Monitoring report form for CDM project activity
(Version 06.0)

MONITORING REPORT		
Title of the project activity	Caieiras landfill gas emission reduction	
UNFCCC reference number of the project activity	0171	
Version number of the PDD applicable to this monitoring report	7.2	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	17/10/2017	
Monitoring period number	#15	
Duration of this monitoring period	01/01/2017 – 30/06/2017	
Monitoring report number for this monitoring report	Not applicable.	
Project participants	Essencis Soluções Ambientais S.A. Nordic Environment Finance Corporation	
Host Party	Brazil	
Sectoral scopes	13 - Waste handling and disposal	
Applied methodologies and standardized baselines	ACM0001 - “Flaring or use of landfill gas” (version 13.0.0)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	-	669,817 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	647,256 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

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The CDM project activity "Caieiras landfill gas emission reduction" is implemented at the UVS-Caieiras landfill[1]. During the considered monitoring period, the project activity promoted real, measurable and permanent abatement of greenhouse gas (GHG) emissions through collection of landfill gas (LFG) and its destruction (through combustion in high temperature enclosed flares) and its utilization as gaseous fuel in a more recently implemented (Jul. 2016) new electricity generation infrastructure[2]. LFG is generated at the UVS-Caieiras landfill as a result of anaerobic decomposition of municipal solid waste (MSW) historically disposed at the landfill.

The construction of the UVS-Caieiras landfill was initiated in year 2002 and it has been operated by the project owner and host-country project participant Essencis Soluções Ambientais S.A. since its commissioning date in September 2002. The project's LFG collection and destruction infrastructure was completely implemented at the landfill in February 2007. The construction of the project's LFG capture and destruction infrastructure (using high temperature enclosed flares) was initiated in March 2006 and was concluded in December 2006. While related testing and commissioning phases occurred in January 2007, the official starting of the project activity encompassing LFG collection and destruction (with monitoring data measurements being recorded) is 01/02/2007. The project's electricity generation infrastructure (under its 1st implementation phase) started its operations in July/2016.

Milestone for the starting of operations of the project's new electricity generation infrastructure (under phase 1):

- 01/07/2016: Connection of the project's new electricity generation infrastructure to the project's main LFG supply pipeline, thus technically allowing collected LFG to be sent to such project's new infrastructure for being used as gaseous fuel for electricity generation.
- 08/07/2016: Starting of operations of the project's new electricity generation infrastructure as part of the conclusion of testing and commissioning work for such new infrastructure. While the project's monitoring data gathering, processing and recording system was not yet fully/appropriately configured, no monitoring records for the project's new electricity generation infrastructure are available for the period from 08/07/2016 to 11/07/2016.
- 11/07/2016: Upon conclusion of all related testing and commissioning activities for the project's new electricity generation infrastructure and upon conclusion of all required configuration of the project's monitoring data gathering, processing and recording system;

[1] The designation of the landfill hosting the project activity was changed in early 2017 from "CTR Caieiras landfill" to "UVS - Caieiras landfill", where UVS stands for "Unidade de Valorização Sustentável" in Portuguese language (contextually translated into English language as "unit for sustainable valuation (of solid waste)"). Such occurred change in the designation of the landfill was promoted by the project participant and project owner Essencis Soluções Ambientais S.A. as part of the operationalization of the company's commercial, marketing and sustainability strategy. As outlined in previous versions of the PDDs valid for both the 1st and 2nd 7-year crediting periods of the project activity, the landfill hosting the project activity was previously named/designated as "CTR Caieiras landfill", where CTR Caieiras is an abbreviation (in Portuguese language) for "Centro de Tratamento de Resíduos Caieiras" (which is translated in English language as Caieiras Waste Treatment Center). The occurred change in the designation of the landfill does not represent any change in its design and/or operation.

[2] As indicated in a revised version of the PDD valid for the 2nd 7-year crediting period of the project activity (of which validation opinion assessment was completed an independent assessment under the "prior approval" process track for addressing post-registration changes (PRCs) and for which a request of approval was submitted to UNFCCC on 08/09/2017 under ref. PRC-0171-004 (assessment not performed in the context of the verification assessment for the monitoring period encompassed by this Monitoring Report)), since July/2016 the project design has also encompassed utilization of collected LFG as gaseous fuel for electricity generation in an electricity generation infrastructure.

continuous operation of the project activity (with all required monitoring data being measured, processed and recorded) has started.

As part of the complete operation of the project activity, during the considered monitoring period, LFG generated at the UVS-Caieiras landfill was collected and converted into carbon dioxide (CO_2) through both combustion in the high temperature enclosed flares and in the project's new electricity generation infrastructure (since 11/07/2016 (with appropriate monitoring being performed)). The operation of the project activity, under its revised design configuration, thus mitigates emissions of the greenhouse gas (GHG) methane (CH_4) that would otherwise be directly emitted into the atmosphere in the absence of the project activity (baseline scenario). Moreover, since 11/07/2016, the project activity has also promoted measureable carbon dioxide (CO_2) emission reductions due to displacement of electricity under permanent operation (under amount equivalent to the amount of electricity generated by the project's new electricity generation infrastructure) which would otherwise be generated by existing grid-connected power plants, including fossil-fuel fired power plants (and addition of new power generation units) within the National Electricity Grid of Brazil.

By the end of the considered monitoring period, the implemented project's LFG collection system encompassed about 393 vertical LFG collection wells[3]. No horizontal LFG collection trenches have so far been utilized for collecting LFG at the UVS-Caieiras landfill. During the considered monitoring period, LFG was collected at the UVS-Caieiras landfill with the utilization of centrifugal blowers which are connected to the project's LFG collecting pipeline network.

Consumption of electricity by the project activity:
During the period from the start of operation of the project activity in February 2007 until July 2017 all electricity demand for the project activity has been entirely met by consumption of grid-sourced electricity. During this period, during events of temporary interruption of supply of grid-sourced electricity to the project activity, the operation of the project activity was completely interrupted.

Under the revised project design configuration, a backup captive off-grid electricity generator (fuelled by diesel and with 700 kVA of forecasted nameplate installed capacity) was also installed and was made under operational conditions on 01/07/2016 as part of the project's electricity generation component[4]. Such captive off-grid electricity generator is expected to be used

[3] It is important to note that, as outlined in the Section B.6.1 of the PDD, besides of having LFG being effectively collected and destroyed by the active (forced suction) LFG collection and destruction system (that is implemented and has operated as part of the project activity (which currently comprises more than 393 LFG collection wells)), there are still existing a set of conventional passive LFG venting/combustion drains spread around the landfill (about 50 units). In these conventional and passive LFG venting/combustion drains, very small share of generated LFG has been sometimes combusted and sometimes just directly vented into the atmosphere. These remaining conventional LFG venting/combustion infrastructure are not connected to the project activity's LFG collection pipeline network during the considered monitoring period. Unfortunately, venting of LFG has been a practice before and even after the implementation of the project. Although appropriately addressing safety and odor concerns are operational requirements for the CTR Caieiras landfill, the very large area/size of this landfill makes it difficult to keep every single existing conventional drains alight or even convert such drains into appropriate LFG collection wells (and get them connected to the project activity). Moreover, prior of the decision to implement the project activity, sporadic combustion under uncontrolled conditions of minor and not defined share of generated LFG by non-defined fraction of the existing LFG venting/combustion drains (that are not part of the project activity) has been assumed as per applicable design, construction and operational requirements for the CTR Caieiras landfill as a deemed sufficient practice to address safety and odour concerns. A relevant related explanative disclaimer titled "*Challenging/difficulties in converting all conventional and passive LFG venting/combustion drains into appropriated active LFG collecting well connected to the project activity*" is included under a footnote in Section B.6.1 of the PDD.

[4] The use of a backup captive off-grid electricity generator (fuelled by diesel) is also considered for safety reasons in the context of operation of the new yet to be implemented electricity generation facility. In an event of temporary interruption of grid-sourced electricity to the project site, such backup electricity generator will power all management and safety controls of the electricity generation facility thus ensuring that the project's electricity generation component meets applicable data system and communication requirements established by the entity responsible for the operation and management of the National Electricity Grid of Brazil.

whenever the project's electricity demand cannot be met by imports of grid-sourced electricity and/or electricity generated by the project's electricity generation facility.

The main specifications of the backup captive off-grid electricity generator (fuelled by diesel) are summarized below:

Specification for the backup captive off-grid electricity generator (fuelled by diesel)	
Manufacturer	STEMAC Grupos Geradores (Brazil)
Model/product	G – GMC
Power	700 kVA (560 kW for a power factor of 0.8) (440 V voltage, 60 Hz frequency)
Main components	Diesel engine: Scania DC1649A Generator: WEG GTA 312AI45 B35T Command display: model DS7320

As a result of the implementation and continuous operation of the project's new electricity generation infrastructure (which was made in operational condition status July / 2016), the project's electricity demand is thus expected to be met by one of the following sources/approaches along the remaining share of the 2nd 7-year crediting period for the project activity:

- Consumption of small fraction of electricity generated by the project activity (with most of generated electricity being exported/commercialized through the National Electricity Grid of Brazil);
- Imports of grid-sourced electricity
- Electricity supply by the installed backup captive off-grid electricity generator (fuelled by diesel) (only during temporary planned or unplanned circumstances where:
    - project's electricity generation facility is temporarily not under operation and/or
    - supply of grid-sourced electricity is temporarily interrupted).

The decision of meeting the project's electricity demand (under normal project operational circumstances) through any one of the options above summarized depends on commercial, cost and technical aspects related to commercialization of generated electricity, transmission of electricity generated by the project activity and/or agreements with the local electricity distribution company. For the considered monitoring period, all project's electricity demand was met mostly through consumption of small fraction of electricity generated by the project activity. While electricity supplied by the installed backup captive off-grid electricity generator (fuelled by diesel) was also utilized for meeting the project's electricity demand, there were also some minor imports of grid-sourced electricity for meeting the project's electricity demand during the considered monitoring period.

As part of the operation of the project activity during the considered monitoring period, the largest share of collected LFG was directed to the project's new electricity generation infrastructure, with minor share being sent for destruction in the high temperature enclosed flares within the project's LFG collecting pipeline network. This is under conformance with the revised design configuration of the project activity.

The amount and quality of collected LFG which was sent to each individual flare and to each engine-generator set of the project's new electricity generation infrastructure during the considered monitoring period was continuously measured, recorded and are reported (under every-minute frequency) in the emission reduction calculations that are enclosed to the Monitoring Report. Monitoring activities encompass measuring, recording and reporting of (i) LFG flow sent to each individual flare, LFG flow sent to each engine-generator set of the project's new electricity generation infrastructure, (ii) CH_4 content of collected LFG, (iii) LFG temperature and (iv) LFG pressure.

Furthermore, the status/conditions of the high temperature enclosed flares and their compliance with operational requirements (as established by the flare equipment manufacturer) as well as the status of each engine-generator set of the project's electricity generation infrastructure were also monitored during the considered monitoring period. This is under conformance with the revised version of the PDD (hereinafter termed "PDD").

Thermocouples for measuring temperature of the exhaust gas of the flares are installed in the upper section of each high temperature enclosed flare. The installed four high temperature enclosed flares are also equipped with Ultra-violet (UV) flame detectors (of which status (flare "*on*" or flare "*off*") is also continuously monitored). The set of LFG flaring/utilization related continuous measurements are recorded and reported with every minute frequency. Data is stored/archived in a computerized database located in the project's control room.

The MSW disposal area at the UVS-Caieiras landfill that is currently covered by the project's LFG collection well has about 567,000 square meters. About 33,355,000 ton of MSW are disposed in such area. During the considered monitoring period, about 75% of the project's existing LFG collecting wells were connected to the project's LFG collecting pipeline (in the average)[5].

Further details about installed GHG abatement equipment are included in Section B.1. Details about all installed monitoring equipment/instruments are made available in Section D.2.

GHG emission reductions achieved by the project activity during the considered monitoring period from 01/01/2017 to 30/06/2017: 669,817 tCO_2e.

A.2. Location of project activity

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The UVS-Caieiras landfill is located at Bandeirantes highway, km 33 in the municipality of Caieiras, São Paulo State, in Brazil. The project site is located in the extreme Northeast region of Caieiras municipality. Caieiras is one of the municipalities encompassing the Metropolitan Region of São Paulo (RMSP).

The project site has the following geographical coordinates:

- 23°20'40" S (-23.3444)
- 46°46'20" W (-46.7722)

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Essencis Soluções Ambientais S.A.	No
Norway	Nordic Environment Finance Corporation	No

A.4. Reference to applied methodologies and standardized baselines

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[5] As part of the normal operation of the UVS-Caieiras landfill (and also as part of the normal operation of the project activity), some of the project's LFG collecting wells are often temporarily disconnected from the project's LFG collection pipeline in order to facilitate continuous activities of MSW disposal, repair, operational and/or maintenance reasons. (welding and other repair services at the wells and/or pipeline, repositioning of the LFG pipeline, maintenance in the head of the LFG wells, etc.).

The project activity applies the following large-scale CDM baseline and monitoring methodology:

- ACM0001 - ”Flaring or use of landfill gas” (version 13.0.0). (http://cdm.unfccc.int/filestorage/E/Y/F/EYFHCV3K4J5P06DTQSG9WLMOBNUX2I/EB67_repan12_ACM0001_ver13.0.0.pdf?t=aWV8bmVmZHlhfDAbkn62RDZuyjHVzDOMoxMx)

For the considered monitoring period, as also established in the PDD, the following methodological tools are also applied[6]:

- “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 02.0.0, EB 61) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v2.0.0.pdf);

A.5. Crediting period type and duration

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From 13/12/2013 to 30/03/2020 (2nd 7-year renewable crediting period).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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The total technical Municipal Solid Waste (MSW) disposal capacity for the UVS-Caieiras landfill is defined as about 60,000,000 ton of MSW. By the end of the considered monitoring period, an accumulated amount of about 33,350,000 ton of MSW was disposed in this landfill. During the considered monitoring period, MSW has been disposed with an average rate of about 2,840,000 ton of MSW per year[7]. The UVS-Caieiras landfill is currently not expected to close prior to year 2030.

[6] The PDD also refer 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 tools 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 thus not applied for the ex-post determination of emission reductions achieved by the project activity.

[7] It is relevant to note that from year 2007, a significant increase in daily MSW disposal at the CTR Caieiras landfill occurred. Such occurred increase and its impact over baseline emissions for the project activity are explained in Section A.3 of the PDD.

The LFG collecting wells are used to extract LFG from inner section of the landfill. At the ending date of the considered monitoring period, the project's LFG collection system consisted of about 296 operational LFG collecting wells interconnected through a high density polyethylene (HDPE) pipeline network transported to both the project's LFG flaring infrastructure and project's electricity generation infrastructure through the high density polyethylene pipeline network passing through one condensation pot (where most of the moisture in collected LFG is removed through condensation). All collected LFG sent to the project's electricity generation infrastructure passes through additional centrifugal blowers and through a LFG cooling/treatment unit where additional moisture in LFG is removed and LFG is cooled.

After passing through centrifugal blowers, temperature of collected LFG is significantly increased (typical temperature increment of about 30°C or more). As per the project design configuration, the quantity and quality of collected LFG sent to each one of the high temperature enclosed flares and to each engine-generator set of the project's electricity generation infrastructure are measured, recorded and reported as per applicable monitoring guidance of ACM0001 (version 13.0.0) and the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) (with Option C being applied). Thus, the determination of the absolute humidity of the gaseous stream is not required.

Fraction of CH_4 in collected LFG stream as well as LFG flow for each individual flare and to each engine-generator set (monitoring parameters "Volumetric flow of LFG stream in time interval *t* on a wet basis" ($V_{t,wb}$) and "Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis" ($v_{CH4,t,wb}$) respectively) are thus both assumed as monitored on the same basis.

As per construction and operational design of the UVS-Caieiras landfill, a geo-membrane of PVC or similar material is expected to be eventually installed to cover disposed MSW by the time of the closure of the cells of the landfill[8].

During the considered monitoring period encompassing the period from 01/07/2016 to 31/12/2016, the project activity encompassed the operation of the following equipment:

- 1 condensation trap to separate liquids in the collected LFG (leachate and condensate);
- 3 centrifugal blowers of 4-stage type, with nameplate capacity of 7,000 Nm^3/h, manufactured by Houston Service Industries – his and powered by electric motor (with nameplate power of 200 HP (149 kW)).
- 4 high temperature enclosed flares manufactured by BTS - Termodinâmica de Sistemas Ltda. Ltda. The flares are equipped with a pilot flame fuelled by LPG[9].
- One off-grid captive backup electricity generator (fuelled by diesel) with 700 kVA (560 kW for a power factor of 0.8) of nameplate power generation capacity. As per the project design, this back-up off-grid electricity generator is used for emergency purposes only (during temporary interruptions of supply of grid-sourced electricity to the project activity and/or when the project's electricity generation infrastructure is not under operation). The installed backup captive off-grid power generation unit is manufactured by STEMAC Grupos Geradores (Brazil) and is of model G – GMC / 440 V voltage / 60 Hz. This back-up power generator normally enters into operation automatically whenever an interruption of supply of grid-sourced electricity to the project activity occurs.

- An electricity generation facility fuelled only by collected LFG comprising 21 engine-generator modular package sets (container based assembly) of which each one includes an engine-generator set manufactured by GE Jenbacher, of type 4 model G-420 with individual nameplate installed capacity of 1.4 MW. The new project's electricity generation

[8] It is important to note that as per the design of the CTVA Caieiras landfill, geo-membrane is actually placed in the bottom and sides of the cells of the landfill (prior of disposing MSW in the cell area) for sealing purposes.

