Project design document form
(Version 11.0)

BASIC INFORMATION	
Title of the project activity	São João Landfill Gas to Energy Project (SJ)
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	4.0
Completion date of the PDD	24/01/2020
Project participants	Prefeitura Municipal de São Paulo (Municipality of São Paulo) Biogás Energia Ambiental S.A. KfW Bankengruppe Mercuria Energy Trading SA
Host Party	Brazil
Applied methodologies and standardized baselines	ACM0001 – “Flaring or use of landfill gas” (version 19.0)
Sectoral scopes	1 – Energy industries (renewable / non-renewable sources) 13 - Waste handling and disposal
Estimated amount of annual average GHG emission reductions	76,429 tCO_2e/year

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

São João Landfill Gas-to-Energy (LFGE) is a project designed to explore the landfill gas (LFG) produced in Aterro Sanitário “Sítio São João” (SJ) – São João landfill, which is one of the biggest landfills in Brazil. This landfill is located in the metropolitan region of São Paulo, Brazil’s biggest city and financial center of the country. With an estimated population of around 11 million citizens, São Paulo generates nearly 20.1 ktonnes of waste daily[1].

SJ’s goal is to explore São João’s LFG for electricity generation. Although the landfill has been designed according to modern practices, the designed solution for the LFG at the time of the landfill’s conception was to collect it through passive venting, eventually flaring it at the head of the wells, which is not efficient in terms of methane destruction. This is due to the poorly constructive and operational characteristics of the wells, where there is no technique seeking efficiency in the mixture biogas/air and the flaring time.

The project is fully operational and is composed by three enclosed flares, a power house with 25.60 MW of installed capacity (16 engines with 1,600 kW capacity each[2]) and a transmission system composed by two transmission lines with approximately 30 km length. By using that transmission system, the project can dispatch energy into the Brazilian Interconnected Grid (“SIN” from the Portuguese Sistema Interligado Nacional).

SJ also purchases LFG from CTL (Central de Tratamento de Resíduos Leste) – also a CDM project PA5947 – in order to comply with the electricity amount settled in its power purchase agreement. The main reason for not reaching the project full performance is due to the pioneering initiative while using LFG for electricity generation. In addition, at the time of the project conception, method available to estimate methane was very shallow as can be checked on differences of methodology to estimate methane generation from the first version of the registered PDD to this one.

As discussed in the post-registration change (PRC) approved on 12/11/2019, all emission reduction generated from PA5947’s LFG is of PA5947’s right and will be claimed by them. SJ will not claim CERs from this LFG[3]. Detailed information regarding PRCs conducted in the first crediting period of project is presented in appendix 7.

São João LFGE project boundary encompasses the site where the LFG is captured, flared or used, *i.e.* the landfill, power plant and flares. As PA5947’s LFG is not considered for SJ emission reduction, it is not included in the project boundary. According to ACM0001, the baseline scenario for LFG destruction is LFG2 (atmospheric release) and for electricity generation is E3 (electricity generation in existing and/or new plants connected to SIN). Detailed description of the baseline scenario is presented in section B4 below. During the second crediting period, the project activity is expected to reduce 535,005 tCO_2e, *i.e*. 76,429 tCO_2e/year.

SJ provides major contribution towards sustainable development due to:

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[1] Data from 2012 year. Information available in Integrated Management Plan of Sao Paulo Municipal Solid Waste (MSW), pages 6-8 Available at: <http://www.prefeitura.sp.gov.br/cidade/secretarias/upload/servicos/arquivos/PGIRS-2014.pdf>

[2] 1.54MW installed capacity for each engine was considered in the first crediting period based on the nameplate of the equipment and site specifications. However, during this second crediting period, the DOE required the consideration of the installed capacity exactly according to the nameplate of the equipment. A post-registration change was approved to reflect this “correction”. Please refer to timeline presented in annex 7.

[3] Term of Agreement signed by Ecourbis and São João Energia Ambiental on 31/07/2015. The document states that Ecourbis and São João Energia Ambiental agree that CERs from LFG produced at Ecourbis Landfill inside the expansion area will belong exclusively to Ecourbis and will be enjoyed by CTL Landfill Gas Project.

- Renewable energy generation;
- Methane emission reductions through flaring and generating electricity, avoiding global warming and reducing explosion risks at the landfill site;
- Replicability of technology and know-how in the Host Country, since there are very few projects using LFG in spite of its large potential in Brazil;
- Jobs creation, mainly during implementation and operation phases;
- Increase of local income since revenues from certified emission reductions (CERs) are shared with the Municipality of São Paulo ("PMSP" from the Portuguese Prefeitura Municipal de São Paulo), increasing cash flow towards investments such as rubbish damps recovery, waste management awareness and other environmental benefits.

It can be clearly demonstrated that SJ contributes to sustainable development.

