data are electronically collected and continually stored in a server.
The errors and uncertainties applied in the relevant monitoring period are presented below:

Measuring equipment - Operational Data							Calibration			
Instrument	Manufacturer	Model	Serial Number	Operational range	Start Date	Finish Date	Calibration frequency	Date of Calibration	Validity	Error used in data discount (%)
Flow meter to GGs	Endress Hauser	Prowirl R200	K820E019000	0 - 7262 Nm³/h	01/01/19	30/06/19	-	21/09/15	Lifelong calibration according to manufacturer	-
Residual gas analyzer	Nova	912A	9387	0-100% CH4	01/01/19	30/06/19	Annual	07/07/12	06/07/13	1.000%
LFG Pressure	Endress Hauser	Cerabar S	K805241509C	0 - 400 bar	01/01/19	30/06/19	Annual	Not performed	-	0.810%
LFG Temperature	Endres Hauser	Omnigrad S TR63	K804381430A	–200 to 600 °C	01/01/19	30/06/19	Annual	Not performed	-	3.000%
Export electricity meter GG1							Meter calibration and maintenance continuously carried out by the energy distribution company			-
Export electricity meter GG2										-
Export electricity meter GG3										-

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

The following ex ante 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:

- Waste composition
- 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 ($\varphi_{default}$)
- 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)
- Universal ideal gas constant (R_u)
- Atmospheric pressure at reference conditions (Pref)
- Temperature at reference conditions (Tref)
- Molecular mass of greenhouse gas I (MMi)
- Molecular mass of gas k (MMk)
- Molecular mass of water (MMH2O)

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	Default value used, according to ACM0001
Purpose of data	Calculation of baseline emission
Additional comment	Applicable to Step A

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	Build margin emission factor of the Chilean grid
Source of data	Chilean grid
Value(s) applied	0.2549 (2016)
Choice of data or Measurement methods and procedures	SIC (Sistema Interconectado Central – Central Interconnected System)
Purpose of data	Calculation of baseline emission
Additional comment	All data and parameters to determine the grid electricity emission factor, as required by the “Tool to calculate the emission factor for an electricity system”, were included in the monitoring plan.

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	CO_2 emission factor of the Chilean grid electricity during the year y
Source of data	Chilean grid
Value(s) applied	0.3552 (2016)
Choice of data or Measurement methods and procedures	SIC (Sistema Interconectado Central – Central Interconnected System)
Purpose of data	Calculation of baseline emission
Additional comment	All data and parameters to determine the grid electricity emission factor, as required by the “Tool to calculate the emission factor for an electricity system”, were included in the monitoring plan.

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO_2/MWh
Description	Operating margin emission factor of the Chilean grid
Source of data	Chilean grid
Value(s) applied	0.6562 (2016)
Choice of data or Measurement methods and procedures	SIC (Sistema Interconectado Central – Central Interconnected System)

Purpose of data	Calculation of baseline emission
Additional comment	All data and parameters to determine the grid electricity emission factor, as required by the "Tool to calculate the emission factor for an electricity system", were included in the monitoring plan.

Data/Parameter	GWP_{CH4}
Unit	t CO_2e/t CH_4
Description	Global warming potential of CH_4
Source of data	IPCC
Value(s) applied	25. Updated for the 2nd commitment period according to COP/MOP decisions[16]
Choice of data or measurement methods and procedures	Default value used, according to IPCC Fourth Assessment Report: Climate Change 2007, item 2.10.2: Direct Global Warming Potentials, Table 2.14
Purpose of data/parameter	Calculation of baseline emission
Additional comments	-

Data/Parameter	NCV_{CH4}
Unit	TJ/t CH_4
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	-
Purpose of data/parameter	-
Additional comments	-

[16]IPCC Fourth Assessment Report: Climate Change 2007, item 2.10.2: Direct Global Warming Potentials, Table 2.14, available at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html , accessed on 11/01/2018 and in accordance with EB69, Annex 3 and decision 4/CMP.7, available at: http://cdm.unfccc.int/Reference/Standards/meth/reg_stan02.pdf , accessed on 11/01/2018.