[9] The pilot flame system for the installed high temperature enclosed flares are fuelled by LPG which is sourced (when under operation) by 2 LPG cylinders with 45 kg of LPG each.

infrastructure also includes a LFG cooling/treatment unit (electrical LFG chilling and activated-carbon LFG purification/filtering equipment). Each installed container-based modular engine-generator set is connected to 2 high voltage power transformers located in a main power substation (from which generated electricity is exported through the grid). All currently installed modular package sets (21 units) are controlled by a common power generation control infrastructure (incl. a shared main supervisory control and data acquisition system (SCADA) for the whole power generation infrastructure that also became under full operational conditions/status on 11/07/2016).

Also as per the design configuration of the project's new electricity generation infrastructure, all of such individual power transformer units are connected to a shared power substation (also built as part of the new electricity generation facility). Through such power substation (that is connected to the National Electricity Grid of Brazil), net electricity generated by the project's new electricity generation infrastructure are able to be export.

Details about monitoring instruments/equipment under operation during the considered monitoring period are included in Section C.

The following pictures provide overview of the project activity's available infrastructure as per the current configuration of the project activity:

Figure 1 – Aerial view of the project's LFG destruction infrastructure (LFG pipeline, blowers and condensation traps)

Figure 2 – Aerial view of project's electricity generation infrastructure

Figure 3: Aerial partial view of project's electricity generation infrastructure (view of the LFG treatment and cooling facility) + the project's LFG flaring infrastructure

Figure 4: Aerial partial view of the project's electricity generation infrastructure + the project's LFG flaring infrastructure

In general, during the considered monitoring period, the project activity was implemented and has operated under full conformance with the revised design configuration of the activity (as described in the yet to be approved and currently under validation revised version of the PDD).

During the considered monitoring period, the project activity faced events when it became temporarily out of operation due to different reasons (occurred temporarily interruption of the project's electricity generation infrastructure, temporarily interruption in the supply of grid-sourced electricity, occurrence of previously planned or unplanned equipment maintenance/repair events, performance regular calibration events, draining of condensate material from the project's LFG pipeline, identification of unexpected problems in the PLC panel, data communication problems, etc.).

Furthermore, it is also crucial to note that due to lack of operational LFG collection infrastructure covering all the whole area of the UVS-Caieiras landfill, the project activity operated under limited activity level during the whole considered monitoring period (when compared to the quantitative estimates of the project's potential for promoting LFG collection and GHG emission reductions as outlined in the PDD). That is reflected in a relative reduction in the total amount of LFG sent to both the flares and to the project's electricity infrastructure (when compared to related estimates as per the provisions of the PDD).

The UVS-Caieiras landfill is regarded as a very well-designed and well-managed landfill. It currently applies the best practice available in Brazil in terms of MSW landfilling from both design and operation perspectives. As established by the valid environmental and operational permits, all disposed MSW is covered and levelled with the use of heavy equipment (excavators, compacting equipment, etc.). Furthermore, safety requirements are defined and addressed as part of the operation of the UVS-Caieiras landfill by using a preventative approach. No practice to increase the amount of methane generated at the UVS-Caieiras landfill has ever been applied. While the implementation and operation of the project activity, despite of promoting rational and environmental friendly utilization of LFG, also represents real improvement in terms of LFG management at the landfill when compared to the situation prior to the implementation of the project activity (baseline scenario), no change in terms of MSW disposal practice at the UVS-

Caieiras landfill was ever promoted or influenced by the project activity. Further details are included in Section D.2 (under details for the monitoring parameter “Management of SWDS”).

B.2. Post-registration changes[10]

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

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Not applicable. The considered monitoring period does not encompass any occurred deviation from the registered monitoring plan and/or applied CDM baseline methodology for which a request of approval of post-registration changes (PRCs) was previously submitted and approved by the CDM-EB or for which a request of approval of PRCs will be submitted as part of its request for issuance of CERs.

B.2.2. Corrections

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Not applicable. It is however important to note that there are post-registration changes that were previously addressed under request for approval of PRCs with reference PRC-0171-004 (assessment not performed in the context of the verification assessment for the monitoring period encompassed by this Monitoring Report and for which approved by UNFCCC’s CDM-EB is yet to occur). The submission of CER issuance request for the considered monitoring period is fully

[10] As outlined in Section A.1, since 01/07/2016 the project design has also encompassed utilization of collected LFG as gaseous fuel for electricity generation in a new electricity generation infrastructure. The yet under development independent validation opinion assessment for post-registration changes for the inclusion of the new project’s electricity generation infrastructure as a permanent change in the project design is not being performed in the context of the verification assessment for the monitoring period encompassed by this Monitoring Report. As per applicable CDM rules, no CER issuance request for the considered monitoring period will be submitted to UNFCCC prior to the effective approval of such yet under development independent PRC validation opinion assessment.

The following permanent changes in the design of the project activity are encompassed by a revised version of the PDD of which request of approval is yet to be submitted under the “prior approval” process track as per applicable CDM procedures for addressing post-registration changes:

- Gradual/phased implementation of the project’s electricity generation infrastructure (using collected LFG as gaseous fuel for electricity generation) with forecasted final combined nameplate installed capacity of 38.5 MW (upon the conclusion of the implementation of its last phase)) + ancillary equipment/systems (i.e. LFG treatment and cooling facility, power sub-station and control/emergency/fire-fighting system) (initiating in 01/01/2016).
- Implementation of a backup captive off-grid electricity generator (fuelled by diesel) (with nameplate installed capacity of 700 kVA (560 kW for a power factor of 0.8)) on 01/07/2016.

The following permanent changes from the registered monitoring plan are encompassed by a revised version of the PDD of which request of approval is yet to be submitted under the “prior approval” process track as per applicable CDM procedures for addressing post-registration changes:

- Full revision of the applied monitoring and calculation approaches in order to include required monitoring and calculation approaches for determining the following GHG emissions:
  (i) Baseline emissions for methane and baseline emissions for electricity generation for the utilization of collected LFG as gaseous fuel for electricity generation;
  (ii) Project emissions due to the consumption of electricity to be sourced by a backup captive off-grid electricity generator (fuelled by diesel))

dependent on the effective and successful approval by UNFCCC's CDM-EB of such request of approval for PRC validation opinion assessment. [11]

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

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[11] As outlined in Section A.1, since July/2016 the project design has also encompassed utilization of collected LFG as gaseous fuel for electricity generation in a new electricity generation infrastructure. A validation opinion assessment for post-registration changes was performed as an independent assessment for inter-alia the inclusion of the new project's electricity generation infrastructure as a permanent change in the project design It is relevant that such independent PRC validation opinion assessment (for which a request of approval was submitted to UNFCCC on 08/09/2017 under ref. PRC-0171-004) was not performed in the context of the verification assessment for the monitoring period encompassed by this Monitoring Report. As per applicable CDM rules, a CER issuance request for the considered monitoring period will be submitted to UNFCCC only upon the effective and successful approval by UNFCCC of such request of approval for PRC validation opinion assessment.

The following permanent changes in the design of the project activity are encompassed by a revised version of the PDD of which request of approval was submitted under the "prior approval" process track as per applicable CDM procedures for addressing post-registration changes (under UNFCCC ref. PRC-0171-004):

Permanent changes in the design of the project activity:

- Occurred and yet to occur phased implementation of the project's new electricity generation infrastructure (using collected LFG as gaseous fuel for electricity generation) with starting of operation (and forecasted starting of operations) occurring in July/2016, year 2019 and year 2020 with forecasted final combined nameplate installed capacity of 37.8 MW (upon the conclusion of the implementation of its last phase in year 2020)) + ancillary equipment/systems (i.e. LFG treatment and cooling facility, power sub-station and control/emergency/fire-fighting system).
- Occurred installation of a backup captive off-grid electricity generator (fuelled by diesel) (with nameplate installed capacity of 700 kVA (560 kW for a power factor of 0.8)) in July/2016.

Permanent changes from the registered monitoring plan:

- Full revision of the applied monitoring and calculation approaches in order to add additional monitoring requirements and calculation approaches for determining the following emissions as a result of occurred and yet to occur permanent changes in the project design: (i) Baseline emissions for methane (due to combustion of LFG in the project's new electricity generation infrastructure) (ii) Baseline emissions of CO2 (due to displacement of electricity by electricity generated by the project's new electricity generation infrastructure); (iii) Project emissions (due to the consumption of electricity to be sourced by the installed backup captive off-grid electricity generator (fuelled by diesel))

Corrections (that do not affect the project design):

- General text and terminology revision of project description in order to fully comply with the currently applicable requirements for completing the CDM-PDD form (version 10.1) (as established by its attachment "Instructions for completing this form") and to enhance/improve the project design description.
- Minor text improvements (incl. review of statements and correction of previously existent typographic mistakes) in order to improve the overall project description.
- Revision of ex-ante estimates of emission reductions to be achieved by the project activity during its 2nd 7-year crediting period (by inter alia taking into account baseline emissions associated to utilization of collected LFG as gaseous fuel for electricity generation along remaining share of the 2nd 7-year crediting period).
- The name of the landfill hosting the project activity is changed from "CTR Caieiras landfill" to "UVS - Caieiras landfill" reflecting the occurred change in early 2017 of the designation of the landfill hosting the project activity that was made by the project participant and project owner Essencis Soluções Ambientais S.A. as part of the operationalization of the company's commercial, marketing and sustainability strategy.
- Updated contact information details for the project participant Essencis Soluções Ambientais S.A. is added (in line with the latest version of the completed Modalities of Communication (MoC) form for the project activity).
- Details about performed task-force involving capital and labour-intensive maintenance, repair and parts replacement work in existing project's LFG collection infrastructure and operational improvements for such infrastructure held during the period from July/2016 to July/2017 are added in Section A.3.

Not applicable.

B.2.4. Inclusion of monitoring plan

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Not applicable. While the PDD includes a complete monitoring plan, the considered monitoring period does not encompass any inclusion of a monitoring plan for which a request for approval of PRCs was previously submitted/approved by the CDM-EB or for which a request of approval of PRCs will be submitted together with its request for issuance of CERs.

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

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Not applicable. It is however important to note that there are post-registration changes that were previously addressed under request for approval of PRCs with reference PRC-0171-004 (assessment not performed in the context of the verification assessment for the monitoring period encompassed by this Monitoring Report and for which approved by UNFCCC's CDM-EB is yet to occur). The submission of CER issuance request for the considered monitoring period is fully dependent on the effective and successful approval by UNFCCC's CDM-EB of such request of approval for PRC validation opinion assessment[11].

B.2.6. Changes to project design

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Not applicable. It is however important to note that there are post-registration changes that were previously addressed under request for approval of PRCs with reference PRC-0171-004 (assessment not performed in the context of the verification assessment for the monitoring period encompassed by this Monitoring Report and for which approved by UNFCCC's CDM-EB is yet to occur). The submission of CER issuance request for the considered monitoring period is fully dependent on the effective and successful approval by UNFCCC's CDM-EB of such request of approval for PRC validation opinion assessment[11].

SECTION C. Description of monitoring system

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DATA ACQUISITION, STORAGE AND MANAGEMENT SYSTEM

As part of the application of the designed monitoring plan valid for the 2nd 7-year crediting period, monitoring data is automatically measured, processed and recorded with the use of related monitoring instruments/equipment, a Programmable Logic Controller (PLC) unit, and a database (with customized design and configuration) that are all integrated to a data supervisory system (SCADA) of which design and configuration customized to the project activity.

During the considered monitoring period, a PLC unit was utilized for processing the project's monitoring measurements and a MS-Access based database was used for recording and archiving monitoring data.

The project's data supervisor system that handles LFG and flaring related monitoring data is sourced by Elipse Software Ltda. (model: e3). In the second half of 2013, the project's data

supervisor system was upgraded in order to have the project's monitoring system under full compliance with ACM0001 (version 13.0.0) + applicable methodological tools[12].

During the considered monitoring period, continuous measurements of LFG flow to each individual flare and to each engine-generator set of the new electricity generation facility, LFG pressure, LFG temperature, CH_4 content of collected LFG, temperature of the exhaust gas (for each installed flare), status of the flame detector (for each installed flare) and operational status of each engine-generator set were processed by the project's PLC unit and recorded within an every-minute frequency by the project's MS-Access based database.

As part of the implemented data reporting and emission reduction calculation procedures that are applicable for the 2nd 7-year crediting period of the project activity, two sets of data files (with set of LFG and flaring related monitoring records) are generated for each month of considered monitoring period as follows:

- One MS-Excel format spreadsheet file
- One PDF format data file

Both data files contain monitoring records for every 1-month period encompassed by the considered monitoring period. While data in MS-Excel format is handled as a primary data input for the performance of emission reduction calculations (data is used as input data for the compilation of monthly emission reduction calculation spreadsheets that are enclosed to this Monitoring Report), the PDF format files (which also lists/reports all LFG and flaring related monitoring records in table format within an every-minute frequency for each month of the considered monitoring period) are kept in storage and are considered as proof of authenticity of data retrieved from the SQL/MS-Access databases and exported to MS-Excel format data.

The project's data supervisory system (which is linked to the currently available project's MS-Access database) includes in its user interface functionalities for regularly generating both MS-Excel format data as well as PDF format data files upon request of the system user (functions "*Exporta Excel*" and "*Exporta PDF*" respectively).

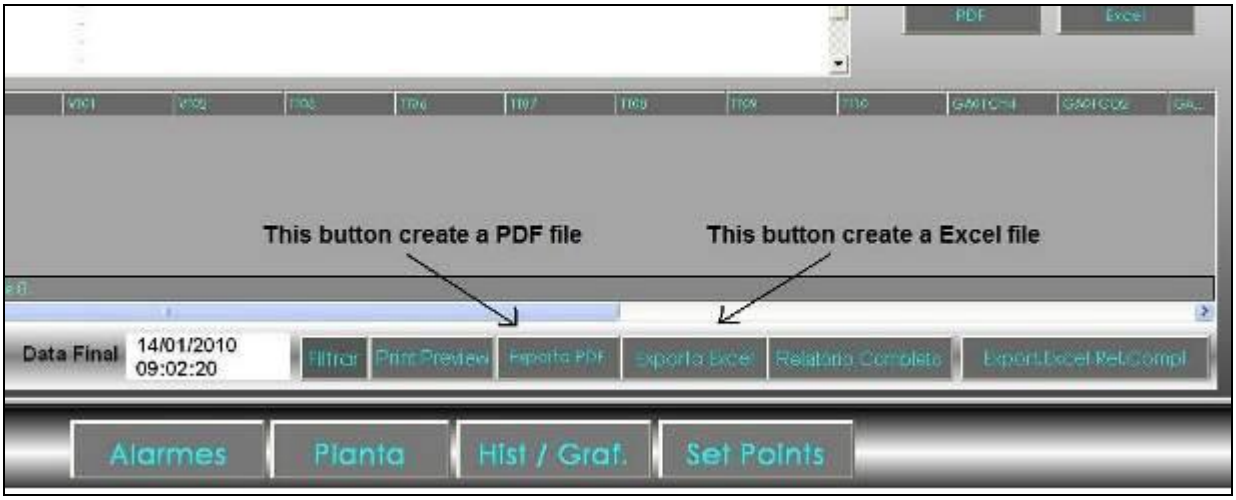


Figure 3 – Zoom view of the buttons (controls) in the user interface of the project's supervisory system that are used to generate MS-Excel format and PDF format files with every minute monitoring data

[12] During the whole 1st 7-year crediting period for the project activity, the project's data supervisor system was configured in order to have the project's monitoring system under compliance with the applied previous version of ACM0001 (version 2).

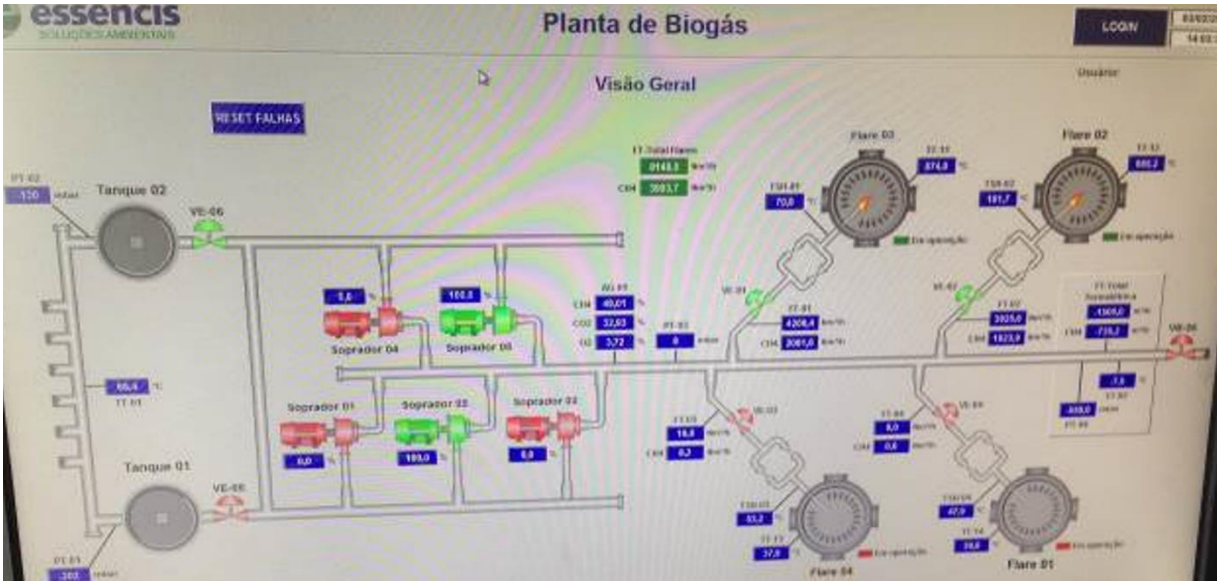


Figure 4 - General view of the screen lay-out of the project's data supervisor system

As per the project's operational procedure valid for the 2nd 7-year crediting period, the following routine (steps) is monthly performed by the project operational staff in order to appropriately report LFG and flaring (temperature of exhaust gas of the flares and flare status) related monitoring records:

1) Every month, a MS-Excel format spreadsheet data file with monitoring records (raw data files) is generated by using the functionality "*Exporta Excel*" of the project's supervisory system. Each generated file includes monitoring data reported for a full month. A PDF format data file with the same monitoring records is also generated for the month in question by using the functionality "*Exporta PDF*" of the project's supervisory system.