A.2. Location of project activity

São João landfill is located in the east part of São Paulo municipality, at km 33 of "Estrada de Sapopemba" – Sapopemba road – close to the border with Mauá municipality (Figure 1). The geographic coordinates of the project site are as follows:

Latitude: -23.6362°

Longitude: -46.4141°

Figure 1 – São Paulo location (Source: http://pt.wikipedia.org).

Figure 2 – São João Landfill location (Source: adapted from Google Earth).

A.3. Technologies/measures

The installation of the SJ Project was executed in three phases in the 2007/2008 period. Firstly, the LFG collecting system was implemented independently to start up flaring LFG. The CH_4 flaring would be enough to avoid GHG emission as prescribed by the UNFCCC. From May 22^{nd}, 2007 to March 2008, the SJ Project activity was limited exclusively to the LFG flaring, as properly verified by the monitoring and verification reports issued for that period.

The LFG degassing system includes more than 30 km of high density polyethylene pipes connected to the about 160 landfill wells; 4 blowers to provide suction for extracting the gas from the landfill; facilities for gas treatment, such as heat exchangers, chillers; and 3 flares with capacity to destroy up to 15,000 Nm^3 per hour of LFG that is not used to generate electricity.

The LFG is extracted from the landfill through the gas wells and is transported to the gas plant by the pipelines for treatment before use as fuel or flaring. During transportation, there might occur the formation of condensates due to temperature gradients requiring drainage of the pipeline to condensate shafts placed along the pipeline. Once in the gas plant, the LFG is cooled again to remove moisture up to a minimum level. The removal of condensates from the LFG flow is a critical step in the gas treatment process should the LFG be used as fuel. LFG condensates contain silica components that can block the gas pipes or damage the gas engines ultimately. Once the condensates are removed, the LFG is heated again by passing through a second heat exchanger, or economizer, to a temperature of around 25 °C, far enough from the dew point of 4 °C to avoid further condensation.

As additional precaution, as per the reasons mentioned in the previous paragraph, a demister was also installed as an extra-guarantee of the LFG quality as fuel for gas engines. The demister is a stainless steel high density filter which separates liquid particles (small amounts of condensate) from the LFG. All liquid removed off the LFG is drained to a condensate shaft.

Blowers are used to provide correct suction pressure into the pipeline system for transportation of the LFG extracted from the landfill up to the gas plant. Flow capacity and pressure are adjusted by electrical motors with frequency control. Blowers are also equipped with necessary safety equipment as well as noise reducing housing.

Sophisticated gas analysing and gas measuring instruments are used on the pressure side of the gas plant to ensure safety, process and operating best controls. Once analysed and properly controlled and measured, the LFG can be used as a fuel for the gas engines which drive electrical generators. Any occasional surplus of the LFG might continue being burned off by the flares.

The whole LFG collecting process and gas plant are controlled by an electrical control system which is provided with a PLC (Programmable Logical Controller) and a SCADA system (visualization of the process on a personal computer), making possible to control and monitor the installation at distance, including through the internet. All the measured process signals are processed by the PLC to feed input signals for the gas-coolers, blowers, flares and gas-engines.

The second implementation phase of the São João LFGE Project was launched later on in June 2007, after the start-up of the gas plant, once the engineering for the Power Plant was properly developed to provide information for the procurement of all equipment and services.

The initial registered PDD version was designed assuming the use of the standard Caterpillar technology based on a set of 14 engines Model CAT 3516. Once the Power Plant was already operational, during the crediting period[4], the PP invested in the acquisition of two additional engines Model CAT 3516, completing so the current existent power capacity of 25.60 MW which is given by the installation of 16 engines Model CAT 3516. This upgrade configures the third phase of the project, which became effective only by the end of October 2008 and since then the output of the São João LFGE project is planned as follows:

1) Model CAT 3520 Capacity at SJ site conditions: 1.60 MW

2) Number of Engine Units: 16

3) Installed Capacity: 16 X 1.60 MWe: 25.60 MWe

Actually, as shown in the chart below, after 18 months of operation, since the plant operation startup in April 2008 up to September 2009, São João LFGE Project has not yet performed to the point of delivering more than 20 MWh/h in 24 hour daily average into SIN.

[4] Changes in the installed capacity of the Project were assessed during the crediting period. For details please refer to the revised registered PDD of the first crediting period available at: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1145141778.29/view>.

