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	15/03/2017	
Monitoring period number and duration of this monitoring period	Monitoring period #11 15/09/2014 to 11/05/2016	
Project participant(s)	KDM S.A. The Kansai Electric Power Co., Inc. Urbaser S.A.	
Host Party	Chile	
Sectoral scope(s)	13 - Waste handling and disposal	
Selected methodology(ies)	ACM0001 - "Flaring or use of landfill gas" (version 15.0)	
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	2,182,529 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
	-	1,174,209 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The design for 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/or 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.

LFG is rich in methane (CH_4), a powerful greenhouse gas (GHG). By combusting LFG, the operation of the project activity thus mitigates CH_4 that would otherwise be directly emitted into the atmosphere in the absence of the project activity (baseline scenario).

Through export of generated electricity through the one of the regional electricity Grid of Chile (SIC Grid), 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 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 SIC grid).

During the considered monitoring period the project activity operated under complete conformance with project design information and applicable monitoring requirements as per the latest version of the PDD valid for 2nd 7-year crediting period of the project activity (PDD version 1.5.1, dated 14/03/2017, herein after termed “PDD”). It is however important to note that during the considered monitoring period, collected LFG was only combusted in the engine-generator sets of the CLLC-1 and CLLC-2 electricity generation facilities (while being utilized as gaseous fuel for electricity generation). As further explained in Section B.1., no collected LFG was destroyed through combustion in anyone of the project’s three high temperature enclosed flares during the considered monitoring period. This is in accordance with the project design as per the registered PDD since the project design is defined, as per the latest version of the PDD, as follows:

> *“The objective of Loma Los Colorados Landfill Gas Project is to develop a landfill gas collection and utilization/destruction system. This involves investing in and operating a system for landfill gas (LFG) collection and electricity generation and/or flaring. Landfill gas flaring or its utilization for electricity generation involves methane combustion leading to greenhouse gas (GHG) emissions reductions.”*

Emission Reductions (ER) achieved during the 11th monitoring period from 15/09/2014 to 11/05/2016 are reported as **1,174,209** tCO_2e**.**

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:

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 large-scale CDM baseline and monitoring methodology:

- ACM0001 - “Flaring or use of landfill gas” (version 15.0) (http://cdm.unfccc.int/methodologies/DB/D44X8FH8SFCXREE6037AXJSBGGFVDO);

For the considered monitoring period, as also established in the PDD, the following methodological tools are also applied[1]:

- “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf).

  The application of this tool refers to the ex-post application of the latest version of the “Tool to calculate the emission factor for an electricity system” (version 04.0) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf)

- “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (version 02) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf)

- “Project emissions from flaring” (version 02.0.0, EB 68) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf);

- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0, EB 61) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v2.0.0.pdf/history_view);

[1] The PDD also refers to the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1, EB66). However, it is crucial to note that, as outlined in the PDD, applicable guidance of this methodological tool is only applied in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year crediting period. This methodological tool is not applied for the ex-post determination of emission reductions achieved by the project activity.

A.5. Crediting period of project activity

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2nd 7-year renewable crediting period from 17/03/2014 to 16/03/2021.

A.6. Contact information of responsible persons/entities

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Completion date for the application of the CDM-MR-FORM: 14/03/2017 (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:

- <u>Two LFG condensate knock-out pot (KOP)</u>[2]

[2] *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 1 - View of the installed project's knock-out pot (KOP)

- 4 LFG centrifugal blowers[3]

Figure 2 – View of the installed project's LFG centrifugal blowers

[3] *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 aluminium 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.

Figure 3 - View of the specification plates available in each one pf the project’s LFG blowers

- <u>Automatic (normally-closed) shut-off valves for the flares (used for safety conditions)</u>[4]

<u>LFG flow measurement</u>

During the considered monitoring period, monitoring of amount of methane combusted by the project activity was performed on the basis of continuous measurements of a single thermal mass LFG flow meter (with company internal Id./ref. “F0”). This particular LFG flow meter is positioned along the project’s main supply pipeline for collected LFG in way to be used for measuring the total flow of collected LFG sent to all the LFG utilization devices under operation during the considered monitoring period (i.e. engine-generator sets of the CLLC-1 and CLLC–2 electricity generation facilities)[5]. The LFG flow meter for which measurements were considered during the considered monitoring period is manufactured by Fluid Components International L.L.C. (FCI) and is of ST98 model.

The LFG flow meter from which measurements were considered provides LFG flow measurements in normalized cubic meters per hours (Nm^3/h). Thus, no additional monitoring of LFG temperature and LFG pressure are required. LFG flow data measurements of collected LFG sent the project’s LFG utilization devices under operation are electronically recorded and reported with an every 1 minute frequency. As per the operational procedure for the project activity, besides of the LFG flow meter in operation, an identical LFG flow meter unit is kept stored in the project site in order to be installed and used during calibration events of the utilized LFG flow meter[6].

[4] *<u>Specification details for the automatic shut-off valves:</u>* 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.

[5] Box 1 includes details and the rationale for the non-operation (non-combustion of LFG) of the project’s high temperature enclosed flares during the considered monitoring period.

[6] The utilized FCI ST98 LFG 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 period are included in Section D.2.

Figure 4 - View of the project's installed
FCI ST 98 LFG flow meter with company internal id./ref "F0"

- 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 that was sent to the biogas utilization devices under operation during the considered monitoring period 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$_2$ by the continuous gas analyser are electronically recorded and reported with every 1-minute frequency.

Figure 5 - View of the project's continuous CH_4/O_2/CO gas analyzer
(used to continuously measuring fraction of CH_4 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

[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)

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

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:

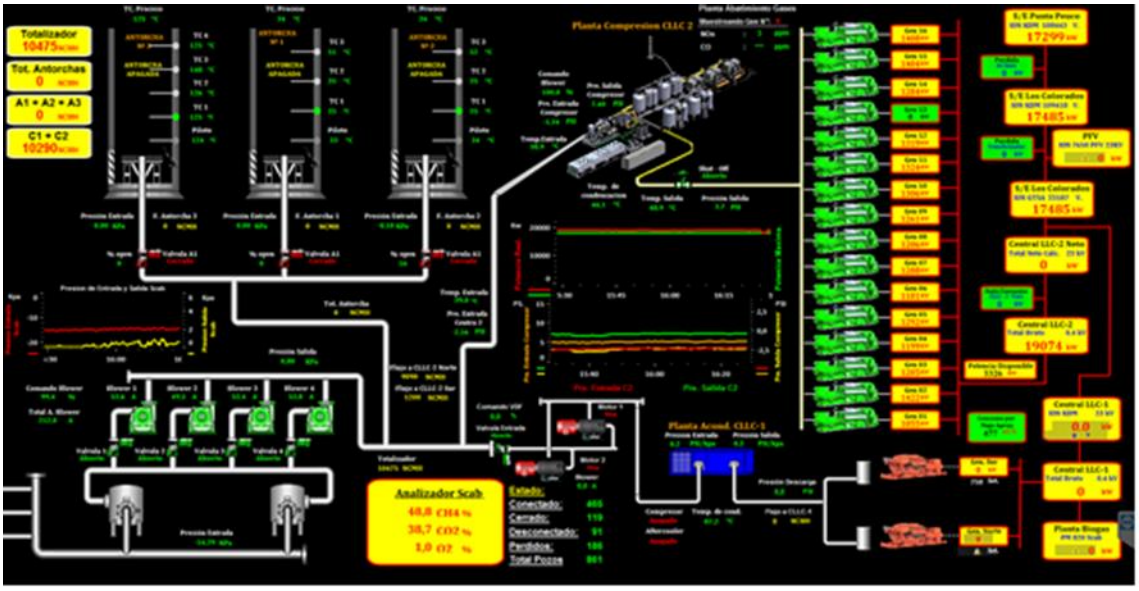

Figure 6 - View of the project's SCADA system screen for the project activity

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

<u>Central Loma Los Colorados-1 (CLLC-1) electricity generation facility</u>

- *<u>Power generation equipment:</u>* The CLLC-1 electricity generation facility comprises 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.

- *<u>LFG cooling station:</u>* 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.

Figure 7 – View of one of the two engine-generator set GE Waukesha APG1000 that are installed as part of CLLC-1 electricity generation facility

- *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 one of the regional 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.

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

- *Power generation equipment*:
  While, as outlined in the PDD, the CLLC-2 electricity generation facility comprises the gradual/phased implementation of up to 22 engine-generator sets, at the end of the considered monitoring period, the CLLC-2 electricity generation facility encompassed 14 GE Jenbacher J420 engine-generator sets (with nameplate installed capacity of 1.4 MW each)[8]. The total nameplate installed capacity for the whole CLLC-2 was thus 19.6 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 technical capacity of up to 20,000 m^3/h. A complete LFG cooling and filtering facility is also available. The CLLC-2 facility's 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 LFG cooling and filtering facility is equipped with an efficient electric chiller and a siloxane removal system (of which have their electricity demand met by the CLLC-2 electricity generation facility). Whenever the operation of the CLLC-2 electricity generation facility is temporarily ceased (due to planned or unplanned interruptions), the operation of the LFG cooling and filtering is also ceased.

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[8] As outlined in the PDD, the gradual/phased implementation schedule for the CLLC-2 electricity generation facility encompasses installation of identical GE Jenbacher J420 engine-generator sets under the following time plan:

Forecasted gradual/phased implementation of CLLC-2 electricity generation facility (as per the PDD):

End of Year	2009 / 2010*	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Number of operational GE-Jenbacher J420 Units	-	7	11	13	14	15	15	16	17	18	18	19	20	21	21	22	22
Total nameplate installed capacity	-	9.9	17.5	18.4	19.8	21.2	21.2	22.6	24.0	25.4	25.4	26.9	28.3	29.7	29.7	31.1	31.1

* - In the end of years 2009 and 2010 the project electricity generation component encompassed only the operation of the CLLC-1 electricity generation facility (with 2.0 MW of nameplate installed capacity).

At the end of the considered monitoring period (11/05/2016) the CLLC-2 comprised the installation and operation of 14 GE Jenbacher J420 engine-generator sets (and not 15 engine-generator sets as previously schedule). In fact, 2 additional GE Jenbacher J420 engine-generator sets were installed and commissioned in January 2017. Thus, such slight delay in the installation of the 15th engine-generator set represents a delay in the phased/gradual implementation of the project's electricity generation component when compared to previously available forecasts as indicated in the PDD.

- *Transmission of generated electricity:*

  All net electricity generated by the project's electricity generation infrastructure (CLLC-1 and CLLC-2 electricity generation facilities) is accounted as exported electricity by the Chilean electricity dispatch coordinating entity (CDEC-SIC[9]) 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)*". Electricity generated by the project's electricity generation infrastructure is also used to meet the electricity demand of the project activity during the whole periods for which the the project's electricity generation infrastructure is under full or partial operational status.

  It is important to note that, whenever the electricity generation facilities CLLC-1 and CLLC-2 are not under operation, the electricity demand of the whole project activity is met by imports of grid electricity measured by electricity meter M2 (since electricity 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 project activity whenever supply of grid electricity to the project activity was temporarily interrupted[10].

  Like in the case of the CLLC-1 electricity generation facility, each engine-generator set of the project's CLLC-2 electricity generation component are 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 SIC electricity grid of Chile through a project dedicated 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 the whole project's electricity generation infrastructure (CLLC-1 and CLLC-2 electricity generation facilities) by converting electricity from 23 kV to 110 kV in a main power transformer. The 20 km length power transmission line connects the project's electricity generation infrastructure to the Punta Peuco power substation, which is part of the Chilean SIC electricity grid.

- *Backup captive off-grid electricity generators (fuelled by diesel):*

  Whenever the project's electricity generation infrastructure is out of operation and supply of grid electricity to the project site is temporarily interrupted, the electricity demand of the project activity is temporarily met by electricity generated by two of the three backup electricity generators (fuelled by Diesel) installed as part of the project activity[11]. These backup electricity generators have nameplate electricity generation capacity of 276 kW and 352 kW.