2) The content of every monthly raw data file (in MS-Excel format) is used as input data in customized and pre-formatted monthly MS-Excel format emission reduction calculation spreadsheet template/model (designed by the project participant Essencis Soluções Ambientais S.A.). This MS-Excel based template is internally denominated as "*MMYYYY*", where "*MM*" is the number of the month and "*YYYY*" is the year of the input data.

As per applicable and currently valid documented working procedures, the project activity is managed by the CDM Project Superintendent at Essencis Soluções Ambientais S.A. The CDM Project Superintendent supervises the CDM Project supervisor who is the one in charge of all monitoring related activities (handling of data, preparation of the Monitoring Report and emission reduction calculation spreadsheet).

Both the CDM Project Superintendent and the CDM Project supervisor are fully supported by CDM specialists (consultants) from the CDM consultancy company UniCarbo Energia e Biogás Ltda. The operation of the project activity and the application of the monitoring plan is responsibility of the CDM Project Supervisor, who reports all relevant project related issues to the CDM Project Superintendent (operation status of the project activity, results and events, collection and storage of monitoring data, calibration events, and maintenance of equipment). The CDM specialists (consultants) also support the project team in operational and monitoring related issues. The project operational team encompasses staff from both Essencis Soluções Ambientais S.A. and Termoverde Caieiras Ltda[13].

[13] As outlined in the revised version of the PDD, the enterprise "Termoverde Caieiras Ltda." is incorporated and registered as an independent power producer (IPP) as per the rules and procedures of the Brazilian power market and it is the entity that is in charge of the operation of the project's electricity generation infrastructure. The company Solvi Valorização Energética Ltda. is the main equity holder of "Termoverde Caieiras Ltda." While Solvi Valorização Energética Ltda. is per se owned by Solvi Group (www.solvi.com), Essencis Soluções Ambientais S.A. also has Solvi Group as its main shareholder.

The diagram bellow shows the hierarchy for the project management until the end of the considered monitoring period.

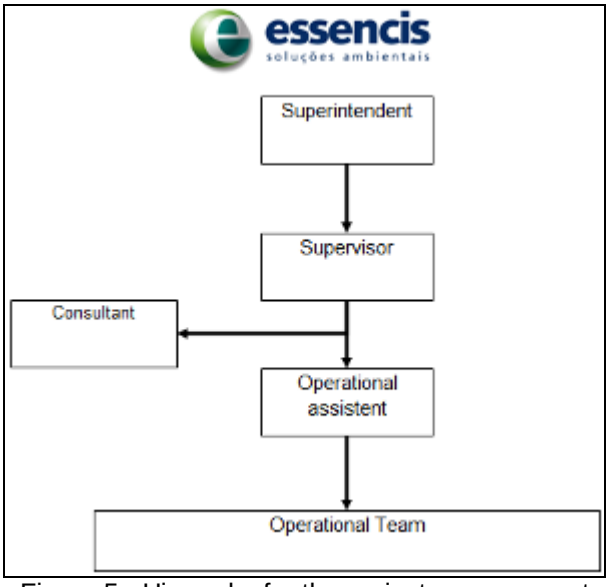


Figure 5 - Hierarchy for the project management of the project activity

The currently valid project's operational and management structure relies on trained staff with responsibilities clearly defined. All collaborators and employees involved with operation of project activity and/or its monitoring are trained internally and/or externally. Training efforts includes *inter alia*:

a) General competence development about LFG generation, collection and flaring;
b) General competence development about utilization of collected LFG as gaseous fuel for electricity generation
c) Review of equipment operational principles and captors;
d) Maintenance and calibration requirements for project's related equipment/instruments;
e) Procedures for data monitoring (incl. data gathering, data handling and data archiving)[14];
e) Emergency and safety procedures.

The schematic diagram below illustrates the monitoring system of the project activity and summarizes the monitoring points for measuring instruments/equipment (under the project design configuration valid until the end of the considered monitoring period):

[14] The revised version of the PDD valid for the 2nd 7-year crediting period (that applies ACM0001 (version 13.0.0) + applicable methodological tools) includes somehow differentiated monitoring requirements (when compared to the PDD valid for the 1st 7-year crediting period (that applies ACM0001 (version 2), of which monitoring requirements were followed by the project's operational staff during the 1st crediting period from year 2007 to 2013). Additional training was thus provided to the project's operational and monitoring staff in order to have such differentiated monitoring requirements being met. The project activity's monitoring infrastructure was also upgraded at the time of its renewal of the crediting period in order to fulfil such additional monitoring and methodological requirements. Furthermore, while the operation of the project's electricity generation infrastructure also demands additional monitoring efforts, additional training was thus also provided to the project's operational and monitoring staff in order to have monitoring requirements for the project's electricity generation infrastructure also being met.

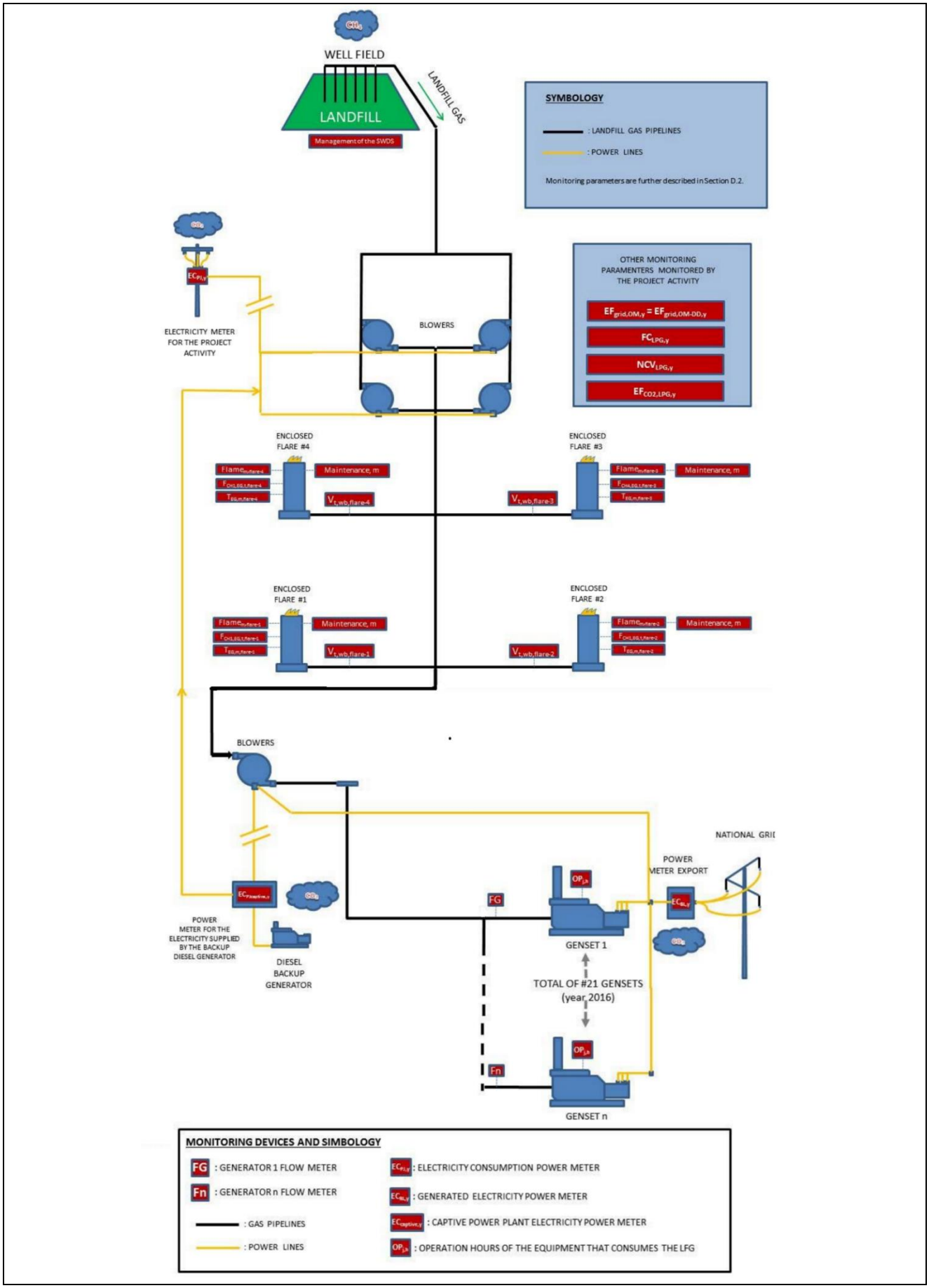


Figure 6 - Schematic diagram for the monitoring system of the project activity under the design configuration valid until the end of the considered monitoring period
(monitoring points for measuring instruments/equipment)

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

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 13.0.0). 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 13.0.0)
Purpose of data/parameter	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/parameter	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/parameter	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 13.0.0) 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.
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Compound	Structure	Molecular mass (kg/kmol)
Nitrogen	N_2	28.0

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): Compound: Methane; Structure: CH_4; Molecular mass (kg/kmol): 16.0
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	P_n
Unit	Pa
Description	Total pressure at normal conditions
Source of data	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/parameter	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/parameter	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/parameter	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/or for grid sourced electricity consumed by the project activity
Source of data	The PDD refers to the applicable default values as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01).
Value(s) applied	3% (for generated electricity exported through the electricity grid the project activity is connected to ($TDL_{grid,export,y}$)) 20% (for electricity imported by the project activity through the electricity grid the project activity is connected to ($TDL_{grid,import,y}$))
Choice of data or measurement methods and procedures	The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) defines, as alternative, default value of 20% for project consumption sources (applicable for determination of project

	emissions due to consumption of grid-sourced electricity by the project activity) and default value of 3% for baseline electricity consumption sources (applicable for the determination of baseline emissions for electricity generation by the project activity). The selection of these default values are under conformance with applicable guidance of ACM0001 (version 13.0.0). It is relevant to note that as per the project design, the amount of electricity to be consumed by the project activity (project electricity consumption sources) to which scenario C of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) refers is smaller than the so-called electricity consumption of baseline electricity consumption sources ($EC_{BL,k,y}$) as per such tool (where $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ,y}$) as defined by ACM0001 (version 13.0.0)). Under these conditions, also considering the 3% default value for electricity imported by the project activity (through the electricity grid the project activity is connected to) in thesis would represent an acceptable alternative. However, as a conservative approach, the generic 20% default value of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) applicable for project consumption sources is selected. This approach results in higher project emissions, thus reducing emission reductions to be achieved by the project activity accordingly.
Purpose of data/parameter	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 new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the National Electricity Grid of Brazil).
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 03.0.0). 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 3.0.0) is selected.
Purpose of data/parameter	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 new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the National Electricity Grid of Brazil).
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 03.0.0). 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 3.0.0) is selected.
Purpose of data/parameter	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 new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the National Electricity Grid of Brazil).
Additional comments	-

Data/Parameter	**$SPEC_{flare}$**
Unit	°C (for temperature values) Nm^3/h (for LFG flow values) Number of days (for maintenance schedule interval values)
Description	Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval.
Source of data	The PDD refers to data as per the flares's designer and 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.
Value(s) applied	Flare 1, Flare 2, Flare 3 and Flare 4:

$SPEC_{flare, Flare 1}$ $SPEC_{flare, Flare 2}$ $SPEC_{flare, Flare 3}$ $SPEC_{flare, Flare 4}$	Min.	Max.
Operational LFG flow for each flare (for continuous operation):	650 Nm^3/h	7,500 $Nm^3/$
Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):	500 °C	1,200 °

	Required minimum frequency for inspection and maintenance service in each flare (incl. inspection in the conditions of the flare isolation ceramics revetment material): — Min. every 6 months Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material in each flare: — after 10 years of regular and appropriate operation
Choice of data or measurement methods and procedures	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 flares, 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.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	All flare specification and operation details/requirements are based on information provided by the equipment manufacturer.

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 selected value is the value calculated by the DNA of Brazil and valid for year 2012 ($EF_{grid,BM,2012}$).
Value(s) applied	0.2010
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/parameter	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 new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the National Electricity Grid of Brazil).
Additional comments	-

Data/Parameter	$PP_{CP,Diesel\text{-}generator}$
Unit	MW
Description	Rated capacity of the installed captive backup electricity generator fuelled by diesel.
Source of data	Name plate capacity of the captive generator, manufacturer's specifications or catalogue references.
Value(s) applied	0.144
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	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 $PP_{CP,Diesel\text{-}generator}$ will only be used in case alternative approach 4 is used for the determination of Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generator (fuelled by Diesel) ($PE_{EC,captive,y}$).

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	-
Purpose of data/parameter	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) ($PE_{EC,captive,y}$).

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/parameter	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 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) ($PE_{EC,captive,y}$).

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)
- 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 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 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, the management of the UVS-Caieiras landfill is on an at least yearly frequency compared against the previously conceived original construction and operational design of the landfill in order to confirm that the overall management and operation for UVS-Caieiras landfill (including relevant aspects related to landfilling practice) were not deliberately modified with the unique aim to increase generation of methane on site. As part of the performed checking, it is monitored whether any practice aiming to increase methane generation in the landfill has occurred or promoted. As required by ACM0001 (version 13.0.0), any change in the management of the landfill after the implementation of the project activity should be justified by referring

	to applicable technical or regulatory specifications.
Source of data	A technical evaluation was performed by the independent 3rd party engineering company "Cepollina Engenheiros Consultores Ltda.". The findings for the performed evaluations are reported in a declaration document issued by such company that is dated 04/08/2016 (a previous evaluation was also performed by Cepollina Engenheiros Consultores Ltda. on 04/08/2016). As part of the performed technical evaluation, the current configuration and operational conditions of the UVS-Caieiras landfill were compared against the previously conceived design and operational conditions of the landfill prior to the implementation of the project activity on the basis of different sources, including inter alia: - Original design documents of the landfill (as described in the documentation required for all phases of the environmental licensing for the UVS-Caieiras landfill); - Applicable local or national regulations - Expertise and experience of "Cepollina Engenheiros Consultores Ltda." with the UVS-Caieiras landfill. Since January 2007 "Cepollina Engenheiros Consultores Ltda." has performed regular technical inspections at the UVS-Caieiras landfill as part of the continuously performed assessment/control of geotechnical stability monitoring for the landfill cells. Such assessments/controls are required to be performed on monthly basis by the competent environmental authority from São Paulo State (Companhia de Tecnologia de Saneamento Ambiental - CETESB) as a prerequisite for the validity of the environmental and safety permit/licensing for the UVS-Caieiras landfill.
Value(s) of monitored parameter	As outlined in the issued internal technical evaluation/declaration report dated 04/08/2016, the previously conceived original design of the landfill (that was conceived prior to the implementation of the project activity) is confirmed as not to being modified during the whole period from 01/02/2007 (date when the project activity started to operate) until 31/12/2016. The issued technical evaluation report confirms that no practices to increase methane generation at the UVS-Caieiras landfill have ever occurred (when compared to management and MSW landfilling practices prior to implementation of the project activity or after its implementation). 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 Brazil (and in other developing and even developed countries) has its own economics, dynamics, politics and related regulations. That makes MSW disposal activity for the UVS-Caieiras landfill and other similar landfills in Brazil completely independent from the CDM mechanism and/or potential revenues associated to the commercialization of CERs generated by project based methane destruction/utilization initiatives implemented in landfill sites. In the particular case of the UVS-Caieiras landfill, it is important to note that the landfill was designed and it has operated inter alia as per terms and conditions of the public service concession contracts for MSW management previously established with the Administration of the Municipality of São Paulo. The design and operation of the UVS-Caieiras landfill is also under conformance with terms and conditions for the environmental licensing that were previously defined and of which indicators/operational requirements are regularly monitored by the competent environmental authority from São Paulo State (CETESB).