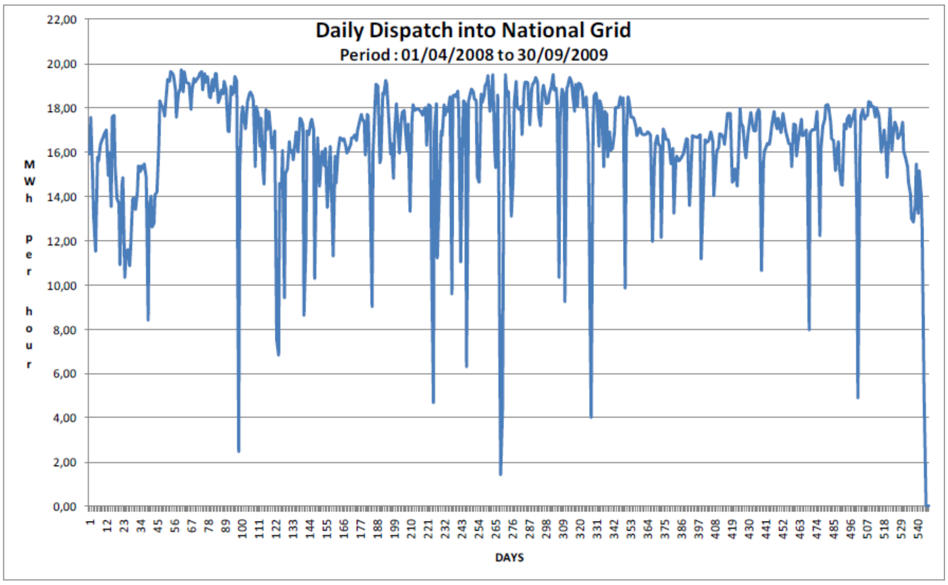

Figure 3 – Daily dispatch of electricity by the São João Landfill power plant.

Despite not having achieved yet its full expected performance in terms of energy production, as of September 2009, the São João LFGE is one of the largest project registered in Brazil under the CDM. It has become already a world benchmark for this kind of project, fostering the replication of this project activity in several others landfill gas throughout Brazil and abroad. The replication renders the project to assist climate change mitigation even if it is not counted as direct benefit to the project activity itself. Moreover, considering the electricity generation culture in Brazil is overall based towards hydropower, the project plays an important role in spreading the development of renewable energy sources other than hydro.

As presented in the manufacturer's technical record, the combustion temperature curve varies from 1,000°C to 1,200°C. Flare dimensions are: 8,262 m height and 3,098m diameter (low height flare).

The table below summarizes the equipment that are currently operational.

Table 1 – Technical description of project's equipment.

Description	Blower	Flare	El. Generator	Diesel Generator
Manufacturer	Continental Blower LLC	Hofstetter	Caterpillar	Caterpillar
Model	151A.05	Efficiency 5000	CAT3516	CAT3406
Quantity	4	3	16	1
Capacity per unit	3,000 – 7,000 scfm	Min: 500Nm^3/h Max: 5,000Nm^3/h	1,600 kW	400KW/500KVA
Reference	Technical Data Sheet Continental Blower LLC	Hofstetter's operating instructions	Caterpillar's gas engine technical data and equipment tag	Equipment tag

Given the project magnitude in terms of power generation using exclusively LFG as fuel, it would not have happened without technology transfer. The main success for BLFGE implementation is the shareholders of Biogás Energia Ambiental S.A, which had international experience and, therefore, they contributed for the design of the LFG system and the project implementation and operation. Most of the equipment was imported, such as engines for energy generation, flow

meters, gas analyzer and flares, as the Brazilian industry was not prepared yet to supply this kind of equipment, at least with the size and characteristics demanded for the São João LFGE project. Both project's implementation and operation have happened under strict environmental regulations, ensuring that technology transference could be made in safe and proper environmental conditions at SJ.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil(host)	Public entity - Prefeitura Municipal de São Paulo (Municipality of São Paulo)	No
	Private entity - Biogás Energia Ambiental S.A.	
Germany	Private entity - KfW Bankengruppe	No
Switzerland	Private entity - Mercuria Energy Trading SA	No

A.5. Public funding of project activity

There is no public funding from Parties included in Annex I involved in this project activity.

A.6. History of project activity

The Project Participants confirm that:

(a) The proposed CDM project activity is not included as a component project activity (CPA) in a registered CDM programme of activities (PoA);

(b) The proposed CDM project activity is not a project activity that has been deregistered;

(c) The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA;

(d) The proposed CDM project activity is not a registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not applicable. SJ is a large scale project type.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

São João Landfill Gas to Energy Project applies the ACM0001 methodology – "*Flaring or use of landfill gas*" (version 19.0) and the following methodological tools:

- *TOOL02:* "*Combined tool to identify the baseline scenario and demonstrate additionality" (version 7.0);*
- *TOOL04:* "*Emissions from solid waste disposal sites"* (version 08.0);

- *TOOL05:* "*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"* (version 03.0);
- *TOOL06:* "*Project emissions from flaring"* (version 03.0);
- *TOOL07: "Tool to calculate the emission factor for an electricity system"* (version 07.0)*;*
- *TOOL08: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"* (version 03.0);
- *TOOL11: "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of a crediting period"* (version 03.0.1).

Please note that *"Tool to determine the baseline efficiency of thermal or electric energy generation systems" (TOOL09)* and the *"Project and leakage emissions from transportation of freight"* (*TOOL12*) are not applicable to the project activity, since the project does not involve thermal energy generation nor LFG transported by trucks. The *"Tool to determine the remaining lifetime of equipment" (TOOL10)* is also not used, since the project equipment does not exist in the baseline scenario (no reform or expansion is involved).

