Monitoring report form
(Version 05.1)

MONITORING REPORT		
Title of the project activity	Loma Los Colorados Landfill Gas Project	
UNFCCC reference number of the project activity	0822	
Version number of the monitoring report	1.0	
Completion date of the monitoring report	01/02/2017	
Monitoring period number and duration of this monitoring period	Monitoring period #9 01/01/2013 to 16/03/2014	
Project participant(s)	KDM S.A. The Kansai Electric Power Co., Inc. Urbaser S.A.	
Host Party	Chile	
Sectoral scope(s)	1 – Energy industries (renewable/non-renewable sources); 13 – Waste handling and disposal	
Selected methodology(ies)	ACM0001 – Consolidated methodology for landfill gas project activities (version 4); ACM0002 - Consolidated methodology for grid-connected electricity generation from renewable sources (version 6)	
Selected standardized baseline(s)	Not applicable	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	872,776 tCO_2e	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	-	965,086 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The CDM project activity "Loma Los Colorados Landfill Gas Project" encompasses collection of landfill gas (LFG) at the Loma los Colorados landfill; its destruction through combustion in high temperature enclosed flares and its utilization as gaseous fuel for electricity generation in two electricity generation facilities (the Central Loma Los Colorados 1 (CLLC-1) and the Central Loma Los Colorados 2 (CLLC-2) electricity generation facilities).

LFG is generated at the Loma Los Colorados landfill as a result of anaerobic decomposition of municipal solid waste (MSW) historically disposed at the landfill.

As part of the operation of the project activity during the considered monitoring period, collected LFG generated at the Loma Los Colorados landfill was collected and converted into carbon dioxide (CO_2) through its combustion in 3 high temperature enclosed flares and through its utilization as gaseous fuel for electricity generation in engine-generator sets of the electricity generation facilities CLLC-1 and CLLC-2. The operation of the project activity mitigates emissions of the greenhouse gas (GHG) methane (CH_4) that would otherwise be directly emitted into the atmosphere in the absence of the project activity (baseline scenario). The project activity has also promoted carbon dioxide (CO_2) emission reductions due to displacement of electricity (under amount equivalent to the amount of electricity generated by the project's new electricity generation facility) which would otherwise be generated by existing grid-connected power plants, including fossil-fuel fired power plants (and addition of new power generation units) within the National Electricity Grid of Chile (SIC grid).

At the end of the considered monitoring period, as part of the project activity, there were 325 LFG collecting wells[1] built over a 55 Ha surface of the landfill.

During the considered monitoring period the project activity operated under complete conformance with project design information and applicable monitoring requirements as per the PDD valid for the 1st 7-year crediting period of the project activity (herein after termed "PDD").

Emission Reductions (ER) achieved during the 9th monitoring period (from 01/01/2013 to 16/03/2014) are **965,086** tCO_2e.

9th Monitoring period	Achieved emission reductions (tCO_2e)
From 01/09/2012 to 31/12/2012	**965,086**

A.2. Location of project activity

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The project activity is implemented at the Loma Los Colorados landfill. This landfill site is located in the administrative district ("Comuna") of Til-Til, 63.5 km North of Santiago through the Route 5. Til-Til is located near a village named Montenegro and it is located 578 meters above the sea level. According to the latest demographic census available (2012), Til-Til has a population of 16,558 inhabitants covering an area of 667.3 km^2.

The geographical coordinates of the project site (in decimal and in Degree, Minute, Second (DMS) formats) are as follows:

[1] It is important to note that the registered PDD simply does not specify the number of LFG collection wells to be implemented as part of the project activity. Furthermore, gradual addition of LFG collection wells (in order to accommodate the earlier forecasted growth of amount of disposed waste in the landfill and thus growth of amount of LFG to be generated) is a common practice in LFG collection and destruction/utilization initiatives implemented in landfills.

Format	Latitude	Longitude
Decimal	-32.9564	-70.8013
DMS	32° 57' 23.04" S	70° 48' 4.6794" W

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Chile (host)	KDM S.A	No
Japan	The Kansai Electric Power Co., Inc.	No
Spain	Urbaser S.A.	No

A.4. Reference of applied methodology and standardized baseline

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The project activity applies the following baseline and monitoring methodologies:

- ACM0001 - "Consolidated baseline methodology for landfill gas project activities" (version 4);
- ACM0002 - "Consolidated Baseline Methodology for Grid- Connected Power Generation from Renewable Sources" (version 6);

As per the registered PDD, the following methodological tools are also applied in order to determine project emissions:

- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 1);
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 2);

A.5. Crediting period of project activity

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From 17/03/2007 to 16/03/2014 (7-year renewable crediting period).

A.6. Contact information of responsible persons/entities

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Completion date for the application of the CDM-MR-FORM: 01/02/2017 (date of the initial version of this Monitoring Report).

Responsible entity / person:

Mr. Nuno Barbosa
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UniCarbo Energia e Biogás Ltda.
São Paulo, Brazil

UniCarbo Energia e Biogás Ltda. is a CDM consulting and advisory services company hired by the project participant KDM S.A. UniCarbo Energia e Biogás Ltda. is not a project participant.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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During the considered monitoring period, the project activity encompassed the operation of the following installed equipment:

- Three enclosed high temperature flares supplied by LFG Specialities L.L.C. with the following specifications and operational conditions[2]:
    - Min. LFG flow: 800 Nm^3/h (500 scfm)
    - Max. LFG flow: 5,097 Nm^3/h (3,000 scfm)
    - Min. temperature of exhaust gas: 800 ^oC (in order to ensure acceptable combustion efficiency)
    - Max. temperature of exhaust gas:1,095 ^oC (in order to ensure acceptable combustion efficiency

[2] *Design details of the installed two high temperature enclosed flares:*
Details about the stacks: Carbon steel construction with ANSI 150 lb flanged inlet connection. The top portion of flare stack is made with 304 stainless steel. Carbon steel shell (10' diameter, 45' height) is internally insulated with ceramic fibber insulation (to resist operation temperatures, reaching values of 1095°C). Flare stacks are painted inside and outside with high temperature painting. As per manufacturer's specification, the flares have a flow range of 500 – 3,000 scfm (800 – 5,097 Nm^3/h).
Details about the thermal insulation of the enclosed flares: The enclosed flare interior is insulated with a nominal 2 inches of ceramic fibber blanket insulation. This amount of insulation will result in a hot metal skin temperature which is useful in preventing acid gas condensation from occurring on the metal shell ID.
Details about the burner assembly for the enclosed flares: All 304 stainless steel construction. Burner is suitable for operation over a 6:1 turndown range. (Proper blower and drive selection is required to accomplish the full 6:1 turndown range)
Details about the igniter assembly for the enclosed flares: The igniter is a small burner used to light the main burner and it is fuelled by Liquefied Petroleum Gas (LPG). The igniter assembly consists of a 304 stainless steel burner tube with spark plug ignition and type K thermocouple for flame confirmation. The spark plug is supplied with high temperature leads and a transformer in a NEMA 4 enclosure.
Details about the flame supervision/monitoring for the enclosed flares: Ultraviolet flame detector in order to confirm flame integrity.
Details about temperature control for the enclosed flares: A dedicated closed loop temperature controller is used to maintain flare temperature set-point. Process temperature is selectable from among multiple thermocouples (Pyromation), and control is maintained by modulating combustion air dampers at the flare base.
Details about the system controller for the enclosed flares: The Flame-Trol IV PLC (programmable logic controller) based control system is used. This is a technically advanced, fully automatic flare system controller specifically designed for maximum operating flexibility and efficiency.
Details about the sample collecting ports for the enclosed flares: sample collection ports are made available in the upper section of the flare as specified by applicable requirements of US-EPA in order to allow for emissions compliance testing/monitoring.
Details about the flame arrestor for the enclosed flares: This device prevents flame flash back in the event of high oxygen concentrations in the landfill gas. The standard flame arrestor is equipped with an aluminium core assembly.

Figure 1 - View of the installed two high temperature enclosed flares
(Flare 1 and Flare 2 from left to right) prior to the installation of the third flare

- Two condensate knock-out pot (KOP)[3]

Figure 2 - View of the installed knock-out pot (KOP)
prior to the installation of the third flare

- 4 LFG centrifugal blowers[4]

[3] *Design details for the condensate knock-out pot:*
The installed KOP unit has 60 inch diameter x 90 inch high (1.524 x 2.286 m) and it is supplied by OAH LFG Specialties L.L.C. It has 150# flanged 24 inch inlet (0.6096 m) and 18 inch (0.4572 m) outlet connections. The KOP has the following design characteristics:

- Internal coating of hi-build epoxy to resist acidic condensate
- External finish with rust resistant primer and industrial enamel color coat
- Stainless steel mist extraction pad with a 98% filtration efficiency of free liquids and solid particles of 20 microns or larger
- Removable lid to facilitate inspection and repair of coating if necessary
- Heavy duty gage glass liquid indicator
- Drain connection with manual ball valve and plug
- Liquid level switch for high condensate level alarm/shutdown

Figure 3 – View of the 3 installed LFG centrifugal blowers
(prior to the installation of the 4th centrifugal blower)

Figure 4 - View of the specification plates available in each LFG blower

Figure 5 and 6 – View of the piping system of the LFG flaring plant

- Automatic shut-off valves for the flares (used for safety conditions)[5]

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[4] *Design details of the LFG centrifugal blowers:* Each LFG centrifugal blower is powered by with 380 V, 3 phase, 50 Hz electricity required to power a 75 HP (56 kW) TEFC electrical motor. Each blower is of centrifugal type, spark proof, cast iron construction, cast aluminum impellers, The impellers, inlet & outlet heads, and blower casing are coated with resistant phenolic coating. Each blower delivers 3,000 SCFM (5,097 Nm^3/h) gas flow with 60 in. water column (14,944.92 Pa) inlet vacuum and 15 in. water column (3,736.23 Pa) discharge pressure.

[5] *Specification details for the automatic shut-off valves:* The valves are 12 in. bubble-tight carbon steel wafer type butterfly valves, which includes Teflon seat materials and stainless steel shafts and discs with a Bettis CB Series or equal pneumatic actuator and 3 way solenoid valve with a spring operated "fail safe" closing in case of a power failure.

LFG flow measurement

- During the considered monitoring period, 6 thermal mass LFG flow meters (with company internal Id. "F0", "F1", "F2", "F3", "F4" and "F5") were used for measuring the total flow of collected LFG and flows of LFG sent to Flare 1, Flare 2, Flare 3 as well as the flows of LFG sent to the CLLC-1 and CLLC–2 power plants. All utilized LFG flow meters are manufactured by Fluid Components International L.L.C. (FCI) and are of ST98 model.
  These LFG flow meters provide LFG flow measurements in normalized cubic meters per hours (Nm^3/h). Thus, no additional monitoring of LFG temperature and LFG pressure are required. All LFG flow data measurements are electronically recorded and reported with an every 1 minute frequency. As per the operational procedure for the project activity, besides of the 5 LFG flow meters in operation, 5 identical LFG flow meter units are kept stored in the project site in order to be installed and used during calibration events of LFG flow meters[6].

Figure 7 - View of one of the installed FCI ST 98 LFG flow meters

- LFG pressure/vacuum transmitters & Variable frequency drives for the LFG blowers: 1 Yokogawa vacuum transmitter and 2 Yokogawa pressure transmitters are installed. The control panel for the high temperature enclosed flares receives signals from such transmitters and, based on the values of these signals, the variable frequency drivers are controlled. The variable frequency drivers controls the speed of the electric motors for the LFG blower by using signals of the LFG pressure/vacuum transmitter as input signal. LFG vacuum and pressure measurements are also electronically recorded.

- Continuous gas analyzer (to measure fraction of CH_4 in collected LFG): Fraction of CH_4 in collected LFG has been continuously measured by a Siemens Ultramat 23 gas analyzer. This gas analyzer continuously monitors the composition of collected LFG in terms of methane, oxygen, and carbon dioxide. As per the setting adjustments made in the gas analyzer, alarm signals are sent to the control panel for the high temperature enclosed flares whenever CH_4 content of collected LFG is out of the user-set range[7]. CH_4 content measurements performed$_2$

[6] FCI ST98 flow meters available in the project site are sent to the calibration/testing workshop of Fluid Components International L.L.C. (which is located in the United States) every 18-months in order to be tested and calibrated. This is in accordance to the calibration and testing requirements established by this equipment manufacturer for the FCI ST98 units. Further information about performed calibration events valid for the considered monitoring periods are included in Section D.2.