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:

- $P_{H20,t,Sat}$: Saturation pressure of H_2O at temperature Tt in time interval t
- $F_{CH4,EG,t}$: Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t
- $EC_{PJ2,y} = EG_{EC2,y}$: Quantity of electricity consumed from diesel generator by the project activity during the year y
- $V_{t,w,b}$ = Volumetric flow of the gaseous stream in time interval t on a wet basis
- $V_{i,t,wb}$ = Volumetric fraction of greenhouse gas i in a time interval t on a wet basis

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

Data/parameter:	TDL_y
Unit	-
Description	Average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site.
Measured/calculated/default	Default value
Source of data	World Bank Database
Value(s) of monitored parameter	7%
Monitoring equipment	Not applicable
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):	Not applicable
QA/QC procedures	-
Purpose of data/parameter	Calculation of baseline/project emissions or actual net GHG removals by sinks;
Additional comments	Extracted from World Bank Database (http://databank.worldbank.org/)

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;
Measured/calculated/default	Continuously measured by electricity meter.
Source of data	Measurement from 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	Available in a separate spreadsheet
Measuring/reading/recording frequency:	Continuously
Calculation method (if applicable):	Not applicable
QA/QC procedures	As per the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" According to electricity reports provided by the local Electricity Trader Company (main data) and Electricity Chamber Company (cross check data).
Purpose of data/parameter	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comments	The data will be archived throughout the crediting period and two years thereafter.

ACM0001: Flaring or use of landfill gas --- Version 18.0

Data/parameter:	Management of SWDS
Unit	-
Description	Management of SWDS
Measured/calculated/default	As per the adopted monitoring procedure for the project activity, the management of the landfill is yearly compared against the previously conceived original construction and operational design of the landfill in order to confirm that the overall management and operation of the landfill (including relevant aspects related to landfilling practice) were not modified with the unique aim to increase generation of methane on site. By performing the checking annually, it is monitored whether any practice aiming to increase methane generation in the landfill has occurred. As required by ACM0001, any change in the management of the landfill after the implementation of the project activity should be justified by referring to applicable technical or regulatory specifications.
Source of data	Project Participant The current configuration and operational conditions of the landfill were compared against the previously conceived design and operational conditions of the landfill prior to the implementation of the project activity. According to the declaration issued by the Project Participant on April 2020: a) Inside landfill does not exist organic waste recycling; b) All leachate from the landfill is not recirculated inside the landfill waste massif.
Value(s) of monitored parameter	Not applicable
Monitoring equipment	-
Measuring/reading/recording frequency:	Annually

Calculation method (if applicable):	Not applicable
QA/QC procedures	-
Purpose of data/parameter	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comments	-

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
Measured/calculated/default	Measured by Project Participant
Source of data	Electricity meter
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	Available in a separate spreadsheet
Measuring/reading/recording frequency:	Continuous
Calculation method (if applicable):	Not applicable
QA/QC procedures	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" According to electricity reports provided by the local Electricity Trader Company (main data) and Electricity Chamber Company (cross check data).
Purpose of data/parameter	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comments	-

Data/parameter:	$O_{pj,h}$
Unit	-
Description	Operation of the equipment that consumes the LFG

Measured/calculated/default	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
Source of data	Measurements by Project participant using a device integrated with the operational software at the landfill gas plant.
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 detection system / Flares temperature meters
Measuring/reading/recording frequency:	Hourly
Calculation method (if applicable):	Not applicable
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/parameter	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comments	-

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

Data/parameter:	$V_{t,db}$
Unit	m^3 /h
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis
Measured/calculated/default	Measured
Source of data	Measurements by Project participants using a flow meter
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	Available in a separate spreadsheet
Measuring/reading/recordin g frequency:	Continuous recorded and hourly aggregated