In 2014, during the renewal of the project crediting period, the PP submitted a request for deviation of ACM0001 (version 12) – M-DEV-493. The request for deviation was made for the exemption to monitor the amount of methane for the sixteen generators individually, given the high cost (around USD200,000 would be required to install 16 flow meters) and the project design (no space available). Also, the IASTECH system installed at the project site allows identifying non-working hours or any deviation measurement. Based on the clarifications provided, the request for deviation was accepted by the CDM Board on 02/08/2016[5]. In spite of the request for deviation acceptance, ACM0001 was revised to exclude the requirement to monitor *"each item of electricity generation or heat generation equipment or the natural gas distribution system"*. The updated version ACM0001 (version 19.0) states that: *"if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detectors records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices"*. Details are presented in appendix 7.

B.2. Applicability of methodologies and standardized baselines

According to ACM0001, it is applicable to "*project activities that include the destruction of methane emissions and displacement of a more-GHG-intensive service by capturing landfill gas from the landfill site and/or flaring and/or using to produce energy (i.e. electricity, thermal energy); and/or using to supply consumers through natural gas distribution network, dedicated pipeline or trucks"*. Then ACM0001 is applicable to the project activity as it destructs methane by capturing landfill gas from the landfill site to produce electricity and eventually flaring. The inclusion of PA5947's LFG does not change the project scope.

The project complies with the applicability conditions described in the methodology ACM0001 as further detailed below.

This methodology is applicable under the following conditions:

(a) Install a new LFG capture system in an existing or new SWDS where no LFG capture system was or would have been installed prior to the implementation of the project activity; or

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Available at: <.

[56] CTL is a CDM project activity and its LFG supplying to SJEA project was accepted by the CDM Secretariat on 21/09/2018. SJEA will not claim emission reductions from CTL landfill.

(b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:

(i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and

(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.

(c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:

(i) Generating electricity;

(ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or

(iii) Supplying the LFG to consumers through a natural gas distribution network;

(iv) Supplying compressed/liquefied LFG to consumers using trucks;

(v) Supplying the LFG to consumers through a dedicated pipeline.

(d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.

Previously to the implementation of the project activity, the LFG flow could not be controlled to avoid free emission to the atmosphere. The project activity aims at capturing the LFG and generating electricity. The project activity has also installed enclosed flares for emergency purposes. The LFG from PA5947[6] is used only to comply with the power purchase agreement as the project activity is not generating the electricity settled in the contract. To the Project Participants' understanding, item b) above is only applicable if São João LFGE project claimed CERs from the CTL landfill which does not occur. In spite of the LFG increase, no emission reductions related to PA5947's LFG is or will be claimed by SJ. Detailed information is presented in the PRC approved by the CDM-EB on 12/11/2019.

Furthermore, the implementation of the proposed CDM project activity does not reduce the amount of organic waste that would be recycled in the absence of the project activity. There is no recycling system in the region. Currently, the landfill is closed and, since 2009 year, it did not receive waste[7].

The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is

(a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and

(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln;

(i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or

[6] CTL is a CDM project activity and its LFG supplying to SJEA project was accepted by the CDM Secretariat on 21/09/2018. SJEA will not claim emission reductions from CTL landfill.

Public available information at:

[7] Comissão Interministerial de Mudança Global do Clima (CIMGC). Available at: <.

(ii) *For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary.*

(c) *In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas;*

(d) *In the case of LFG from a greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.*

The baseline scenario applied to the project activity is option (a) and (b), since it avoids methane generation and produces renewable electricity. Please refer to Section B.4 for details.

This methodology is not applicable:

(a) *In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a the kiln or glass melting furnace;*

(b) *If the management of the SWDS in the project activity is deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.*

ACM0001 is applicable to the proposed CDM Project Activity since the São João LFGE Project does not use other CDM approved methodology. SJ also is not claiming emission reductions from PA5947's LFG due to energy efficiency measures. Only LFG from SJ landfill will be used for emission reductions accounting and a conservative approach for ER calculation is considered while applying discounts factors as described in the monitoring plan and appendix 7. In addition, the management of the landfill in the project activity is not changed in order to increase methane generation compared to the situation prior to the implementation of the project activity (e.g. other to meet a technical or regulatory requirement). There is neither the addition of liquids to the SWDS and pre-treating waste to seed it with bacteria for the purpose of increasing the anaerobic degradation environment of the SWDS nor changing the shape of the SWDS to increase the Methane Correction Factor.

Besides the ACM0001 methodology applicability conditions, the ones listed in the tools applied must also be assessed. Regarding *TOOL08*, the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions. Therefore, this tool is applicable.