	While the occurrence of changes in the quantitative condition related to MSW disposal in this landfill (such as the occurred increment in the amount of disposed MSW in the landfill as explained in the PDD) are completely independent from the CDM project activity, the project activity per se does not represent any incentive for promoting a change in the management of the landfill in order to increase the amount of methane generated in the site. The registered CDM project activity does not encompass any MSW management related measures. Currently, there is still no climate change of waste management policy in Brazil 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 UVS-Caieiras landfill). In this context, it is crucial to note that, regarding the amount of methane that is generated at the UVS-Caieiras landfill and collected by the project activity, as outlined in the PDD (under Footnote 68 (Section B.6.1) and Footnote 84 (Section B.6.2)), significant amount of methane generated at the UVS-Caieiras landfill has unfortunately not been collected and destroyed as part of the operation of the project activity due to the lack of complete LFG collection infrastructure covering all regions of the very large UVS-Caieiras landfill.
Monitoring equipment	Not applicable. No measuring equipment is used for monitoring management of the UVS-Caieiras 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	As required by ACM0001 (version 13.0,0), 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 25 LFG flow meters (one flow meter for each of the 4 installed high temperature enclosed flare and one flow meter for each

	of the 21 engine-generator set of the electricity generation facility).
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (25 flow meters) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) include all records of measurement data of LFG flow sent to each installed high temperature enclosed flare and to each engine-generator set during the considered monitoring period. Measurement data is recorded and reported with an every-minute frequency. While measurements are performed by installed 25 LFG flow meters (one flow meter for each individual installed flare and one for each engine-generator set), the monitoring parameter $V_{t,wb}$ is thus measured, recorded and reported on the basis of the following sub-parameters: - $V_{t,wb,flare-1}$: Volumetric flow of LFG to Flare 1 - $V_{t,wb,flare-2}$: Volumetric flow of LFG to Flare 2 - $V_{t,wb,flare-3}$: Volumetric flow of LFG to Flare 3 - $V_{t,wb,flare-4}$: Volumetric flow of LFG to Flare 4 - $V_{t,wb,genset-1}$: Volumetric flow of LFG to the engine-generator set 1 - $V_{t,wb,genset-2}$: Volumetric flow of LFG to the engine-generator set 2 - $V_{t,wb,genset-3}$: Volumetric flow of LFG to the engine-generator set 3 - $V_{t,wb,genset-4}$: Volumetric flow of LFG to the engine-generator set 4 - $V_{t,wb,genset-5}$: Volumetric flow of LFG to the engine-generator set 5 - $V_{t,wb,genset-6}$: Volumetric flow of LFG to the engine-generator set 6 - $V_{t,wb,genset-7}$: Volumetric flow of LFG to the engine-generator set 7 - $V_{t,wb,genset-8}$: Volumetric flow of LFG to the engine-generator set 8 - $V_{t,wb,genset-9}$: Volumetric flow of LFG to the engine-generator set 9 - $V_{t,wb,genset-10}$: Volumetric flow of LFG to the engine-generator set 10 - $V_{t,wb,genset-11}$: Volumetric flow of LFG to the engine-generator set 11 - $V_{t,wb,genset-12}$: Volumetric flow of LFG to the engine-generator set 12 - $V_{t,wb,genset-13}$: Volumetric flow of LFG to the engine-generator set 13 - $V_{t,wb,genset-14}$: Volumetric flow of LFG to the engine-generator set 14 - $V_{t,wb,genset-15}$: Volumetric flow of LFG to the engine-generator set 15 - $V_{t,wb,genset-16}$: Volumetric flow of LFG to the engine-generator set 16 - $V_{t,wb,genset-17}$: Volumetric flow of LFG to the engine-generator set 17 - $V_{t,wb,genset-18}$: Volumetric flow of LFG to the engine-generator set 18 - $V_{t,wb,genset-19}$: Volumetric flow of LFG to the engine-generator set 19 - $V_{t,wb,genset-20}$: Volumetric flow of LFG to the engine-generator set 20 - $V_{t,wb,genset-21}$: Volumetric flow of LFG to the engine-generator set 21

Monitoring equipment	Measurements of LFG flow sent to each flare are performed by LFG flow meters installed in independent sections of the LFG pipeline located between the centrifugal blowers and each one of the installed 4 high temperature enclosed flares, thus ensuring the flow of LFG sent to each one of the flares is continuously measured. Measurements of LFG flow sent to each one of the 21 engine-generator sets of the project's electricity generation component have been performed by 21 LFG flow meters which are installed in independent sections of the LFG pipeline close to each one of the 21 engine-generator modular package sets (for each engine-generator set, the LFG flow meter is installed next to the set). It is thus ensured that flow of LFG sent to the flare and flow of LFG sent to each element of project's electricity generation component (each engine-generator set) is independently and continuously measured. *Specifications and calibration details for the LFG flow meters used during the considered monitoring period for measuring the flow of LFG sent to the flares:* *Flow meter used for measuring $V_{t,wb,flare-1}$ (Flare 1):* • Manufacturer: Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. • Model: FT-2 • Accuracy: +/-1% • Serial Number: 1412000235 • Instrument internal identification number: FT-01 • Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes the following: "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* • Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years • Dates for performed calibration events valid for the considered monitoring period: 04/06/2014 and 15/07/2016 • Validity of the performed calibration events: The calibration event dated 04/06/2014 is valid until 04/06/2016 (2 years) and the calibration event dated 15/07/2016 is valid until 15/07/2018 (2 years). • Entity/company responsible for performing the calibration events: Both calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Flow meter used for measuring $V_{t,wb,flare-2}$ (Flare 2):* • Manufacturer:Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. • Model: FT-2 • Accuracy: +/-1% • Serial Number: 1412000236 • Instrument internal identification number: FT-02 • Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes the following: "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* • Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years • Dates for performed calibration events valid for the considered

	monitoring period: 04/06/2014 and 25/05/2016 • Validity of the performed calibration events: The calibration event dated 04/06/2014 is valid until 04/06/2016 (2 years) and the calibration event dated 25/05/2016 is valid until 25/05/2018 (2 years). • Entity/company responsible for performing the calibration events: Both calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Flow meter used for measuring $V_{t,wb,flare-3}$ (Flare 3):* • Manufacturer:Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. • Model: FT-2 • Accuracy: +/-1% • Serial Number: 1412000237 • Instrument internal identification number: FT-03 • Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes the following: "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* • Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years • Dates for performed calibration events valid for the considered monitoring period: 04/06/2014 and 15/06/2016 • Validity of the performed calibration events: The calibration event dated 04/06/2014 is valid until 04/06/2016 (2 years) and the calibration event dated 15/06/2016 is valid until 15/06/2018 (2 years) • Entity/company responsible for performing the calibration events: Both calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Flow meter used for measuring $V_{t,wb,flare-4}$ (Flare 4):* • Manufacturer:Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. • Model: FT-2 • Accuracy: +/-1% • Serial Number: 1412000238 • Instrument internal identification number: FT-04 • Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes the following: "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* • Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years • Dates for performed calibration events valid for the considered monitoring period: 04/06/2014 and 08/04/2016 • Validity of the performed calibration events: The calibration event dated 04/06/2014 is valid until 04/06/2016 (2 years) and the calibration event dated 08/04/2016 is valid until 08/04/2018 (2 years) • Entity/company responsible for performing the calibration events: Both calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Specifications and calibration details for the LFG flow meters used for measuring the flow of LFG sent to the engine-generator sets of the project's electricity generation facility:*

21 LFG flow meter sets (each one incl. a measurement element (annubar) and a pressure signal processing + data transmission unit) are installed for measuring LFG flow to the engine-generator sets:

LFG flow meter used for measuring $V_{t,wb,genset-1}$ (engine-generator set 1):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model: 2600T
- Serial number (S/N): 3K646614034712
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-2}$ (engine-generator set 2):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A..
- Model: 2600T
- Serial number (S/N): 3K646614034710
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-3}$ (engine-generator set 3):

Measurement element (annubar):

	- Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A.. - Model: 2600T - Serial number (S/N): 3K646614034700 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-4}$ (engine-generator set 4):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A.. - Model: 2600T - Serial number (S/N): 3K646614034706 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-5}$ (engine-generator set 5):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the

application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A..
- Model: 2600T
- Serial number (S/N): 3K646614034704
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-6}$ (engine-generator set 6):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034698
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-7}$ (engine-generator set 7):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.

- Model:2600T
- Serial number (S/N): 3K646614034704
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-8}$ (engine-generator set 8):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034702
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-9}$ (engine-generator set 9):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034704
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2

	years) *LFG flow meter used for measuring $V_{t,wb,genset-10}$ (engine-generator set 10):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034738 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-11}$ (engine-generator set 11):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034714 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-120}$ (engine-generator set 12):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1%

	- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034720 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-13}$ (engine-generator set 13):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034724 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-14}$ (engine-generator set 14):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034716
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-15}$ (engine-generator set 15):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K64661403718
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG flow meter used for measuring $V_{t,wb,genset-16}$ (engine-generator set 16):

Measurement element (annubar):
- Manufacturer: Rosemount Inc.
- Model: 485 Annubar
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning).

Pressure signal processing + data transmission unit:
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034722
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).

	- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-17}$ (engine-generator set 17):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034742 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-18}$ (engine-generator set 18):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034730 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-19}$ (engine-generator set 19):* *Measurement element (annubar):*

	- Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034728 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-20}$ (engine-generator set 20):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034734 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG flow meter used for measuring $V_{t,wb,genset-21}$ (engine-generator set 21):* *Measurement element (annubar):* - Manufacturer: Rosemount Inc. - Model: 485 Annubar - Accuracy: ±1% - Calibration frequency and maintenance requirements: no regular calibration is required for the annubar element as per declaration of the equipment manufacturer. Anyhow, by taking into account the application for the installed elements, the regional technical representative of the annubar element recommends the performance

	of a dimensional checking (metrology analysis) in the element every 5 years in order to confirm the dimensional integrity of the instrument (this is a required condition for its proper functioning). *Pressure signal processing + data transmission unit:* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034740 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years)
Measuring/reading/recording frequency	Continuous measurements are recorded and reported with an every-minute frequency.
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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The design of the installed LFG flow meters used for measuring the flow of LFG sent to the flares during the considered monitoring period ensures that measurement data is automatically converted and recorded in normal cubic meters per hour (Nm^3/h). Due to that, measurements of LFG pressure and LFG temperature are not required for determining values of the calculation parameter $V_{t,wb,n,flare}$ in the context of calculation of achieved emission reductions. Reported values of $V_{t,wb,flare}$ are thus equivalent to values of $V_{t,wb,n,flare}$ and are thus directly used for the determination of the amount of methane in the LFG flared by the project activity ($F_{CH4,flared,y}$) 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 monthly emission reduction calculation spreadsheets enclosed to this Monitoring Report). For the particular case of the LFG flow meter sets used for continuously measuring the flow of LFG sent to each one of the engine-generator sets, while such instrument sets do not automatically convert measurements in normal cubic meter per hour (Nm^3/h), measurements of LFG pressure and LFG temperature (monitoring parameters "Temperature of the LFG stream in time interval *t"* (T_t) and "Pressure of the LFG stream in time interval *t"* (P_t) respectively) are considered for converting measurements of $V_{t,wb,genset-n}$ into in normal cubic meter per hour (Nm^3/h) ($V_{t,wb,genset-n}$) (where n = 1, 2, 3, 4, 5 and 6) in the context of the determination of values for the calculation parameters $V_{t,wb,n,genset-n}$) (where n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21) as outlined in the monthly emission reduction calculation spreadsheets enclosed to this Monitoring Report).

Data/Parameter	$v_{CH4,t,wb}$
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 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 recordable electronic signal).
Value(s) of monitored parameter	The monthly 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.

Monitoring equipment	*Specifications and calibration details for the installed continuous CH_4 content gas analyzer:* • Manufacturer: BGM Instrumentação Controle e Automação Ltda. • Model: CENTRUM AG 4000 • Accuracy: ±2.0% • Serial Number: NS 53159 • Instrument internal identification number: GA01 • Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed with a maximum interval of 3 months. Although the validity for each performed calibration event is 3 months, as per the applied monitoring practice, equipment has been calibrated within shorter intervals. Dates and validity for performed calibration events valid for the considered monitoring period: •27/06/2016 (valid until 27/09/2016) •04/07/2016 (valid until 04/10/2016) - Entity/company responsible for performing the calibration events: all calibration events were performed by trained responsible staff of the project participant Essencis Soluções Ambientais S.A. by following the applicable internal working procedure titled "*CA.BG.01.05 – Rev 09 Calibração analisador de gases"* (*CA.BG.01.05 – Rev 09* – Calibration of gas analyser). Calibration events valid for the considered monitoring period were performed by using certified span gas cylinders with a known CH_4 composition. Certified span gases utilized for performing the calibration events valid for the considered monitoring period: - Gas cylinders with N_2 with a minimum purity of 99.999%: cylinder S/N 1507099 certificate number IBG02390815, supplied by IBG – Indústria Brasileira de Gases Ltda. - Gas cylinders with a calibration mixture of 5.01 cmol/mol of O_2: cylinder n° S/N 3933516, certificate number IBG00590114, supplied by IBG – Indústria Brasileira de Gases Ltda. - Gas cylinders with a calibration mixture of 60.14 cmol/mol of CO_2: cylinder n° S/N 4849752, certificate number IBG04180814 supplied by IBG – Indústria Brasileira de Gases Ltda. - Gas cylinders with a calibration mixture of 60.14 cmol/mol of CH_4: cylinder n° S/N 35112, certificate number IBG03151015 supplied by IBG – Indústria Brasileira de Gases Ltda.
Measuring/reading/recording frequency	Continuously measurements 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**T_t**
Unit	K
Description	Temperature of the LFG stream in time interval *t*
Measured/calculated/ default	Continuously measured by different LFG temperature sensors installed along the LFG pipeline of the project activity within the flaring facility and electricity generation facility. Measurements are primarily recorded and reported in ^oC. Recorded/reported data is converted into Kelvin and data is also reported in this unit, thus meeting the related monitoring requirement as per the PDD.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (temperature sensor) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes measurement data for T_t that are recorded and reported with an every-minute frequency. While measurements are performed by installed 21 LFG temperature sensors installed along the LFG pipeline of the project activity within the flaring facility and electricity generation facility (one temperature sensor prior the high temperature enclosed flares and, since 11/07/2016, one temperature sensor set for each individual engine-generator set of the electricity generation facility), the monitoring parameter T_t is thus measured, recorded and reported on the basis of the following sub-parameters: - $T_{tflares}$: Temperature of the LFG sent to the Flares - $T_{tgenset-1}$: Temperature of the LFG sent to the engine-generator set 1 - $T_{tgenset-2}$: Temperature of the LFG sent to the engine-generator set 2 - $T_{tgenset-3}$: Temperature of the LFG sent to the engine-generator set 3 - $T_{tgenset-4}$: Temperature of the LFG sent to the engine-generator set 4 - $T_{tgenset-5}$: Temperature of the LFG sent to the engine-generator set 5 - $T_{tgenset-6}$: Temperature of the LFG sent to the engine-generator set 6 - $T_{tgenset-7}$: Temperature of the LFG sent to the engine-generator set 7 - $T_{tgenset-8}$: Temperature of the LFG sent to the engine-generator set 8 - $T_{tgenset-9}$: Temperature of the LFG sent to the engine-generator set 9 - $T_{tgenset-10}$: Temperature of the LFG sent to the engine-generator set 10 - $T_{tgenset-11}$: Temperature of the LFG sent to the engine-generator set 11 - $T_{tgenset-12}$: Temperature of the LFG sent to the engine-generator set 12 - $T_{tgenset-13}$: Temperature of the LFG sent to the engine-generator set 13 - $T_{tgenset-14}$: Temperature of the LFG sent to the engine-generator set 14 - $T_{tgenset-15}$: Temperature of the LFG sent to the engine-generator set 15 - $T_{tgenset-16}$: Temperature of the LFG sent to the engine-generator set 16 - $T_{tgenset-17}$: Temperature of the LFG sent to the engine-generator set 17 - $T_{tgenset-18}$: Temperature of the LFG sent to the engine-generator set 18 - $T_{tgenset-19}$: Temperature of the LFG sent to the engine-generator set 19 - $T_{tgenset-20}$: Temperature of the LFG sent to the engine-generator set 20 - $T_{tgenset-21}$: Temperature of the LFG sent to the engine-generator set 21

Monitoring equipment	Measurements of temperature of LFG which is sent to the flares are performed by installed LFG temperature sensor that is installed in the main LFG pipeline within the flaring facility in a section between the centrifugal blowers and the high temperature enclosed flares. Since 11/07/2016, measurements of temperature of LFG which is sent to each one of the 21 engine-generator sets of the project's electricity generation component are performed by 21 LFG temperature sensor sets with each one being installed in an independent section of the LFG pipeline for each engine-generator modular package set prior next to the engine-generator set within the electricity generation facility. It is thus ensured that the temperature of LFG which is sent to the flare and to each element of project's electricity generation component (each engine-generator set) is independently and continuously measured. *LFG temperature sensors used for measuring $T_{tflares}$ (Flares):* • Manufacturer: Pressgage instrumentos de Medição e Controle Ltda. • Model: STP-100 • Accuracy: ±1.0% • Serial Number (S/N): 161054 • Instrument internal identification number: TT02 • Calibration frequency: as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity. • Calibration frequency (as per the application of the monitoring plan): yearly • Dates for performed calibration events valid for the considered monitoring period: The temperature sensor with Serial Number 161054 was calibrated on 17/01/2016 (Calibration Certificate 16105460976/16, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). • Validity of the performed calibration event: The calibration event dated 17/01/2016 is valid until 17/01/2017 (1 year) *LFG temperature sensor sets used for measuring $T_{tgenset-n}$ (engine-generator sets) since 11/07/2016:* *LFG temperature sensor set used for measuring $T_{tgenset-1}$ (engine-generator set 1):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0009 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 (Calibration Certificate E15PT000964885/16) - Validity of performed calibration events: 18/10/2018 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-2}$ (engine-generator set 2):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0008 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 (Calibration Certificate E15PT000864885/16) - Validity of performed calibration events: 18/10/2018 (2 years)