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

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[9] The "Centro de Despacho Económico de Carga (CDEC-SIC)" is the national electricity dispatch coordinating entity in Chile. Besides of coordinating the dispatch 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

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

[11] A 3rd backup captive off-grid electricity generation (fuelled by diesel) is kept at the SELLC sub-station. This backup electricity generator is only used as a backup system during power failures to the SELLC sub-station.

The mains specifications of 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)
Diesel Backup Generator I	Atlas Copco (using a Volvo diesel generator)	QAS 325 Vd	0.276
Diesel Backup Generator II	Cummins	SDC - 400	0.352
Diesel Backup Generator III	Protelec	S 100 - 10	0.080

The figures below show the three backup captive off-grid electricity generators (fuelled by diesel) installed and operational as part of the project activity:

Figure 8 – View of the project's captive off-grid electricity generator "Diesel Backup Generator I"

Figure 9 – View of the project's captive off-grid electricity generator "Diesel Backup Generator II"

Figure 10 – View of the project’s backup captive off-grid electricity generator “Diesel Backup Generator III”

The next figures show external and internal views of the project’s CLLC-2 power plant at the Loma Los Colorados Landfill:

Figure 11 - External view of CLLC-2 electricity generation facility

Figure 12 - Internal view of CLLC-2 electricity generation facility

- Power sub-station Loma los Colorados (SELLC):
  This small power sub-station is located inside the area of the Loma Los Colorados landfill and this facility represents the starting point of the 20 km length 110 kV voltage transmission line connecting the project's electricity generation infrastructure to the Punta Peuco power sub-station. This power sub-station includes one of the project's backup captive off-grid electricity generator (fuelled by diesel) with internal reference "Diesel Backup Generator III") with 80 kW of nameplate installed capacity. This backup electricity generator is only used as a backup electricity supply system during power supply failure to the SELLC's control systems.

- Punta Peuco sub-station:
  This large power 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).

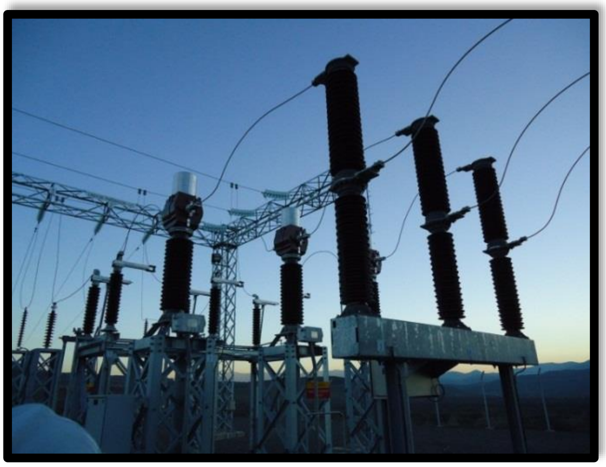

Figure 13 - Detail of the power transmission lines leaving the SELLC power sub-station (used to export net-generated electricity by CLLC-1 and CLLC-2 facilities)[12]

Note:
The project design also encompasses three enclosed high temperature flares supplied by LFG Specialities L.L.C. with the following specifications and operational conditions:

Flare 1 and Flare 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

Flare 3:

- Min. LFG flow: 510 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

[12] Under circumstances where the CLLC-1 and/or the CLLC-2 electricity generation facilities are both not under operational status, imports of the grid-sourced electricity is made through the SELLC power sub-station.

However, as further explained below in Box 1, it is crucial to note that during the considered monitoring no collected LFG was sent to the project's flares for destruction.

Box 1 - Operation of the project activity during the whole considered monitoring period with no excess of collected LFG being sent for destruction in the project's high temperature enclosed flares:

Since the implementation and commissioning of the CLLC-2 electricity generation in year 2011, the operational strategy for the project activity in terms of destination of collected LFG has been operationalized by prioritizing as most as possible the utilization of collected LFG as gaseous fuel for electricity generation in the installed power generation infrastructure (instead of destroying most of collected LFG through flaring like in the scenario prior to the occurred implementation of CLLC-2 power plant). Due to that, under the more recent operational goal of promoting as much as possible utilization of collected LFG as gaseous fuel for electricity generation in both CLLC-1 and CLLC-2 electricity generation facilities, only excess of collected LFG has been expected being sent for destruction (under controlled and efficient conditions) in the installed 3 high temperature enclosed flares under typical operational conditions of the project activity. While, as outlined in the PDD the nameplate installed capacity for the CLLC-2 has been gradually increased since its starting of operations and such nameplate installed capacity is expected to further increase up to year 2026 as established by the project design, in the latest years (incl. the considered monitoring period) the project participant and project owner KDM S.A. has, due to different reasons, faced difficulties on quantitatively increasing collection of LFG in a way that increased demand for LFG of the project's electricity generation is met and, at the same time, excess of collected LFG is made available for being destroyed in the installed project flares (with total combined nominal max. LFG flaring capacity of 15,091 Nm^3/h). While combustion of LFG in the project flares generates no revenues other than CDM revenues, one particular factor in the related difficulties faced in the latest years by KDM S.A. is the fact that any incremental and required investment on improvement of LFG collection infrastructure at the Loma Los Colorados landfill (e.g. increase of the number and/or quality of LFG collection wells beyond the number/specifications previously considered as part of the project design conceptualization) in order to allow excess of LFG to be combusted in the flares would indeed represent incremental capital expenditures (CAPEX) for which return of investment are very difficult to occur under the unfavourable market conditions for the commercialization of Certified Emission Reductions (CERs) in the latest years (low prices and low liquidity for CERs). Furthermore, a range of not previously expected day-to-day challenges in the operation of the project's LFG collection infrastructure (i.e. LFG collection wells and LFG pipeline network) have also limited desirable increases in the amount of LFG collected as part of the project activity.

In practical terms, these aspects are *inter alia* translated into partial operation of the project activity infrastructure during the considered monitoring period. The project operation has thus been set/configured (i.e. LFG collection strategy in terms of setting of LFG suction pressure, management of individual LFG collection wells, etc.) in a way to ensure that LFG consumption demand of the project's electricity generation infrastructure is always met and expected generation of electricity is always ensured, however with no excess of collected LFG being made available and sent for destruction in the project's flares. Also as part of the setting/configuration of the operation of the project activity, the safety shut-off valves located in the sections of project LFG pipeline prior to each one of the flares were all temporarily selected under "closed" position on 10/03/2014 (prior to the starting of the considered monitoring period), thus temporarily interrupting any possibility of supply of collected LFG to the flares. It is also relevant to note that during the whole considered monitoring period the status of such valves have been continuously electronically monitored, with recording of data being performed on every-minute basis.

As a result of the awareness of the temporary non-operation of the project flares prior to the starting of the considered monitoring period, the operationalization of the monitoring system for the project activity has also been temporarily flexibilized. The performance of selected monitoring activities that are uniquely applicable for the project flaring infrastructure were also temporarily interrupted (e.g. performance of regular (every 6-months) 3rd party measurements in the installed flares as part of required monitoring work for the parameter "Temperature in the exhaust gas of the enclosed flare in minute m" ($T_{EG,m}$) was temporarily ceased).

As the operator of the Loma los Colorados landfill, KDM S.A. does expect that as a result of on-going solid waste disposal activities in the landfill and also upon expected future improvements of the market conditions for CER commercialization, quantitative increments in the LFG stream collected at the landfill

may occur. Under such positive scenario, it is expected that even with further increases in the nameplate installed capacity for the CLLC-2 facility (that will represent further increase in the LFG demand of the project's electricity generation infrastructure as a whole), there will exist excess of collected LFG that will be combusted in the project's flares. Under such circumstances, the project monitoring will again encompass monitoring for selected flaring related parameters.

In summary, KDM S.A. does expects the project's flares to be put under continuous operation again in the future. Due to that, the current situation in terms of flaring and monitoring as part of the operation of the project activity is regarded as temporary.

It is crucial to note that due to its temporary nature, the above explained operation of the project activity during the whole considered monitoring period with no excess of collected LFG being sent for destruction in the project's high temperature enclosed flares does not represent a permanent change in the project design (that would be required to be addressed as per applicable CDM rules and procedures for addressing post-registration changes). The above-explained occurred flexibilization of the operationalization of the monitoring system for the project activity is also regarded as temporary and does not negatively affect the overall integrity and accuracy of monitoring. Due to that, such flexibilization does not represent a post-registration change to the project activity either.

B.2. Post-registration changes

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

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Not applicable.

B.2.2. Corrections

>>
Not applicable.

B.2.3. Changes to start date of crediting period

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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[13].

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

>>
Not applicable.

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[13] It relevant to note that prior to the completion of this Monitoring Report, a revised version of the PDD including permanent post-registration changes (PRCs) was completed, assessed/validated by Designed Operation Entity (DOE) under the "*Prior approval*" process track as an independent assessment (**not as part of the verification assessment for the monitoring period encompassed by this Monitoring Report and/or any other verification assessment**) and submitted to UNFCCC for approval (under ref. PRC-0822-002) on 13/02/2017. Such revised version of the PDD includes the following PRCs:

Revision of the monitoring plan from the registered PDD:

- Consideration/utilization of alternative monitoring approaches as per "Appendix - Additional data handling and monitoring guidance for determining the mass flow of methane in biogas" of the latest version of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) as follows:
  - Depending on operational conditions, monitoring approach as per Item *1. "Data substitution for methane content or biogas flow"* may be applied (in case missing data are encountered in the course of determining the methane mass flow as part of the determination of $F_{CH4,sent\_flare,y}$ *and* $F_{CH4,EL,y}$ along the 2nd 7-year crediting period).
  - Depending inter alia on availability of monitoring equipment, monitoring approach as per Item *2.* "*Use of a single flow meter for multi-use of recovered biogas"* may be applied.
- Inclusion of the monitoring details for the new/additional monitoring parameter "Operational status of biogas destruction devices" (Status of the biogas destruction device)" as required by the later version of the applied methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0).

Corrections (in information that do not affect the project design):

- Missing monitoring details for the monitoring parameter "Maintenance events completed in year *y* as monitored by the project participants ($Maintenance_y$)" are added in Section B.7.3.
- Figure 2 – "*Schematic flow diagram: delineation of the project boundary for the project activity during the 2nd 7-year crediting period*" is corrected in terms of the number of engine-generator sets for the project's CLLC-2 electricity generation facility and location of LFG flow meters
- The formula for the determination of baseline emissions of methane ($BE_{CH4,y}$) in the context of ex-ante estimates of emission reductions to be achieved by the project activity is corrected in Section B.6.3. Related calculations of ex-ante estimates of emission reductions to be achieved by the project activity during the 2nd 7-year crediting period are also corrected in both Section B.6.3 and in a revised version of the emission reduction calculation spreadsheet (that is enclosed to the PDD).
- Reporting in Section B.6.2 of the previously determined value for the ex-ante determined parameter "Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity (2006)" ($F_{CH4,BL,x-1}$) is corrected from 41,122 tCH_4/yr to 516.16 tCH_4/yr.
- A clarification disclaimer referring to both the issuance of the environmental license for the CLLC-2 electricity generation facility + current compliance of the implementation and operation of the facility with all valid and applicable environmental requirements (as defined by the competent environmental authority in Chile) was added in Section D.2.
- Minor previously existent typo mistakes were corrected in different sections of the PDD.

Details are available online:
https://cdm.unfccc.int/PRCContainer/DB/prcp461994672/view

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

>>
Not applicable.

SECTION C. Description of monitoring system

>>

Box 2 - Measurements of collected LFG supplied to a set of available/operational biogas destruction/utilization devices (i.e. engine-generator sets) performed by a single LFG flow meters during the considered monitoring period (under conformance with the alternative and simplified monitoring approach termed "Use of a single flow meter for multi-use of recovered biogas"):

During the considered monitoring period, measurements of collected LFG supplied to a set of available/operational biogas destruction/utilization devices (i.e. engine-generator sets) were performed by a single LFG flow meters (under conformance with the alternative and simplified monitoring approach termed in Section B.7.3 of the latest version of the PDD as *"Use of a single flow meter for multi-use of recovered biogas*") and not by applying an individual LFG flow meter for each particular biogas destruction/utilization device[14].