TOOL04 is applicable as it is used under Application A: *¨The CDM project activity mitigates methane emissions from a specific existing SWDS. Methane emissions are mitigated by capturing and flaring or combusting the methane (e.g. "ACM0001: Flaring or use of landfill gas"). The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In these cases, the tool is only applied for an ex- ante estimation of emissions in the CDM-PDD. The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS).*

TOOL05 is applicable since the project activity dispatches electricity to the grid (baseline emissions) and there is fossil fuel consumption for electricity generation in case of emergency (project emissions). Further, *TOOL07* is applicable since, as further described below in section B.6.1., off-grid power plants are not considered. Hence, the requirements of Appendix 2 of the tool, referring to the applicability conditions that shall be met when this kind of plants are considered,

are not applicable. Besides, the Brazilian Electricity System is neither partially nor totally located in any Annex-I country.

TOOL06 is applicable to the flaring of flammable greenhouse gases where:

- *Methane is the component with the highest concentration in the flammable residual gas;*
- *The source of the residual gas is coal mine or gas from biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).*

The flammable residual gas is LFG (gas from biogenic source), which is composed by CH_4, H_2S, CO_2 and N_2, among other components. By default, the methodology adopts that the default fraction of methane in the LFG is 50%. Therefore, it can be assumed that methane is the component with the highest concentration in the LFG. In this sense, both applicability conditions of the tool are met.

TOOL02 is used following §243 of the CDM Project Standard for Project Activities (v2.0) as described in section B.5.

B.3. Project boundary, sources and greenhouse gases (GHGs)

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative
		CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity
	Emissions from electricity generation	CO_2	Yes	Major emission source since power generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from heat generation	CO_2	No	Excluded since heat generation is not included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	Excluded since supply of LFG through a natural gas distribution network is not included in the project activity
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	No	Not applicable to the proposed CDM Project Activity.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from flaring	CO_2	No	Emissions are considered negligible
		CH_4	Yes	May be an important emission source
		N_2O	No	Emissions are considered negligible
	Emissions from electricity consumption due to the project activity	CO_2	Yes	May be an important emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from distribution of LFG using trucks	CO_2	No	Not applicable to the proposed CDM Project Activity.
		CH_4	No	Not applicable to the proposed CDM Project Activity.
		N_2O	No	Not applicable to the proposed CDM Project Activity.

According to the ACM0001 methodology the project boundary includes *the site where the LFG is captured* (São João Landfill) *and*:

(a) *Sites where the LFG is flared or used (e.g. flare, power plant, boiler, air heater, glass melting furnace, kiln, natural gas distribution network, dedicated pipeline or biogas processing facility);*

(b) *Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity to the project activity;*

(c) *Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity in the baseline that is displaced by electricity generated by captured LFG in the project activity;*

(d) *Heat generation equipment or sources which are supplying heat in the baseline that is displaced by heat generated by captured LFG in the project activity; and*

(e) *The transportation of the compressed/liquefied LFG from the biogas processing facility to consumers.*

In the case of the proposed CDM Project Activity, the sites where the LFG is flared/used consists of the collection system, electricity generation plant and gas station facilities (including flaring) – item (a) above.

Regarding item (b), all the power generation sources connected to SIN is included in the project boundary, since electricity is dispatched into and also consumed from the from the grid. On May 26th, 2008, the Brazilian Designated Authority published Resolution #8[8] defining the Brazilian Interconnected Grid as a single system covering all five geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence, this is the configuration of the national grid that is to be considered. Items (c) and (d) are not applicable to the project activity.

The figure below is a representation of the project boundary.

Comissão Interministerial de Mudança Global do Clima (CIMGC). Available at: <.

[8] Some of the icons used to illustrate the project boundary were adapted from the CDM Methodology Booklet available at <