[7] During the considered monitoring period, the gas analyzer unit was set in a way that alarm signals are sent whenever measurements are out of the following ranges:

- From 30% - 70% (for measurements of CH_4 content in collected LFG flow)
- From 0% - 100% (for measurements of CO_2 content in collected LFG flow)
- From 0% - 5% (for measurements of O_2 content in collected LFG flow)

by the continuous gas analyser are electronically recorded and reported with every 1-minute frequency.

Figure 8 - View of the continuous $CH_4/O_2/CO$ gas analyzer
(used to measure fraction of CH4 in collected LFG)

- Project data supervisory/controlling system (supervisory control and data acquisition system (SCADA)): Win CC platform is used for control the operation of the project activity. Win CC solution is supplied by Siemens A.G. and it is customized to the project activity. A general view of the installed SCADA system during the present monitoring period is shown in the below:

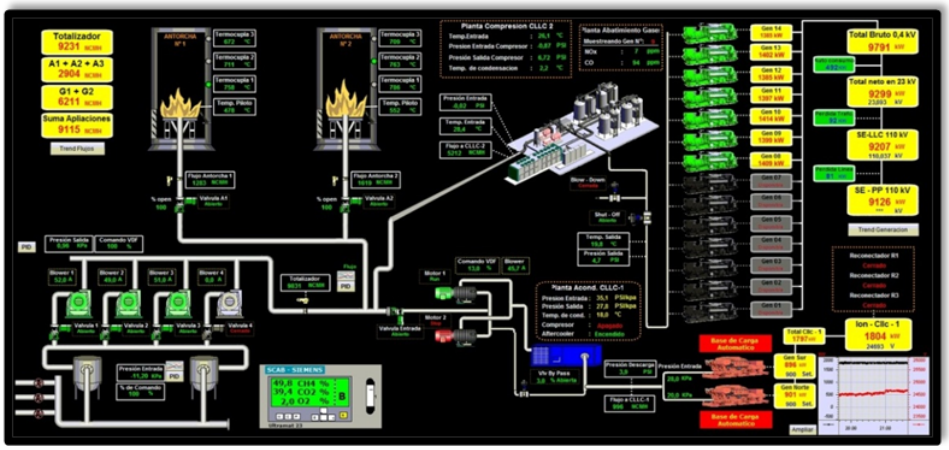

Figure 9 - View of the SCADA system for the project activity
(prior to the installation of the third flare)

It is important to note that while the operational status of each engine-generator set of the CLLC-2 electricity generation facility is managed by the Win CC platform, the CLLC-2 has its own SCADA system.

The following paragraphs include general details about the project's electricity generation component.

Central Loma Los Colorados-1 (CLLC-1) electricity generation facility

- *Power generation equipment:* The CLLC-1 electricity generation facility is equipped with two identical engine-generator set units manufactured by GE Waukesha and of APG1000 model. Each GE Waukesha APG1000 engine-generator set has 1.0 MW of nameplate power generation capacity.

- *LFG cooling station:* All LFG sent to the CLLC-1 electricity generation facility passes through a LFG cooling station where temperature of LFG is reduced through the use of heat exchangers.

The main reason for such settings that trigger alarm signals are safety and operational reasons.

Figure 10 – View of the installed engine-generator set GE Waukesha APG1000 as part of CLLC-1 electricity generation facility

Figure 11 – View of the LFG destruction facility (referenced as "*FLARE 1*", "*FLARE 2*" and "*BLOWER SKID*"), CLLC-1 electricity generation facility (referenced as "*POWER PLANT*"). The LFG cooling station for LFG sent to the CLLC-1 power plant is referenced as "*CONDITIONING PLANT*" in the picture

- Transmission of electricity generated at the CLLC-1 power plant: During the considered monitoring period, all electricity generated by CLLC–1 electricity generation facility was exported to the National Electricity Grid of Chile (SIC grid) through the same 110 kV voltage and 20 km length transmission line which was built for exporting electricity generated by the CLLC–2 electricity generation facility.

All electricity generated by both electricity generation facilities (CLLC-1 and CLLC-2) was accounted as exported electricity by the Chilean electricity dispatch coordinating entity (CDEC-SIC[8]) on the basis of measurements performed by a dedicated meter and regularly recorded in monthly transfer balances of electricity for the power generation source registered at the CDEC-SIC as "*CTRL_LOMA_LOS_COLORG_LOM_LCOAES GENER (KDM)*".
It is important to note that regardless of electricity being generated at the project site by 2 electricity generation facilities (CLLC-1 and CLLC-2), during the considered monitoring period, electricity demand for all equipment of the LFG flaring station was met by imports of grid electricity. The electricity demand of both electricity generation facilities (CLLC-1 and CLLC-2) (electricity demand for auxiliary equipment) whenever the plants are not under operation are met by imports of grid electricity measured by electricity meter M2 (since electricity for both power plants is exported/imported trough the same line), as explained in further sections of the present monitoring report. Moreover, three captive off-grid electricity generators (fuelled by diesel) were used as a backup power source for the LFG flaring station, CLLC-1 and CLLC-2 whenever supply of grid electricity to the project activity was temporarily interrupted[9].

Central Loma Los Colorados-2 (CLLC-2) electricity generation facility

- *Power generation equipment*:
  At the end of the considered monitoring period, the CLLC-2 electricity generation facility encompassed 13 GE Jenbacher J420 engine-generator sets (with nameplate installed capacity of 1.4 MW each). The total nameplate installed capacity for CLLC-2 was 15.4 MW at the end of the considered monitoring period. Exhaust gases from each one of the installed GE Jenbacher J420 engine-generator sets are evacuated through ducts equipped with a double filtration and emission abatement system (consisting of a catalytic oxidation filter (which reduces carbon monoxide emissions), and a selective catalytic reduction (SCR) type filter (which abates NO_x emissions).

- *LFG cooling and filtering facility:*
  All engine-generator sets of the CLLC-2 electricity generation facility are fuelled by LFG through a LFG supply pipeline of maximum LFG supply capacity of up to 20,000 m^3/h. A complete LFG cooling and filtering facility is also available. The LFG cooling and filtering facility is designed to cool LFG and also eliminate unwanted contaminants from the collected LFG (such as moisture and siloxanes). This facility is equipped with an efficient electric chiller (which is has its electricity demand met by the CLLC-2 electricity generation facility).

- *Transmission of electricity generated at the CLLC-2 power plant:*
  Each engine-generator set of the CLLC-2 power plant is coupled to a power transformer that increases the voltage level of generated electricity from 400 Volts to 23 kVolts. From these power transformers, electricity generated by each engine-generator set is transmitted through an overhead power line leading collector that concentrates all the electricity generated in a main power sub-station. From the main power station, electricity is exported to the National Electricity Grid of Chile through the 110 kV voltage and 20 km length transmission line. This transmission line, that starts at the Loma Los Colorados Landfill (at the sub-station named Sub-station Loma los Colorados (SELLC)), transmits electricity generated by both the CLLC-1 and CLLC-2 power plants by converting electricity from 23 kV to 110 kV in a main power transformer. The 20 km length transmission line connects the CLLC-1 and CLLC-2 electricity generation facilities to the Punta Peuco power substation, which is part of the SIC grid.

[8] The "Centro de Despacho Económico de Carga (CDEC-SIC)" is the national electricity dispatch coordinating entity in Chile. Besides of coordinating the dispacht of all grid connected power generation sources in Chile, this entity also has the role of
- Keeping safety of the service in electrical system
- Guarantee the most economical operation for the set of electrical system installations.
- Guarantee the right of easement over transmission systems established by concession.

Further details about the CDEC-SIC are available online: https://www.cdec-sic.cl/index_en.php

[9] More details on the utilization of the backup diesel generators are found further on this Monitoring Report.

- *Backup captive off-grid electricity generators (fuelled by diesel):*
  Besides the captive off-grid electricity generator (fuelled by diesel) with 276 kW of nameplate electricity generation capacity used as a backup power source for the LFG flaring station and CLLC-1 (incl. LFG blowers, lighting, control equipment, etc.) whenever supply of grid electricity to the project's LFG flaring station and control room was temporarily interrupted, an emergency backup captive and off-grid electricity generator (fuelled by diesel) (and with internal reference "Diesel Backup Generator II") with 352 kW of nameplate power was used to meet the electricity demand of the CLLC-2 electricity generation facility whenever no electricity is being generated at this power plant (HVAC, lighting, control room, LFG cooling and filtering facility, etc.) during power generation interruption events with no connection to the grid available. Under circumstances with no power generation but with connection to the grid available, the electricity demand of the CLLC-2's HVAC, lighting, control room, LFG cooling and filtering facility, etc. is temporarily met by imports of electricity from the grid. When the CLLC-2 is under normal operation (generation of electricity by the engine-generator sets), all electricity demand of the whole CLLC-2 facility is met by the electricity generated at the facility.

  Moreover, at the earlier mentioned SELLC, an additional emergency backup captive and off-grid electricity generator (fuelled by diesel and with internal reference "Diesel Backup Generator III") with 80 kW of nameplate power was also installed. This backup generator is only used as a backup system during power failures to the SELLC.

  On the next table is shown the backup captive off-grid electricity generators (fuelled by diesel) that were under operation on the project activity during the considered monitoring period:

Equipment id/tag	Manufacturer	Model Number	Power (MW)	Purpose
Diesel Backup Generator I	Atlas Copco (using a Volvo diesel generator)	QAS 325 Vd	0.276	Gas flaring systems and CLLC-1 auxiliary systems backup
Diesel Backup Generator II	Cummins	SDC - 400	0.352	CLLC-2 auxiliary systems backup
Diesel Backup Generator III	Protelec	S 100 - 10	0.080	SELLC systems backup

The figures below show the three captive off-grid electricity generators (fuelled by diesel) installed at the project activity:

Figure 12 – View of the captive off-grid electricity generator “Diesel Backup Generator I” (fuelled by diesel) used whenever supply of grid electricity to the project's LFG flaring station and control room is temporarily interrupted.

Figure 13 – View of the captive off-grid electricity generator “Diesel Backup Generator II” (fuelled by diesel) used for CLLC-2 auxiliary systems backup whenever grid electricity is temporarily interrupted.

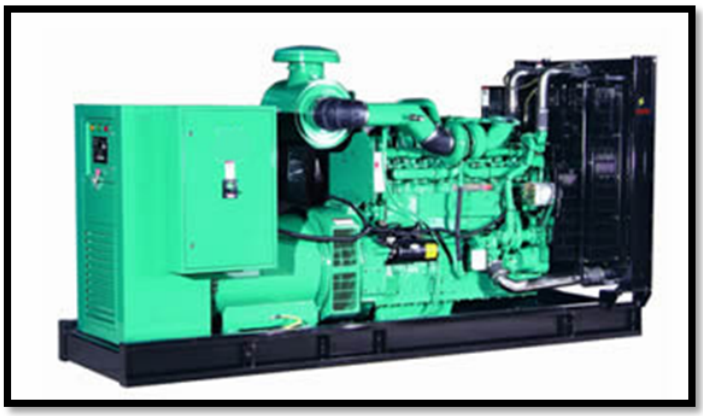

Figure 14 – View of the captive off-grid electricity generator “Diesel Backup Generator III” (fuelled by diesel) used for SELLC systems backup

The next figures show the CLLC-2 power plant at the Loma Los Colorados Landfill:

Figure 15 - External view of CLLC-2 electricity generation facility
(during its construction phase in Aug. 2011)

Figure 16 - Internal view of CLLC-2 electricity generation facility
(Dec. 2012)

- Sub-station Loma los Colorados (SELLC):
  This sub-station is located inside the area of the Loma Los Colorados landfill and is the starting point of the 20 Km electricity line, that ends and the Punta Peuco sub-station,. This sub-station also includes an additional emergency backup captive and off-grid electricity generator (fuelled by diesel and with internal reference “Diesel Backup Generator III”) which has 80 kW of nameplate power. This backup generator is only used as a backup system during power failures to the SELLC.