By taking into account the applicable additional monitoring requirements valid/applicable specifically for the use of a single or reduced number of LFG flow meters as established in the PDD, the following additional measures were considered for accounting of related emission reductions achieved by the project activity:

(i) It is ensured/demonstrated that within each section of the project's LFG supply pipeline that directs LFG towards each operational individual flare, there is an individual safety valve installed/located within such pipeline section and prior to the underlying biogas destruction device that automatically closes whenever the underlying biogas utilization device becomes under non-operational status. In the particular case of the considered monitoring period, such valves were kept closed during the whole period. Moreover, the status of such valves ("*Open*" or "*Closed*") were monitored during the whole period. Furthermore, for each individual flare, the status of the flare's flame (Flame status "*on*" or flame status "*off*") was also confirmed to always corresponding to flame status "*off*"" (on the basis of continuous monitoring of the parameter "Flame detection of flare in the minute *m*" ($Flame_m$) by the use of UV flame detectors). It is thus ensured/demonstrated that during the whole considered monitoring period, no collected LFG was able to be eventually directly emitted into (vented through) the atmosphere through a non-operational flare.

ii) It is ensured/demonstrated that the biogas utilization devices for which sent of collected LFG was measured by the single LFG flow meters (i.e. engine-generator sets) are all designed in such a manner that it is physically impossible for LFG passing through and being directly emitted into the atmosphere while the underlying engine-generator sets are under non-operational status. It is thus ensured/demonstrated that during the whole considered monitoring period, no collected LFG was able to be eventually directly emitted into (vented through) the atmosphere through a non-operational engine-generator set.

For the considered monitoring period, such confirmations/demonstrations were done through the following approaches:

- Records of electricity generated by the engine generator sets and records from the status of the both the flare(s) (by means of a flame detector(s) and the valves located prior to the flares within the project's LFG pipeline. In the particular case of the engine-generator sets, it is demonstrated that electricity generation (as the output from operation of such devices) corresponds to the flow of LFG actually consumed by the devices (in energy basis).

- For any time instants minute *m* where one or more biogas destruction/utilization devices connected downstream to the utilized single LFG flow meter (i.e. engine-generator set(s) and/or flare(s)) were under non-

[14] While the project's high temperature enclosed flares are termed in both the PDD and in this Monitoring Report as "*biogas destruction devices*", the engine-generator sets of the project's electricity generation infrastructure (CLLC-1 and CLLC-2 electricity generation facilities) are termed in both the PDD and in this Monitoring Report as "*biogas utilization devices*".

operational status, it is demonstrated that the set of remaining devices under operational status (i.e. engine-generator sets utilizing LFG as fuel for electricity generation in the particular case of the considered monitoring period) have the quantitative capacity to combust the amount of LFG flow that was sent to the underlying devices during the underlying minute *m.*

Finally, it is also confirmed/demonstrated that measurement of methane content of collected LFG (monitoring parameter $v_{CH4,t,wb,j}$ or $v_{CH4,t,db,j}$) was conducted during the whole considered monitoring period by a CH_4 content gas analyser that has been located immediately downstream of the utilized LFG flow meter.

General description of the monitoring system (as per the project's operational and monitoring configuration valid for the considered monitoring period):

The schematic diagram below illustrates the applied monitoring system for the project activity during the considered monitoring period (as per the project's operational and monitoring configuration valid for the considered monitoring period):

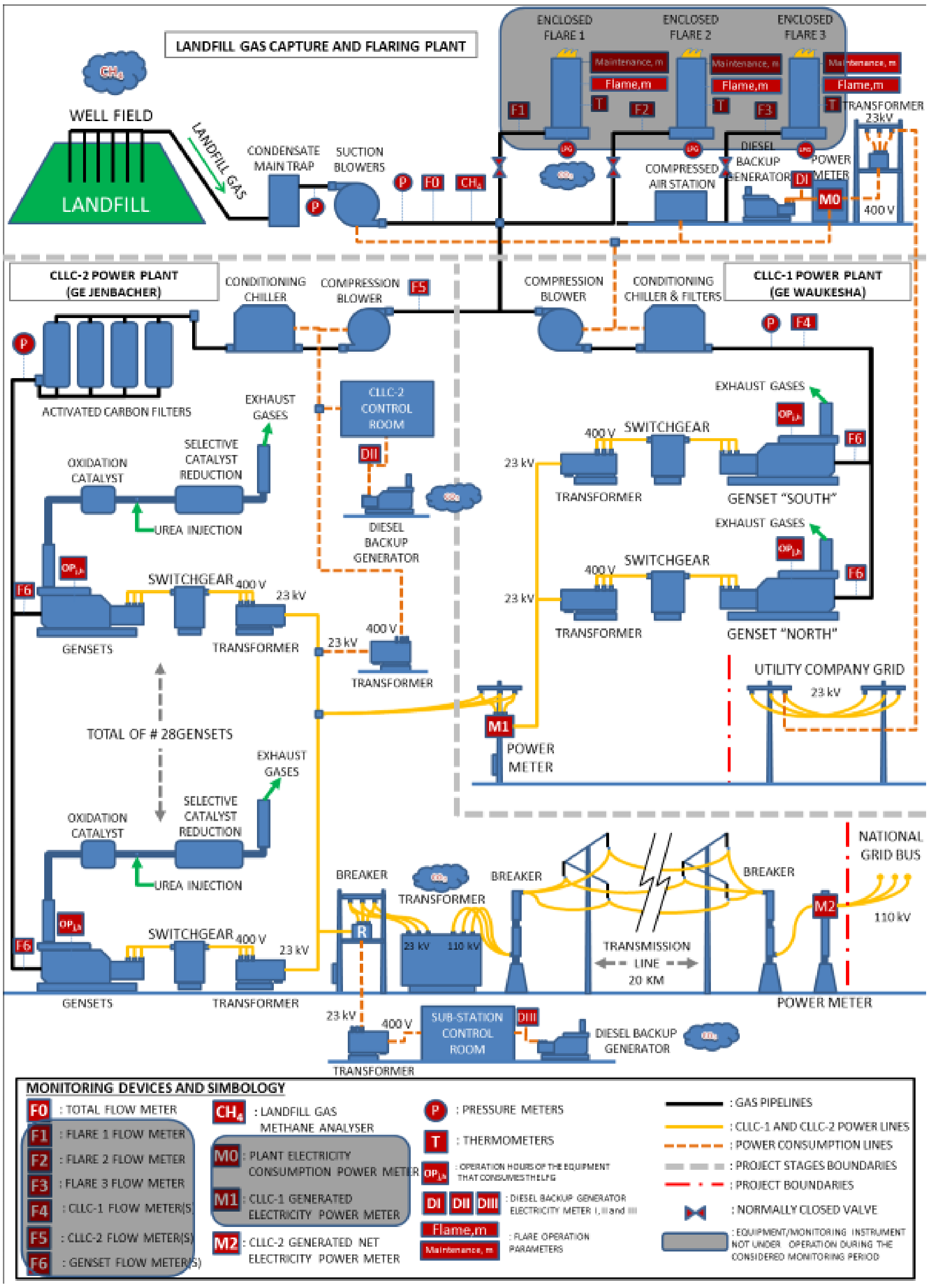

Figure 14 – Schematic diagram for the configuration of the project's monitoring system valid during the considered monitoring period

The figure above reflects the application of the alternative and simplified monitoring approach termed “Use of a single flow meter for multi-use of recovered biogas” as above explained in Box 2.

Gathering, recording and reporting of monitoring data:
During the considered monitoring period, signals for measurements of LFG flow (from the installed LFG flow meter with company internal Id./ref. “F0”), CH_4 fraction in collected LFG as well as other control parameters such as LFG pressure, LFG temperature, flame status of the flares and status of the shut off valves of the flares 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 described above 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 the emission reduction calculation spreadsheet. Furthermore, the “WinCC” platform also receives data records from the bi-directional electricity meter that measures both the amount of net-electricity exported by the project activity and amount of grid-sourced electricity consumed by the project activity.

SECTION D. Data and parameters

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

Data/parameter:	**OX_{top_layer}**
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline.
Source of data	The PDD refers to the default value as per the CDM baseline and monitoring methodology ACM0001 (version 15.0). The value is consistent with how oxidation is accounted for in the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1).
Value(s) applied)	0.1
Choice of data or measurement methods and procedures	Default value as per the applied CDM baseline and monitoring methodology ACM0001 “Flaring or use of landfill gas” (version 15.0)
Purpose of data	Calculation of baseline emissions
Additional comments	**-**

Data/parameter:	**$F_{CH4,BL,x-1}$**
Unit	tCH_4/yr
Description	Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity (2006).
Source of data	Technical study developed by KDM S.A. related to year 2006.

Value(s) applied)	516.16
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	**-**

Data/parameter:	**GWP_{CH4}**
Unit	tCO_2/tCH_4
Description	Global Warming Potential of CH_4
Source of data	The PDD refers to the “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	Calculation of baseline emissions
Additional comments	**-**

Data/parameter:	**R_u**
Unit	$Pa.m^3/kmol.K$
Description	Universal ideal gases constant
Source of data	The PDD refers to the default value as per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0).
Value(s) applied)	8,314
Choice of data or measurement methods and procedures	-

Purpose of data	Calculation of baseline emissions
Additional comments	**-**

Data/parameter:	**MM_k**
Unit	kg/kmol
Description	Molecular mass of gas *k*
Source of data	The PDD refers to the default value as per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0).
Value(s) applied)	As outlined in the PDD, for considered gases *k* that are greenhouse gases (GHGs), the values in the table below are applied for MM_i. As per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”: “*The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the considered gaseous stream. However as a simplification, only the volumetric fraction of gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen. The simplification is not acceptable if it is differently specified in the underlying methodology.*” ACM0001 (version 15.0) does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are considered in related calculations (CH_4 in the particular case of the project activity) should be considered and the difference to 100% is just considered as pure nitrogen. Compound: Nitrogen; Structure: N_2; Molecular mass (kg/mol): 28.01
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	**-**

Compound	Structure	Molecular mass (kg/mol)
Nitrogen	N_2	28.01

Data/parameter:	**MM_i**
Unit	kg/kmol
Description	Molecular mass of greenhouse gas *i*
Source of data	The PDD refers to the default value as per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0).

Value(s) applied)	As outlined in the PDD, the following value of molecular mass is applicable for CH_4 (the only GHG which is considered): <table><tr><th>Compound</th><th>Structure</th><th>Molecular mass (kg/mol)</th></tr><tr><td>Methane</td><td>CH_4</td><td>16.04</td></tr></table>
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	**-**

Data/parameter:	**P_n**
Unit	Pa
Description	Total pressure at normal conditions
Source of data	The PDD refers to the default value as per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0).
Value(s) applied)	101,325
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	In accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), the ex-ante determined parameters Temperature at normal conditions (T_n) and Total pressure at normal conditions (P_n) are not considered.

Data/parameter:	**MM_{H2O}**
Unit	kg/kmol
Description	Molecular mass of water
Source of data	The PDD refers to the default value as per the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0).
Value(s) applied)	18.0152
Choice of data or measurement methods and procedures	-

Purpose of data	Calculation of baseline emissions
Additional comments	**-**

Data/parameter:	**T_n**
Unit	K
Description	Temperature at normal conditions
Source of data	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied)	273.15
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	In accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), the ex-ante determined parameters Temperature at normal conditions (T_n) and Total pressure at normal conditions (P_n) are not considered.