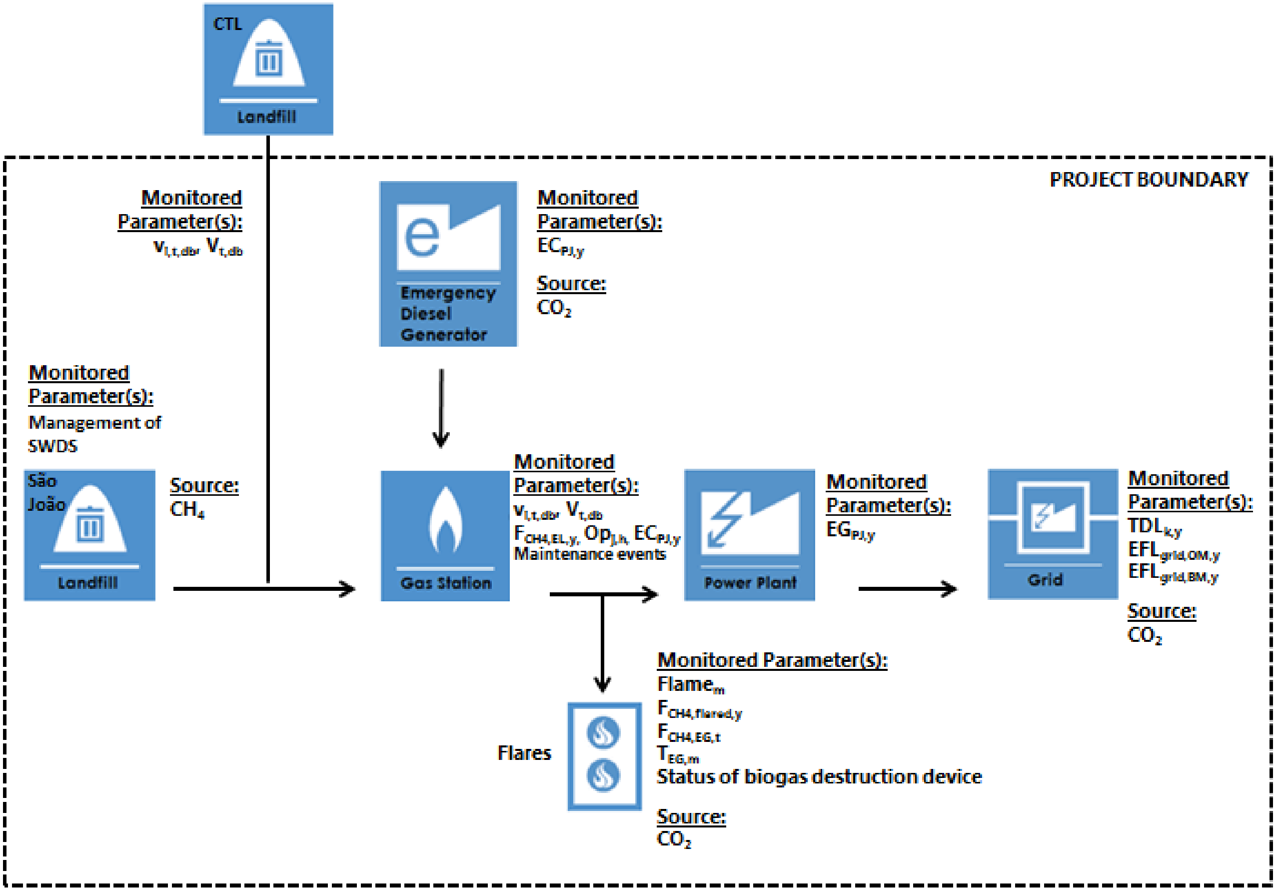

Figure 4 – Simplified diagram of the Project Boundary[9].

ACM0001 establishes that "LFG shall include the LFG is captured", however LFG from PA5947 (CTL landfill) is not used for emission reductions purposes and, therefore, the SWDS of PA5947 is not included in the project boundary.

As explained in the PDD and in the approved PRC on 12/11/2019, PA5947 LFG is fully monitored and is used to comply with the power purchase agreement. No emission reductions from the purchased PA5947's LFG are or will be claimed.

The amount of LFG and methane from PA5947 will be discounted in the calculation of São João baseline emissions. No emission reductions will be claimed from this LFG since emission reductions are already accounted by CTL project. Leakage from gas transportation is also accounted by CTL project[10].

Some of the icons used to illustrate the project boundary were adapted from the CDM Methodology Booklet available at <

[9] Detailed description of calculation is presented in the registered PDD from CTL Project (ref. 5947), available at: <.

Detailed description of calculation is presented in the registered PDD from CTL Project (ref. 5947), available at: <.

*$OX_{top-layer}$ is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool "Emissions from solid waste disposal sites". In addition to this effect, the installation of a LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was considered to be very small, as the operators of the SWDS have in most cases an incentive to main a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption.

B.4. Establishment and description of baseline scenario

According to ACM0001, the following baseline alternatives shall be considered while identifying the baseline scenario: (i) destruction of LFG, (ii) electricity generation and (iii) heat generation:

- *Destruction of LFG*

  LFG1: *The project activity implemented without being registered as a CDM project activity (i.e. capture and flaring or use of LFG);*

  LFG2: *Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons;*

  LFG3: *Atmospheric release of the LFG or capture of LFG in an unmanaged SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons;*

  LFG4: *LFG generation is partially avoided because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS;*

  LFG5: *LFG generation is partially avoided because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS;*

  LFG6: *LFG generation is partially avoided because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS.*

- *Electricity generation*

  E1: *Electricity generation from LFG, undertaken without being registered as CDM project activity;*

  E2: *Electricity generation in existing or new renewable or fossil fuel based captive power plant(s);*

  E3: *Electricity generation in existing and/or new grid-connected power plants;*

- *Heat generation*

  H1: *Heat generation from LFG undertaken without being registered as CDM project activity;*

  H2: *Heat generation in existing or new fossil fuel fired cogeneration plant(s);*

  H3: *Heat generation in existing or new renewable based cogeneration plant(s);*

  H4: *Heat generation in existing or new fossil fuel based boiler(s), air heater(s), glass melting furnace(s) or kiln(s);*