- Punta Peuco sub-station:
  This sub-station is located 20 km away from the project site (in the end of the project's 110 kV voltage transmission line) and it includes a power transformer and protection and control system for high voltage (which is equipped with switches, circuit breakers and transformers).

Figure 17 - Detail of SELLC power transmission lines
(used to export electricity generated by CLLC-1 and CLLC-2 power plants)

Note on electricity metering

During the considered monitoring period, the net exported electricity values applicable for the CLLC-1 power plant are determined on the basis of measurements of the M2 electricity meter. The M1 electricity meter, in its exported electricity component, is only used to calculate operational hours of CLLC-1. Thus, measurements of the M2 electricity meter represent total exported and imported electricity by both CLLC-1 and CLLC-2 power plants.

Figure 18 – Picture of the electricity meter ION 8600, internal id. M2
(Installed in the Punta Peuco power sub-station)

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>>
Not applicable.

B.2.2. Corrections

>>
Not applicable

B.2.3. Changes to start date of crediting period

>>
Not applicable.

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>
Not applicable.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
Not applicable.

B.2.6. Changes to project design of registered project activity

>>
Not applicable.

B.2.7. Types of changes specific to afforestation or reforestation project activity

>>
Not applicable.

SECTION C. Description of monitoring system

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General description of the monitoring system:

The schematic diagram below illustrates the monitoring system of the project activity:

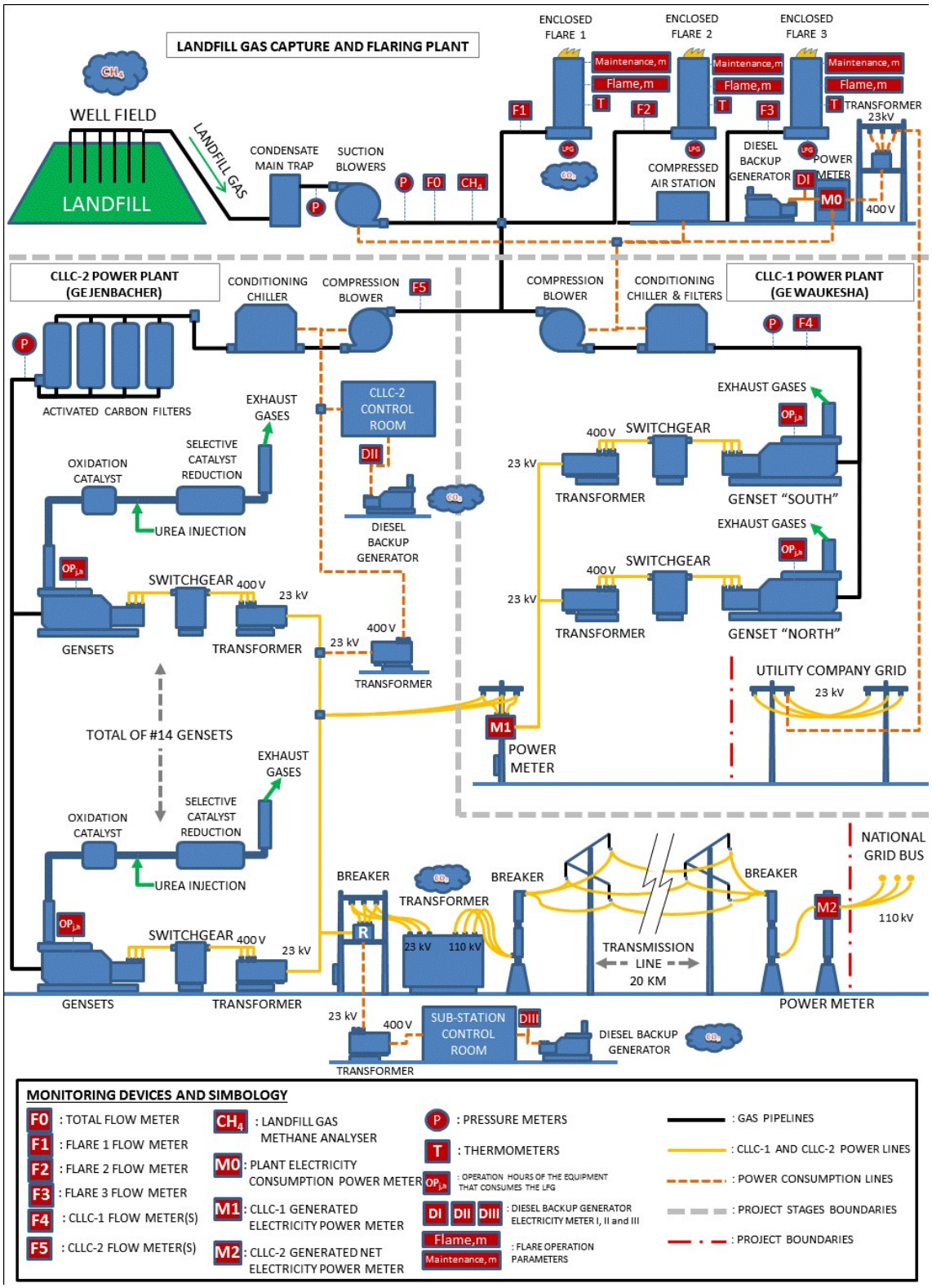

Figure 19 – Schematic diagram for the monitoring system

Gathering, recording and reporting of monitoring data:
During the considered monitoring period, signals for measurements of LFG flow (from the installed LFG flow meters F1, F2, F3, F4, F5 and F0), CH_4 fraction in collected LFG, temperature of the exhaust gas of both Flare 1 and Flare 2 (as well as other control parameters such as LFG pressure, LFG temperature) were received and processed by the project's programmable logical controller unit (PLC unit) and recorded by the project's supervisory and data acquisition system (SCADA) as data records. The available SCADA system is based on the "WinCC" platform. "WinCC" platform is supplied by Siemens AG and it is customized for the project activity. Data records for the measurements above-described are made available for each individual minute of the monitoring period. As per the project's monitoring system, every-minute data records for such measurements are exported and utilized as raw data in monthly emission reduction calculation spread sheets. Such monthly emission reduction calculation spread sheets also report records of the monitoring parameters which are not recorded/handled by the project's SCADA system. Information about this additional parameters are manually inserted in the monthly emission reduction calculation spread sheets.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data/parameter:	**GWP_{CH4}**
Unit	tCO_2e/tCH_4
Description	Global Warming Potential of methane
Source of data	"Global Warming Potential for Given Time Horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon. Available at: www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14 The applied value is also in accordance with the "Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol".
Value(s) applied)	25
Choice of data or measurement methods and procedures	-
Purpose of data	Determination of baseline emissions
Additional comments	-

Data/parameter:	**D_{CH4}**
Unit	tCH_4/m^3CH_4
Description	Density of methane
Source of data	Default value as per ACM0001 (version 4) is applied.
Value(s) applied)	0.0007168
Choice of data or measurement methods and procedures	-

Purpose of data	Determination of baseline emissions
Additional comments	-

Data/parameter:	**$TDL_{grid,y}$**
Unit	**%**
Description	Average technical transmission and distribution losses for grid electricity in year y.
Source of data	Default values as per applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is applied.
Value(s) applied)	20%
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/parameter:	**$MD_{reg,y}$**
Unit	tCH_4
Description	Amount of methane that would have been destroyed during the year in the absence of the project activity
Source of data	Annual value is ex-ante defined in the registered PDD based on previously existent (pre-project) LFG collection and destruction system. Value was adjusted for the considered 440 days monitoring period.
Value(s) applied)	295 tCH_4
Choice of data or measurement methods and procedures	-
Purpose of data	Determination of baseline emissions.
Additional comments	As per the PDD, the value of $MD_{reg,y}$ is 245 tCH_4 per year. While the considered monitoring period encompasses 440 days, the value of $MD_{reg,y}$ for the considered period is calculated as 295 tCH_4

Data/parameter:	**CEF_y**
Unit	tCO_2/MWh
Description	CO_2 emission factor of the electricity grid
Source of data	Calculated ex-ante in the PDD as per ACM0002 (version 6) based on data valid for the CDEC-SIC grid.
Value(s) applied)	0.408 tCO_2e/MWh
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions and project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comments	-

D.2. Data and parameters monitored

<table>
<tr><td>Data/parameter:</td><td>$LFG_{total,y}$</td></tr>
<tr><td>Unit</td><td>Nm^3</td></tr>
<tr><td>Description</td><td>Total amount of landfill gas captured</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured.</td></tr>
<tr><td>Source of data</td><td>Measured by a thermal mass flow meter (KDM internal symbol: F0).</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Every minute measurement records of Total amount of landfill gas captured are reported in the monthly emission reduction calculation spreadsheets (which are enclosed to this Monitoring Report).</td></tr>
<tr><td>Monitoring equipment</td><td><u>Specifications of the installed LFG flow meters used to measure $LFG_{total,y}$:</u>

- Manufacturer: FCI Fluid Components International LLC

- Model: ST98 Thermal Mass Flow meter

- Accuracy: ±1%

- Serial Number: 407207

- Calibration frequency and maintenance requirements:
Every 18 months. The calibration frequencies adopted for the installed LFG flow meters are as per the recommendations of equipment/instrument manufacturer. Both the PDD and ACM0001 (version 4) methodology do not specify any frequency for the calibration of the LFG flow meters. Moreover, the registered PDD and ACM0001 (version 4) methodology do not specify any accuracy or other specification requirement for such instruments/equipment either.

Details about performed calibration events valid for the considered monitoring period:

<table>
<tr><th colspan="2">Calibration Certificate</th><th rowspan="2">Calibration Date</th><th rowspan="2">Customer Order Number</th></tr>
<tr><th>Serial Number (S/N)</th><th>Calibration by</th></tr>
<tr><td>407207</td><td>FCI Fluid Components International LLC</td><td>13/07/2011</td><td>C055419</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Continuous measurements of LFG flow are recorded and reported every minute and made available in the monthly emission reduction calculation spreadsheets.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
</table>

QA/QC procedures:	Each performed calibration event has a validity of 18 months (as per the calibration frequency requirement informed by the equipment manufacturer). However, as part of its internal project's operational control, KDM S.A. normally replaces the LFG flow meter when a flow meter is sent to the supplier FCI for calibration[10]. Under this circumstances a spare and calibrated flow meters is installed.
Purpose of data:	Determination of baseline emissions.
Additional comments:	See informative box "*Taking into account records of $LFG_{total,y}$ (on the basis of continuous measurements of LFG flow from LFG flow meter "F0") in the context of determination of emission reductions*" in Section E.1.

Data/parameter:	**$LFG_{flare,y}$**
Unit	Nm^3
Description	Amount of landfill gas flared
Measured/calculated/default	Measured.
Source of data	While during the considered monitoring period, collected LFG was destroyed in 3 high temperature enclosed flares (Flare 1, Flare 2 and Flare 3), monitoring for $LFG_{flare,y}$ was thus performed on the basis of measurements of LFG sent to each one of the flares ($LFG_{flare,y,Flare-1}$, $LFG_{flare,y,Flare-2}$ and $LFG_{flare,y,Flare-3}$). $LFG_{flare,y,Flare-1}$ was measured by LFG thermal mass flow meter F1. $LFG_{flare,y,Flare-2}$ was measured by LFG thermal mass flow meter F2. $LFG_{flare,y,Flare-3}$ was measured by LFG thermal mass flow meter F5.
Value(s) of monitored parameter	Every minute measurements of Amount of landfill gas flared (for each one of the flares) are reported in the monthly emission reduction calculation spreadsheets which are enclosed to this Monitoring Report.

[10] FCI ST98 flow meters available in the project site are sent to the calibration/testing workshop of Fluid Components International L.L.C. (which is located in the United States) every 18-months in order to be tested and calibrated. This is in accordance to the calibration and testing requirements established by this equipment manufacturer for the FCI ST98 units.