Data/parameter:	**$TDL_{grid,y}$**
Unit	Dimensionless
Description	Average technical transmission and distribution losses for providing electricity to the grid and for grid sourced electricity consumed by the project activity
Source of data	The PDD refers to the applicable default as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01).
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:	**w_{BM}**
Unit	%
Description	Weighting of build margin emissions factor
Source of data	The PDD refers to the applicable default value as per the “Tool to calculate the emission factor for an electricity system” (version 4.0). The selected value is valid for the whole 2nd 7-year renewable crediting period.
Value(s) applied)	0.75 (75%)
Choice of data or measurement methods and procedures	The applicable value valid for 2nd crediting period as per the “Tool to calculate the emission factor for an electricity system” (Version 4.0) is selected.
Purpose of data	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/parameter:	**w_{OM}**
Unit	%
Description	Weighting of operating margin emissions factor
Source of data	The PDD refers to the applicable default value as per the “Tool to calculate the emission factor for an electricity system” (version 4.0). The selected value is valid for the whole 2nd 7-year renewable crediting period.
Value(s) applied)	0.25 (25%)
Choice of data or measurement methods and procedures	The applicable value for the 2nd crediting period as per the “Tool to calculate the emission factor for an electricity system” (version 4.0) is selected.
Purpose of data	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/parameter:	**$EF_{grid,BM,y}$**
Unit	tCO_2/MWh
Description	Build margin CO2 emission factor in year *y*
Source of data	As outlined in the PDD, data is ex-ante determined as per applicable guidance of the “Tool to calculate the emission factor for an electricity system” and value is valid for the whole 2nd 7-year crediting period. The adopted value was calculated with data provided by the CDEC-SIC grid.

Value(s) applied)	0.7046
Choice of data or measurement methods and procedures	Data is determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system" valid for 2nd crediting period.
Purpose of data	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity) and baseline emissions (due to the displacement of an equivalent amount of electricity generated by the project's electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the DCED-SIC grid).
Additional comments	**-**

Data/parameter:	**$EF_{grid,OM,y}$**
Unit	tCO_2/MWh
Description	Operating margin CO2 emission factor in year *y*
Source of data	As outlined in the PDD, data is ex-ante determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system" and value is valid for the whole 2nd 7-year crediting period. The adopted value was calculated with data provided by the CDEC-SIC grid. As per the selected approach from the "Tool to calculate the emission factor for an electricity system", $EF_{grid,OM,y} = EF_{grid,OM-adj,y}$.
Value(s) applied)	0.7479
Choice of data or measurement methods and procedures	Data is determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system" valid for 2nd crediting period.
Purpose of data	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity) and baseline emissions (due to the displacement of an equivalent amount of electricity generated by the project's electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the DCED-SIC grid).
Additional comments	The adopted value of $EF_{grid,OM-adj,y}$ represents the average of years 2010, 2011 and 2012.

<table>
<tr><td>Data/parameter:</td><td>$SPEC_{flare}$</td></tr>
<tr><td>Unit</td><td>°C (for temperature values)
Nm^3/h (for LFG flow values)
Number of days (for maintenance schedule interval values)</td></tr>
<tr><td>Description</td><td>Manufacturer’s flare specifications for temperature, flow rate and maintenance schedule interval.</td></tr>
<tr><td>Source of data</td><td>The PDD refers to data as per the flare manufacturer. Data is used as a reference for later ex-post determination of values of flare efficiency ($\eta_{flare,m}$) for each individual high temperature enclosed flare in the context of determination of baseline emissions.</td></tr>
<tr><td>Value(s) applied)</td><td>
<table>
<tr><th>$SPEC_{flare, Flare 1}$
$SPEC_{flare, Flare 2}$
$SPEC_{flare, Flare 3}$</th><th colspan="2">Min.</th><th>Max.</th></tr>
<tr><td rowspan="3">Operational LFG flow (for continuous operation):</td><td>Flare 1</td><td>850 Nm^3/h</td><td>5,097 Nm^3/h</td></tr>
<tr><td>Flare 2</td><td>850 Nm^3/h</td><td>5,097 Nm^3/h</td></tr>
<tr><td>Flare 3</td><td>510 Nm^3/h</td><td>5,097 Nm^3/h</td></tr>
<tr><td rowspan="3">Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):</td><td>Flare 1</td><td>760 °C</td><td>1,093 °C</td></tr>
<tr><td>Flare 2</td><td>760 °C</td><td>1,093 °C</td></tr>
<tr><td>Flare 3</td><td>760 °C</td><td>1,093 °C</td></tr>
<tr><td rowspan="3">Required minimum frequency for inspection and maintenance service (incl. inspection in the conditions of the flare isolation ceramics revetment material):</td><td>Flare 1</td><td colspan="2" rowspan="3">Min. every year</td></tr>
<tr><td>Flare 2</td></tr>
<tr><td>Flare 3</td></tr>
<tr><td rowspan="3">Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material:</td><td>Flare 1</td><td colspan="2" rowspan="3">After 10 years of regular and appropriate operation</td></tr>
<tr><td>Flare 2</td></tr>
<tr><td>Flare 3</td></tr>
</table>
</td></tr>
<tr><td>Choice of data
or measurement methods and procedures</td><td>As established by the methodological tool “Project emissions from flaring”, the flare specifications and operational + maintenance requirements (as set/recommended by the equipment manufacturer) are documented and considered for the ex-ante determination of applicable values for the parameter $SPEC_{flare}$. During the 2nd 7-year crediting period, ex-ante selected data will be compared against monitored data related to the operation of the flare, including:
a) Minimum and maximum monitoring records for data regarding inlet LFG flow rate,
(b) Minimum and maximum monitoring records for data of temperature in the exhaust gas of each individual high temperature enclosed flare; and
(c) Duration in days of time periods between maintenance events for each individual high temperature enclosed flare.</td></tr>
</table>

Purpose of data	Calculation of baseline emissions
Additional comments	All flare specification and operation details/requirements are based on information provided by the equipment manufacturer. It is crucial to note that, as further explained in Section B.1., no collected LFG was destroyed through combustion in anyone of the project's three high temperature enclosed flares during the considered monitoring period.

Data/parameter:	$PP_{CP,Diesel\text{-}generator}$
Unit	MW
Description	Rated capacity of the installed captive backup electricity generators fuelled by diesel
Source of data	Nameplate capacity of the installed captive generator as per manufacturer's specifications or catalogue references
Value(s) applied)	The specifications of the installed captive backup electricity generators (fuelled by diesel) are shown in the table below: <table><tr><th>Equipment id/tag</th><th>Manufacturer:</th><th>Model Number</th><th>Power (MW)</th></tr><tr><td>Diesel Backup Generator I</td><td>Atlas Copco (using a Volvo diesel generator)</td><td>QAS 325 Vd</td><td>0.276</td></tr><tr><td>Diesel Backup Generator II</td><td>Cummins</td><td>SDC - 400</td><td>0.352</td></tr><tr><td>Diesel Backup Generator III</td><td>Protelec</td><td>S 100 - 10</td><td>0.080</td></tr></table> Thus, the Rated capacity of the installed captive backup electricity generators fuelled by diesel is considered as 0.708 MW for the 2nd crediting period.
Choice of data or measurement methods and procedures	Specifications of the installed captive backup electricity generators.
Purpose of data	Calculation of project emissions (due to the consumption of electricity sourced by captive off-grid electricity generators by the project activity).
Additional comments	-

Data/parameter:	**$TDL_{captive,y}$**
Unit	-
Description	Average technical transmission and distribution losses for electricity sourced by the captive electricity generator
Source of data	Applicable default as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01).
Value(s) applied)	0
Choice of data or measurement methods and procedures	Data is determined as per applicable guidance of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01).
Purpose of data	Calculation of project emissions (due to the consumption of electricity sourced by captive off-grid electricity generator by the project activity).
Additional comments	The ex-ante determined default value for $TDL_{captive,y}$ will only be used in case alternative approach 1 or approach 2 is used for the determination of Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generators (fuelled by Diesel) ($PE_{EC,captive,y}$). While for the considered monitoring period alternative approach 4 was selected for the determination of $PE_{EC,captive,y}$, the ex-ante determined parameter $TDL_{captive,y\ generator}$ was thus not used in the context of calculation of emission reductions for the considered monitoring period.

Data/parameter:	**$EF_{EL,captive,y}$**
Unit	tCO_2/MWh
Description	CO_2 emission factor for electricity sourced by the captive off-grid electricity generators
Source of data	Applicable default as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) (in case the *Alternative approach 2* is selected (by following option B2 of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”).
Value(s) applied)	1.3
Choice of data or measurement methods and procedures	Data is determined as per applicable guidance of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01).

Purpose of data	Calculation of project emissions (due to the consumption of electricity sourced by captive off-grid electricity generator by the project activity).
Additional comments	The ex-ante determined default value for $EF_{EL,captive,y}$ will only be used in case alternative approach 1 or approach 2 is used for the determination of Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generators (fuelled by Diesel) ($PE_{EC,captive,y}$). While for the considered monitoring period alternative approach 4 was selected for the determination of $PE_{EC,captive,y}$, the ex-ante determined parameter $EF_{EL,captive,y}$ was thus not used in the context of calculation of emission reductions for the considered monitoring period.

Ex-ante determined parameters not used in the context of ex-post determination and calculation of emission reductions achieved by the project activity:

The following ex-ante determined parameters (that are also included in the PDD) are not used for the purpose of ex-post determination of baseline emissions and project emissions achieved by the project activity during the considered monitoring period:

- Efficiency of the LFG capture system that will be installed in the project activity (η_{PJ})
- Default value for model correction factor to account for model uncertainties ($\varphi_{default}$)
- Oxidation factor (reflecting the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste)) (OX)
- Fraction of methane in the SWDS gas (volume fraction) (F)
- Fraction of degradable organic carbon (DOC) in MSW that decomposes in the considered SWDS ($DOC_{f,default}$)
- Methane correction factor ($MCF_{default}$)
- Fraction of degradable organic carbon in the waste type j (weight fraction) (DOC_j)
- Decay rate for the waste type *j* (k_j)
- Weight fraction of the waste type *j* (W_j)

As also outlined in the registered PDD, data for the above-listed parameters are used only in the context of ex-ante estimation of annual accumulated values for the "Amount of methane in the LFG which is destroyed or utilized by the project activity" ($F_{CH4,PJ,y}$) (in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year renewable crediting period). Due to that, details for the above-listed parameters are not included in this Section as they are not relevant in the context of determination of emission reductions achieved by the project activity during the considered monitoring period. Relevant details for such not hereby reported parameters are included in Section B.6.2 of the PDD.

D.2. Data and parameters monitored

Data/parameter:	**Management of SWDS**
Unit	Dimensionless
Description	Management of the SWDS
Measured/calculated/default	As per the adopted monitoring procedure for the project activity, management of the Loma los Colorados landfill is yearly compared against the previously conceived original construction and operational design for the underlying landfill in order to confirm that its overall management and operation (including relevant aspects related to waste disposal/ landfilling practice) were not deliberately modified with the unique aim to intentionally quantitatively increase generation of methane at the landfill. By performing a comparative checking annually, it is monitored whether any practice aiming to increase methane generation in the landfill has occurred or promoted. As required by ACM0001 (version 15.0), any change in the

	management of the Loma los Colorados landfill after the implementation of the project activity should be justified by referring to applicable technical or regulatory specifications.
Source of data	An initial technical evaluation was performed by the independent 3rd party engineering company Emerge Ingenieria. The findings for the performed evaluations are reported in a declaration document issued by such company that is dated 14/10/2014. As per the applicable monitoring procedure, two sequential technical evaluations valid for the considered monitoring period were performed also by the independent 3rd party engineering company Emerge Ingenieria. The findings for such performed evaluations are reported in declaration documents issued by such company and are dated 12/10/2015 and 05/10/2016. The final evaluation covers the period from 17/03/2007 (date when the project was registered as a CDM project activity) to 05/10/2016 (issuance date of the declaration document for the performed evaluation). As part of the performed annual technical evaluation, the current configuration and operational conditions of the Loma Los Colorados landfill were compared against the previously conceived design and operational conditions of the landfill prior of the occurred implementation of the project activity on the basis of different sources and assessments including inter alia: - The original design documents of the landfill (as described in the documentation required for all phases of the environmental licensing and operational permitting for the Loma Los Colorados landfill); - Applicable local or national regulations;
Value(s) of monitored parameter	As outlined in the issued internal technical evaluation/declaration dated 14/10/2014, 12/10/2015 and 05/10/2016 the previously conceived original design of the Loma Los Colorados landfill (dated prior to the implementation of the project activity) is confirmed not to being deliberately modified during the period from 17/03/2007 14/10/2014. Furthermore, no modification in the previously conceived original design of the Loma Los Colorados landfill has occurred or was promoted during the monitoring period from 15/09/2014 to 11/05/2016. The issued technical reports confirm that no practice to increase methane generation at the Loma Los Colorados landfill have occurred or have been promoted (when compared to management and MSW landfilling practices prior to implementation of the project activity). Aspects, conditions and circumstances related to management of the landfill (e.g. waste disposal, waste covering, waste compacting, management of leachate, draining of rainwater, etc.) were not changed with an aim to increase methane generation on site. It is relevant to note that MSW management business (collection and disposal of MSW) in Chile (and in most of the developing countries) has its own economics, dynamics, politics and related regulations. That makes MSW disposal activity for the Loma Los Colorados landfill and other similar landfills in Chile completely independent from the CDM mechanism and/or revenues of commercialization of CERs generated by project based destruction of methane in landfills. Currently, there is still no climate change of waste management policy in Chile which would provide an incentive or a mandate to have MSW being disposed in landfills with better/improved LFG collection / destruction systems (such as the project's LFG collection and destruction system currently implemented at the Loma Los Colorados landfill).