  H5: *Heat generation in existing or new renewable energy based boiler(s), air heater(s), glass melting furnace(s) or kiln(s);*

  H6: *Any other source, such as district heat; and*

  H7: *Other heat generation technologies (e.g. heat pumps or solar energy);*

Before the implementation of the project activity, LFG was collected through passive venting and occasionally flaring. As there was no requirement for methane destruction, no technology was employed up to 2007, when the project activity started construction. Regarding electricity generation, in the absence of the project, it would be generated by the existing power plants connected to the grid. Heat generation is not applicable to the project activity context. Therefore, the baseline scenario identified for LFG destruction and electricity generation is **LFG2** and **E3**, respectively.

B.5. Demonstration of additionality

According to §280 of the CDM Project Standard for Project Activities (v2.0), for renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality. Therefore, the following information is from the registered PDD and it was not updated.

The additionality assessment considers the PR due to the Term of Agreement signed between SJ and Ecourbis to SJ purchase LFG from CTL in order to comply with the power purchase agreement. The amount of LFG and methane from CTL will be discounted in the calculation of São João baseline emissions. No emission reductions will be claimed from this LFG since emission reductions are already accounted by CTL. Leakage from gas transportation is also accounted by CTL[11]. Additionality assessment is as follows in accordance with TOOL02 as follows.

- **STEP 0. Demonstration that a proposed project activity is the first-of-its-kind**

Not applicable since the project activity is not a first-of-its-kind project.

Outcome of Step 0:
Conclusion II: the project is not a first-of-its-kind project. Proceed to Step 1.

- **STEP 1. Identification of alternative scenarios**

Step 1a: Define alternative scenarios to the proposed CDM project activity

Following *TOOL02*, the alternative scenarios to the project are:

S1: The proposed project activity undertaken without being registered as a CDM project activity;

S3: The continuation of the current situation, not requiring any investment or expenses to maintain the current situation:

- LFG2: Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons;
- E3: Electricity generation in existing and/or new grid-connected power plants;

Step 1b: Consistency with mandatory applicable laws and regulations

All listed alternative scenarios are according to current applicable laws and regulations.

Outcome of Step 1:
S1 and S3 are alternative scenarios to the project activity, which follows applicable laws and regulations. Proceed to Step 2 and/or Step 3.

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*$OX_{top-layer}$ is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool "Emissions from solid waste disposal sites". In addition to this effect, the installation of a LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was considered to be very small, as the operators of the SWDS have in most cases an incentive to main a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption.

- **STEP 2. Barrier analysis**

Not applicable. The additionality test was conducted in the light of the investment analysis (step 3).

- **STEP 3. Investment analysis**

In the previous version of the registered PDD, the Internal Rate of Return (IRR) of 13.73%p.y. was compared to the interest government bond rates paying at the time of the project development, *i.e.* 2003 year. The average government bond interest rate at that time was 23.29%. Therefore, it was demonstrated that the project implementation was not economic or financially attractive when analysing the alternative scenario.

Given the unexpected performance of the project and the necessity to comply with the electricity contract sale, the project developer signed a Term of Agreement on 31/07/2015 to purchase LFG from CTL landfill. Therefore, this change resulted in an increase in project investment and operational costs to construct and maintain the LFG interconnection, besides of the cost of the LFG purchase. Therefore, this change negatively impact the project attractiveness as revenues continued to be the same (revenues were already considered in the project cash flow).

According to §244 of the CDM Project Standard of the Project Activity (v.02.0), if changes affect additionality of the project activity, the demonstration of the impacts of the changes on the additionality shall be based on all original input data:

"(a) If investment analysis was used, the project participants shall only modify the key parameters in the original spreadsheet calculations affected by the proposed or actual changes to the project activity"

Although it is clear that there is no increase in the project attractiveness (but the opposite), the project participants revised the project cash flow in order to demonstrate that the project is still additional following § 244 of the standard above.

In addition to the inclusion of Capex and Opex costs due to interconnection, the period of assessment was also increased. In the original cash flow, the period of assessment was up to 2017. In the revision of the cash flow presented below, the assessment period was extended to consider all concession period of the landfill (up to 2023 year). Revisions mentioned above resulted in 11.3% project IRR.

However, during the PRC of the project (approved on 12/11/2019), the CDM Secretariat required the exclusion of financing expenditures and loan interests in light of §13 of TOOL27, where it states:

"The cost of financing expenditures (i.e. loan repayments and interest) shall not be included in the calculation of project IRR".

Although the project participants' understanding is that the original cash flow considered at the time of the investment decision should be used as required by the CDM PS and only key parameters should be changed, the cash flow was revised in order to exclude financing expenditures and loan interests according to TOOL27. Results are as follows:

Table 2 – Cash flow for SJ's landfill gas project.