	LFG temperature sensor used for measuring $T_{tgenset-3}$ (engine-generator set 3): - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0003 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 (Calibration Certificate E15PT000364885/16) - Validity of performed calibration events: 18/10/2018 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-4}$ (engine-generator set 4):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0006 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 (Calibration Certificate E15PT000664885/16) - Validity of performed calibration events: 18/10/2018 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-5}$ (engine-generator set 5):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0013 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 (Calibration Certificate E15PT000564885/16) - Validity of performed calibration events: 18/10/2018 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-6}$ (engine-generator set 6):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0002 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 (Calibration Certificate E15PT000264885/16) - Validity of performed calibration events: 18/10/2018 (2 years) *LFG temperature sensor set used for measuring $T_{tgenset-7}$ (engine-generator set 7):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E16TP0576 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E16TP057664885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-8}$ (engine-generator set 8):*

	- Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0004 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT000464885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-9}$ (engine-generator set 9):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E E15PT0016 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT001664885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-10}$ (engine-generator set 10):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0021 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT002164885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-11}$ (engine-generator set 11):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 09/10/2014 (Calibration Certificate EL14/0598) - Validity of performed calibration events: 09/10/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-12}$ (engine-generator set 12):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0013 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT001364885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor set used for measuring $T_{tgenset-13}$ (engine-generator set 13):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0024

	- Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT002464885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-14}$ (engine-generator set 14):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0011 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT001164885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-15}$ (engine-generator set 15):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0012 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT001266992/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-16}$ (engine-generator set 16):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0014 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT001464885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-17}$ (engine-generator set 17):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E16TP0579 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 09/10/2014 (Calibration Certificate E16TP057966992/16) - Validity of performed calibration events: 09/10/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-18}$ (engine-generator set 18):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E16TP0577 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years

	- Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E16TP057764885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor set used for measuring $T_{tgenset-19}$ (engine-generator set 19):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0017 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT001764885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-20}$ (engine-generator set 20):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E15PT0023 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E15PT002364885/16) - Validity of performed calibration events: 24/07/2016 (2 years) *LFG temperature sensor used for measuring $T_{tgenset-21}$ (engine-generator set 21):* - Manufacturer: Elsi s.r.l. - Model: Y1-SEM203/P - Serial number (S/N): E16TP0580 - Accuracy: ± 0.5 ºC - Calibration frequency and maintenance requirements: Every 2 years - Dates for performed calibration events valid for the considered monitoring period: 24/07/2014 (Calibration Certificate E16TP058064885/16) - Validity of performed calibration events: 24/07/2016 (2 years)
Measuring/reading/recording frequency	Continuously measurements 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**P_t**
Unit	Pa
Description	Pressure of the LFG stream in time interval *t*
Measured/calculated/ default	Continuously measured by LFG pressure sensors installed along the LFG pipeline within the flaring facility and electricity generation facility. Measurements of pressure of LFG are primarily recorded and reported in mbar. Recorded/reported data is converted into Pascal and data is also reported in this unit, thus meeting the related monitoring requirement as per the PDD.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (pressure sensors) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes measurement data for P_t that are recorded and reported with an every-minute frequency. While measurements are performed by installed 21 LFG pressure sensors installed along the LFG pipeline of the project activity within the flaring facility and electricity generation facility (one pressure sensor prior the high temperature enclosed flares and, since 11/07/2016, one pressure sensor for each individual engine-generator set of the electricity generation facility), the monitoring parameter P_t is thus measured, recorded and reported on the basis of the following sub-parameters: - $P_{tflares}$: Pressure of the LFG sent to the Flares - $P_{tgenset-1}$: Pressure of the LFG sent to the engine-generator set 1 - $P_{tgenset-2}$: Pressure of the LFG sent to the engine-generator set 2 - $P_{tgenset-3}$: Pressure of the LFG sent to the engine-generator set 3 - $P_{tgenset-4}$: Pressure of the LFG sent to the engine-generator set 4 - $P_{tgenset-5}$: Pressure of the LFG sent to the engine-generator set 5 - $P_{tgenset-6}$: Pressure of the LFG sent to the engine-generator set 6 - $P_{tgenset-7}$: Pressure of the LFG sent to the engine-generator set 7 - $P_{tgenset-8}$: Pressure of the LFG sent to the engine-generator set 8 - $P_{tgenset-9}$: Pressure of the LFG sent to the engine-generator set 9 - $P_{tgenset-10}$: Pressure of the LFG sent to the engine-generator set 10 - $P_{tgenset-11}$: Pressure of the LFG sent to the engine-generator set 11 - $P_{tgenset-12}$: Pressure of the LFG sent to the engine-generator set 12 - $P_{tgenset-13}$: Pressure of the LFG sent to the engine-generator set 13 - $P_{tgenset-14}$: Pressure of the LFG sent to the engine-generator set 14 - $P_{tgenset-15}$: Pressure of the LFG sent to the engine-generator set 15 - $P_{tgenset-16}$: Pressure of the LFG sent to the engine-generator set 16 - $P_{tgenset-17}$: Pressure of the LFG sent to the engine-generator set 17 - $P_{tgenset-18}$: Pressure of the LFG sent to the engine-generator set 18 - $P_{tgenset-19}$: Pressure of the LFG sent to the engine-generator set 19 - $P_{tgenset-20}$: Pressure of the LFG sent to the engine-generator set 20 - $P_{tgenset-21}$: Pressure of the LFG sent to the engine-generator set 21

Monitoring equipment	Measurements of pressure of LFG which is sent to the flares are performed by installed LFG pressure sensor that is installed in the main LFG pipeline within the flaring facility in a section between the centrifugal blowers and the high temperature enclosed flares. Since 11/07/2016, measurements of pressure of LFG which is sent to each one of the 21 engine-generator sets of the project's electricity generation component are performed by 21 LFG pressure sensors with each one being installed in an independent section of the LFG pipeline for each engine-generator modular package set prior next to the engine-generator set within the electricity generation facility. It is thus ensured that the pressure of LFG which is sent to the flare and to each element of project's electricity generation component (each engine-generator set) is independently and continuously measured. *LFG pressure sensors used for measuring $P_{tflares}$ (Flares):* • Manufacturer: Pressgage instrumentos de Medição e Controle Ltda. • Model: TPI-PRESS • Accuracy: ±1.5% • Serial Number: 683612 • Instrument internal identification number: PT002 • Calibration frequency (as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity • Calibration frequency (as per the application of the monitoring plan): yearly • Dates for performed calibration events valid for the considered monitoring period: The pressure sensor with Serial Number 683612 was calibrated on 17/01/2016 (Calibration Certificate 1758660976/16, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). • Validity of the performed calibration events: The calibration event dated 17/01/2016 is valid until 17/01/2017 (1 year) *LFG pressure sensors (each one encompassing pressure signal processing + data transmission unit) used for measuring $P_{tgenset-n}$ (engine-generator sets) since 25/07/2016:* *LFG pressure sensor used for measuring $P_{tgenset-1}$ (engine-generator set 1):* - Manufacturer: ABB S.p.A. - Model: 2600T - Serial number (S/N): 3K646614034712 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-2}$ (engine-generator set 2):* - Manufacturer: ABB S.p.A.. - Model: 2600T - Serial number (S/N): 3K646614034710 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG pressure sensor used for measuring $P_{tgenset-3}$ (engine-generator set 3):
- Manufacturer: ABB S.p.A..
- Model: 2600T
- Serial number (S/N): 3K646614034700
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG pressure sensor used for measuring $P_{tgenset-4}$ (engine-generator set 4):
- Manufacturer: ABB S.p.A..
- Model: 2600T
- Serial number (S/N): 3K646614034706
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG pressure sensor used for measuring $P_{tgenset-5}$ (engine-generator set 5):
- Manufacturer: ABB S.p.A..
- Model: 2600T
- Serial number (S/N): 3K646614034704
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG pressure sensor used for measuring $P_{tgenset-6}$ (engine-generator set 6):
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034698
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG pressure sensor used for measuring $P_{tgenset-7}$ (engine-generator set 7):
- Manufacturer: ABB S.p.A.
- Model:2600T
- Serial number (S/N): 3K646614034704
- Accuracy: ±1%
- Calibration frequency and maintenance requirements: Every 2 years (minimum).
- Dates for performed calibration events valid for the considered monitoring period: 19/10/2016
- Validity of the performed calibration event: valid until 19/10/2018 (2 years)

LFG pressure sensor used for measuring $P_{tgenset-8}$ (engine-generator set 8):

	- Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034702 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-9}$ (engine-generator set 9):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034704 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-10}$ (engine-generator set 10):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034738 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-11}$ (engine-generator set 11):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034714 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-12}$ (engine-generator set 12):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034720 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-13}$ (engine-generator set 13):* - Manufacturer: ABB S.p.A. - Model:2600T

	- Serial number (S/N): 3K646614034724 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-14}$ (engine-generator set 14):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034716 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-15}$ (engine-generator set 15):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K64661403718 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-16}$ (engine-generator set 16):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034722 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-17}$ (engine-generator set 17):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034742 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-18}$ (engine-generator set 18):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034730 - Accuracy: ±1%

	- Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-19}$ (engine-generator set 19):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034728 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-20}$ (engine-generator set 20):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034734 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years) *LFG pressure sensor used for measuring $P_{tgenset-21}$ (engine-generator set 21):* - Manufacturer: ABB S.p.A. - Model:2600T - Serial number (S/N): 3K646614034740 - Accuracy: ±1% - Calibration frequency and maintenance requirements: Every 2 years (minimum). - Dates for performed calibration events valid for the considered monitoring period: 19/10/2016 - Validity of the performed calibration event: valid until 19/10/2018 (2 years)
Measuring/reading/recording frequency	Continuously measurements 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

<table>
<tr><td>Data/Parameter</td><td>$EC_{PJ,y}$</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Amount of grid electricity consumed by the project activity during the year y</td></tr>
<tr><td>Measured/calculated/ default</td><td>Continuously measured by electricity meter.</td></tr>
<tr><td>Source of data</td><td>During the whole considered monitoring period, consumption of grid-sourced electricity by the project activity was measured continuously by the same bi-directional electricity meter used for monitoring “Amount of electricity generated using LFG by the project activity in year y” ($EC_{BL,y}$).</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Monthly records of grid-sourced electricity consumption valid for the considered monitoring period:
<table>
<tr><th>Month</th><th>Amount of consumed grid-sourced electricity (MWh)</th></tr>
<tr><td>Jan. 2017</td><td>346.757</td></tr>
<tr><td>Feb. 2017</td><td>497.372</td></tr>
<tr><td>Mar. 2017</td><td>378.629</td></tr>
<tr><td>Apr. 2017</td><td>0.261</td></tr>
<tr><td>May 2017</td><td>1.771</td></tr>
<tr><td>Jun. 2017</td><td>2.948</td></tr>
</table>
</td></tr>
</table>

Monitoring equipment	*Specifications and calibration details for the installed electricity meter:* • Manufacturer: Manufacturer: KRON Instrumentos Elétricos Ltda. • Model: MULT-K • Accuracy: ±0.2% • Serial Number: 465025 • Calibration frequency (as specified by the monitoring methodology/tool): As per the PDD, all monitoring equipment must be calibrated periodically. The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" establishes the following regarding maintenance and calibration for electricity meters: "*(...) meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO)*". • Calibration frequency (as per the recommendation of the meter manufacturer): it is important to note that the installed meter is approved/certified by INMETRO (The Brazilian national authority for metrology and standardization issues), and it is thus in conformance with INMETRO's requirements for maintenance and testing of electricity meters. According to the instrument manufacturer, the meter is to be calibrated every 5 years. A calibration frequency of 5 years was adopted. • Date of valid calibration events: Electricity meter: 19/03/2012 (Calibration Certificate:R-0702/12, issued by Naka Comércio e Indústria de Instrumentação Industrial Ltda. • Validity of the performed calibration events: the calibration event dated 19/03/2012 is valid until 19/03/2017 (5 years)
Measuring/reading/recording frequency	Accumulated values for continuous measurements of consumption of grid-sourced electricity are recorded once a month. Continuous measurements of consumption of grid-sourced electricity as performed by installed bi-directional electricity meter are automatically transmitted, aggregated and recorded by the Brazilian Chamber of Electric Energy Commercialization (CCEE). Accumulated measurement records are reported every month.
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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comments	-

<table>
<tr><td>Data/Parameter</td><td>$EC_{BL,y}$</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Amount of electricity generated using LFG by the project activity in year y</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured as part of the operation of the project activity by applying appropriate electricity meter(s).</td></tr>
<tr><td>Source of data</td><td>Measurement records from 2 installed electricity meters that are maintained by the local electricity transmission/distribution company name Companhia Estadual de Distribuição de Energia Elétrica – CEEE-D, with related electricity measurements being performed, recorded and transmitted under conformance with requirements and rules of the Brazilian Chamber of Electric Energy Commercialization (CCEE)[15].</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Monthly records of electricity generated by the project activity valid for the considered monitoring period:
<table>
<tr><th>Month</th><th>Amount of electricity generated using LFG (kWh)</th></tr>
<tr><td>Jan. 2017</td><td>19,679,607</td></tr>
<tr><td>Feb. 2017</td><td>17,711,496</td></tr>
<tr><td>Mar. 2017</td><td>19,494,178</td></tr>
<tr><td>Apr. 2017</td><td>18,861,600</td></tr>
<tr><td>May 2017</td><td>19,002,165</td></tr>
<tr><td>Jun. 2017</td><td>18,462,721</td></tr>
</table></td></tr>
</table>

[15] The Brazilian Chamber of Electric Energy Commercialization (CCEE) was created under the Federal Law 10,848, of March 2004 as a private and not-for profit institution with the responsibilities of administrating both regulated and free contracting environments for electricity generation under direct regulation and inspection of the Brazilian National Regulatory Agency for Electricity (ANEEL). CCEE has inter alia the main attribution of keeping records of the electricity contracting and acquire online measuring data of all market agents in the Brazilian interconnected electricity system.

Monitoring equipment	*Specification of the bi-directional electricity meters (located in the power substation that the project's electricity generation infrastructure is connected to) which is operated and maintained by the local electricity transmission/distribution company name Companhia Estadual de Distribuição de Energia Elétrica – CEEE-D:* *Electricity meter 1:* - Manufacturer: Schneider Electric - Model: ION 8650 - Serial Number: MW-1502A891-02 - Accuracy: ±0.2%. - Calibration frequency and maintenance requirements: Every 5 years - Date for performed calibration event valid for the considered monitoring period: 07/05/2015 - Validity of the performed calibration event: valid until 06/05/2020 (5 years) *Electricity meter 2:* - Manufacturer: Schneider Electric - Model: ION 8650 - Serial Number: MW-1502A157-02 - Accuracy: ±0.2%. - Calibration frequency and maintenance requirements: Every 5 years - Date for performed calibration event valid for the considered monitoring period: 07/05/2015 - Validity of the performed calibration event: valid until 06/05/2020 (5 years)
Measuring/reading/recording frequency	Accumulated values for continuous measurements of net electricity generation exported through the electricity grid are recorded once a month. Continuous measurements of net electricity generation as performed by installed electricity meter are automatically transmitted, aggregated and recorded by the Brazilian Chamber of Electric Energy Commercialization (CCEE). Accumulated measurement records are reported every month.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	-
Purpose of data/parameter	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 National Electricity Grid of Brazil).
Additional comments	-

Data/Parameter	$\mathbf{EF_{grid,OM,y}}$ = $\mathbf{EF_{grid,OM\text{-}DD,y}}$
Unit	tCO_2/MWh
Description	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y*
Measured/calculated/	Calculated (based on official monthly values as calculated and published by

default	the DNA of Brazil).
Source of data	Value for year 2016 is selected. Selected value is the average of monthly official values as calculated and currently made available (published) by the DNA of Brazil. Monthly official values are made available online: http://www.mct.gov.br/upd_blob/0240/240983.html
Value(s) of monitored parameter	0.6228 tCO_2/MWh
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Values are calculated annually.
Calculation method (if applicable)	Value applicable for year 2016 is calculated by the DNA of Brazil as per applicable guidance of the calculation method "dispatch data analysis operating margin CO_2 emission factor" of the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	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 new electricity generation facility which would otherwise be generated by existing grid-connected power plants (and addition of new power generation units) within the National Electricity Grid of Brazil).
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: - $Op_{genset-1,h,y}$: 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 - $Op_{genset-15,h,y}$: Operation of the engine-generator 15 - $Op_{genset-16,h,y}$: Operation of the engine-generator 16 - $Op_{genset-17,h,y}$: Operation of the engine-generator 17 - $Op_{genset-18,h,y}$: Operation of the engine-generator 18 - $Op_{genset-19,h,y}$: Operation of the engine-generator 19 - $Op_{genset-20,h,y}$: Operation of the engine-generator 20 - $Op_{genset-21,h,y}$: Operation of the engine-generator 21
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 Essencis Soluções Ambientais 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/parameter	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 National electricity grid of Brazil.
Additional comments	-