Calculation method (if applicable):	Not applicable
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/parameter	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comments	The design of the installed LFG flow meter for measuring the LFG flow to the flare ensures that measurement data is automatically converted and recorded in normal cubic meters per hour (Nm3 /h). Due to that, as further explained in Section D.1, measurements of LFG pressure and LFG temperature are not required for determining $V_{t,db}$ Monitored in case of Option A from tool

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
Measured/calculated/default	Continuously measured by continuous CH_4 content gas analyzer.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (CH_4 content gas analyzer)
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	Available in a separate spreadsheet
Measuring/reading/recording frequency:	Continuous recorded and hourly aggregated
Calculation method (if applicable):	Not 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	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comments	-

Data/parameter:	T_t
Unit	K
Description	Temperature of the gaseous stream in time interval t
Measured/calculated/default	Measured by Project Participant using temperature sensor
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (temperature sensor)
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	Available in a separate spreadsheet
Measuring/reading/recordin g frequency:	Continuous
Calculation method (if applicable):	Not applicable
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/parameter	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
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). However, if the applicability condition related to the gaseous stream flow temperature being below 60ºC is adopted, this parameter must be monitored continuously to assure the applicability condition is met.

Data/parameter:	P_t
Unit	Pa
Description	Pressure of the gaseous stream in time interval t
Measured/calculated/default	Measurements by Project participant using a pressure meter
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (pressure meter)
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	Available in a separate spreadsheet
Measuring/reading/recordin g frequency:	Continuous
Calculation method (if applicable):	Not applicable
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/parameter	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
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)

Data/parameter:	Status of biogas destruction device
Unit	-

Description	Operational status of biogas destruction devices
Measured/calculated/default	Measured by Project Participant
Source of data	Flame detector
Value(s) of monitored parameter	-
Monitoring equipment	UV flame detector
Measuring/reading/recording frequency:	Continuous
Calculation method (if applicable):	Not applicable
QA/QC procedures	-
Purpose of data/parameter	(a) Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comments	For Flame detector devices refer to the methodological tool "Project emissions from flaring"

Methodological tool "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	Measurements by project participants using a continuous Ultra Violet flame detector
Source of data	Whenever flame is detected in the flare, flame status "on" or "1" value is attributed. Whenever no flame is detected in the flare, flame status "off" or "0" is attributed.
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	UV flame detectors in each flare
Measuring/reading/recording 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
Calculation method (if applicable):	Not applicable
QA/QC procedures	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations
Purpose of data/parameter	Calculation of baseline and project emissions when the flame is on[17].
Additional comments	-

Data/parameter:	$Maintenance_y$
Unit	Calendar dates
Description	Maintenance events completed in year y
Measured/calculated/default	-
Source of data	Project participants maintenance logs

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

Value(s) of monitored parameter	As per the applied maintenance practice for the project activity, general inspection services on the flares are performed daily. Performed maintenance and overhauling services in the flare are performed under by specialized technical service team under conformance with maintenance requirements for the flares (as established by equipment manufacturer) and as required by the ex-ante determined parameter SPECflare. Further details about the parameter SPECflare are included in Section D.1.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency:	Daily
Calculation method (if applicable):	Not applicable
QA/QC procedures	Records must be kept in a maintenance log for two years beyond the life of the flare
Purpose of data/parameter	Calculation of baseline and project emissions when the flame is on[18].
Additional comments	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($SPEC_{,flare}$).