Monitoring equipment

LFG flow meters used to measure $LFG_{flare,y,Flare-1}$ in Flare 1:

Specifications of the monitoring equipment:

- Manufacturer: FCI Fluid Components International LLC
- Model: ST98 Thermal Mass Flow meter
- Accuracy: ±1%
- Serial Number: 268935

Details about performed calibration events valid for the considered monitoring period:

Calibration Certificate		Calibration Date	Customer Order Number
Serial Number (S/N)	**Calibration by**		
268935	FCI Fluid Components International LLC	29/03/2012	RA34940

LFG flow meters used to measure $LFG_{flare,y,Flare-2}$ in Flare 2:

Specifications of the monitoring equipment:

- Manufacturer: FCI Fluid Components International LLC
- Model: ST98 Thermal Mass Flow meter
- Accuracy: ±1%
- Serial Number: 341600-A

Details about performed calibration events valid for the considered monitoring period:

Calibration Certificate		Calibration Date	Customer Order Number
Serial Number (S/N)	**Calibration by**		
341600-A	FCI Fluid Components International LLC	01/08/2011	RA34075

LFG flow meters used to measure $LFG_{flare,y,Flare-3}$ in Flare 3:

Specifications of the monitoring equipment:

- Manufacturer: FCI Fluid Components International LLC
- Model: ST98 Thermal Mass Flow meter

<table>
<tr><td></td><td>
- Accuracy: ±1%
- Serial Number: 341600-A

Details about performed calibration events valid for the considered monitoring period:

<table>
<tr><th colspan="2">Calibration Certificate</th><th rowspan="2">Calibration Date</th><th rowspan="2">Customer Order Number</th></tr>
<tr><th>Serial Number (S/N)</th><th>Calibration by</th></tr>
<tr><td>341600-A</td><td>FCI Fluid Components International LLC</td><td>01/08/2011</td><td>RA34075</td></tr>
</table>

Calibration frequency and maintenance requirements: Every 18 months. The calibration frequencies adopted for the installed LFG flow meters are as per the recommendations of equipment/instrument manufacturer.

The registered PDD and ACM0001 (version 4) methodology do not specify any frequency for the calibration of the LFG flow meters. Moreover, the registered PDD and ACM0001 (version 4) methodology do not specify any accuracy or other specification requirement for such instruments/equipment either.
</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Continuous measurement.
Measured values of LFG flow are to be recorded and reported every minute and made available in monthly emission reduction calculation spreadsheets.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>Each calibration event has a validity of 18 months, as informed by the equipment manufacturer. However, for internal operational control, KDM S.A. normally replaces the LFG flow meter (which is sent to the supplier for a calibration), on each replacement event a calibrated flow meters is installed.</td></tr>
<tr><td>Purpose of data:</td><td>Determination of baseline emissions.</td></tr>
<tr><td>Additional comments:</td><td>-</td></tr>
</table>

Data/parameter:	**$LFG_{electricity,y}$**
Unit	Nm^3
Description	Amount of landfill gas combusted in power plant
Measured/calculated/default	Measured.
Source of data	While during the considered monitoring period, collected LFG was used as fuel for electricity generation in both the CLLC-1 and CLLC-2 electricity generation facilities, monitoring for $LFG_{electricity,y}$ was thus performed on the basis of measurements of LFG sent to each one of the power plants ($LFG_{electricity,y,CLLC-1}$ and $LFG_{electricity,y,CLLC-2}$). $LFG_{electricity,y,CLLC-1}$ was measured by LFG thermal mass flow meter F3.

	$LFG_{electricity,y,CLLC-2}$ was measured by LFG thermal mass flow meter F4.
Value(s) of monitored parameter	Every minute measurements of Amount of landfill gas combusted in power plant are reported in the monthly emission reduction calculation spreadsheets (which are enclosed to this Monitoring Report). The amount of landfill gas sent the CLLC-1 electricity generation facility was measured by the F3 flow meter and the amount of landfill gas sent the CLLC-2 electricity generation facility was measured by the F4 flow meter.

Monitoring equipment

Specifications of the installed LFG flow meters used to measure $LFG_{electricity,y}$ sent to CLLC-1 Power plant ($LFG_{electricity,y,CLLC-1}$):

- Manufacturer: FCI Fluid Components International LLC
- Model: ST98 Thermal Mass Flow meter
- KDM internal symbol: F3
- Accuracy: ±1%
- Serial Number: 325926

Details about performed calibration events valid for the considered monitoring period:

Calibration Certificate		Calibration Date	Customer Order Number
Serial Number (S/N)	Calibration by		
325926	FCI Fluid Components International LLC	28/03/2012	RA34940

Specifications of the installed LFG flow meters used to measure $LFG_{electricity,y}$ sent to CLLC-2 Power plant ($LFG_{electricity,y,CLLC-2}$):

- Manufacturer: FCI Fluid Components International LLC
- Model: ST98 Thermal Mass Flow meter
- KDM internal symbol: F4
- Accuracy: ±1%
- Serial Number: 325925

Details about performed calibration events valid for the considered monitoring period:

Calibration Certificate		Calibration Date	Customer Order Number
Serial Number (S/N)	Calibration by		
325925	FCI Fluid Components International LLC	02/12/2011	RA34595

Calibration frequency and maintenance requirements: Every 18 months. The calibration frequencies adopted for the installed LFG flow meters are as per the recommendations of equipment/instrument manufacturer. The registered PDD and ACM0001 (version 4) methodology do not specify any frequency for the calibration of the LFG flow meters. Moreover, the registered PDD and ACM0001 (version 4) methodology do not specify any accuracy or other specification requirement for such instruments/equipment either.

Measuring/reading/recording frequency:	Continuous measurement. Measured values of LFG flow are to be recorded and reported every minute and made available in monthly emission reduction calculation spread sheets.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Each calibration event has a validity of 18 months, as informed by the equipment manufacturer. However, for internal operational control, KDM S.A. normally replaces the LFG flow meter (which is sent to the supplier for a calibration), on each replacement event a calibrated flow meters is installed.
Purpose of data:	Determination of baseline emissions.
Additional comments:	-

Data/parameter:	**FE**
Unit	%
Description	Flare/combustion efficiency
Measured/calculated/default	FE is determined *inter-alia* on the basis of regular measurements of the amount of residual methane content in the exhaust gas of the flare (every year), which are performed by a third party independent inspection service company. The operational status of the flare (which is also considered in the context of the determination of adopted FE values for every minute of the considered monitoring period) is also determined based on continuous monitoring of the temperature of exhaust gas of the flares (T_{flare}).[11] Whenever flare temperature is lower than 500ºC or higher than 1,095ºC (valid for the 3 flares (Flare 1, Flare 2 and Flare 3): $T_{flare\text{-}Flare\text{-}1}$, $T_{flare,Flare\text{-}2}$ and $T_{flare,Flare\text{-}3}$), no emission reduction is claimed for the time instant in question.[12]
Source of data	While during the considered monitoring period, collected LFG was destroyed in 2 high temperature enclosed flares (Flare 1, Flare 2 and Flare 3), monitoring for flare/combustion efficiency (FE) was thus performed on the basis of measurements and calculations applicable for each one of the flares ($FE_{Flare\text{-}1}$, $FE_{Flare\text{-}2}$ and $FE_{Flare\text{-}3}$). As established in the PDD and in accordance with ACM0001 (version 4), values of FE were regularly determined for each flare based inter-alia on (i)

[11] Temperature of the exhaust gas of the flares is not explicitly listed as a monitoring parameter as per the monitoring plan of the registered PDD neither as per ACM0001 (version 4). However, as per the monitoring plan of the registered PDD, monitoring details for the parameter Flare combustion/efficiency (FE) include the following requirements:
- *"(...) The flare operation shall be continuously monitored by continuous measurement of operation time of flare using a run time meter connected to a flame detector or a flame continuous temperature controller, irrespective of whether the flare efficiency is monitored (...)".*
- *"The enclosed flares shall be operated and maintained as per the specifications prescribed by the flare manufacturer."*

The temperature of the exhaust gas of the flares (T_{flare}) was thus also monitored in order to meet the above-described requirements for determination of FE and its consideration/application in every minute time instant of the considered monitoring period (for the determination of values of methane destroyed by the flares ($MD_{flare,Flare\text{-}1}$, $MD_{flare,Flare\text{-}2}$ and $MD_{flare,Flare\text{-}3}$) for every minute of the considered monitoring period.

[12] The conditions $T_{flare} > 500$ºC and $T_{flare} < 1{,}095$ºC (for the flares 1, 2 and 3) are thus regarded as pre-requisite for determining values for FE and $MD_{flare,y}$ values for any particular 1-minute period of the monitoring period based inter-alia on valid regular measurements of amount of residual methane in the exhaust gas of the flare. Whenever these conditions are not met, the amount of methane destroyed by the flare in question ($MD_{flared,y,Flare\text{-}1}$ or $MD_{flared,y,Flare\text{-}2}$) are assumed as null (zero). The three flares are equipped with flame detectors. No LFG is sent for combustion to Flare 1, Flare 2 or Flare 3 if no flame is detected for the flare in question. The use of flame detectors in the flares also address the above-quote requirement of the monitoring plan of the registered PDD.

measurements of flow of methane sent to the flare in question (performed by KDM S.A.) as well as (ii) performed measurements of residual methane content in the exhaust gas of the flare in question (as per measurements in collected samples of exhaust gas for each flare performed by the accredited external laboratory Airón, Ingeniería y Control Ambiental S.A.) and (iii) related calculations.

After the collection of measurement data related to the FE calculation for the flare in question, reported value for FE is calculated by KDM S.A. by following applicable procedure. All calculations are summarized in Section D.2 and detailed in a calculation spreadsheet enclosed to the Monitoring Report.

All performed measurements and results are evidenced and detailed in the following technical reports:

Technical Report number	Flare identification	Measurement date
562A-2012	Flare 1	09/07/2012
568A-2012	Flare 2	10/07/2012
568A-2012	Flare 3	10/07/2012

Value(s) of monitored parameter

Determined values of Flare/combustion efficiency are valid for the periods as indicated below:

Flare no	Period	Value of FE
Flare 1	From 01/01/2013 to 16/03/2014	99.9971%
Flare 2	From 01/01/2013 to 16/03/2014	99.9973%
Flare 2	From 01/01/2013 to 16/03/2014	99.9988%

Monitoring equipment	All related measurements were performed by following applicable requirements as per applicable procedure of the U.S. Environmental Protection Agency (US-EPA). All related measurements of residual methane fraction in the exhaust gas of the flares were performed by Airón Ingeniería y Control Ambiental S.A. by following the measurement methods/procedures as follows: - Method 3A "Determination of O_2 and CO_2 concentration in stationary source, procedure with instrumental analyzer" Measurement equipment: Manufacturer: California Analytical Instruments Model: ZRH Sensitivity: 0.1% - Method 6C "Determination of SO_2 concentration in stationary source, procedure with instrumental analyzer" Measurement equipment: Manufacturer: Thermo Environmental Instruments Model: 43C HL Sensitivity: 0.1 a 1 ppm - Method 7E "Determination of NO_x concentration in stationary source, procedure with instrumental analyzer" Measurement equipment: Manufacturer: Thermo Environmental Instruments Model: 42H Sensitivity: 0.1 a 1 ppm - Method 10 "Determination of CO concentration in stationary source, procedure with instrumental analyzer" Measurement equipment: Manufacturer: California Analytical Instruments Model: ZRH Sensitivity: 0.1 a 1 ppm - Method CH-25A: "Determination of Total Organic Compounds" Measurement equipment: Manufacturer: DANI Instruments Model: TNMH 462 Sensitivity: 0.1 a 1 ppm - Method CH-2 "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)" Measurement equipment: Manufacturer: Dwyer Instruments Model: 42H Sensitivity: 0.1 a 1 ppm For monitoring LFG flow and CH_4 content of the LFG sent to the flares, measurement data recorded by KDM S.A. used for monitoring the parameters "Amount of landfill gas flared" ($LFG_{flare,y}$) for flares 1, 2 and 3as well as methane fraction in the landfill gas ($W_{CH4,y}$) were used in the context of the calculation of parameter Flare/combustion efficiency (FE). For monitoring LFG flow in the exhaust gas of the flares and CH_4 content of the LFG in the exhaust gas of the flares the following equipment/instruments were used: *Pitot Tube:* Manufacturer: Environmental Supply Company, Inc Model: Stainless Steel Type "S" Pitot Tube Sensitivity: 1.0%