Data/Parameter	**$F_{CH4,EG,t}$**
Unit	kg
Description	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*
Measured/calculated/ default	Measurements are performed by a third party accredited entity.
Source of data	Related measurements and calculations were performed by the independent third party inspection service company "Merieux NutriSciences / Bioagri Ambiental Ltda." (measurements performed on 07/12/2016 and 22/06/2017 (Flare 4), 06/12/2016 and 23/06/2017 (Flare 1), 05/12/2016 and 22/06/2017 (Flare 2), 17/02/2017 and 22/06/2017 (Flare 3). Biannual measurements of mass flow of methane in the exhaust gas are performed on the basis of measurements of CH_4 concentration in a collected gas sample + measurements of speed of exhaust gas in the upper section of the flares with one hour of duration each. Measurements were performed as per applicable guidance of the following standards: • US-EPA Method 18 – Measurement of Gaseous Organic Compound Emission by Gas Chromatography (available online: https://www3.epa.gov/ttnemc01/promgate/m-18.pdf); • CETESB L9.221 - "Pipelines and chimneys in stationary emission sources- Sampling points determination procedure) (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.221.pdf) • CETESB L9.222 - "Pipelines and chimneys in stationary emission sources – Determination of speed and outflow of gases) (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.222.pdf) • CETESB L9.223 - "Pipelines and chimneys in stationary emission sources – Determination of dry molecular mass and the excess of the air flow gas" (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.223.pdf) • CETESB L9.224 - "Pipelines and chimneys in stationary emission sources – Determination of humidity of effluents" (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.224.pdf)
Value(s) of monitored parameter	While biannual related measurements were performed for each one of the installed 4 flares, the monitoring parameter $F_{CH4,EG,t}$ is thus measured, recorded and reported on the basis of the following sub-parameters: - $F_{CH4,EG,t,flare-1}$: Mass flow of methane in the exhaust gas of Flare 1 - $F_{CH4,EG,t,flare-2}$: Mass flow of methane in the exhaust gas of Flare 2 - $F_{CH4,EG,t,flare-3}$: Mass flow of methane in the exhaust gas of Flare 3 - $F_{CH4,EG,t,flare-4}$: Mass flow of methane in the exhaust gas of Flare 4 For the determination of values of $F_{CH4,EG,t}$, average the accumulated mass of methane measured during one hour of continuous measurements are considered (average of every-minute measurements). The table below summarizes the performed biannual determination of $F_{CH4,EG,t}$ for each one of the installed flares valid for the considered monitoring period:

	<table><tr><th>Flare</th><th>Dates of performed measurements</th><th>Company responsible for the performance of measurements</th><th>Identified value of $F_{CH4,EG,t,flare-n}$</th></tr><tr><td rowspan="2">Flare 1 ($F_{CH4,EG,t,flare-1}$)</td><td>06/12/2016</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0287</td></tr><tr><td>23/06/2017</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0463</td></tr><tr><td rowspan="2">Flare 2 ($F_{CH4,EG,t,flare-2}$)</td><td>05/12/2016</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0794</td></tr><tr><td>22/06/2017</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0283</td></tr><tr><td rowspan="2">Flare 3 ($F_{CH4,EG,t,flare-3}$)</td><td>17/02/2017</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0463</td></tr><tr><td>22/06/2017</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.6810</td></tr><tr><td rowspan="2">Flare 4 ($F_{CH4,EG,t,flare-4}$)</td><td>07/12/2016</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0537</td></tr><tr><td>22/06/2017</td><td>Merieux NutriSciences / Bioagri Ambiental Ltda.</td><td>0.0187</td></tr></table>
Monitoring equipment	Measurements were performed by the independent 3rd party inspection service company “Merieux NutriSciences / Bioagri Ambiental Ltda.” using appropriated chromatographer and a pitot tube.
Measuring/reading/recording frequency	Biannual
Calculation method (if applicable)	-
QA/QC procedures	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company’s ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS). The independent 3rd party inspection service company Merieux NutriSciences / Bioagri Ambiental Ltda. Is a licensed independent third party inspections services company specialized in inspections and testing of air emissions from stationary sources. In Brazil, operation of inspection entities and labs are regulated by the Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO) (the Brazilian national authority for metrology and certification affairs).

Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**$T_{EG,m}$**
Unit	^{o}C
Description	Temperature in the exhaust gas of the enclosed flare in minute *m*
Measured/calculated/ default	Continuously measured by thermocouples installed in the upper section of the 4 flares (one thermocouple for each installed high temperature enclosed flare).
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (thermocouples) (with recordable electronic signal).
Value(s) of monitored parameter	Values for each one of the installed 4 high temperature enclosed flares are reported in the monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report). Measurement data is recorded and reported with an every-minute frequency. While measurements are performed by 4 thermocouples (one thermocouple installed in the upper section of each individual installed flare), the monitoring parameter $T_{EG,m}$ is measured, recorded and reported on the basis of the following sub-parameters: - $T_{EG,m,flare-1}$: Temperature in the exhaust gas of Flare 1 - $T_{EG,m,flare-2}$: Temperature in the exhaust gas of Flare 2 - $T_{EG,m,flare-3}$: Temperature in the exhaust gas of Flare 3 - $T_{EG,m,flare-4}$: Temperature in the exhaust gas of Flare 4

Monitoring equipment	*Specifications and calibration details for the installed/utilized thermocouples:* *Thermocouple used for measuring $T_{EG,m,flare-1}$ (Flare 1):* • Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. • Model: NKTC-3000, type N • Accuracy: ±0.75% • Serial Number: 099160 • Instrument internal identification number: TT11 • Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity • Calibration frequency (as per the application of the monitoring plan): yearly • Calibration Dates: 27/02/2015 (Calibration Certificate 7755/2015, issued by Pakari Indústria e Serviços LTDA.) and 17/01/2016 (Calibration Certificate 09916060270/16, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). • Validity of the performed calibration events: The calibration event dated 27/02/2015 is valid until 27/02/2016 (1 year) and the calibration event dated 17/01/2016 is valid until 17/01/2017 (1 year) *Thermocouple used for measuring $T_{EG,m,flare-2}$ (Flare 2):* • Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. • Model: NKTC-3000, type N • Accuracy: ±0.75% • Serial Number: 099157 • Instrument internal identification number: TT12 • Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity • Calibration frequency (as per the application of the monitoring plan): yearly • Calibration Dates: 27/02/2015 (Calibration Certificate 7753/2015, issued by Pakari Indústria e Serviços LTDA.) and 17/01/2016 (Calibration Certificate 09915760270/16, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). • Validity of the performed calibration events: The calibration event dated 27/02/2015 is valid until 27/02/2016 (1 year) and the calibration event dated 17/01/2016 is valid until 17/01/2017 (1 year) *Two thermocouples of the same model were used alternately for measuring $T_{EG,m,flare-3}$ (Flare 3) during the considered monitoring period. Their specifications are as follows:* • Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. • Model: NKTC-3000, type N • Accuracy: ±0.75% • Serial Numbers / period in use within the considered monitoring period: 099158 – installed during the period from 01/01/2016 to 17/01/2016. 169027 – installed during the period from 17/01/2016 to 30/06/2016 • Instrument internal identification number: TT13 • Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity • Calibration frequency (as per the application of the monitoring plan): yearly

	• Calibration Dates: Thermocouple with Serial Number 099158 - 11/03/2015 (Calibration Certificate 7751/2015, issued by Pakari Indústria e Serviços LTDA.) Thermocouple with Serial Number 169027 - 17/01/2016 (Calibration Certificate 16902760270/16, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). • Validity of the performed calibration events: The calibration event for the thermocouple with Serial Number 099158 dated 11/03/2015 is valid until 11/03/2016 (1 year) and the calibration event for the thermocouple with Serial Number 169027 dated 17/01/2016 is valid until 17/01/2017 (1 year) *Thermocouple used for measuring $T_{EG,m,flare-4}$ (Flare 4):* • Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. • Model: NKTC-3000, type N • Accuracy: ±0.75% • Serial Number: 099159 • Instrument internal identification number: TT14 • Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity • Calibration frequency (as per the application of the monitoring plan): yearly • Calibration Dates: 11/03/2015 (Calibration Certificate 7752/2015, issued by Pakari Indústria e Serviços LTDA.) and 17/01/2016 (Calibration Certificate 09915960270/16, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). • Validity of the performed calibration events: The calibration event dated 11/03/2015 is valid until 11/03/2016 (1 year) and the calibration event dated 17/01/2016 is valid until 17/01/2017 (1 year)
Measuring/reading/recording frequency	Continuously measurements are recorded/reported every minute.
Calculation method (if 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Measurements outside the operational temperature specified/recommended by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. As part of the monitoring procedure, these events are noted in the site records along with any corrective action that was implemented to correct the issue. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met.

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 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 4 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 4 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 - $Flame_{m,flare-4}$: Flame detection in Flare 4

Monitoring equipment	*Specifications and calibration details for the installed/utilized UV Flame detectors:* *UV Flame detector for measuring* $Flame_{m,flare-1}$ *(Flare 1):* • Manufacturer: SELCON Sistemas Eletrônicos de Controle Ltda. • Model: SEL-SV-UL-K4 • Serial Number: 323730808 • Instrument internal identification number: UV01 • Calibration frequency: No calibration is required as the equipment has a self-checking function. *UV Flame detector for measuring* $Flame_{m,flare-2}$ *(Flare 2):* • Manufacturer: SELCON Sistemas Eletrônicos de Controle Ltda. • Model: SEL-SV-UL-K4 • Serial Number: 55600905 • Instrument internal identification number: UV02 • Calibration frequency: No calibration is required as the equipment has a self-checking function. *UV Flame detector for measuring* $Flame_{m,flare-3}$ *(Flare 3):* • Manufacturer: Honeywell Analytics Ltd. • Model: C7061 • Serial Number: R7861 • Instrument internal identification number: UV03 • Calibration frequency: No calibration is required as the equipment has a self-checking function. *UV Flame detector for measuring* $Flame_{m,flare-4}$ *(Flare 4):* • Manufacturer: SELCON Sistemas Eletrônicos de Controle Ltda. • Model: SEL-SV-210230-K6 • Serial Number: 565400312 • Instrument internal identification number: UV04 • Calibration frequency: No calibration is required as the equipment has a self-checking function.
Measuring/reading/recording frequency	Continuously measurements 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Not applicable

Data/Parameter	**$Maintenance_y$**
Unit	Calendar dates
Description	Maintenance events completed in year *y* as monitored by the project

	participants.
Measured/calculated/ default	-
Source of data	Maintenance logs
Value(s) of monitored parameter	The following relevant maintenance events (inspection and maintenance services) are applicable for the flares during the considered monitoring period: - 03/08/2015: General inspection/maintenance service on Flares 1, 2, 3 and 4 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flames, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the LFG injectors, checking of painting conditions). - 17/01/2016: General inspection/maintenance service on Flares 1, 2, 3 and 4 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flames, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the LFG injectors, checking of painting conditions). - 01/06/2016: General inspection/maintenance service on Flare 3 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flames, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the LFG injectors, checking of painting conditions). - 09/06/2016: General inspection/maintenance service on Flares 1 and 4 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flames, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the LFG injectors, checking of painting conditions). - 22/06/2016: General inspection/maintenance service on Flare 3 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flames, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the LFG injectors, checking of painting conditions). As per the applied maintenance practice for the project activity, general inspection/maintenance services on the flares are opportunely performed during planned or unplanned interruptions of operation of the flares within a time interval between 2 performed inspection/maintenance services events never higher than 6 months. After the project's commissioning, the isolation ceramics revetment material of the Flare 1 and Flare 2 were replaced once in February 2009 and

	February 2012 respectively. For Flares 3 and Flare 4 (which were installed in July 2011 and February 2012 respectively), the isolation ceramics revetment material was not yet replaced. The expected lifetime for the isolation ceramics revetment material for the flares is of at least 10 years (as established in details for the ex-ante determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$)). Performed maintenance and overhauling services in the flare are performed under by specialized technical service team under conformance with maintenance requirements for the flares (as established by equipment manufacturer) and as required by the ex-ante determined parameter $SPEC_{flare}$. Further details about the parameter $SPEC_{flare}$ are included in Section D.1.
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Not applicable.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	The maintenance event logs and documentation for the whole project activity are recorded as per requirement of the company's ISO 9001 and ISO 14001 certified quality and control (QA/QC) and environmental management (EMS) system that is implemented for activities undertaken at the UVS-Caieiras landfill.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($SPEC_{flare}$).

Data/Parameter	**$FC_{LPG,y}$**
Unit	Ton
Description	Quantity of LPG consumed by the project activity in year *y*
Measured/calculated/ default	Measured.
Source of data	Monitored values of $FC_{LPG,y}$ are based on measurements performed by the local LPG distribution company Cia Ultragas S.A. as part of LPG delivery events.
Value(s) of monitored parameter	As per the adopted monitoring procedure, the total amount of LPG consumed by the project activity during the considered monitoring period is 270 kg (0.270 ton) of LPG. Thus, $FC_{LPG,y} = 0.270\ ton_{LPG}$ LPG was consumed for lighting/igniting the flares (flare pilot). The reported value corresponds to all the LPG acquired during or before the considered

	monitoring period (in the present case 6 cylinders of 45 kg of LPG were acquired by the project participant), conservatively assuming that all the LPG was used during the monitoring period. .
Monitoring equipment	*Monitoring details for "Amount of consumed LPG" ($FC_{LPG,y}$)*: LPG consumption was monitored based on measurements performed by the local LPG distribution company Cia Ultragaz S.A. using the weight scale of which specifications are provided below. The adopted weighing procedure is as per working procedure IT-CO.61.0008 of the ISO9001 certified QA/QC management system of Cia Ultragaz S.A. *Specifications and calibration details for the installed weight scale for measurements of $FC_{LPG,y}$:* • Manufacturer: Mettler-Toledo Inc. • Model: 2180 • Capacity: max. 250 kg • Accuracy: ± 50g • Serial Number: 10423008 • Calibration frequency (as specified by the monitoring methodology/tool): The monitoring plan of the PDD and ACM0001 (version 13.0.0) do not specify any calibration frequency requirements for the weight scales. As per the PDD, all equipment must be calibrated periodically. As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO). • Date of valid calibration: 28/11/2014 (Calibration Certificate 5778/14). • Entity/company responsible for the performed calibration events: Grupo Caieiras Balanças • Validity of the performed calibration events: The calibration event dated 28/11/2014 is valid until 28/11/2017 (3 years).
Measuring/reading/recording frequency	Amount of LPG is measured upon the supply of cylinders of LPG with 45 kg capacity each.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	The amount of consumed LPG is cross-checked with internal records of cost expenditures for fuel LPG as per the internal financial/accounting management system of Essencis Soluções Ambientais S.A. 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 Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of project emissions (due to consumption of LPG by the project activity).
Additional comments	-

Data/Parameter	$NCV_{LPG,y}$
Unit	GJ/ton LPG
Description	Net calorific value of the fuel LPG
Measured/calculated/ default	Default value is selected.
Source of data	National default value as per the Brazilian National Energetic Balance Report for year 2016 (Balanço Energético Nacional (BEN) – 2016) / Table VIII.9 – Specific Mass and Heating Values (Higher Heating Value). This annual report is the latest issued version and it is based on data valid for year 2015. This official document was published by the public entity Empresas de Pesquisas Energéticas (EPE). While create and established in accordance with the Federal Law 10.847 of 15/03/2004, the EPE is a governmental entity that undertakes energy planning related investigation and research services. The BEN-2016 report is available online: https://ben.epe.gov.br/BENRelatorioFinal.aspx?anoColeta=2016&anoFimColeta=2015 Reported value in kcal/kg is converted into GJ/ton.
Value(s) of monitored parameter	46.5
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	In accordance with the PDD, as national default value is considered, an every year monitoring frequency is thus applied.
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 in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of project emissions (due to consumption of LPG by the project activity)
Additional comments	-

Data/Parameter	$EF_{CO2,LPG,y}$
Unit	tCO_2/GJ LPG
Description	CO_2 emission factor of fuel LPG in year *y*
Measured/calculated/ default	Default value is selected.
Source of data	Value is selected as per 2006 IPCC Guidelines on National GHG Inventories (applicable value at upper limit of uncertainty at 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy)).

Value(s) of monitored parameter	0.0656
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	In accordance with the PDD, as IPCC default value is considered, an every year monitoring frequency is thus applied.
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 in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data/parameter	Calculation of project emissions (due to consumption of LPG by the project activity)
Additional comments	-

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).
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meters.
Value(s) of monitored parameter	0 MWh

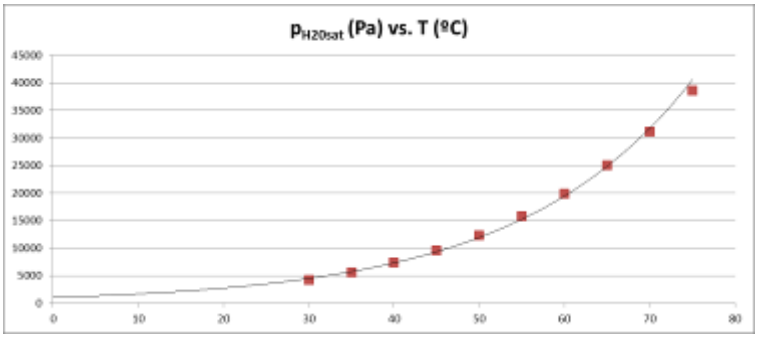
<table>
<tr><td>Monitoring equipment</td><td>- Manufacturer: Schneider Electric
- Model: PM820MG
- Serial Number: 26207716
- Class: ±0.5
- Accuracy: ±0.5%
Calibration events valid for the considered monitoring period:
<table><tr><th>Serial Number:</th><th>Calibration certificate number:</th><th>Calibration date:</th><th>Validity of the calibration event</th></tr><tr><td>26207716</td><td>KD201505000002</td><td>13/05/2015</td><td>12/05/2017</td></tr></table>Calibration frequency and/or maintenance requirements: 2 years</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous measurements performed by installed electricity meters are recorded/reported every hour.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures</td><td>Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed in accordance with detailed working instructions that are included in the company’s ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of project emissions.</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data/Parameter	$p_{H2O,t,Sat}$
Unit	Pa
Description	Saturation pressure of H_2O at temperature T_t in time interval *t*
Measured/calculated/ default	Default values as per selected literature.
Source of data	Data selected as per the literature “*Fundamentals of Classical Thermodynamics*”. Authors: Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 3rd Edition 1986. Published by John Wiley & Sons, Inc.
Value(s) of monitored parameter	$p_{H2O,t,Sat}$ is determined as a function of temperature of LFG (T_t by the equation: $p_{H2O,t,sat} = 1{,}031.3 * e^{(0.049 * Tt)}$, with a correlation coefficient of $R^2 = 0.998$. Further details are presented below in “Calculation Method”.