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

Data/parameter:	$T_{EG,m}$
Unit	º C
Description	Temperature in the exhaust gas of the enclosed flare in minute m
Measured/calculated/default	Measurements by project participants with thermocouples installed in each enclosed flares
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (thermocouples)
Value(s) of monitored parameter	No operational flare during this monitoring period
Monitoring equipment	No operational flare during this monitoring period
Measuring/reading/recording frequency:	Once per minute
Calculation method (if applicable):	Not applicable
QA/QC procedures	Thermocouples will be replaced or calibrated every year
Purpose of data/parameter	(b) Calculation of project emissions or actual net GHG removals by sinks;
Additional comments	-

D.3. Implementation of sampling plan

>>
Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

>>
Baseline emission calculation

The table below shows the consolidated collected and calculated data for the current monitoring period.

	BE,y	BEEC,y	BECH4,y	FCH4PJ,y	FCH4BL,y	FCH4flared,y	FCH4EL,y	% CH4	FCH4 sentflare,y	ECBL	Total methane for Group generators	Total methane to Flare	FCH4RG,t	PEflare,y
	tCO2	tCO2	tCO2	tCH4	tCH4	tCH4	tCH4	%	tCH4	MWh	Nm³CH4	Nm³CH4	kg	tCO2
01/2019	7,298	695	6,602	377	75	0.0	377	35.77	0.0	1,834	526,331	0	0	0
02/2019	5,295	535	4,760	272	54	0.0	272	32.74	0.0	1,412	379,459	0	0	0
03/2019	4,942	695	4,246	243	49	0.0	243	24.46	0.0	1,724	338,523	0	0	0
04/2019	4,057	445	3,611	206	41	0.0	206	29.48	0.0	1,175	287,904	0	0	0
05/2019	6,068	688	5,380	307	61	0.0	307	30.20	0.0	1,815	428,913	0	0	0
06/2019	5,730	632	5,098	291	58	0.0	291	31.05	0.0	1,667	406,372	0	0	0

The baseline emission was calculated according to the following formula:

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

Where:

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

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

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

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

Where:

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

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

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

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

The following requirements apply:

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

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

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

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

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

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

Where:

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

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

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

Option A

Flow measurement on a dry basis is not doable for a wet gaseous stream. Therefore, it is necessary to demonstrate that the gaseous stream is dry to use this option. The demonstration will be made as following:

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

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

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

With

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

Where:
$F_{i,t}$ = Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (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.m^3/kmol.K)
T_t = Temperature of the gaseous stream in time interval *t* (K)

$PE_{flare,y}$ 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(s) have been installed in the project activity to increase the destruction efficiency. Those flares reach 99% (minimum)[19] of methane destruction efficiency.

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

STEP 1: Determination of the methane mass flow of the residual gas;
STEP 2: Determination of the flare efficiency;
STEP 3: Calculation of project emissions from flaring.

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

The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be used to determine the following parameter:

Parameter	SI Unit	Description

[19] The document about the specification of the flare efficiencies has been provided to DOE.

$F_{CH4,m}$	kg	Mass flow of methane in the residual gaseous stream in the minute m

The following requirements apply:

- The gaseous stream tool shall be applied to the residual gas;
- The flow of the gaseous stream shall be measured continuously;
- CH4 is the greenhouse gas i for which the mass flow should be determined;
- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool); and
- The time interval t for which mass flow should be calculated is every minute m

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

The option chosen for the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" by the project participant is option A.

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.

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

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 chose to determine $n_{flare,calc,m}$ using Option B.1 where the measurement is conducted by an accredited entity on a biannual basis.

Option B.1: Biannual measurement of the flare efficiency

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

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

Where:

$\eta_{flare,calc,y}$	=	Flare efficiency in the year y
$F_{CH4,EG,t}$	=	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t (kg)
$F_{CH4,RG,t}$	=	Mass flow of methane in the residual gas on a dry basis at reference conditions in the time period t (kg)
t	=	The two time periods in year y during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months

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

Flare efficiency results have been presented in a separate spreadsheet related to this monitoring period.