	For measuring the residual concentration of CH4 in the exhaust gas of the flare, the following equipment was used: *Gas analyzer:* Manufacturer: Synspec BV Model: Alpha Model 115 Methane/TNMHC Sensitivity: 0.1 to 10 ppm for methane For measuring temperature of exhaust gas of the flares, the following equipment were used: *Thermocouple used for monitoring temperature of exhaust gas on Flare 1*: Manufacturer: Reotemp Instrument Corporation Model: DMT, type K Accuracy: ±1.0% Serial Number/Period in use: 59555 – from 01/01/2013 to 16/03/2014Instrument internal identification number: $T_{flare\text{-}Flare\text{-}1}$ *Thermocouple used for monitoring temperature of exhaust gas on Flare 2*: Manufacturer: Reotemp Instrument Corporation Model: DMT, type K Accuracy: ±1.0% Serial Number/Period in use: 64568 – from 01/01/2013 to 16/03/2014 Instrument internal identification number: $T_{flare,Flare\text{-}2}$ *Thermocouple used for monitoring temperature of exhaust gas on Flare 3*: Manufacturer: Reotemp Instrument Corporation Model: DMT, type K Accuracy: ±1.0% Instrument internal identification number: $T_{flare,Flare\text{-}3}$ **Note about the thermocouples**: The thermocouples are not calibrated. Instead, project participants exchange the thermocouples every 12 months, according to manufacturer recommendation.
Measuring/reading/recording frequency:	The value of Flare/combustion efficiency is calculated based on: (i) Continuous measurement of LFG flow and CH_4 content of the LFG sent to the flares, which are recorded and reported every minute and made available in monthly emission reduction calculation spreadsheets. (ii) Periodic measurements of LFG flow in the exhaust gas of the flares and CH_4 content of the LFG in the exhaust gas of the flares, which shall be monitored yearly. Thus, the value for Flare/combustion efficiency shall be monitored yearly.
Calculation method (if applicable):	See Section E.1.
QA/QC procedures:	Information about calibration of sampling equipment and further related relevant issues are described in inspection reports issued by Airón, Ingeniería y Control Ambiental S.A.
Purpose of data:	Determination of baseline emissions.
Additional comments:	-

Data/parameter:	$W_{CH4,y}$
Unit	m^3 CH_4/m^3 LFG
Description	Methane fraction in the landfill gas
Measured/calculated/default	Measured.
Source of data	Continuous measurements performed by an installed continuous $CH_4/O_2/CO_2$ content gas analyzer.
Value(s) of monitored parameter	Every minute measurement records are presented in the monthly emission reduction calculation spreadsheets which are enclosed to the Monitoring Report.

Monitoring equipment

Specification of the $CH_4/O_2/CO_2$ content gas analyzer unit:
One $CH_4/O_2/CO_2$ content gas analyzer unit was utilized for measuring CH_4 content of collected LFG during the whole monitoring period. The specifications of the $CH_4/O_2/CO_2$ content gas analyzer unit are as follows:

- Manufacturer: Siemens AG
- Model: Ultramat 23
- Serial Number: N1-W2-678
- Accuracy: ±1%

Calibration events valid for the considered monitoring period:

Serial Number	Calibration event date
N1-W2-678	01/10/2011
	26/09/2012
	29/10/2012
	03/12/2012

As part of each individual calibration event performed in the installed $CH_4/O_2/CO_2$ content gas analyzer unit by trained staff of Siemens AG, the measurement error/deviation has been always appropriately identified, calculated and reported in the calibration certificate issued by TAG Instrumentación y Automatización de Processos Industriales, a SIEMENS Solution Partner in Chile.

Calibration frequency and/or maintenance requirements: Calibration is to be performed yearly (as established by the internal calibration procedure which is in accordance with calibration frequency recommendation from the equipment manufacturer). No calibration frequency requirements are specified in the monitoring plan of the registered PDD or AM0001 (version 3).

During the current monitoring period, an extra $CH_4/O_2/CO_2$ content gas analyzer unit was available at the flaring plant for backup purposes, only if necessary. This equipment was properly calibrated by TAG Instrumentación y Automatización de Processos Industriales, a SIEMENS solution partner in Chile, and has not been in operation since its installation.

- Manufacturer: Siemens AG
- Model: Ultramat 23
- Serial Number: N1-B2-711
- Accuracy: ±1%

Calibration events valid for the considered monitoring period:

Serial Number	Calibration event date
N1-B2-711	01/10/2011
	26/09/2012
	29/10/2012
	03/12/2012

Measuring/reading/recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Regular maintenance and calibration events are performed in the equipment in order to ensure accuracy and availability of measurements.
Purpose of data:	Determination of baseline emissions.
Additional comments:	A measurement error/deviation of 1.44% (beyond the maximum accuracy of the equipment (±1%)) was identified as a result of the calibration event dated 29/10/2012 in the Ultramat-23 $CH_4/O_2/CO_2$ gas Analyzer Unit Serial number N1-W2-711. A deduction factor of 1.44% was thus applied in the context of emission reductions calculation from 26/09/2012 (the previous calibration event) to 29/10/2012.

Data/parameter:	**Regulatory Requirements**
Unit	-
Description	Regulatory requirements relating to landfill gas projects
Measured/calculated/default	Not applicable.
Source of data	According to the KDM internal procedure P-GEN-AMB-003, regulatory requirements must be revised every year, the technical staff which take part of such revision are the Environmental engineers of the specific area, with collaboration of the quality department of the company. On specific cases, a request of revision of such regulatory requirements should be asked to an external staff of advocates. For this specific monitoring period, the applicable revision was performed on 02/01/2013. For this period the mentioned report shows no new incidents/changes on the Project activities or in the local environmental regulations. The mentioned procedure and document are available for the audit team.
Value(s) of monitored parameter	Not applicable.
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Not applicable.
Purpose of data:	Determination of baseline emissions.
Additional comments:	-

Data/parameter:	**$EL_{EXP\ LFG,y}$**
Unit	MWh
Description	Total amount of net electricity exported out of the project
Measured/calculated/default	Measured.
Source of data	During the considered monitoring period, collected LFG was used as fuel for electricity generation in both the CLLC-1 and CLLC-2 electricity generation facilities, monitoring for $EL_{EXP\ LFG,y}$ was thus performed on the basis of measurements of exported electricity which was generated by both power plants ($EL_{EXP\ LFG,y,CLLC-1+2}$) .
Value(s) of monitored	Every hour measurements electronically recorded by the installed electricity

<table>
<tr><td>parameter</td><td>meters are presented in the monthly emission reduction calculation spreadsheets which are enclosed to the Monitoring Report. Accumulated value for ELEXP LFG,y during the whole monitoring period is reported as follows:

<table><tr><th>Accumulated monthly amount of electricity generated by the CLLC-1 and CLLC-2 power plants ($EL_{EXP\ LFG,y,CLLC-1+2}$) and exported through the electricity grid (MWh)</th></tr><tr><td>150,471</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>An electricity meter measures the electricity exported by the project activity.

<u>Specifications of the installed electricity meter used to measure $EL_{EXP\ LFG,,CLLC-1+2}$ by the CLLC-1 and CLLC-2 Power plants</u>

- Manufacturer: Schneider Electric

- Model: ION 8600

- Serial Number: PT-1011A447-01

- Class: ±0.2

- Accuracy: ±0.2%

- Serial number: PT-1011A447-01

Calibration events valid for the considered monitoring period:

<table><tr><th>Serial Number:</th><th>Calibration certificate number:</th><th>Calibration date:</th><th>Calibrated by:</th></tr><tr><td rowspan="2">PT-1011A447-01</td><td>KD201202000002</td><td>22/02/2012</td><td>CAM Chile S.A.</td></tr><tr><td>KD201209000003</td><td>05/09/2012</td><td>CAM Chile S.A.</td></tr></table></td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Continuous measurements are recorded/reported every hour.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>Amount of electricity exported measured by the installed electricity meter was crosschecked with the monthly CDEC SIC report.</td></tr>
<tr><td>Purpose of data:</td><td>Determination of baseline emissions.</td></tr>
<tr><td>Additional comments:</td><td>The manufacturer of the ION 8600 electricity meter, Schneider Electric, states in Technical note 70074-0193-01 that the digital ION™ electricity meters do not require any calibration, but only a periodic verification of the precision. The equipment’s supplier – Schneider electric - does not specify the frequency of verifications, thus project participants contacted a well experienced supplier of this equipment and the conclusion is that common practise is to verify the electricity meters every 2 years. Thus project participants did not calibrate the ION 8600 S/N PT-1011A447-01 electricity meter.</td></tr>
</table>

Data/parameter:	Operational Hours
Unit	Hours
Description	Operation of the power plant
Measured/calculated/default	Measured.
Source of data	For every individual hour of the whole monitoring period, it is monitored whether the electricity generation facilities were under operation. This is checked on the basis of available records of electricity generation at the CLLC-1 and CLLC-2 electricity generation facilities for the hour in question + records of flow of LFG sent to the CLLC-1 and CLLC-2 electricity generation facility in the same hour. The amount of operational hours as reported in the monthly emission reduction calculation spreadsheets is increased by 1 (one) unit in the hour *h* whenever both conditions for the following logical tests are met: For Operational $Hours_{CLLC-1}$: - Record of LFG flow sent to the CLLC-1 electricity facility (in m^3/h) for the hour $h > 0$ - Record of electricity exported by the CLLC-1[13] electricity generation facility (in kWh) for the hour $h > 0$ For Operational $Hours_{CLLC-2}$: - Record of LFG flow sent to the CLLC-2 electricity facility (in m^3/h) for the hour $h > 0$ - Record of electricity exported by the CLLC-2 electricity generation facility (in kWh) for the hour $h > 0$ The reported quantity of hourly periods for which operation of the electricity generation facility is confirmed (on the basis of records of electricity generation and flow of LFG sent to the electricity generation facility) is thus used for the determination of accumulated monthly values of parameter Operation of the power plant (Operational Hours).
Value(s) of monitored parameter	Every minute records of Operational Hours for both power plants CLLC-1 and CLLC-2 are reported in the monthly emission reduction calculation spreadsheets (which are enclosed to this Monitoring Report).

[13] It is noteworthy that records of electricity exported by the CLLC-1 power plant used in the calculation of Operational $Hours_{CLLC-1}$ are measured by the electricity meter M1, which measures only electricity exported and imported by the CLLC-1 power plant. It is also important to note that this meter is only used in the context of the calculations for the parameter Operational $Hours_{CLLC-1.}$ Records of electricity exported by the CLLC-1 power plant which are registered by the M1 electricity meter are not used in the context of the parameter $EL_{EXP\ LFG,y.}$

Monitoring equipment	The determination of the quantity of hourly periods for which the electricity generation facility is confirmed to be under operative status is confirmed on the basis of comparison of records of electricity generation against records of flow of LFG sent to the electricity generation facility in the same time instant (hour h). All data is made available in the monthly emission reduction calculation spread sheets. Given the purpose of the parameter "Operation of the power plant" in the context of emission reduction determination, the comparative spread sheet thus acts as a reliable counter for operation hour of the electricity generation facility. The specifications of the flow meters used to measure flow of LFG sent to both the CLLC-1 and CLLC-2 power plants are presented in the table of the parameter $LFG_{electricity,y}$. Two different electricity meters were used for monitoring electricity generated by the CLLC-1 and CLLC-2 electricity generation facilities (meters M1 and M2). The specifications of the meter M2 (used for measuring electricity generated by both the CLLC-1 and CLLC-2 electricity generation facilities) are presented in the table for the parameter $EL_{EXP\ LFG,y}$. The specifications of the meter M1 (which is only used in the context of the calculation of Operational $Hours_{CLLC-1}$) are presented below: - Manufacturer: Schneider Electric - Model: ION 7650 - Serial Number: PJ-1201A782-03 - Class: ±0.2 - Accuracy: ±0.2% There are no calibration requirements for the ION meters, as per Technical Note issued by the manufacturer Schneider Electric, only verification of the accuracy is required. Howevera calibration event for the ION 7650 meter was performed on 04/09/2012 by CAM Chile S.A. with certificate number KDM201209000002.
Measuring/reading/recording frequency:	Records for "Operation of the power plant" (Operational Hours) are determined, recorded and reported on an hourly basis. Accumulated monthly values are also reported in the monthly emission reduction calculation spreadsheets.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	-
Purpose of data:	Determination of baseline emissions.
Additional comments:	-

<table>
<tr><td>Data/parameter:</td><td>$EC_{grid,y}$</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Amount of grid electricity consumed by the project activity</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured.</td></tr>
<tr><td>Source of data</td><td>Measured by installed electricity meters (KDM Internal symbol: M0) and also by M2 – bidirectional meter – whenever the CLLC-1 and CLLC-2, are not under operation.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Measurement records are presented in the summarized emission reduction calculations spreadsheet which is enclosed to the Monitoring Report.</td></tr>
<tr><td>Monitoring equipment</td><td>Specifications of electricity meter M2 are presented in the table for the parameter $EL_{EXP\ LFG,y}$.