<table>
<tr><td>Monitoring equipment</td><td>Not applicable.</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Not applicable.</td></tr>
<tr><td>Calculation method
(if applicable)</td><td>The Absolute Vapor Pressure of Water was obtained from the mentioned literature and is presented in the following table within the rage of interest for the required calculations:

<table>
<tr><th>Temperature</th><th>$p_{H2O,t,Sat}$</th></tr>
<tr><td>ºC</td><td>Pa</td></tr>
<tr><td>30</td><td>4,246</td></tr>
<tr><td>35</td><td>5,628</td></tr>
<tr><td>40</td><td>7,384</td></tr>
<tr><td>45</td><td>9,593</td></tr>
<tr><td>50</td><td>12,349</td></tr>
<tr><td>55</td><td>15,758</td></tr>
<tr><td>60</td><td>19,940</td></tr>
<tr><td>65</td><td>25,030</td></tr>
<tr><td>70</td><td>31,190</td></tr>
<tr><td>75</td><td>38,580</td></tr>
</table>

The following graphic represents the above data and the regression calculated to adjust data:



As $p_{H2O,t,Sat}$ is a function of temperature and best represented by an exponential function, the exponential regression method is applied to the above data and the following equation is obtained:

$p_{H2O,t,sat} = 1{,}031.3 * e^{(0.049 * Tt)}$

This equation represents the above data with a correlation coefficient of $R^2 = 0.998$.

Thus, by applying the above equation, $p_{H2O,t,sat}$ is determined as a function of the temperature.</td></tr>
<tr><td>QA/QC procedures</td><td>Not applicable.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Additional comments</td><td>It is important to note that $p_{H2O,t,Sat}$ is only used in the context of the determination of the methane mass flow in the residual gas (in a dry basis)</td></tr>
</table>

	for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured (parameter $F_{CH4,RG,t}$). The calculations of every-minute values of $p_{H2O,t,Sat}$ for the 2 time periods during which the flare efficiency is measured is thus presented only in the flare efficiency calculation spreadsheet. "*MR 13 - Caieiras - V.2 - 27.10.2016 – FE*".

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 achieved by the project activity during the considered monitoring period:

- Volumetric flow of LFG stream in time interval t on a dry basis ($V_{t,db}$)
- Volumetric fraction of CH_4 in the collected LFG in time interval t on a dry basis ($v_{CH4,t,db}$)
- Mass flow of the LFG stream in time interval t on dry basis ($M_{t,db}$)
- 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* ($EF_{CO2,Diesel,y}$)

D.3. Implementation of sampling plan

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Not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

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Under conformance with provisions and calculation approaches of the PDD, baseline emissions (BE_y) for the considered monitoring period 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 CTVA Caieiras 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 82,395 MWh (rounded value). Related monitoring details for the monitoring parameter $EC_{BL,y}$ are included in Section D.2.

$TDL_{grid,y}$ Average technical transmission and/or distribution losses for providing electricity to the grid and/or for grid sourced electricity consumed by the project activity. For the particular case of determination of $BE_{EC,y}$, $TDL_{,grid,y}$ is ex-ante determined as being 3% ($TDL_{grid,export,y}$).

$EF_{EL,grid,y}$ 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*. As per the applied monitoring procedure, the selected value for the monitoring parameter $EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$ (0.6228 tCO_2/MWh) represents to the official average value for year (vintage) 2016 as calculated and made public available by the DNA of Brazil. Further details about the monitoring parameter $EF_{grid,OM}$ are included in Section D.2.

$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year *y*. The value for $EF_{grid,BM,y}$ is ex-ante determined as 0.2010 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 0.3065 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 42,576 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 ACM0001 (version 13.0.0), the determination of $BE_{CH4,y}$ is based on the amount of methane that is actually captured and combusted (destroyed) by the project activity and also by taking into account 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 conventional LFG destruction system. In addition, the effect of methane oxidation (that, as per ACM0001 (version 13.0.0), 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. 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. 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:

$$F_{CH4,BL,y} = 0.2 * F_{CH4,PJ,capt,y}$$

Where:

$F_{CH4,PJ,capt,y}$ Amount of methane collected by the project activity.

In the particular case of the project activity, $F_{CH4,PJ,capt,y}$ 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 parameters $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$*").

$F_{CH4,sent,flare,y}$ Amount of methane in the LFG which is sent to the flares. Details for the determination of every-minute values for $F_{CH4,sent\_flare,y}$ are presented below (under "*Determination of every-minute values for the calculation parameters $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$*").

For the considered monitoring period, the accumulated value for $F_{CH4,BL,y}$ is calculated as 6,992 tCH_4.

$F_{CH4,PJ,y}$ 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 $F_{CH4,EL,y}$ for each individual engine-generator set during the 190-day share of the considered monitoring period that is encompassed by electricity generation are presented below (under "*Determination of every-minute values for the calculation parameters $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$*").

$F_{CH4,flared,y}$ Amount of methane in the LFG flared by the project activity (in tCH_4). In accordance with calculation guidance included in the PDD and by following applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", for each individual flare every-minute values for $F_{CH4,flared,y}$ are determined as the difference between the amount of methane supplied to the flares and residual methane emissions from combustion of LFG in the flares, as follows:

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

Where:

$F_{CH4,sent\_flare,y}$	Amount of methane in the LFG which is sent to the flares. Details for the determination of every-minute values for $F_{CH4,sent\_flare,y}$ for each individual flare are presented below (under "*Determination of every-minute values for the calculation parameters $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$*").
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream. Details for the determination of every-minute values for $PE_{flare,y}$ for each individual flare are presented below (under "*Determination of $PE_{flare,y}$*").

Determination of every-minute values for the calculation parameters $F_{CH4,sent\_flare,y}$ and $F_{CH4,EL,y}$:
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 flares and to the electricity generation facility)[17] is the selected option for determination of values of $F_{CH4,sent\_flare,y}$ valid for each installed flare (calculation sub-parameters $F_{CH4,sent\_flare,y,flare-1}$, $F_{CH4,sent\_flare,y,flare-2}$, $F_{CH4,sent\_flare,y,flare-3}$ and $F_{CH4,sent\_flare,y,flare-4}$) and independent values of $F_{CH4,EL,y}$ (applicable for each individual engine-generator set of the electricity generation facility (based on the calculation of the sub-parameters $F_{CH4,EL,y,genset-1}$, (…) , $F_{CH4,EL,y,genset-21}$).

Determination of $F_{CH4,sent\_flare,y}$:
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) for each installed flare is determined as follows:

$$F_{CH4,sent\_flare,y,flare-n} = F_{CH4,t,flare-n} = V_{t,wb,n,flare-n} * v_{CH4,t,wb} * \rho_{CH4,n}$$

Where:

Sulfix "*Flare-n*": (flare in question: Flare 1, Flare 2, Flare 3 and Flare 4)

$V_{t,wb,n,flare-n}$	Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis at normal conditions. For the considered monitoring period, every-minute values of the calculation parameter $V_{t,wb,n,flare-n}$ valid for each flare (calculation sub-parameters $V_{t,wb,n,flare-1}$, $V_{t,wb,n,flare-2}$, $V_{t,wb,n,flare-3}$ and $V_{t,wb,n,flare-4}$) are measured and reported (in Nm^3 wet gas/h) in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period (and enclosed to this Monitoring Report).

[17] It is relevant to note that the PDD states the following regarding the calculation approach for values of $F_{CH4,sent\_flare,y}$:

> "*Applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" will be applied to determine $F_{CH4,sent\_flare,y}$ 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."*

While in the particular case of the project activity, during the considered monitoring period, volumetric flow of the gaseous stream (LFG) valid for each flare is already measured in Nm^3 wet gas/h (normal conditions), the following assumption is valid:

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

Where:

$V_{t,wb,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis for flare *n* (n = 1, 2, 3 and 4).

Note: 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), monitoring of "Pressure of the LFG stream in time interval t" (P_t) and "Temperature of the LFG stream in time interval *t*" (T_t) are not required for the determination of $V_{t,wb,n,flare-n}$. Moreover, the ex-ante determined parameters Temperature at normal conditions (T_n) and Total pressure at normal conditions (P_n) are not considered either.

$v_{CH4,t,wb}$ Volumetric fraction of CH_4 in the gaseous stream in time interval *t* on a wet basis. As per the applied monitoring procedure, every-minute values of the monitoring parameter $v_{CH4,t,wb}$ (in m^3 of CH_4 / m^3 of wet LFG) are reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period (and enclosed to this Monitoring Report). Further monitoring details about the monitoring parameter $v_{CH4,t,wb}$ are included 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 registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

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 registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

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 registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

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 registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

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

While for each installed flare, the calculated every-minute values of $F_{i,t,flare-n}$ are equivalent to every-minute values for $F_{CH4,sent\_flare,y,flare-n}$, (where n = 1, 2, 3 and 4) the monthly emission reduction calculation spreadsheets valid for the considered monitoring period include the determination of every minute values of $F_{CH4,sent\_flare,y,flare-n}$ that is applicable for each one of the installed 4 high temperature enclosed flares for which collected LFG is sent for combustion.

$F_{CH4,EL,y}$ (calculation sub-parameters $F_{CH4,EL,y,genset-1}$, (…), $F_{CH4,EL,y,\ genset-21}$):

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) to each individual engine-generator set of the project's electricity generation infrastructure ($F_{CH4,EL,y,genset-1}$, (…), $F_{CH4,EL,y,\ genset-21}$) is determined as follows:

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

Where:

n The engine-generator set in question (n = 1, 2, 3, …, 21)

$V_{t,wb,n,genset-n}$ Volumetric flow of the gaseous stream (LFG) to the engine-generator set n in time interval *t* on a wet basis at normal conditions. For the considered monitoring period, every-minute values of $V_{t,wb,n.genset-n}$ (calculation sub-parameters $V_{t,wb,n,genset-1}$, $V_{t,wb,n,genset-2}$, $V_{t,wb,n,genset-3}$, (…),$V_{t,wb,n,genset-21}$) are calculated and reported (in Nm^3 wet gas/h) in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period (and enclosed to the Monitoring Report).

While in the particular case of the project activity, during the considered monitoring period, measurements of volumetric flow of the gaseous stream (LFG) sent to each one of the engine-generator sets *n* are not processed and recorded in Nm^3 of wet gas/h (normal conditions), values of $V_{t,wb,n.genset-n}$ (calculation sub-parameters $V_{t,wb,n,genset-1}$, $V_{t,wb,n,genset-2}$, $V_{t,wb,n,genset-3}$, (…),$V_{t,wb,n,genset-21}$) valid for each minute encompassed by the 190-day share of the considered monitoring period after the occurred starting of operation of the project's electricity generation component is thus calculated as follows:

Under conformance with related provisions of the registered PDD, the following equation is used to convert the measured volumetric flow of LFG sent to the engine-generator sets from actual conditions to normal conditions of temperature and pressure:

$$V_{t,wb,n,genset-n} = V_{t,wb,genset-n} * (T_n / T_{tgenset-n}) * (P_{tgenset-n} * P_n)$$

Where:

$V_{t,wb,genset-n}$ Volumetric flow of the gaseous stream (LFG) to the engine-generator set n in time interval *t* on a wet basis at actual conditions. Every-minute values of $V_{t,wb,genset-n}$ for each engine-generator set *n* (where *n* = 1, 2, 3, (…), 21) are reported (in m³ wet gas/h) in the monthly emission reduction calculation spreadsheets enclosed to the Monitoring Report.
Further monitoring details about the sub-parameters $V_{t,wb,genset-n}$ are included under details for the monitoring parameter $V_{t,wb,flare}$ in Section D.2.

$T_{tgenset-n}$ Temperature of the gaseous stream in time interval *t*. Every-minute values of $T_{tgenset-n}$ for each engine-generator set *n* (where *n* = 1, 2, 3, (…), 21) are reported (in Kelvin) in the monthly emission reduction calculation spreadsheets enclosed to the Monitoring Report. Further monitoring details about the sub-parameters $T_{tgenset-n}$ are included under details for the monitoring parameter T_t in Section D.2.

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 registered PDD.

$P_{tgenset-n}$ Pressure of the gaseous stream in time interval *t*. Every-minute values of $P_{tgenset-n}$ for each engine-generator set n (where *n* = 1, 2, 3, (…), 21) are reported (in Pa) in the monthly emission reduction calculation spreadsheets enclosed to the Monitoring Report. Further monitoring details about the sub-parameters $P_{tgenset-n}$ are included under details for the monitoring parameter P_t in Section D.2.

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 registered PDD.

n Number of the installed engine-generator set. n = 1, 2, 3, (…), 21.

All related calculation are presented in the monthly emission reduction calculation spreadsheets that are enclosed to the Monitoring Report.

$v_{CH4,t,wb}$ 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. $\rho_{CH4,n}$ is calculated as 0.7156650 $kgCH_4$ / m^3CH_4 as reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period. Details about the determination of $\rho_{CH4,n}$ are presented above.

Determination of $PE_{flare,y}$:

$PE_{flare,y}$ is determined for each one of the installed flares ($PE_{flare,y,flare-1}$, $PE_{flare,y,flare-3}$ and $PE_{flare,y,flare-4}$) by following the applicable stepwise guidance of the methodological tool "Project emissions from flaring" (version 2). Every minute values for $PE_{flare,y,flare-1}$, $PE_{flare,y,flare-2}$, $PE_{flare,y,flare-3}$ and $PE_{flare,y,flare-4}$ are determined as a function of every-minute records of mass flow of methane sent to the flare in question (for each flare *n*, $F_{CH4,RG,m,flare-n} = F_{CH4,sent\_flare,y,flare-n}$, where *n* = 1, 2, 3 and 4) as well as based on calculated values for flare efficiency ($\eta_{flare,m} = \eta_{flare,calc,y}$) for each one of the flares as follows:

$$PE_{flare,y} = GWP_{CH4} * \sum_{m=1}^{525,600} F_{CH4,RG,m} * (1 - \eta_{flare,m}) * 10^{-3}$$

Where:

$F_{CH4,RG,m}$ Methane mass flow in the residual gas for the considered flare. For each minute *m* of the considered monitoring period and for each individual flare *n*, values for $F_{CH4,RG,m}$ are equal to every-minute reported measurement records of the calculation sub-parameter "Amount of methane in the LFG which is sent to the flares" ($F_{CH4,sent\_flare,y}$) that is valid for each individual flare (calculation sub-parameters $F_{CH4,sent\_flare,y,flare-1}$, $F_{CH4,sent\_flare,y,flare-2}$, $F_{CH4,sent\_flare,y,flare-3}$ and $F_{CH4,sent\_flare,y,flare-4}$)).

$\eta_{flare,m}$ Flare efficiency in minute m. For the considered monitoring period, $\eta_{flare,m}$ is calculated based on performed measurements of methane in exhaust gas of the flare by following applicable guidance as per Option B (Measured flare efficiency) of the methodological tool "Project emissions from flaring" from which the following related guidance of the PDD is applied:

> *"(…)*
> *Option B: Measured flare efficiency:*
> *For each one of the high temperature enclosed flares which are part of the project activity, the flare efficiency in the minute m is determined as a value which is calculated based on performed related measurements ($\eta_{flare,m} = \eta_{flare,calc,m}$) when the following two conditions are simultaneously met (in order to demonstrate that the flare is operating):*
> *(1) The temperature of the exhaust gas of the flare (monitoring parameter $T_{EG.m}$) and the flow rate LFG to the flare (monitoring parameter $F_{CH4,RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m*
> *(2) Flame is detected in the flare in minute m (monitoring parameter $Flame_m$).*
>
> *Otherwise $\eta_{flare,m}$ is set as 0%.*
> *(…)"*

In applying Option B, the project participants chose to determine $\eta_{flare,calc,m}$ for each individual flare by applying guidance of Option B.1 (with related measurements of emission of methane in the exhaust gas of the flare being performed by an accredited independent third party entity (e.g. an independent inspection/analysis service company) on a biannual basis).

In order to calculate the flare efficiency value for each flare ($\eta_{flare,calc,m}$) biannual values for the monitoring parameter "Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t" ($F_{CH4,EG,t}$)) are considered as per the following calculation formula:

Option B.1: Biannual measurement of the flare efficiency":

For each individual flare, the calculated flare efficiency $\eta_{flare,calc,y}$ is determined as follows:

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

Where:

$F_{CH4,EG,t}$ Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*. As established by the PDD, for the considered monitoring period, $F_{CH4,EG,t}$ was measured for each individual flare as per appropriate national or international standard during 2 sets of measurement events. For each flare, 1-hour length biannual measurements of residual methane in the exhaust gas of the flare and measurements of speed of exhaust gas of the flare (for the determination of flow of methane exhaust gas of the flares) were performed by the third party inspection service company "Merieux NutriSciences" / "Bioagri Ambiental Ltda.", which is an inspection service company specialized in emission measurements and air pollution inspections.

t The two time periods in year y during which the flare efficiency is measured, each a minimum of one hour.