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:

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

Where:

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

Table 4 – Parameters[20] used in the Tool "Project emissions from flaring"

Parameter	Description	Value	Unit
P_{ref}	Atmospheric pressure at reference conditions	101,325	Pa
R_u	Universal ideal gas constant	0.008314472	$Pa.m^3/kmol.K$
T_{ref}	Temperature at reference conditions	273.15	K
GWP_{CH4}	Global warming potential of methane valid for the commitment period	25[21]	tCO_2/tCH_4
$\rho_{CH4,n}$	Density of methane at reference conditions	0.716	kg/m^3

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

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

$$F_{CH4,BL,y} = F_{CH4,BL,sys,y} = F_{CH4,sent\_flare,y}$$

Where:

$F_{CH4,BL,sys,y}$ = Amount of methane in the LFG that would be flared in the baseline in year y for the case of an existing LFG capture system (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)

The amount of methane captured with the existing system will be monitored along with the amount captured under the project activity and there is no historic data on the amount of methane that was captured in the year prior to the implementation of the project activity. Thus, the situation to determine $F_{CH4,BL,y}$ is:

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

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

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

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

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

Where:

$BE_{EC,y}$ = Baseline emissions from electricity generation in year *y* (tCO2/yr)
$EC_{BL,k,y} = EG_{PJ,y}$ = Net amount of electricity generated using LFG in year y (MWh/yr)
$EF_{EL,k,y}$[22] = Emission factor for electricity generation for source *k* in year *y* (tCO2/MWh)
$TDL_{k,y}$ = Average technical transmission and distribution losses for providing electricity to source *k* in year *y*.

[20] As the Option B.1 of the tool "*Project emissions from flaring*" has been adopted to calculate the flare efficiency, the molecular mass parameters are not mentioned.

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

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

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

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

>>

The table below shows the consolidated collected and calculated data for the current monitoring period.

	PE,y	PEEC1	PEEC2	ECPJ1	ECPJ2
	tCO2	tCO2	tCO2	MWh	MWh
01/2019	75.84	75.82	0.02	200.00	0.01
02/2019	75.84	75.82	0.02	200.00	0.01
03/2019	75.84	75.82	0.02	200.00	0.01
04/2019	75.84	75.82	0.02	200.00	0.01
05/2019	75.84	75.82	0.02	200.00	0.01
06/2019	75.84	75.82	0.02	200.00	0.01

Project emissions:

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

Where:

PE_y	=	Project emissions in year *y* (t CO_2/yr)
$PE_{EC,y}$	=	Emissions from consumption of electricity due to the project activity in year *y* (t CO_2/yr)
$PE_{FC,y}$	=	Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (t CO_2/yr)

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

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

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

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

Thus,

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

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

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

> *Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$).*

Thus, the project emission is calculated as following:

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

Where:

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

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

As electricity will be consumed from diesel generators (off-grid captive power plant), a conservative approach was adopted and the option B2 of the scenario B was chosen because: “The electricity consumption source is a project or leakage electricity consumption source”. Therefore, the value used will be 1.3 tCO2/MWh for project emission from diesel generator(s).

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

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.

E.3. Calculation of leakage emissions

>>
Not applicable

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

	Baseline GHG emissions or baseline net GHG removals ($t CO_2e$)	Project GHG emissions or actual net GHG removals ($t CO_2e$)	Leakage GHG emissions ($t CO_2e$)	GHG emission reductions or net anthropogenic GHG removals ($t CO_2e$)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	33,390	455	-	-	32,932	32,932

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)
32,932	96,047[23]

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

>>
Calculated using the PDD estimation for 2019 (188,911) multiplied by the number of days in the monitoring period (181) and divided by number of days in the year (365).

E.6. Remarks on increase in achieved emission reductions

>>
The difference between the CERs calculated value for this monitoring period and estimated value in registered PDD is -66%.

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

>>
Not applicable.

[23]Calculated using the PDD estimation for 2019 (188,911) multiplied by the number of days in the monitoring period (181) and divided by number of days in the year (365).

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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.

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