Monitoring equipment	Not applicable. No measuring equipment is used for monitoring management of the Loma Los Colorados landfill.
Measuring/reading/recording frequency:	Annual checking is performed.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. (private entity) in accordance with detailed working instructions that are included in the company's quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comments:	As required by ACM0001 (version 15.0), any change in the management of the landfill after the implementation of the project activity will be justified by referring to technical or regulatory specifications and impacts of such changes in the determination of baseline emissions should in this case be taken into account appropriately. Such monitoring requirement will be used for the determination/confirmation of baseline emissions and/or confirmation of the project's implementation as described in the PDD (in terms of operation and management conditions of the landfill from which LFG is combusted).

Data/parameter:	$\mathbf{V_{t,wb}}$
Unit	m^3 wet gas/h
Description	Volumetric flow of LFG stream in time interval *t* on a wet basis
Measured/calculated/default	Continuously measured by an installed LFG flow meter.
Source of data	Continuous measurements performed by the installed LFG flow meter are recorded in the project's acquisition system with an every-minute frequency.
Value(s) of monitored parameter	The emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes all records of measurement data of LFG flow sent to the project's biogas destruction/utilization devices under operational status under the considered monitoring period (i.e. engine-generator sets of the electricity generation infrastructure). Measurement data is recorded and reported with an every-minute frequency.

<table>
<tr><td>Monitoring equipment</td><td>

Specifications and calibration details for the LFG flow meter utilized during the considered monitoring period:

- LFG flow meter internal id no./reference: F0
- Manufacturer: FCI Fluid Components International LLC
- Model: ST98 Thermal Mass Flow meter
- Accuracy: ±1%
- Serial number of installed/operational instrument (by considering the period in use within the considered monitoring period):
  - 407207 – instrument installed and under operation during the period from 15/09/2014 to 07/12/2015
  - 467251-A – instrument installed and under operation during the period from 07/12/2015 to 15/06/2016

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">Validity of the calibration event</th><th rowspan="2">Customer Order Number</th></tr>
<tr><th>Instrument Serial Number (S/N)</th><th>Calibration event performed by</th></tr>
<tr><td>407207</td><td>FCI Fluid Components International LLC</td><td>12/06/2014</td><td>11/12/2015</td><td>RA37594</td></tr>
<tr><td>467251-A</td><td>FCI Fluid Components International LLC</td><td>20/05/2015</td><td>19/11/2016</td><td>RA377047</td></tr>
</table>

Calibration frequency and maintenance requirements: Every 18 months. The calibration frequency adopted for the installed/operatiomal instruments is as per the recommendations of equipment/instrument manufacturer. The registered PDD and ACM0001 (version 15.0) methodology do not specify any frequency for the calibration of the LFG flow meter.
</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Continuous measurements are recorded and reported with an every-minute frequency.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>

Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer.

Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company's quality management and control (QA/QC) and environmental management system (EMS).
</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments:</td><td>The design of the LFG flow meter instruments used during the considered monitoring period ensure that measurement data is automatically converted</td></tr>
</table>

	and recorded in normal cubic meters per hour (Nm^3/h). Due to that, as further explained in Section D.1, measurements of LFG pressure and LFG temperature are not required for determining values of the calculation parameter $V_{t,wb,n}$ in the context of calculation of achieved emission reductions. Reported values of $V_{t,wb}$ are thus equivalent to values of $V_{t,wb,n}$ and are thus directly used for the determination of the amount of methane in the LFG destroyed by the project activity ($F_{CH4,PJ,y}$) as per Option C of the applicable methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (measurements of volume flow in a wet basis) (as outlined in the emission reduction calculation spreadsheets enclosed to this Monitoring Report). As further explained above in Section C (Box 2), during the considered monitoring period, measurements of collected LFG supplied to a set of available/operational biogas destruction/utilization devices (i.e. engine-generator sets) were performed by a single LFG flow meters (under conformance with the alternative and simplified monitoring approach termed in Section B.7.3 of the latest version of the PDD as *"Use of a single flow meter for multi-use of recovered biogas*").

Data/parameter:	$\mathbf{v_{CH4,t,wb}}$
Unit	m^3 CH_4/m^3 wet gas
Description	Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis
Measured/calculated/default	Continuously measured by continuous CH_4/O_2 content gas analyzer.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (CH_4 content gas analyser) (with continuous measurements being electronically recorded).
Value(s) of monitored parameter	The emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) include measurement data for $v_{CH4,t,wb}$ that are recorded and reported with an every-minute frequency.

<table>
<tr><td>Monitoring equipment</td><td>Continuous CH_4/O_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:

<table>
<tr><th>Equipment/instrument Serial Number</th><th>Calibration event date</th><th>Validity of the calibration event</th></tr>
<tr><td rowspan="3">N1-W2-678</td><td>23/09/2014</td><td>22/09/2015</td></tr>
<tr><td>04/09/2015</td><td>03/09/2016</td></tr>
<tr><td>19/08/2016</td><td>18/08/2017</td></tr>
</table>

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 15.0).</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Continuously measurements are recorded/reported every minute.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer.

Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company’s quality management and control (QA/QC) and environmental management system (EMS).</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments:</td><td>It is also confirmed/demonstrated that measurement of methane content of collected LFG (monitoring parameter $v_{CH4,t,wb,j}$ or $v_{CH4,t,db,j}$) was conducted during the whole considered monitoring period by a CH_4 content gas analyser that has been located immediately downstream of the utilized LFG flow meter.</td></tr>
</table>

Data/parameter:	**Status of biogas destruction device**
Unit	-
Description	Operational status of biogas destruction devices[15]
Measured/calculated/default	Continuously measured.
Source of data	Records of operation of each individual engine-generator set of the project's electricity generation infrastructure. The electronic control system for each engine-generator set of the project's electricity generation component continuously monitor operational status of the set (engine-generator set under operation "on" or not under operation "off"). Records confirming the non-operational status for the 3 installed high temperature enclosed flares are also considered. Continuous monitoring of the signal of the UV flame detectors installed in each one of the flares were continuously monitored during the considered monitoring period. Related monitoring details are included under details for the monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$).
Value(s) of monitored parameter	<u>*Engine-generator sets for the CLLC-1 and CLLC-2 electricity generation facilities:*</u> Records for every-minute operational status of each engine-generator set (under operation ("on") = 1 or not under operation ("off") = 0) are made available in the emission reduction calculation spreadsheets that are enclosed to this Monitoring Report. While the operational status for each individual engine-generator set consuming LFG is independently monitored, the monitoring parameter "Status of biogas destruction device" is thus recorded and reported on the basis of the following sub-parameters: *CLLC-1 power plant:* - $Status_{genset-north}$: Operational status of the engine-generator north - $Status_{genset-south}$: Operational status of the engine-generator south *CLLC-2 power plant:* - $Status_{genset-1}$: Operational status of the engine-generator 1 - $Status_{genset-2}$: Operational status of the engine-generator 2 - $Status_{genset-3}$: Operational status of the engine-generator 3 - $Status_{genset-4}$: Operational status of the engine-generator 4 - $Status_{genset-5}$: Operational status of the engine-generator 5 - $Status_{genset-6}$: Operational status of the engine-generator 6 - $Status_{genset-7}$: Operational status of the engine-generator 7 - $Status_{genset-8}$: Operational status of the engine-generator 8 $Status_{genset-9}$: Operational status of the engine-generator 9 - $Status_{genset-10}$: Operational status of the engine-generator 10

[15] As established by the applied methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0), the monitoring parameter "Status of biogas destruction device" is applicable for both the project's high temperature enclosed flares (termed in both the PDD and in this Monitoring Report as "*biogas destruction devices*") and for the engine-generator sets of the project's electricity generation infrastructure (termed in both the PDD and in this Monitoring Report as "*biogas utilization devices*"). Thus, despite of its name/description, monitoring details for this particular monitoring parameter includes both the terms "*biogas destruction device(s)*" and "*biogas utilization device(s)*" for sake of completeness and transparency and are thus applicable for both types of devices.

	- $Status_{genset-11}$: Operational status of the engine-generator 11 $Status_{genset-12}$: Operational status of the engine-generator 12 - $Status_{genset-13}$: Operational status of the engine-generator 13 - $Status_{genset-14}$: Operational status of the engine-generator 14 *High temperature enclosed flares:* Continuous monitoring of the signal of the UV flame detectors installed in each one of the flares were continuously monitored during the considered monitoring period. Related monitoring details are included under details for the monitoring parameter “Flame detection of flare in the minute *m*” ($Flame_m$). Although none of the installed three high temperature enclosed flares combusted LFG during the considered monitoring period, for sake of completeness and appropriateness of monitoring, the signal from the flame detector in each one of the flares have been continuoysly monitored despite of the non-operational status of the flares during the considered monitoring period.
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Values are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company’s quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions.
Additional comments:	-

Data/parameter:	$\mathbf{EC_{PJ,grid,y}}$
Unit	MWh
Description	Amount of grid electricity consumed by the project activity during the year *y*
Measured/calculated/default	Continuously measured by a bi-directional electricity meter.
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meter.
Value(s) of monitored parameter	123.3 MWh

<table>
<tr><td>Monitoring equipment</td><td><u>Specifications of the installed/utilized electricity meter:</u>

- Manufacturer: Schneider Electric
- Model: ION 8600 (bi-directional meter)
- Serial Number: PT-1011A447-01
- Class: ±0.2
- Accuracy: ±0.2%
Calibration events valid for the considered monitoring period:

<table>
<tr><th>Serial Number:</th><th>Calibration certificate number:</th><th>Calibration date:</th><th>Validity of the calibration event</th><th>Calibrated by:</th></tr>
<tr><td rowspan="2">PT-1011A447-01</td><td>KD201403000001</td><td>05/03/2014</td><td>04/03/2016</td><td>CAM Chile S.A.</td></tr>
<tr><td>KD201505000002</td><td>12/05/2015</td><td>11/05/2017</td><td>CAM Chile S.A.</td></tr>
</table>
Calibration frequency and/or maintenance requirements:
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>
<tr><td>Measuring/reading/recording frequency:</td><td>Accumulated values for continuous measurements of grid-sourced electricity consumption are recorded once a day.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures:</td><td>Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer.

Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company's quality management and control (QA/QC) and environmental management system (EMS).</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).</td></tr>
<tr><td>Additional comments:</td><td>-</td></tr>
</table>

Data/parameter:	**$EC_{BL,y}$**
Unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year *y*
Measured/calculated/default	Measured as part of the operation of the project activity by applying appropriate bi-directional electricity meter.