Installed electricity meters M0:
Two electricity meters have been utilized simultaneously since 13/03/2007 (prior the monitoring period) for measuring grid electricity consumption by the project activity. The specifications of the electricity meters are as follows:

- Manufacturer: Schneider Electric

- Model: Power Logic PM710

- Serial Number: 02B0629 and 02B0637

- Class: ±1.0

- Accuracy: ±1.0%

According to a letter delivered by the manufacturer Schneider Electric dated of 23/04/2007, the installed Power Logic meters which are used to register the electricity consumption of the flaring station, require no calibration, because they are digital and do not possess any internal mechanical system to realize the functions of measure and control.
However, in order to demonstrate that the electrical meters used for measure the electricity consumption of the flaring station are in perfect operation conditions, KDM requested the following external calibrations:

<table>
<tr><th>Serial Number</th><th>Certificate Number</th><th>Calibration date</th><th>Calibrated by</th></tr>
<tr><td>02B0629</td><td>0790-PM44BCA53B</td><td>05/07/2011</td><td>Under Fire Laboratorio de Ensayos</td></tr>
<tr><td>02B0637</td><td>0789-PM450530E</td><td>05/07/2011</td><td>Under Fire Laboratorio de Ensayos</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Continuous measurements are recorded/reported every hour.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>Not applicable.</td></tr>
<tr><td>Purpose of data:</td><td>Determination of project emissions.</td></tr>
</table>

Additional comments:	Whenever CLLC-1 or CLLC-2 are not under operation electricity may be consumed either from the grid or from the diesel backup generators. For each case the attached spread sheets take that electricity consumption in account as project emissions, calculated by the applicable provisions in the registered PDD. Grid electricity is not directly sourced to the project's LFG collection and destruction (flaring) system by the regional electricity distribution company. The local distribution company Empresa Eléctrica Municipal de Til Til supply electricity to the whole Loma Los Colorados landfill in 23 kV medium voltage, with all supplied grid electricity landfill being monthly invoiced against KDM S.A. (based on measurements as per applicable legislation of the Chilean power market) by using an electricity meter which is located prior to the main power transformer in the entrance of the landfill. After passing through the main power transformer, grid electricity supplied by the Empresa Eléctrica Municipal de Til Til is distributed (with 400 kV voltage) to several power consumers located within the landfill area. All power consumers located in the area of the landfill are part of the operations of KDM S.A. (including the CDM project activity "Loma Los Colorados Landfill Gas Project"). There are no internal billing process implemented within KDM S.A. In the particular case of the project activity, measurements of consumed amount of grid electricity are performed in order to meet applicable CDM monitoring requirements and also for operational reasons. Since no invoices, receipts or control are monthly issued for billing/accounting reasons, no internal invoices for consumption of grid electricity are thus available. Thus, available monitoring records were not checked against invoices or receipts of purchase of grid electricity.

Data/parameter:	**$PP_{CP,Diesel\text{-}generator}$**
Unit	MW
Description	Rated capacity of the installed captive off-grid electricity generator (fuelled by Diesel)
Measured/calculated/default	Measured.
Source of data	According to name plate of the three installed generators.
Value(s) of monitored parameter	0.708 MW = 0.276 MW + 0.352 MW + 0.080 MW

<table>
<tr><td>Monitoring equipment</td><td>The project activity from the start-up of CLLC – 2 onwards encompasses 3 diesel backup generators:

Specifications of the captive off-grid electricity generators:
<table>
<tr><th>Equipment id/tag</th><th>Manufacturer:</th><th>Model Number</th><th>Power (MW)</th><th>Fuel consumption (liters per hour) at 100% load</th><th>Purpose</th></tr>
<tr><td>Diesel Backup Generator I</td><td>Atlas Copco (using a Volvo diesel engine)</td><td>QAS 325 Vd</td><td>0.276</td><td>71.6</td><td>Gas flaring systems and CLLC-1 auxiliary systems backup</td></tr>
<tr><td>Diesel Backup Generator II</td><td>Cummins</td><td>SDC - 400</td><td>0.352</td><td>77.9</td><td>CLLC-2 auxiliary systems backup</td></tr>
<tr><td>Diesel Backup Generator III</td><td>Protelec</td><td>S 100 - 10</td><td>0.080</td><td>16.2</td><td>SELLC systems backup</td></tr>
</table></td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Not applicable.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>Not applicable.</td></tr>
<tr><td>Purpose of data:</td><td>Determination of project emissions.</td></tr>
<tr><td>Additional comments:</td><td>-</td></tr>
</table>

Data/parameter:	**$FC_{LPG,y}$**
Unit	Ton
Description	Quantity of fuel LPG combusted by the project activity
Measured/calculated/default	Measured.
Source of data	Amount of consumed LPG was measured by the LPG supplier in each event of supply of cylinders of LPG with 45 kg capacity each to the project site. To determine the amount of LPG of each cylinder consumed during the considered monitoring period, the cylinders of LPG are weighed by a weight scale installed at the project site.
Value(s) of monitored parameter	49.1 kg During the considered monitoring period, two cylinders containing 45 kg of LPG each were supplied to the project activity. $FC_{LPG,y}$ was determined by weighing the LPG cylinders every week.

Monitoring equipment	*Specifications of the weight scale used to measure quantity of LPG consumed by the project activity:* - Manufcaturer: Mettler-Toledo AG - Model: IND 221 - Serial Number: 61673256GM - Capacity: 150 kg - Accuracy: ± 0.02 kg The IND 221 weight scale was calibrated on 19/07/2012 by Precision (Certificate number 42608).
Measuring/reading/recording frequency:	The measurements of consumption of LPG by the project activity were performed prior the beginning of the monitoring period and every week during the whole monitoring period.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Not applicable.
Purpose of data:	Determination of project emissions.
Additional comments:	-

Data/parameter:	**$EF_{CO2,LPG,y}$**
Unit	tCO_2/GJ
Description	CO_2 emission factor for fuel LPG
Measured/calculated/default	Default value.
Source of data	The applicable conservative default value as established by the "Tool to calculate baseline, project and/or leakage emissions from fossil fuel combustion" is selected.
Value(s) of monitored parameter	0.0656 tCO_2/GJ (as per IPCC 2006 volume 2 chapter 1)
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Not applicable.
Purpose of data:	Data is used for project emissions.
Additional comments:	-

Data/parameter:	$NCV_{LPG,y}$
Unit	TJ/ton LPG
Description	Net calorific value of the fuel LPG
Measured/calculated/default	Default value.
Source of data	The applicable conservative default value as established by the option d) of the "Tool to calculate baseline, project and/or leakage emissions from fossil fuel combustion" is selected.
Value(s) of monitored parameter	52.2 GJ/ton_{LPG} (as per IPCC 2006 volume 2 chapter 1)
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Not applicable.
Purpose of data:	Data is used for project emissions.
Additional comments:	-

The following parameters (which are also identified as parameters to be monitored ex-post in the monitoring plan of the registered PDD) were **not** monitored:

- Temperature of the landfill gas (T).

Justification for non-monitoring of T:
While the installed LFG flow meters automatically convert and express the measurement of LFG flow in normalized cubic meters per hour (Nm^3/h), monitoring of Temperature of the landfill gas (T) is thus not required.

- Pressure of the landfill gas (P).

Justification for non-monitoring of P:
While the installed LFG flow meters automatically convert and express the measurement of LFG flow in normalized cubic meters per hour (Nm^3/h), monitoring of Pressure of the landfill gas (P) is thus not required.

- Amount of electricity sourced by the captive off-grid electricity generator (fuelled by Diesel) and consumed by the project activity ($EC_{captive,y}$).
- Quantity of fuel Diesel combusted by the captive off-grid electricity generator (FC_{Diesel}).
- Net calorific value of fuel Diesel (NCV_{Diesel}).
- CO_2 emission factor of fuel Diesel ($EF_{CO2,Diesel}$).
- Quantity of electricity generated by captive off-grid electricity generator fuelled by Diesel ($EG_{Diesel\text{-}generator}$).

Justification for non-monitoring of $EC_{captive,y}$, FC_{Diesel}, NCV_{Diesel}, $EF_{EL,captive,y}$, $EF_{CO2,Diesel}$ and $EG_{Diesel\text{-}generator}$:
Project emissions due to consumption of electricity sourced by the back-up captive off-grid electricity generator (fuelled by diesel) ($PE_{EC,captive,y}$) are calculated by applying the conservative option B4 of the "Tool to calculate baseline, project and/or leakage emissions from fossil fuel combustion" to each of the diesel generators) during the considered monitoring period, as follows:

$PE_{EC,captive,y} = 11,400 * PP_{CP,Diesel\text{-}generator}$

Where:

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

Thus, by considering the applied approach to calculate the project emissions due to sourcing of electricity by the backup captive electricity generators, monitoring of $EC_{captive,y}$, $FC_{Diesel,}$ $NCV_{Diesel,}$ $EF_{CO2,Diesel}$ and $EG_{Diesel\text{-}generator}$ are not required.

D.3. Implementation of sampling plan

>>
Not applicable.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>
For the monitoring period covered by this Monitoring Report, GHG emission reductions are achieved by mitigation of emissions two GHGs:

- Destruction of methane (through combustion of LFG in enclosed high temperature flares and combustion of LFG in engine-generator sets)
- Reduction of CO_2 emissions due to generation of electricity which is exported through the grid and thus displace the generation of equivalent amount of electricity that, in the absence of the project activity (baseline scenario) would be generated by fossil fuel power plants and by new additions of power generation sources also using fossil fuel.

At the end of each subsection a sample of the calculations is presented.

Determination of baseline emissions for the project's methane destruction component:

Baseline emissions associated with methane destruction promoted by the project activity (ERM_y) during the considered monitoring period are calculated as the sum of amount of methane actually collected and combusted in the high temperature enclosed flares and combusted in the engine-generator sets of the CLLC-1 and CLLC-2 electricity generation facility ($MD_{project,y}$) minus the amount of the methane that is assumed as destroyed in the baseline scenario (absence of the project) ($MD_{reg,y}$). times ex-ante determined values for Global Warming Potential for methane (GWP_{CH4}) as follows:

$ERM_y = (MD_{project,y} - MD_{reg,\,y}) * GWP_{CH4}$

Where:

GWP_{CH4} Global Warming Potential for methane. GWP_{CH4} is ex-ante selected as 21 tCO_2e/tCH_4
Further details about the ex-ante determined parameter GWP_{CH4} are made available in Section D.1.