$F_{CH4,RG,t}$ Mass flow of methane in the residual gas on a dry basis at reference conditions in the time period *t.* Details for the determination of every-minute values for $F_{CH4,RG,t}$ for each individual flare are presented below.

Determination of $F_{CH4,RG,t}$:

As per the applicable guidance of the methodological tool "Project emissions from flaring" and also as per the PDD, the methane mass flow in the residual gas (in a dry basis) for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured shall be calculated by following the applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". Values for the parameter $F_{CH4,RG,t}$ valid for each flare (calculation sub-parameters $F_{CH4,RG,t,flare-1}$, $F_{CH4,RG,t,flare-2}$, $F_{CH4,RG,t,flare-3}$ and $F_{CH4,RG,t,flare-4}$) are thus calculated as follows:

$$F_{CH4,RG,t,flare-n} = V_{t,db,n,flare-n} * v_{CH4,t,db} * \rho_{CH4,n}$$

Where:

$\rho_{CH4,n}$ Density of greenhouse gas *i* (*i* = CH_4) in the gaseous stream (LFG) at normal conditions. Further details for the determination of $\rho_{CH4,n}$ are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*".

$v_{CH4,t,db}$ Volumetric fraction of greenhouse gas *i* (*i* = CH_4) in the gaseous stream in a time interval *t* on a dry basis. The following is stated in footnote 3 of the methodological tool

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

> "*(…) Flow measurement on a dry basis is not feasible at reasonable costs for a wet gaseous stream, so there will be no difference in the readings for volumetric fraction in wet basis analyzers and dry basis analyzers (…)*."

Thus, every-minute values of $v_{CH4,t,db}$ are regarded as equal to every-minute values of the monitoring parameter $v_{CH4,t,wb}$ (for which further details are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*").

$V_{t,db,n,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a dry basis for flare *n* (n = 1, 2, 3 and 4). As per Option B of the applicable methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", the volumetric flow of the gaseous stream on a dry basis for each flare (calculation sub-parameters $V_{t,db,n,flare-1}$, $V_{t,db,n,flare-2}$, $V_{t,db,n,flare-3}$ and $V_{t,db,n,flare-4}$) is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

$$V_{t,db,n,flare-n} = V_{t,wb,n,flare-n} / (1 + v_{H2O,t,db})$$

Where:

$V_{t,wb,n,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis at normal conditions. Further details of $V_{t,wb,n,flare-n}$ are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*"

$v_{H2O,t,db}$ Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", $v_{H2O,t,db}$ is calculated as follows:

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

Where:

MM_{H2O} Molecular mass of H_2O. MM_{H2O} is ex-ante determined as 18.0152 kg/kmol. Further details about the ex-ante determined parameter MM_{H2O} are included

in Section D.1 and in the registered PDD.

$MM_{t,db}$ Molecular mass of the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", $MM_{t,db}$ is calculated as follows:

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

Where:

k All gases, except H_2O, contained in the gaseous stream (e.g. N_2, CO_2, O_2, CO, H_2, CH_4, N_2O, NO, NO_2, SO_2, SF_6 and PFCs). See simplification below.

$V_{k,t,db}$ Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "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 gaseous stream. However, as a simplification, the volumetric fraction of only the 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."*

ACM0001 (version 13.0.0) 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 measured and the difference to 100% is just considered as pure nitrogen. Further details for the determination of the volumetric fraction of CH_4 in the gaseous stream ($V_{k,t,db}$ = $v_{CH4,t,db}$) are presented above under the calculation parameter $v_{CH4,t,db}$.

MM_k Molecular mass of gas *k* (*k* = CH_4 and N_2). The molecular mass of CH_4 and N_2 are ex-ante determined as 16.04 and 28.01, respectively. Further details about the ex-ante determined values for MM_k are included in Section D.1 and in the registered PDD.

$m_{H2O,t,db}$ Absolute humidity in the gaseous stream in time interval *t* n a dry basis. As per Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", by conservatively assuming that the gaseous stream is saturated ($m_{H2O,t,db}$ = $m_{H2O,t,db,Sat}$), $m_{H2O,t,db}$ is calculated as follows [18]:

[18] It is important to note that the simplified calculation for the absolute humidity of the gaseous stream ($m_{H2O,t,db}$) presented in Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be applied by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. Footnote 4 of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" states the following:

> "*An assumption that the gaseous stream is saturated is conservative for the situation that the mass flow of greenhouse gas I is underestimated (applicable for calculating baseline emissions). Conversely, an assumption that the gas stream is dry is conservative for the situation that the greenhouse gas t is overestimated (applicable for calculating project emissions).*"

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

Where:

MM_{H2O} Molecular mass of H_2O. MM_{H2O} is ex-ante determined as 18.0152 kg/kmol. Further details about the ex-ante determined values for MM_{H2O} are included in Section D.1 and in the registered PDD.

P_t Absolute pressure of the gaseous stream in time interval *t*. Further monitoring details for P_t are included in Section D.2.

$MM_{t,db}$ Molecular mass of the gaseous stream in a time interval *t* on a dry basis. Further details for the determination of $MM_{t,db}$ are presented above.

$p_{H2O,t,Sat}$ Saturation pressure of H_2O at temperature T in time *t*, Further monitoring details about the monitoring parameter $p_{H2O,t,Sat}$ are included in Section D.2.

In summary, for the considered monitoring period, the following values of $\eta_{flare,m} = \eta_{flare,calc,y}$ were obtained:

Determined (calculated) values for $\eta_{flare,m} = \eta_{flare,calc,y}$ for the considered monitoring period	Flare 1 ($\eta_{flare,calc,y,flare-1}$)	Flare 2 ($\eta_{flare,calc,y,flare-2}$)	Flare 3 ($\eta_{flare,calc,y,flare-3}$)	Flare 4 ($\eta_{flare,calc,y,flare-4}$)
	0.9999424	0.9999327	0.9993625	0.9999177

In this particular case, $m_{H2O,t,db}$ is calculated for the determination of the mass flow of methane in the residual gas on a dry basis during the time period t ($F_{CH4,RG,t}$). While $F_{CH4,RG,t}$ is used for the determination of the parameter $PE_{flare,y}$ (project emissions from flaring the residual gas), the assumption that the gaseous stream is dry (conservatively applicable for calculating project emissions) would not be conservative in this case as an overestimation of the amount of methane in the residual gas would actually increase the calculated efficiency of the flares, thus resulting in a reduction of $PE_{flare,y}$ and consequent increment of emission reductions.

As per the applied monitoring procedure, compliance with operational and maintenance requirements for the flares, as established by the *ex-ante* determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$), is also considered for the determination and application of the values of $\eta_{flare,m} = \eta_{flare,calc,y}$ for the determination of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period. This is reflected in the monthly emission reduction spreadsheets. Data records for the monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$) are also considered for the determination and application of the values of $\eta_{flare,m}$ for the determination of values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period. This is reflected in the monthly emission reduction spreadsheet.

For each installed flare, the time the flare has operated is determined by monitoring the flame combustion status/condition by using an UV flame detector (of which status signal (flame status "*on*" or "*off*") is continuously recorded and reported). Moreover, the monitoring requirements related to operational requirements/conditions for the flare (as established in the specifications for operational conditions defined by the flares' designer and manufacturer as per the ex-ante determined parameter $SPEC_{flare}$ (min. and max. flow of LFG to the flares + temperature of exhaust gas of the flares + meeting of maintenance requirements)) are also considered in the context of the application of determined values for $\eta_{flare,m}$ along the considered monitoring period. As outlined in the monthly emission reduction spreadsheets, for each minute *m* within the considered monitoring period when the flare have combusted LFG by not operating in accordance with the operational criteria as established by the ex-ante estimated parameter $SPEC_{flare}$ (in terms of LFG flow, temperature of exhaust gas or maintenance practice), no destruction of methane is accounted for the flare as part of the calculation values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ achieved by the project activity.

For the considered monitoring period, the accumulated value for $F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y}$ is calculated as 34,893 tCH_4.

For the considered monitoring period, baseline emissions of methane from the SWDS ($BE_y = BE_{CH4,y}$) are calculated as 627,773 tCO_2e. The summarized emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) summarizes the determination of $BE_y = BE_{CH4,y}$ for the considered monitoring period.

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

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As outlined in the registered PDD, the operation of the project activity requires consumption of both grid-sourced electricity and Liquefied Petroleum Gas (LPG). 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", respectively.

Under conformance with provisions and calculation approaches of the registered PDD, project emissions (PE_y) for the considered monitoring period are determined (in tCO_2e) as follows:

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

Where:

$PE_{EC,grid,y}$ Project emissions due to the consumption of grid-sourced electricity by the project activity

$PE_{LPG,y}$ Project emissions due to the consumption of LPG by the project activity

$PE_{EC,captive,y}$ 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)

Project emissions due to the consumption of grid-sourced electricity by the project activity:

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:

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

Where:

$TDL_{grid,y}$ Average technical transmission and/or distribution losses for providing electricity to the grid and/or for grid sourced electricity consumed by the project activity. For the particular case of determination of $PE_{EC,grid,y}$, $TDL_{,grid,y}$ is ex-ante determined as being 3% ($TDL_{grid,export,y}$). Further details are included in Section D.1 and in the revised version of the PDD valid for the 2nd 7-year renewable crediting period for the project activity.

$EC_{PJ,grid,y}$ Quantity of grid sourced electricity consumed by the project activity in year y. As per the applied monitoring procedure, monthly records of grid-sourced electricity consumption valid for the considered monitoring period are summarized below:

Month	Amount of consumed grid-sourced electricity (MWh)
Jan. 2017	346.757
Feb. 2017	497.372
Mar. 2017	378.629
Apr. 2017	0.261
May 2017	1.771
Jun. 2017	2.948

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

$EF_{EL,grid}$ Emission factor for grid sourced electricity in year *y.* $EF_{EL,grid}$ 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. w_{OM} is ex-ante selected as 25%. Further details about the ex-ante selected parameter w_{OM} are included in Section D.1 and in the registered PDD

valid for the 2nd 7-year renewable crediting period for the project activity.

w_{BM} Weighting of operating margin emissions factor. w_{BM} is ex-ante selected as 75%. Further details about the ex-ante selected parameter w_{BM} are included in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

$EF_{grid,OM}$ Operating margin CO_2 emission factor in year *y*. As per the applied monitoring procedure, the selected value for the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM\text{-}DD,y}$ (0.6228 tCO_2/MWh) represents to the official average value for year (vintage) 2016 as calculated and made public available by the DNA of Brazil. Further details about the monitoring parameter $EF_{grid,OM}$ are included in Section D.2.

$EF_{grid,BM}$ Build margin CO_2 emission factor in year *y*. $EF_{grid,BM}$ is ex-ante determined as 0.2010 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{grid,BM}$ are included in Section D.1.

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:

$PE_{EC,grid,y}$ = 1,227.738 MWh * (0.25 * 0.6228 tCO_2/MWh + 0.75 * 0.2010 tCO_2/MWh) = 531 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 due to consumption of LPG by the project activity:
Project emissions due to the consumption of LPG by the project activity ($PE_{LPG,y}$) are calculated as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) as follows:

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

Where:

$FC_{LPG,y}$ Quantity of LPG consumed by the project activity in year *y*. As per the adopted monitoring procedure, during the considered monitoring $FC_{LPG,y}$ is determined as 270 kg (0.270 ton) of LPG. Additional monitoring details for the monitoring parameter $FC_{LPG,y}$ are included in Section D.2.

$COEF_{LPG,y}$ CO2 emission coefficient for LPG. As established in the PDD valid for the 2nd 7-year crediting period of the project activity, $COEF_{LPG,y}$ is determined by following applicable guidance as per Option B of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" as follows:

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

Where:

$EF_{CO2,LPG,y}$ CO_2 emission factor of fuel LPG (in energy basis). As per the applied monitoring procedure, $EF_{CO2,LPG,y}$ is determined as 0.0656 tCO_2/GJ. Further details about the monitoring parameter $EF_{CO2,LPG,y}$ are included in Section D.2.

$NCV_{LPG,y}$ Net calorific value of the fuel LPG. As per the applied monitoring procedure, $NCV_{LPG,y}$ is determined as 49.2 GJ/ton for the considered monitoring period. Further details about the monitoring parameter $NCV_{LPG,y}$ are included in Section D.2

Thus, $COEF_{LPG,y}$ = 0.0656 tCO_2/GJ * 46.5 GJ/ton = 3.05 tCO_2/ton

In summary, $PE_{LPG,y}$ is calculated as follows:

$PE_{LPG,y}$ = 0.270 ton LPG * 3.05 tCO_2/ton LPG = 0.55 tCO_2

Project emissions due to the consumption of LPG are thus determined as 1 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 $PE_{LPG,y}$ for the considered monitoring period.

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):

Project emissions from consumption of electricity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel) in year *y* ($PE_{EC,captive,y}$) are calculated by following option B.2 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" as follows:

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

Where:

$EC_{PJ,captive,y}$ Amount of electricity sourced by the captive electricity generator (fuelled by Diesel) and consumed by the project activity. As per the applied monitoring procedure, monthly measurement records of electricity consumed by the project activity that is supplied by the installed backup off-grid captive electricity generator (fuelled by diesel) and valid for the considered monitoring period are summarized below:

Month	Amount of electricity sourced by the installed back-up captive off-grid electricity generator (fuelled by Diesel) (MWh)
Jan. 2017	0
Feb. 2017	0
Mar. 2017	0
Apr. 2017	0
May 2017	0
Jun. 2017	0

Further monitoring details for $EC_{PJ,captive,y}$ are presented in Section D.2.

$TDL_{captive,y}$ Average technical transmission and distribution losses for electricity sourced by the captive electricity generator.
$TDL_{captive,y}$ is ex-ante determined as zero. Further details about the ex-ante determined parameter $TDL_{captive,y}$ are included in Section D.1 and in the registered PDD.

$EF_{EL,captive,y}$ CO_2 emission factor for electricity sourced by the captive off-grid electricity generators $EF_{EL,captive,y}$ is ex-ante determined as 1.3 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{EL,captive,y}$ are included in Section D.1 and in the registered PDD.

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

$PE_{EC,captive,y} = 0\ MWh * 1.3\ tCO_2/MWh * (1 + 0) = 0\ tCO_2$

Total project emissions (PE_y) are calculated as 532 tCO_2 (rounded value).

E.3. Calculation of leakage emissions

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Not applicable.

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

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 01/01/2017 to 30/06/2017, achieved emission reductions are calculated and reported as 669,817 tCO_2e (rounded value):

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	670,349	532	-	-	669,817	669,817

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

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
669,817	647,256[19]

E.6. Remarks on increase in achieved emission reductions

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Achieved emission reductions for the project activity are about ~3% higher than the calculated value of ex-ante estimation of emission reductions as per the PDD that is valid for the considered 181-day monitoring period within the year of 2017. The following aspects justify and explain the relative difference between such value for ex-ante estimation of emission reductions as per the

[19] The 647,256 tCO_2e value is calculated as the share of the estimated total emission reductions for year 2017 to be achieved during the 181-day length considered monitoring period within year 2017. Such estimate is calculated as 1,305,240 tCO_2e * 181 / 365.

PDD (calculated as applicable for the considered monitoring period) and emission reductions actually achieved by the project activity during the considered monitoring period:

Aspects/conditions which represent an increase 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 revised version of the PDD:

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 UVS-Caieiras 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 during the considered monitoring period, the application of this model somehow underestimated the amount of LFG to be actually generated and collected by the project activity.

2) *Performed task-force involving capital and labour intensive maintenance, repair and parts replacement work in the existing project's LFG collection infrastructure and operational improvements for such infrastructure held during the period from July/2016 to July/2017:*
   As outlined in Section A.3 (Box 2b) of the revised version of the PDD, a coordinated task-force involving capital and labour intensive maintenance, repair and parts replacement work was performed in the existing LFG collection wells within the project's existent LFG collection infrastructure was performed during the period from July/2016 to July/2017.
   As intended, such infrastructure improvement work resulted in significant increase the quantity and quality of LFG collected by the project activity (thus reaching LFG collection efficiency rate for the project as a whole closer to previously made forecasts) and also improving the overall qualitative characteristics of LFG effectively collected (i.e. increment of methane (CH_4) fraction, reduction of oxygen (O_2) content in collected LFG; better management of condensate in LFG pipeline network, etc.) when compared to the situation within monitoring periods of the project activity prior to July/2016.

   As also outlined in the revised version of the PDD, the operation of the project's LFG collection infrastructure was also improved with the use of better designed electronic-format mapping for all LFG wells of the project activity (with more frequent and more detailed/reliable recording and updating of the operational status/performance of each individual LFG collection well that is part of the project activity). Such measures also contributed for a relative increase in the quantity and quality of LFG collected by the project activity (i.e. increment of methane (CH_4) fraction, reduction of oxygen (O_2) content in collected LFG) when compared to the situation within previous monitoring periods of the project activity, thus promoting relative increment in achieved emission reductions when also compared to monitoring periods prior to July/2016. It is relevant to note that the performed task-force involving capital and labour intensive maintenance, repair and parts replacement work in the existing project's LFG collection infrastructure and operational improvements for such infrastructure are not addressed under the application of 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.

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Document information

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