Source of data	During the considered monitoring period, collected LFG was used as fuel for electricity generation in the project's electricity generation infrastructure. Monitoring of $EC_{BL,y}$ was thus performed on the basis of measurements of exported electricity which was generated by both power plants ($EC_{BL,y,CLLC-1+2}$) .
Value(s) of monitored parameter	209,239.7 MWh
Monitoring equipment	While monitoring for the parameter $EC_{BL,y}$ is performed on the basis of electricity export measurements performed by the same instrument for which measurements of imports of grid-sourced electricity are made as part of monitoring of the parameter "Amount of grid electricity consumed by the project activity during the year y" ($EC_{PJ,grid,y}$), specifications of the installed electricity meter are presented above in the table with details for the monitoring parameter $EC_{PJ,grid,y}$.
Measuring/reading/recording frequency:	Continuous measurements performed by installed electricity meter are recorded/reported every hour.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Amount of electricity exported measured by the installed electricity meter was crosschecked with the monthly CDEC SIC report.
Purpose of data:	Calculation of baseline emissions (due to the displacement of an equivalent amount of electricity generated by the project's new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the CDEC SIC grid).
Additional comments:	-

Data/parameter:	**$Op_{j,h}$**
Unit	-
Description	Operation of the equipment that consumes LFG (engine-generator sets of the electricity generation facility).
Measured/calculated/default	For each equipment unit *j* using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: (a) Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; (b) Flame. Flame detection system is used to ensure that the equipment is in operation; (c) Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns. $Op_{j,h}$=0 when:

	(a) One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute); (b) Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); (c) No products are generated in the hour h. Otherwise, $Op_{j,h}$=1
Source of data	The electronic control system for each engine-generator set of the project's electricity generation component continuously monitor operational status of the set (engine-generator set under operation "on" or not under operation "off").
Value(s) of monitored parameter	Records for every-minute operational status of the set (engine-generator set under operation ("on") = 1 or not under operation ("off") = 0) are made available in the emission reduction calculation spreadsheets. While the operational status for each individual engine-generator set consuming LFG is independently monitored, the monitoring parameter $Op_{j,h}$ is recorded and reported on the basis of the following sub-parameters: *CLLC-1 power plant:* - $Op_{gensetnorth1,h,y}$: Operation of the engine-generator north - $Op_{genset-south,h,y}$: Operation of the engine-generator south *CLLC-2 power plant:* - $Op_{genset-1,h,y}$: Operation of the engine-generator 1 - $Op_{genset-2,h,y}$: Operation of the engine-generator 2 - $Op_{genset-3,h,y}$: Operation of the engine-generator 3 - $Op_{genset-4,h,y}$: Operation of the engine-generator 4 - $Op_{genset-5,h,y}$: Operation of the engine-generator 5 - $Op_{genset-6,h,y}$: Operation of the engine-generator 6 - $Op_{genset-7,h,y}$: Operation of the engine-generator 7 - $Op_{genset-8,h,y}$: Operation of the engine-generator 8 - $Op_{genset-9,h,y}$: Operation of the engine-generator 9 - $Op_{genset-10,h,y}$: Operation of the engine-generator 10 - $Op_{genset-11,h,y}$: Operation of the engine-generator 11 - $Op_{genset-12,h,y}$: Operation of the engine-generator 12 - $Op_{genset-13,h,y}$: Operation of the engine-generator 13 - $Op_{genset-14,h,y}$: Operation of the engine-generator 14
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency:	Values are reported on a minute basis.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company's quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation baseline emissions (due to the displacement of an equivalent amount of electricity generated by the project's new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the CDEC SIC grid).
Additional comments:	-

Data/parameter:	**Flame$_m$**
Unit	Flame status "*on*" or flame status "*off*"
Description	Flame detection of flare in the minute *m*
Measured/calculated/default	Continuously measured by Ultra violet (UV) flame detectors (one UV flame detector for each installed high temperature enclosed flare).
Source of data	For each one of the installed flares, whenever flame is detected in the flare, flame status "*on*" or "1" value is attributed. Whenever no flame is detected in the flare, flame status "*off*" or "0" is attributed.
Value(s) of monitored parameter	Values for each one of the installed 3 high temperature enclosed flares are reported in the monthly emission reduction calculation spreadsheets (that is enclosed to this Monitoring Report). Measurement data is recorded and reported with an every-minute frequency. While measurements are performed by 3 UV flame detectors (one UV flame detector installed in each individual installed flare), the monitoring parameter Flame$_m$ is thus measured, recorded and reported on the basis of the following sub-parameters: - Flame$_{m,flare-1}$: Flame detection in Flare 1 - Flame$_{m,flare-2}$: Flame detection in Flare 2 - Flame$_{m,flare-3}$: Flame detection in Flare 3
Monitoring equipment	Measurements are performed by appropriate ultra violet (UV) flame detectors:
Measuring/reading/recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company's quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comments:	Although none of the installed three high temperature enclosed flares combusted LFG during the considered monitoring period, for sake of completeness and appropriateness of monitoring, the signal from the flame detector in each one of the flares have been continuously monitored despite of the non-operational status of the flares during the considered monitoring period. The sections of the LFG supply pipeline prior to the flares are equipped with automatic (normally-closed) shut-off valves. During the whole monitoring period, such values were under closed position and the status of such valves have been continuously monitored, with recording of data being performed on every-minute basis.

Data/parameter:	**$EC_{PJ,captive,y}$**
Unit	MWh
Description	Quantity of electricity generated in captive diesel backup generator during the year *y*
Measured/calculated/default	Measured as part of the operation of the project activity by applying appropriate electricity meter(s). It is important to note that, while there are 3 captive diesel backup generators installed as part of the project activity (“Diesel Backup Generator I”, “Diesel Backup Generator II” and “Diesel Backup Generator III”), the electricity meter installed for measuring electricity generated by the “Diesel Backup Generator II” did not function properly during the considered monitoring period. Thus, as further described in Section E.2, for the particular case of the “Diesel Backup Generator II”, a conservative approach is adopted for the determination of project emissions due to the consumption of electricity generated by this diesel backup generator.
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meters.
Value(s) of monitored parameter	Quantity of electricity generated by the Diesel Backup Generator I ($EC_{PJ,captive,y,1}$): 38.102 MWh Quantity of electricity generated by the Diesel Backup Generator III ($EC_{PJ,captive,y,3}$): 0.780 MWh

Monitoring equipment	*Specifications of the electricity meter utilized for measuring electricity generated by the Diesel Backup Generator I ($EC_{PJ,captive,y,1}$):* - Manufacturer: Schneider Electric - Model: PM820MG - Serial Number: 26207716 - Class: ±0.5 - Accuracy: ±0.5% Calibration events valid for the considered monitoring period:

Serial Number:	Calibration certificate number:	Calibration date:	Validity of the calibration event	Calibrated by:
26207716	KD201405000002	06/05/2014	05/05/2015	CAM Chile S.A.
	KD201505000002	13/05/2015	12/05/2016	CAM Chile S.A

Calibration frequency and/or maintenance requirements: 2 years

Specifications of the electricity meter utilized for measuring electricity generated by the Diesel Backup Generator III ($EC_{PJ,captive,y,3}$):

- Manufacturer: Schneider Electric
- Model: PM820MG
- Serial Number: 26205401
- Class: ±0.5
- Accuracy: ±0.5%

Calibration events valid for the considered monitoring period:

Serial Number:	Calibration certificate number:	Calibration date:	Validity of the calibration event	Calibrated by:
26205401	KD201405000004	07/05/2014	06/05/2015	CAM Chile S.A.
	KD201505000001	11/05/2015	10/05/2016	CAM Chile S.A

Calibration frequency and/or maintenance requirements: 2 years

Measuring/reading/recording frequency:	Continuous measurements performed by installed electricity meters are recorded/reported every hour.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at KDM S.A. in accordance with detailed working instructions that are included in the company's quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of project emissions.
Additional comments:	-

The following monitoring parameters (which are also included in the monitoring plan of the registered PDD) were not monitored as the methodological options for which they are applicable were not selected as the monitoring or calculation approaches for the determination of baseline emissions and/or project emissions achieved by the project activity during the considered monitoring period:

- Volumetric flow of LFG stream in time interval t on a dry basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s)) ($V_{t,db,j}$)
- Volumetric fraction of CH_4 in the collected LFG in time interval t on a dry basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s)) ($v_{CH4,t,db,j}$)
- Mass flow of the LFG stream in time interval t on dry basis for *j* (where *j* is the LFG delivery pipeline to each item of electricity generation and LFG delivery pipeline to the flare(s)) ($M_{t,db,j}$)
- Temperature of the LFG stream in time interval *t* (T_t)
- Pressure of the LFG stream in time interval *t* (P_t)
- Quantity of electricity generated in captive diesel backup generator during the year *y* ($EC_{PJ,captive,y}$)
- Quantity of fuel Diesel combusted by the captive off-grid electricity generator ($FC_{Diesel,y}$)
- Net calorific value of the fuel Diesel in year *y* ($NCV_{Diesel,y}$)
- CO_2 emission factor of fuel Diesel in year *y* ($EF_{CO2,Diesel,y}$)

The following monitoring parameters (which are also included in the monitoring plan of the registered PDD) were not monitored as no collected LFG was sent for combustion in anyone of the three installed high temperature enclosed flare during the considered monitoring period:

- Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t* ($F_{CH4,EG,t}$)
- Temperature in the exhaust gas of the enclosed flare in minute *m* ($T_{EG,m}$)
- Maintenance events completed in year *y* as monitored by the project participants ($Maintenance_y$)
- Quantity of LPG consumed by the project activity in year *y* ($FC_{LPG,y}$)
- Net calorific value of the fuel LPG ($NCV_{LPG,y}$)
- CO_2 emission factor of fuel LPG in year *y* ($EF_{CO2,LPG,y}$)
- Saturation pressure of H_2O at temperature T_t in time interval *t* ($p_{H2O,t,Sat}$)

D.3. Implementation of sampling plan

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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

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Baseline emissions (BE_y) are determined (in tCO_2e) as follows:

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

Where:

$BE_{CH4,y}$ Baseline emissions of methane from the SWDS[16].

$BE_{EC,y}$ Baseline emissions associated with electricity generation in year *y* (in tCO_2e/yr).

[16] SWDS = Solid Waste Disposal Site. For the case of the project activity, the SWDS is the Loma los Colorados landfill.

Determination of baseline emissions associated with electricity generation ($BE_{EC,y}$)

Baseline emissions associated with electricity generation ($BE_{EC,y}$) is determined as follows:

$$BE_{EC,y} = EC_{BL,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$$

Where:

$EC_{BL,y}$ Net amount of electricity generated using LFG in year y (in MWh). Total net electricity generated by the project activity (using collected LFG as gaseous fuel) for the considered monitoring period are reported as 67,752.8 MWh Related monitoring details for the monitoring parameter $EC_{BL,y}$ are included in Section D.2.

$EF_{EL,grid,y}$ Emission factor for grid sourced electricity in year *y* (in tCO_2/MWh). $EF_{EL,grid,y}$ is determined as the combined margin emission factor ($EF_{grid,CM,y}$) that is calculated as the weighted average of the operating margin and build margin emission factors. To weight these two factors, the default values applicable to both for the 2nd crediting period are applied. The combined margin emission factor is thus obtained as follows:

$$EF_{EL,grid,y} = EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where:

w_{OM} Weighting of operating margin emissions factor. The value for w_{OM} is ex-ante selected as 0.25%. Further details about the ex-ante selected parameter w_{OM} are included in Section D.1 and in the PDD.

w_{BM} Weighting of operating margin emissions factor. The value for w_{BM} is ex-ante selected as 0.75%. Further details about the ex-ante selected parameter w_{BM} are included in Section D.1 and in the PDD.

$EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year *y*. The value for $EF_{grid,OM,y}$ is ex-ante determined as 0.7479 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{grid,OM,y}$ are included in Section D.1 and in the PDD.

$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year *y*. The value for $EF_{grid,BM,y}$ is ex-ante determined as 0.7046 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{grid,BM,y}$ are included in Section D.1 and in the PDD.

For the considered monitoring period, $EF_{EL,grid,y}$ is thus calculated as 0.7154 tCO_2/MWh.

Baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) for the considered monitoring period are calculated and reported as 179,628 tCO_2e. All related calculation are presented in an emission reduction calculation spreadsheet that is enclosed to this Monitoring Report.

Determination of baseline emissions of methane from the SWDS ($BE_{CH4,y}$):

Baseline emissions of methane from the SWDS ($BE_{CH4,y}$) are determined as follows:

$BE_{CH4,y}$ Baseline emissions of methane from the SWDS. As established by both ACM0001 (version 15.0) and the registered PDD, the determination of $BE_{CH4,y}$ is based on the amount of methane that is actually captured and combusted (through destruction of collected LFG in the flares and/or through utilization of collected LFG as gaseous fuel for electricity generation by the project activity. As established by both ACM0001 (version 15.0) and the registered PDD, the amount of methane that, in the absence of the project activity (baseline scenario), would be otherwise captured and destroyed in the landfill (by the pre-project previously existent conventional LFG destruction system) is also taken into account. In addition, the effect of methane oxidation (that, as per ACM0001 (version 15.0) is assumed as existing in the baseline and not in the project scenario) is also taken into account. $BE_{CH4,y}$ is thus determined as follows:

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

Where:

OX_{top_layer} Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline scenario. The value for OX_{top_layer} is ex-ante determined as 10%. Further details about the selection of the value for OX_{top_layer} is included in Section D.1 and in the PDD.

$GWP_{CH4,y}$ Global warming potential of CH_4. The value for GWP_{CH4} is ex-ante determined as 25. Further details about the selection of the value for GWP_{CH4} is included in Section D.1 and in the PDD.

$F_{CH4,BL,y}$ Amount of methane in the LFG that would be flared in the baseline scenario (absence of project activity). As outlined in Section B.6.1 of the PDD, $F_{CH4,BL,y}$ is calculated as follows:

$$F_{CH4,BL,y} = F_{CH4,hist,y} = F_{CH4,BL,x-1} / F_{CH4,x-1} * F_{CH4,PJ,y}$$

Where:

$F_{CH4,hist,y}$ Historical amount of methane in the LFG which is captured and destroyed (in t CH_4/yr).

$F_{CH4,BL,x-1}$ Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity. The value for $F_{CH4,BL,x-1}$ is ex-ante selected as 516.6 t CH_4/yr. Further details about the selection of the value for $F_{CH4,BL,x-1}$ is included in Section D.1 and in the PDD.

$F_{CH,x-1}$ Amount of methane in the LFG generated in the SWDS in the year prior to the implementation of the project activity. The value for $F_{CH4,BL,x-1}$ is ex-ante determined as 41,292.16 t CH_4/yr (year 2006). Further details about the selection of the value for $F_{CH4,BL,x-1}$ = $F_{CH4,BL,2006}$ is included in the emission reduction calculation that is enclosed to the PDD.

$F_{CH4,PJ,capt,y}$ Amount of methane collected by the project activity. In the particular case of the project activity and for the considered monitoring period, $F_{CH4,PJ,capt,y}$ is determined as follows:

$$F_{CH4,PJ,capt,y} = F_{CH4,sent,flare,y} + F_{CH4,EL,y}$$

Where:

$F_{CH4,EL,y}$ Amount of methane in the LFG which is used for electricity generation in year y (in tCH_4/yr). Details for the determination of every-minute values for $F_{CH4,EL,y}$ are presented below (under "*Determination of every-minute values for the calculation parameter $F_{CH4,EL,y}$*").

$F_{CH4,sent\_flare,y}$ Amount of methane in the LFG which is sent to the flare. While no collected LFG was sent to the flares during the considered monitoring period, $F_{CH4,sent\_flare,y}$ is thus considered as null.

For the considered monitoring period, the accumulated value for $F_{CH4,BL,y}$ is calculated and reported as 567 tCH_4. All related calculation are presented in the emission reduction calculation spreadsheets that are enclosed to the Monitoring Report.

$F_{CH4,PJ,y}$ Amount of methane in the LFG which is flared and/or used in the project activity. In the particular case of the project activity, $F_{CH4,PJ,y}$ is determined as follows:

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

Where:

$F_{CH4,EL,y}$ Amount of methane in the LFG which is used for electricity generation in year *y* (in tCH_4/yr). Details for the determination of every-minute values for $F_{CH4,EL,y}$ are presented below (under "*Determination of every-minute values for the calculation parameter $F_{CH4,EL,y}$*").

$F_{CH4,flared,y}$ Amount of methane in the LFG flared by the project activity (in tCH_4) during the whole monitoring period. While no collected LFG was sent to the flares during the considered monitoring period, $F_{CH4,flared,y}$ is thus considered as null.

Determination of every-minute values for the calculation parameter $F_{CH4,EL,y}$:
For the considered monitoring period, Option C of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (where the gaseous stream the tool shall be applied to is the stream of collected LFG that is sent to the electricity generation infrastructure)[17] is the selected option for determination of values $F_{CH4,EL,y}$.

[17] It is relevant to note that the PDD states the following regarding the calculation approach for values of $F_{CH4,EL,y}$: "Applicable guidance of the Methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) will be applied to determine $F_{CH4,EL,y}$ by using Option 2: *Simplified calculation without measurement of the moisture content*, and one of the options A, C or D. The selection of the determination option will depend on project conditions and equipment to be installed. Furthermore, monitoring approach as per Item *2.* "*Use of a single flow meter for multi-use of recovered biogas"* from "*Appendix. - Additional data handling and monitoring guidance for determining the mass flow of methane in biogas*" of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) is also applied.

By following calculation option C (that is one of the applicable calculation methods the PDD refers to), the mass flow of greenhouse gas i ($F_{i,t}$) (i = CH_4) sent to the project's electricity generation infrastructure is determined as follows:

$$F_{CH4,EL,y} = V_{t,wb} * v_{CH4,t,wb} * \rho_{CH4,n}$$

Where:

$V_{t,wb,n}$ Volumetric flow of the gaseous stream (LFG) sent to the electricity generation infrastructure in time interval *t* on a wet basis at normal conditions. While in the particular case of the project activity, during the considered monitoring period, volumetric flow of the gaseous stream (LFG) is already measured in Nm^3 wet gas/h (normal conditions), the following assumption is valid:

$V_{t,wb,n}$ is equivalent to $V_{t,wb}$

Where:

$V_{t,wb}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis.

$v_{CH4,t,wb}$ Volumetric fraction of CH_4 in the gaseous stream in time interval *t* on a wet basis. Further monitoring details about the monitoring parameter $v_{CH4,t,wb}$ are included above and in Section D.2.

$\rho_{CH4,n}$ Density of CH_4 in the gaseous stream (LFG) at normal conditions. For the considered monitoring period, value of $\rho_{CH4,n}$ (in kg of CH_4 / m^3 of CH_4) is calculated and reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period (and enclosed to this Monitoring Report) as follows:

$$\rho_{CH4,n} = (P_n * MM_i) / (R_u * T_n)$$

Where:

P_n Absolute pressure at normal conditions. P_n is ex-ante determined as 101,325 Pa. Further details about the ex-ante determined parameter P_n are included in Section D.1 and in the PDD.

T_n Temperature at normal conditions. T_n is ex-ante determined as 273.15 Kelvin. Further details about the ex-ante determined parameter T_n are included in Section D.1 and in the PDD.

MM_i Molecular mass of greenhouse gas *i* (*i* = CH_4). MM_i (*i* = CH_4) is ex-ante determined as 16.04 kg/mol. Further details about the ex-ante determined parameter MM_i (*i* = CH_4) are presented in Section D.1 and in the PDD.

R_u Universal ideal gases constant. R_u is ex-ante determined as 8,314 Pa.m^3 /kmol.K. Further details about the ex-ante determined parameter R_u are presented in Section D.1 and in the PDD.

$\rho_{CH4,n}$ is calculated as 0.7156650 $kgCH_4$ / m^3CH_4 as reported in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period.

During the entire monitoring period, measurements of collected LFG supplied to a set of available/operational biogas destruction/utilization devices (i.e. engine-generator sets) were performed by a single LFG flow meters (under conformance with the alternative and simplified monitoring approach termed in Section B.7.3 of the latest version of the PDD as *"Use of a single flow meter for multi-use of recovered biogas*"). Applicable additional monitoring requirements valid/applicable specifically for the use of a single or reduced number of LFG flow meters as established in the PDD were considered in the context of the determination of $F_{CH4,EL,y}$ as follows:

(i) It is ensured/demonstrated that within each section of the project's LFG supply pipeline that directs LFG towards each operational individual flare, there is an individual safety valve installed/located within such pipeline section and prior to the underlying biogas destruction device that automatically closes whenever the underlying biogas utilization device becomes under non-operational status. In the particular case of the considered monitoring period, such valves were kept closed during the whole period. Moreover, the status of such valves ("*Open*" or "*Closed*") were monitored during the whole period. Furthermore, for each individual flare, the status of the flare's flame (Flame status "*on*" or flame status "*off*") was also confirmed to always corresponding to flame status "*off*"" (on the basis of continuous monitoring of the parameter "Flame detection of flare in the minute *m*" ($Flame_m$) by the use of UV flame detectors).

(ii) It is ensured/demonstrated that the biogas utilization devices for which sent of collected LFG was measured by the single LFG flow meters (i.e. engine-generator sets) are all designed in such a manner that it is physically impossible for LFG passing through and being directly emitted into the atmosphere while the underlying engine-generator sets are under non-operational status. It is thus ensured/demonstrated that during the whole considered monitoring period, no collected LFG was able to be eventually directly emitted into (vented through) the atmosphere through a non-operational engine-generator set.

For the considered monitoring period, such confirmations/demonstrations were done through the following approaches:

- Records of electricity generated by the engine generator sets and records from the status of the both the flare(s) (by means of a flame detector(s) and the valves located prior to the flares within the project's LFG pipeline. In the particular case of the engine-generator sets, it is demonstrated that electricity generation (as the output from operation of such devices) corresponds to the flow of LFG actually consumed by the devices (in energy basis).

- For any time instants minute *m* where one or more biogas destruction/utilization devices connected downstream to the utilized single LFG flow meter (i.e. engine-generator set(s) and/or flare(s)) were under non-operational status, it is demonstrated that the set of remaining devices under operational status (i.e. engine-generator sets utilizing LFG as fuel for electricity generation in the particular case of the considered monitoring period) have the quantitative capacity to combust the amount of LFG flow that was sent to the underlying devices during the underlying minute *m.*

- Finally, it is also confirmed/demonstrated that measurement of methane content of collected LFG (monitoring parameter $v_{CH4,t,wb,j}$ or $v_{CH4,t,db,j}$) was conducted during the whole considered monitoring period by a CH_4 content gas analyser that has been located immediately downstream of the utilized LFG flow meter.

For the considered monitoring period, the accumulated value for $F_{CH4,PJ,y}$ = $F_{CH4,EL,y}$ is calculated as 45,153 tCH_4.

For the considered monitoring period, baseline emissions of methane from the SWDS ($BE_{CH4,y}$) are calculated as 1,001,768 tCO_2e.

The summarized emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) summarizes the determination of $BE_y = BE_{CH4,y} + BE_{EC,y}$ for the considered monitoring period.

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

>>
As outlined in the PDD, the operation of the project activity still requires consumption of grid-sourced electricity and electricity sourced by the installed backup off-grid electricity generator fuelled by Diesel. As also established in the PDD, project emissions due to consumption of these energy carriers are determined by following the applicable guidance of the “Tool to calculated baseline, project and/or leakage emissions from electricity consumption“ and “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”.

Project emissions (PE_y) for the considered monitoring period are determined (in tCO_2e) as follows:

$$PE_y = PE_{EC,grid,y} + PE_{EC,captive,y}$$

Where:

$PE_{EC,grid,y}$ Project emissions due to the consumption of grid electricity due to the project activity in year *y* (in tCO_2/year)

$PE_{EC,captive,y}$ Project emissions from consumption of electricity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel) in year *y* (in tCO_2/yr)

<u>Project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$):</u>

Project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$) are calculated as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) as follows:

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

Where:

$TDL_{grid,y}$ Average technical transmission and distribution losses for grid sourced electricity consumed by the project activity in year *y.* The value of $TDL_{grid,y}$ is ex-ante selected as 20%. Further details about the ex-ante determined parameter $TDL_{grid,y}$ are included in Section D.1 and in the PDD.