$MD_{reg,y}$ Amount of methane that is assumed as destroyed in the baseline scenario (absence of the project). $MD_{reg,y}$ is ex-ante determined as 245 ton of methane per year (365

days). As the monitoring period from encompasses exactly **440** days, $MD_{reg,y}$ is thus equal to 295 tCH_4,

$MD_{project,y}$ Amount of methane actually destroyed by the project activity during the considered monitoring period. As defined by the PDD, $MD_{project,y}$ is determined as the sum of the values of the parameter for each individual minute of the whole monitoring period as follows[14]:

$MD_{project,y} = MD_{flared,y} + MD_{electricity,y}$[15]

Where:

$MD_{electricity,y}$ Quantity of methane destroyed by generation of electricity. During the considered monitoring period, $MD_{electricity,y}$ is determined (in tCH_4) as follows:

$MD_{electricity,y} = MD_{electricity,y,CLLC-1} + MD_{electricity,y,CLLC-2}$

Where:

$MD_{electricity,y,CLLC-1}$ Amount of methane destroyed by generation of electricity in the CLLC-1 power plant.

$MD_{electricity,y,CLLC-2}$ Amount of methane destroyed by generation of electricity in the CLLC-2 power plant.

In accordance with provisions of the PDD for the determination of $MD_{electricity,y}$, values of $MD_{e1electricity,y,CLLC-1}$ and $MD_{e1electricity,y,CLLC-2}$ are determined as the sum of the values of the parameter for each individual minute of the whole monitoring period as follows:

$MD_{electricity,y,CLLC-1} = LFG_{electricity,y,CLLC-1} * w_{CH4,y} * D_{CH4}$

And

$MD_{electricity,y,CLLC-2} = LFG_{electricity,y,CLLC-2} * w_{CH4,y} * D_{CH4}$

Where:

$LFG_{electricity,y,CLLC-1}$ Quantity of landfill gas fed into the CLLC-1 power plant during the year y measured in normalized cubic meters (Nm^3/h). Measurements of $LFG_{electricity,y,CLLC-1}$ reported in Nm^3/h are converted to Nm^3/min (by dividing every 1-minute measurement by 60) for the calculation of values of $MD_{electricity,y,CLLC-1}$ for every minute. Further monitoring details about $LFG_{electricity,y,CLLC-1}$ are presented in section D.2.

$LFG_{electricity,y,CLLC-2}$ Quantity of landfill gas fed into the CLLC-2 power plant during the year y measured in

[14] The calculation requirements as presented in the informative box "*Taking into account records of $LFG_{total,y}$ (measurements from LFG flow meter "F0" in the context of emission reductions*" are also taken into account for the determination of every minute values for $MD_{project,y}$.

[15] For the considering monitoring period $MD_{flared,y} = MD_{flared,y,Flare-1} + MD_{flared,y,Flare-2} + MD_{flared,y,Flare-3}$ and $MD_{electricity,y} = MD_{electricity,y,CLLC-1} + MD_{electricity,y,CLLC-2}$ thus $MD_{project,y}$ can be calculated as $MD_{project,y} = MD_{flared,y,Flare-1} + MD_{flared,y,Flare-2} + MD_{flared,y,Flare-3} + MD_{electricity,y,CLLC-1} + MD_{electricity,y,CLLC-2}$.

normalized cubic meters (Nm^3/h) [16] . Measurements of $LFG_{electricity,y,CLLC-2}$ reported in Nm^3/h are converted to Nm^3/min (by dividing every 1-minute measurement by 60) for the calculation of values of $MD_{electricity,y,CLLC-2}$ for every minute. Further monitoring details about $LFG_{electricity,y,CLLC-2}$ are presented in section D.2.

$w_{CH4,y}$ and D_{CH4} are determined as explained below.

$MD_{flared,y}$ Amount of methane destroyed by flaring. While during the considered monitoring period methane has been destroyed by flaring in 3 high temperature enclosed flares, $MD_{flared,y}$ is thus determined (in tCH_4) as the sum of methane actually destroyed in each one of the flares as follows:

$$MD_{flared,y} = MD_{flared,y,Flare-1} + MD_{flared,y,Flare-2} + MD_{flared,y,Flare-3}$$

Where:

$MD_{flared,y,Flare-1}$ Amount of methane destroyed in Flare 1
$MD_{flared,y,Flare-2}$ Amount of methane destroyed in Flare 2
$MD_{flared,y,Flare-3}$ Amount of methane destroyed in Flare 3

In accordance with provisions of the PDD for the determination of $MD_{flared,y}$, values of $MD_{flared,y,Flare-}1$, $MDflared_{,y,Flare-2}$ and $MD_{flared,y,Flare-3}$ are determined as the sum of the values of the parameter for each individual minute of the whole monitoring period as follows as follows:

$$MD_{flared,y,Flare-n} = LFG_{flare,y,Flare-n} * w_{CH4,y} * D_{CH4} * FE_n$$

Where:

$LFG_{flare,y,Flare-n}$ Amount of landfill sent to Flare n (where n = flare number). $LFG_{flare,y,Flare-n}$ is determined on the basis of every minute measurement records of LFG flow sent to the flare n (in Nm^3/h) [17] . Measurements of $LFG_{flare,y,Flare-1}$, $LFG_{flare,y,Flare-2}$ and $LFG_{flare,y,Flare-3}$ reported in Nm^3/h are converted to Nm^3/min (by dividing every 1-minute measurement by 60) for the calculation of values of $MD_{flared,y,Flare-1}$, $MD_{flared,y,Flare-2}$ and $MD_{flared,y,Flare-3}$ for every minute.

[16] Whenever measurements of the parameters $LFG_{flare.y}$ ($LFG_{flare,y,Flare-1}$, $LFG_{flare,y,Flare-2}$ and $LFG_{flare,y,Flare-3}$), $LFG_{electricity,y}$ ($LFG_{electricity,y,CLLC-1}$ and $LFG_{electricity,y,CLLC-2}$), $w_{CH4,y}$ and temperature of the landfill gas are recorded as outside the interval indicated below, it is assumed that related equipment (Flare 1, Flare 2, Flare 3 and the generator sets of the CLLC-1 and CLLC-2 power plant) are operating outside the manufactures specifications/requirements. In such case, data records are not taken in account for the calculation of emission reductions of the project activity (no emission reductions from methane destruction is claimed).

Equipment	Flow of LFG (Nm^3/h)	Temperature (ºC)	Methane (%)
Flare 1	800 - 5,097	500 - 1,095	30 - 70
Flare 2	800 - 5,097	500 - 1,095	30 - 70
Flare 3	800 - 5,097	500 - 1,095	30 - 70
CLLC-1	100 - 1,800	-	30 - 70
CLLC-2	180 - 12,600	-	30 - 70

Further monitoring details about $LFG_{flare,y,Flare-n}$ are presented in section D.2

$w_{CH4,y}$ Methane fraction of collected landfill gas (in m^3CH_4/m^3LFG). Every minute measurement records are considered for the determination of every minute values of $MD_{flared,y,Flare-n}$. Further monitoring details about $w_{CH4,y}$ are presented in section D.2.

D_{CH4} Density of methane. D_{CH4} is ex-ante determined

as 0.0007168 tCH_4/m^3CH_4.

FE_n Flare/combustion efficiency of flare n (the fraction of the methane destroyed) In accordance to the PDD, FE_n is determined based in a mass balance, within the period of measurement of the flare efficiency, between the flow and the amount of residual methane in the exhaust gases of flares and also in the gas sent to the flares as follows:

$FE_n = 1- (MD_{nd,kg/h,\ n}/MD_{flared,kg/h,\ n})$

Where:

$MD_{nd,kg/h,\ n}$ Quantity of methane non destroyed in each flare (kg/hour). $MD_{nd,kg/h,\ n}$ is determined as follows:

$MD_{nd,kg/h,\ n} = (LFG_{residual,y,\ n} * w_{CH4,y,residual,\ n}) / 1,000,000$ [kg/g]

Where:

$LFG_{residual,y,n}$:

Amount of landfill gas in the exhaust gas of each flare (Nm^3/h). This value is measured by the third party company Airón Inginiería y Control Ambiental S.A.

$w_{CH4,y,residual,n}$:

Determined as the average of the measured CH_4 content in the exhaust gas of each flare during the interval of time in which the value for $FE_{,n}$ is applied for each $FE_{,n}$ determination. This value is measured by the third party company Airón Inginiería y Control Ambiental S.A.

$MD_{flared,kg/h,\ n}$ Quantity of methane sent to each flare (kg/hour). $MD_{flared,kg/h,n}$ is determined as follows:

$MD_{flared,kg/h,\ n,} = LFG_{flare,y,\ n} * w_{CH4,y,average} * D_{CH4} * 1{,}000$ [kg/ton]

Where:

$LFG_{flare,y,n}$:

Amount of landfill gas flared in each flare (Nm^3/h). Data measured by flow meters F1, F2 and F5 is used for the calculation of FE_1, FE_2 and FE_3, respectively.

$w_{CH4,y,average}$:

Determined as the average of the measured value for monitoring parameter $w_{CH4,y}$ during the interval of time in which the value for FE is applied for each FE determination.

The calculated values for $FE_{,n}$ ($MD_{nd,kg/h.n}$ and $MD_{flared,kg/h,n}$) in the context of each one of the valid third party evaluations are indicated in the table below:

Calculated values for $MD_{nd,kg/h,n}$ and $MD_{flared,kg/h,n}$:

Flare	Date of the evaluation/testing	$MD_{nd,kg/h,n}$ (kg/h)	$MD_{flared,kg/h,n}$ (kg/h)
1	09/07/2012	0.0446229	1,516.04592
2	10/07/2012	0.0388776	1,451.659045
3	10/07/2012	0.0327851	1,421.365471

The calculated values for FE_n, in order to determine the applicable values of the parameter $MD_{project,y}$ as follows:

Adopted values for FE_n along the monitoring period

Flare	Period within the considered monitoring period	Value of FE
1	All monitoring period	99.9971%
2	All monitoring period	99.9973%
3	All monitoring period	99.9988%

Taking into account records of $LFG_{total,y}$ (on the basis of continuous measurements of LFG flow from LFG flow meter "F0") in the context of determination of emission reductions:

In accordance with applicable guidance of ACM0001 (version 4) and available provisions in the PDD, during the considered monitoring period, baseline emission calculations due to methane destruction by the project activity was calculated by also taking into account the following conditions involving measurements of total amount of LFG collected by the project activity which was sent to Flare 1, Flare 2, Flare 3, CLLC-1 and CLLC-2 power plant.

a) In case the condition "$MD_{total,y} > MD_{flared,y} + MD_{electricity,y}$" is met for a particular minute of the monitoring period, $MD_{project,y}$ is calculated as follows for the minute in question:

$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} = (LFG_{flare,y,Flare-1} * w_{CH4,y} * D_{CH4} * FE_1) + (LFG_{flare,y,Flare-2} * w_{CH4,y} * D_{CH4} * FE_2) + (LFG_{flare,y,Flare-3} * w_{CH4,y} * D_{CH4} * FE_3) + (LFG_{electricity,y,CLLC-1} * w_{CH4,y} * D_{CH4}) + (LFG_{electricity,y,CLLC-2} * w_{CH4,y} * D_{CH4})$

b) In case the condition "$MD_{total,y} < MD_{flared,y} + MD_{electricity,y}$" is met for a particular minute of the monitoring period, $MD_{project,y}$ is calculated as follows for the minute in question:

$MD_{project,y} = MD_{total,y} = LFG_{total,y} * w_{CH4,y} * D_{CH4} * Min(FE_1;FE_2)$[18]

By taking into account the calculated values for $MD_{flared,y}$ and $MD_{electricity,y}$ for the considered monitoring period, $MD_{project,y}$ is thus calculated as **36,833** tCH_4.

During the present monitoring period ERM_y = **913,441** tCO_2e

Baseline emissions for the project's renewable energy generation component:

As outlined in the PDD, baseline CO_2 emissions for electricity generation using LFG as fuel (which promotes displacement of equivalent amount of electricity that would otherwise be generated by existing fossil fuel plants and new generation sources additions in the SIC-grid in Chile) are determined by following calculation and monitoring approaches as per ACM0002 (version 6).

As per ACM0002 (version 6), such baseline emissions are determined as associated emission for equivalent amount of electricity that would otherwise be generated in existing and/or new grid-connected power plants in the absence of the project activity (baseline scenario).

As also defined in the PDD, baseline CO_2 emissions for the project's renewable energy generation component (ERC_y) for the considered monitoring period are determined (in tCO_2) as follows:

$ERC_y = EL_y * CEF_y$ (Where: $EL_y = EL_{EXPLFG,y}$) , thus $ERC_y = EL_{EXPLFG,y} * CEF_y$

Where:

$EL_{EXPLFG,y}$ Quantity of electricity generated by the project activity using LFG as fuel which is exported (in MWh). For the considered monitoring period, the accumulated value of $EL_{EXP\ LFG,y}$ during the whole monitoring period is reported as **150,471** MWh. Further monitoring details about $EL_{EXP\ LFG,y}$ are presented in Section D.2.

CEF_y Emissions factor for electricity generation (in tCO_2/MWh). CEF_y is ex-ante calculated as 0.408 tCO_2/MWh.

For the considered monitoring period, ERC_y = **61,392** tCO_2.

[18] As per the registered PDD in case the condition "$MD_{total,y} < MD_{flared,y} + MD_{electricity,y}$" is met, $MD_{project,y} = MD_{total,y} = LFG_{total,y} * w_{CH4,y} * D_{CH4}$. However, as such calculation approach does not take in account values for Flare/combustion efficiency (FE); the project participants thus also applied the lowest value of flare/combustion efficiency (FE_n) in the formulae as a conservative approach for the determination of baseline emission in all particular minutes of the whole monitoring period where the condition "$MD_{total,y} < MD_{flared,y} + MD_{electricity,y}$ " was met.

Total baseline emissions for the project activity

Total baseline emissions for the project activity (BE_y) are determined (in tCO_2e) as the sum of (i) baseline emissions associated with methane destruction promoted by the project activity (ERM_y) and (ii) baseline CO_2 emissions for the project's renewable energy generation component (ERC_y). For the considered monitoring period, ERM_y is calculated as follows:

$BE_y = ERM_y$ **+** ERC_y **= 913,441** + **61,392** = **974,833** tCO_2e

All calculations of baseline emissions are detailed in emission reduction calculation spreadsheets enclosed to the Monitoring Report.

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

The project activity has three sources of project emissions:

- Project emissions due to the consumption of grid electricity by the project activity
- Project emissions emissions due to consumption of electricity sourced by the backup captive off-grid electricity generators (fuelled by diesel)
- Project emissions due to the consumption of LPG by the project activity

The project emissions are calculated as follows[19]:

$$PE_{i,y} = PE_{EC,grid,y} + PE_{EC,captive,y} + PE_{LPG}$$

Where:

$PE_{EC,y}$ Project emissions due to electricity consumption in year y (in tCO_2).

$PE_{LPG,y}$ Project emissions due to consumption of fossil fuel LPG[20] by the project activity (for uses other than electricity generation) (in tCO_2).

$PE_{EC,captive,y}$ Project emissions due to the consumption of electricity sourced by the backup captive off-grid electricity generator (fuelled by diesel) (in tCO_2).

Project emission due to the consumption of grid electricity by the project activity:

Project emissions due to electricity consumption ($PE_{EC,grid,y}$) are determined (in tCO_2) as follows:

$$PE_{EC,grid,y} = EC_{grid,y} * CEF_y * (1 + TDL_{grid,y})$$

Where:

$EC_{grid,y}$ Amount of grid electricity consumed by the project activity. For the considered monitoring period $EC_{grid,y}$ was determined based on measurements as per applicable provisions of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". For the considered monitoring period $EC_{grid,y}$ is equal as **53** MWh. Further monitoring details for $EC_{grid,y}$ are presented in Section D.2.

[19] Details of calculations are shown in the annex spread sheet of the Monitoring Report.

[20] Liquefied Petroleum Gas (LPG) is used for igniting the flares.

CEF_y CO_2 emission factor for grid electricity. CEF_y is ex-ante determined as **0.408** tCO_2/MWh. Further details of CEF_y are presented in Section D.1.

$TDL_{grid,y}$ Average technical transmission and distribution losses for grid electricity. In accordance with applicable provisions of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and the PDD, $TDL_{grid,y}$ is ex-ante determined as 20% (conservative default value fixed along the whole crediting period). Further details about $TDL_{grid,y}$ are presented in Section D.1.

$PE_{EC,grid,y}$ is thus calculated as 53 * 0.408 * (1 + 0.20) = **26** tCO_2

E.2.2. Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generator (fuelled by diesel):

By following applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) as highlighted in the PDD, project emissions due to consumption of electricity sourced by a captive off-grid electricity generator (fuelled by diesel) ($PE_{EC,captive,y}$) are taken into account in the determination of emission reductions.

Since the amount of electricity actually sourced by the captive electricity generators (fuelled by diesel) and consumed by the project activity (parameter $EC_{captive,y}$) was not monitored in accordance with the related provisions of the monitoring plan, $PE_{EC,captive,y}$ is thus determine by applying the conservative approach of option B4 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 1). The PDD refers to this option as a conservative alternative for determining $PE_{EC,captive,y}$.

On the next table it is shown the backup captive diesel generators under operation during the considered monitoring period, as well as the period that they were under operation and their nameplate power.

Equipment id/tag	Nameplate installed power generation capacity (MW)	Period under operation
Diesel Backup Generator I	0.276	During all monitoring period (440 days – 10,560 hours)
Diesel Backup Generator II	0.352	
Diesel Backup Generator III	0.080	
Total	**0.708**	

As per option B4 of the methodological tool, only the rated capacity of the captive off-grid electricity generator is to be monitored since under a very conservative simplification, emission factor of 1.3 tCO_2/MWh and operation time of 8,760 hours during the year at the rated capacity are considered as follows:

$PE_{EC,captive,y} = 11,400$[21] * $PP_{CP,Diesel\text{-}generator}$

Where:

$PP_{CP,Diesel\text{-}generator}$ Rated capacity of the installed captive off-grid electricity generator fuelled by diesel ($PP_{CP,Diesel\text{-}generator}$) (in MW). $PP_{CP,Diesel\text{-}generator}$ is selected as 0.276, 0.352 and 0.080 MW. These values are indicated as the nameplate power of

[21] 11,400 = 8,760 * 1.3, i.e., the number of hours per year multiplied by the conservative emission factor 1.3 tCO_2/MWh. For the determination of $PE_{EC,captive,y}$ for the considered monitoring period "10,560" is used instead of "8,760" in order to correctly consider the number of hours encompassed by the considered monitoring period.

the installed captive off-grid electricity generators. Further details about the determination of $PP_{CP,Diesel\text{-}generator}$ are included in Section D.2.

By applying the value of $PP_{CP,Diesel\text{-}generator}$ as well as the period the installed captive off-grid electricity generators were under operation:

$PE_{EC,captive,y}$ = 1.3 * 10,560 * (0.276 + 0.352 + 0.080) = **9,720** tCO_2

Thus, project emissions due to the consumption of electricity sources by the backup captive offgrid electricity generator (fuelled by diesel) are calculated as **9,720** tCO_2.

E.2.3. Project emissions due to the consumption of LPG by the project activity:

As defined by the revised version of the PDD, GHG emissions due to the consumption LPG by the project activity (PE_{LPG}) are also accounted as project emissions. Such project emissions are determined by following applicable guidance of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" as also outlined in the PDD. As per such methodological tool related project emissions source are determined as follows:

$PE_{LPG,y} = FC_{LPG,y} * COEF_{LPG,y}$

Where:

$FC_{LPG,y}$ Amount of fossil fuel (LPG) consumed by the project activity. During the considered monitoring period, $FC_{LPG,y}$ was determined by weighing the LPG cylinders every week as shown in the next table.

Date	Gross measured mass (weight) of the LPG cylinder (kg)[22]	
	Cylinder number 37464	Cylinder number 432
18/08/2012	77.38	78.62
25/08/2012	74;06	78.62
01/09/2012	70.74	78.62
08/09/2012	71.89	78.62
15/09/2012	69.72	78.62
22/09/2012	68.70	78.62
29/09/2012	68.18	78.62
06/10/2012	66.65	78.62
13/10/2012	62.05	78.62
20/10/2012	59.75	78.62
27/10/2012	57.45	78.62
03/11/2012	54.16	78.62
10/11/2012	54.00	78.62
17/11/2012	53.02	78.62
23/11/2012	51.00	76.55

[22] Gross measured mass (weight) of each one of the LPG cylinders includes the mass of the empty cylinder + mass of amount of LPG available inside the cylinder.

01/12/2012	50.87	74.48
08/12/2012	50.00	74.48
15/12/2012	50.00	74.48
22/12/2012	49.00	74.48
29/12/2012	49.00	70.34
02/01/2013	47.32	59.58
LPG consumed determined as the difference between gross mass of the LPG cylinder on the beginning and of the considered monitoring period (kg)	30.06	19.04
Total LPG consumed (kg)	49.10	

During the considered monitoring **49.1** kg (**0.0491** ton) of LPG were consumed by the project activity. Further monitoring details for $FC_{LPG,y}$ are presented in Section D.2.

$COEF_{LPG,y}$ CO_2 emission factor for consumed LPG (in mass basis). $COEF_{LPG}$ is determined as the product between the Net Calorific Value for consumed LPG (NCV_{LPG}) and the CO_2 emission factor for consumed LPG (in energy basis) (EF_{LPG}), as follows:

$$COEF_{LPG,y} = EF_{CO2,LPG,y} * NCV_{LPG,y}$$

Where:

$EF_{CO2,LPG,y}$ Emission factor for consumed LPG (in energy basis). The value for $EF_{CO2,LPG,y}$ is selected as 0.0656 tCO_2/GJ. This value is selected as per IPCC Guidelines for National Greenhouse Gas Inventories, 2006 (IPCC, 2006), Chapter 1, Volume 2, Table 1.4 - value at the upper limit of the uncertainty at 95% confidence interval. Further details about the determination of $EF_{CO2,LPG,y}$ are described in Section D.2.

$NCV_{LPG,y}$ Net Calorific Value for consumed LPG $NCV_{LPG,y}$. The value for $NCV_{LPG,y}$ is 52.2 GJ/ton_{LPG}. This value is selected as per IPCC Guidelines for National Greenhouse Gas Inventories, 2006 (IPCC, 2006), Chapter 1, Volume 2, Table 1.2 - value at the upper limit of the uncertainty at 95% confidence interval. Further details about the determination of $NCV_{LPG,y}$ are described in Section D.2.

By applying the above summarized calculation, $COEF_{LPG,y}$ is thus determined as **3.43 tCO_2/ton_{LPG}**

By taking into account the determined values for $FC_{LPG,y}$ and $COEF_{LPG,y}$ within the considered monitoring period, $PE_{LPG,y}$ is thus calculated as = **0.2 tCO_2, rounded up to 1.0 tCO_2**.

E.2.4. Total project emissions:

By taking into account the determined values for $PE_{EC,grid,y}$, $PE_{EC,captive,y}$ and PE_{LPG},; total project emissions ($PE_{i,y}$) are thus determined as calculated as **9,747 tCO_2** (rounded value), as show in the next formula:

$PE_{j,y} = PE_{EC,grid,y} + PE_{EC,captive,y} + PE_{LPG} = 26 + 9{,}720 + 1.0 =$ **9,747 tCO_2** (rounded up value)

All calculations of baseline and project emissions are summarized in a emission reduction calculation spreadsheet enclosed to the Monitoring Report. Monthly details are available at the monthly spreadsheets.

E.3. Calculation of leakage

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Not applicable. As per ACM0001 (version 4) and registered PDD, no leakage emissions are to be accounted.

E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	974,833	9,747	0	-	965,086	965,086

E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	872,776	965,086

E.6. Remarks on difference from estimated value in registered PDD

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No relative increase in the achieved emission reductions occurred when compared to emission reduction estimations for a comparable period as per the registered PDD. As demonstrated in Section E.5, the total achieved emission reduction during the monitoring period represents **93**% of the comparable figure for the ex-ante estimations of emission reduction as per the registered PDD.

The values estimated in ex-ante calculation of registered PDD were calculated based on the predicted value of the registered PDD by considering the whole year of 2013 (345 days) and 95 days of year 2014.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
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Document information

Version	*Date*	*Description*
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 (EB70, 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).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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