$EC_{PJ,grid,y}$ Quantity of grid sourced electricity consumed by the project activity in year *y* (in MWh). Total accumulated amount of grid-sourced electricity consumption during the considered monitoring period is reported as 123.3 MWh.

Additional monitoring details about the monitoring parameter $EC_{PJ,grid,y}$ are included in Section D.2.

$EF_{EL,grid,y}$ Emission factor for grid sourced electricity in year *y* (in tCO_2/MWh). $EF_{EL,grid,y}$ is determined as the combined margin emission factor ($EF_{grid,CM,y}$) that is calculated as the weighted average of the operating margin and build margin emission factors. To weight these two factors, the default values applicable to both for the 2nd crediting period are applied. The combined margin emission factor is thus obtained as follows:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where:

w_{OM} Weighting of operating margin emissions factor. The value of w_{OM} is ex-ante selected as 0.25%. Further details about the ex-ante selected parameter w_{OM} are included in Section D.1 and in the registered PDD.

w_{BM} Weighting of operating margin emissions factor. The value of w_{BM} is ex-ante selected as 0.75%. Further details about the ex-ante selected parameter w_{BM} are included in Section D.1 and in the registered PDD.

$EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year *y*. The value of $EF_{grid,OM,y}$ is ex-ante selected as 0.7479 tCO_2/MWh. Further details about the ex-ante selected parameter $EF_{grid,OM,y}$ are included in Section D.1 and in the PDD.

$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year *y*. The value of $EF_{grid,OM,y}$ is ex-ante selected as 0.7046 tCO_2/MWh. Further details about the ex-ante selected parameter $EF_{grid,BM,y}$ are included in Section D.1 and in the PDD.

For the considered monitoring period, project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$) are calculated as follows:

$PE_{EC,grid,y}$ = 123.3 MWh * (0.25 * 0.7479 tCO_2/MWh + 0.75 * 0.7046 tCO_2/MWh) = 106 tCO_2 (rounded value)

The summarized emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes all calculations related to the determination of $PE_{EC,grid,y}$ for the considered monitoring period.

Project emissions from consumption of electricity generated by the captive off-grid electricity generators fuelled by fossil fuel (diesel) in year y (in tCO_2/yr):

Project emissions from the consumption of electricity generated by the installed Diesel Backup Generator I and Diesel Backup Generator III during the considered monitoring period are calculated as follows:

$$PE_{EC,captive,y,n} = EC_{captive,y,n} * EF_{EL,captive,y} * (1 + TDL_{captive,y})$$

Where:

n	Diesel Backup Generator number (for the considered monitoring period, *n* = 1 and 3)
$EC_{captive,y,n}$	Amount of electricity sourced by the captive electricity generator (fuelled by Diesel) in question and consumed by the project activity. For the considered monitoring period, total accumulated amount of electricity sourced by the captive backup diesel generators 1 and 3 are reported as 38.102 MWh ($EC_{captive,y,1}$) and 0.780 MWh ($EC_{captive,y,2}$) respectively.
$EF_{EL,captive,y}$	CO_2 emission factor for electricity sourced by the captive off-grid electricity generators (tCO_2/MWh). By following Option B2 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", the value for $EF_{EL,captive,y}$ is ex-ante determined as 1.3 tCO_2/MWh. Further details about the ex-ante selected parameter $EF_{EL,captive,y}$ are included in Section D.1 and in the PDD.
$TDL_{captive,y}$	Average technical transmission and distribution losses for electricity sourced by the captive electricity generator. In accordance with the applicable provisions of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", as a simplification, the value of $TDL_{captive,y}$ is ex-ante determined as zero (fixed value along the whole crediting period). Further details about the ex-ante selected parameter $TDL_{captive,y}$ are included in Section D.1 and in the PDD.

Thus, project emissions due to consumption of electricity generated by the installed backup captive off-grid electricity generators (fuelled by diesel) (Diesel Backup Generator I and Diesel Backup Generator III) during the considered monitoring period are calculated as follows:

$PE_{EC,captive,y,1}$ = 38.102 * 1.3 * (1 + 0) = 50 tCO_2 (rounded value)

$PE_{EC,captive,y,3}$ = 0.780 * 1.3 * (1 + 0) = 2 tCO_2 (rounded value)

Since the amount of electricity actually sourced by the Diesel Backup Generator II and consumed by the project activity (sub-parameter ($EC_{PJ,captive,y,2}$)) was not monitored in accordance with the related provisions of the monitoring plan (due to electricity meter malfunctioned during the considered monitoring period), $PE_{EC,captive,y,2}$ is thus determined by applying the conservative approach of option B4 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" [18].

[18] As established in the PDD, project emissions from the consumption of electricity generated by the backup captive off-grid diesel generators is calculated by using any one of the four approaches based on the determination options of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption": options B1, B2, B3 or B4.

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:

$PE_{EC,captive,y,2}$ = 11,400[19] * $PP_{CP,Diesel\text{-}generator,2}$

Where:

$PP_{CP,Diesel\text{-}generator,2}$ Rated capacity of the installed captive off-grid electricity generator fuelled by diesel ($PP_{CP,Diesel\text{-}generator,2}$) (in MW). The value of $PP_{CP,Diesel\text{-}generator\text{-}2}$ is ex-ante selected as 0.352 MW. This value represents the nameplate power of the installed captive off-grid electricity generator II. Further details about the determination of $PP_{CP,Diesel\text{-}generator,2}$ are included in both Section D.1 and in the PDD.

By applying the value of $PP_{CP,Diesel\text{-}generator,2}$ as well as the period this captive off-grid electricity generator was under operation:

$PE_{EC,captive,y,2}$ = 1.3 * 15,360 * 0.352 = 7,029 tCO_2 (rounded value)

Thus, project emissions due to the consumption of electricity sourced by the backup captive off-grid electricity generators (fuelled by diesel) are calculated as:

$PE_{EC,captive,y} = PE_{EC,captive,y,1} + PE_{EC,captive,y,2} + PE_{EC,captive,y,3}$ = 50 + 2 + 7,029 = 7,081

Total project emissions (PE_y) for the considered monitoring period are calculated as 7,081 tCO_2 (rounded value).

E.3. Calculation of leakage

>>
Not applicable.

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

Emission reductions achieved by the project activity during the considered monitoring period are determined as the difference between baseline emissions (BE_y) and project emissions (PE_y) determined for such period. Calculations of baseline emissions (BE_y) are presented in Section E.1. Calculations of project emissions (PE_y) are presented in Section E.2. As summarized in the table below, during the monitoring period from 15/09/2014 to 11/05/2016, achieved emission reductions are calculated and reported as 1,174,209 tCO_2e (rounded value):

[19] 11,400 = 8,760 * 1.3 (i.e., the number of hours encompassed by one 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 "15,360" is used instead of "8,760" figure, thus correctly taking into account the quantity of hours encompassed by the considered monitoring period of 640 day length (i.e 640 * 24 = 15,360)..

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	1,181,396	7,187	-	-	1,174,209	1,174,209

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)	2,182,529[20]	1,174,209

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

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Emission reductions achieved by the project activity during the considered monitoring period are about ~46% lower than calculated value of ex-ante estimation of emission reductions as per the latest version of the PDD that valid for the considered monitoring period (290-day length monitoring period within year 2014). The following aspects justify and explain the relative difference between such calculated value for ex-ante estimation of emission reductions as per the PDD (calculated as applicable for the considered monitoring period) and emission reductions actually achieved by the project activity during the underlying monitoring period:

<u>Aspects/conditions which represent a decrease factor of reported emission reductions for the considered monitoring period when compared against the *ex-ante* estimation of emission reduction for the same period in the PDD:</u>

1) *Uncertainties associated with the application of First Order Decay (FOD) multi-phased model for estimating the emission reductions in the PDD:*
   As outlined in the PDD, like other similar CDM project activities encompassing LFG collection and destruction/utilization, the amount of methane to be generated by decomposition of MSW disposed at the Loma los Colorados landfill and collected by the project activity was derived by applying the First Order Decay (FOD) model as per the methodological tool "Emission from Solid Waste Disposal Sites" (version 06.0.1) (in the context of the determination of ex-ante estimated emission reductions to be achieved during the 2nd 7-year renewable crediting period). By taking in account all potential uncertainties associated with the application of such multi-phased decay model, it is reasonable to assume that, in the particular case of the project activity and its operation during the considered monitoring period, the application of this model somehow overestimated the amount of LFG to be actually generated, collected and destroyed/utilized by the project activity.

[20] The 2,182,529 tCO_2e value is calculated as the sum of the shares of estimated total emission reductions for years 2014, 2015 and 2016 to be achieved during the considered monitoring period within the share of years 2014, 2015 and 2016 which are valid for the 2nd 7-year crediting period of the project activity (period from 13/03/2014 to 31/12/2016) (calculated as 951,770 tCO_2e * 108 / 290 + 1,242,530 tCO_2 * 365 / 365 + 1,279,789 * 167 / 365).

In this particular context, it is crucial to note that, while the PDD assumes a LFG collection efficiency of 92.80% (ex-ante determined parameter “Efficiency of the LFG capture system that will be installed in the project activity” (η_{PJ})) in the context of the ex-ante estimates of emission reductions to be achieved by the project activity along its 2nd 7-year crediting period, during the considered monitoring period the project activity had limited performance in terms of LFG collection (as outlined in Box 1), thus negatively affecting the overall collection efficiency for LFG generated in the site as part of the operation of the project activity during the considered period. Lower collection of LFG as part of the project activity represented along the considered monitoring period no destruction of LFG through flaring and reduced utilization of collected LFG as gaseous fuel for electricity generation (when compared to ex-ante estimates of emission reductions outlined in the PDD). All these particular aspects represent negative impacts over emission reductions achieved during the period (when compared to estimates in the PDD).

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
Organization name	KDM S.A.
Street/P.O. Box	Alcalde Guzmán 0180, Quilicura
Building	
City	Santiago
State/region	
Postcode	
Country	Chile
Telephone	
Fax	
E-mail	fleon@guk.cl
Website	www.kdm.cl
Contact person	
Title	General Manager
Salutation	Mr.
Last name	Leon
Middle name	
First name	Fernando
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	fleon@guk.cl

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
Organization name	The Kansai Electric Power Co., Inc.
Street/P.O. Box	3-6-16, Nakanoshima, Kita-ku
Building	
City	Osaka
State/region	
Postcode	
Country	Japan
Telephone	+ 81 6 6441 8821
Fax	
E-mail	kadono.naoyoshi@b3.kepco.co.jp
Website	
Contact person	
Title	
Salutation	Mr.
Last name	Toyama
Middle name	
First name	Koji
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	koji.toyama@kepco.co.jp

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
Organization name	URBASER, S.A.
Street/P.O. Box	Avda. Tenerife 4-6, 28703 San Sebastian de los Reyes
Building	
City	Madrid
State/region	
Postcode	
Country	Spain
Telephone	+ 56 2 248 28 600
Fax	
E-mail	sinostroza@gud.cl
Website	
Contact person	
Title	
Salutation	Mr.
Last name	Inostroza
Middle name	Cáceres
First name	Sergio
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	sinostroza@gud.cl

Project participant and/or responsible person/ entity	☐ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	UniCarbo Energia e Biogás Ltda.
Street/P.O. Box	Avenida Eng. Luis Carlos Berrini, 1140 – 72
Building	
City	São Paulo
State/region	São Paulo, SP
Postcode	04571-000
Country	Brazil
Telephone	+ 55 11 9 8596 0950
Fax	+ 55 11 9 8596 0950
E-mail	nuno@unicarbo.com.br
Website	www.unicarbo.com.br
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Salutation	
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Middle name	
First name	Nuno
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

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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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