	SJ "energy"																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
EBIT	0,0	6,8	12,1	12,7	12,8	12,4	13,0	13,0	12,6	6,7	4,1	4,0	5,4	5,4	5,4	5,4	5,4	5,4	5,4
Depreciation and Amortization	0,0	3,8	5,1	5,1	5,1	5,1	5,1	5,1	5,1	5,1	5,1	5,1	5,1	5,1	1,1	0,0	0,0	0,0	0,0
Working Capital variation	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Operational Cash Flow	0,0	10,6	17,2	17,8	18,0	17,6	18,2	18,2	17,7	11,8	9,2	9,2	10,5	10,5	6,5	5,4	5,4	5,4	5,4
Investments	(48,8)	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	(1,0)	(1,9)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Dividends	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Cash Flow after Investments	(48,8)	(4,2)	17,2	17,8	18,0	17,6	18,2	18,2	16,7	9,9	9,2	9,2	10,5	10,5	6,5	5,4	5,4	5,4	5,4
Income Tax (IR)	0,0	(0,4)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)	(0,6)
Income Tax (CSLL)	0,0	(0,2)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)	(0,3)
Capital Increase	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Capital Decrease	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Net Cash Flow	(48,8)	(4,8)	16,2	16,8	17,0	16,6	17,2	17,2	15,7	8,9	8,2	8,2	9,5	9,5	5,5	4,4	4,4	4,4	4,4

	R$ million																		
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
EBIT	-	7	12	13	13	12	13	13	13	7	4	4	5	5	5	5	5	5	5
Tax	0,0	(0,6)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)	(1,0)
Depreciation and Amortization	0	4	5	5	5	5	5	5	5	5	5	5	5	5	1	0	0	0	0
CAPEX	-49	-15	0	0	0	0	0	0	-1	-2	0	0	0	0	0	0	0	0	0
Carbon																			
Total Project Earnings	-48,81	-4,75	16,24	16,80	16,96	16,57	17,16	17,16	15,68	8,91	8,23	8,17	9,54	9,54	5,47	4,40	4,40	4,40	4,40
IRR	22,0%																		
NPV (23,29%)	-3.952.553																		

During the PRC of the project, the CDM Secretariat also requested a sensitivity analysis following TOOL27. According to §28 of TOOL27, a sensitivity analysis should be conducted covering a range of at least +10 per cent and -10 per cent. The revision previously required by the CDM Secretariat in order to exclude financial expenditures from the project cash flow – even when this cash flow was considered in the decision making-context – resulted in an IRR (22.0%) clearly below but not too far from the benchmark (23.29%) and, therefore, the IRR surpasses the benchmark under 10% variations in costs and revenues.

Following §28 of TOOL27, in cases where a scenario results in a financial indicator higher than the benchmark, an assessment of the probability of the occurrence of this scenario is required. As the project is already implemented and operational, a reasonable approach is to analyse actual incurred revenues, as well as actual incurred costs to the project, ruling out uncertainties regarding additionality. The resulted IRR is negative and the net present value (NPV) is –R$43.8MM as can be seen in the spreadsheet attached (Appendix 3 - Enclosure 2 – actual_v.2.xls).

It is important mentioning that all figures considered in this analysis are based on financial statements published in the Sao Paulo State Official Gazette (from the Portuguese Diário Oficial do Estado – D.O.E.) as required by the Brazilian legislation to incorporated companies (from the Portuguese "Sociedade Anônima – S.A."). According to Brazilian legislation, S.A. companies must publish their financial statements of the year, and two publications are required: i) in the D.O.E. and ii) in a high circulated local newspaper. The resulting IRR demonstrates that the project activity is a pioneering project and confirms its additionality.

As can be seen in Table 2 above, the resulted IRR is 22.0%, which is below the benchmark 23.29%, demonstrating that the project continues to be unattractive to investor. No changes in the results of the sensitivity analysis are expected as the IRR reduced.

Outcome of Step 3:

At the time of the investment decision, the project IRR (13.8%) was lower than the benchmark (23.29%). Considering the actual expenditures and revenues, it is confirmed that the IRR is lower than the benchmark, even when corrections in the financial calculation are made in the project cash flow in favour to the project changing the IRR from 13.8% to 22.0%. In fact,

current values demonstrate that projects with LFG energetic use are additional in a country where LFG burnt is more than enough. Based on the results of the investment analysis, the project remains additional. Proceed to Step 4.

- **STEP 4. Common practice analysis**

There is no similar project to SJ being carried out in Brazil at the current moment, in special as regards its magnitude. As mentioned before, the São João LFGE project has ultimately taken the first position in Brazil displacing to the second position the Bandeirantes LFGE project, which is also part of the portfolio of the Biogás Energia Ambiental and as such does not need to be considered in this analysis, despite being also a CDM project. Landfill gas to energy projects are not fully developed yet in Brazil because there is no local technology available and few experts in the field to apply knowledge in actual projects. Moreover most of investors are too risk adverse to invest the resources needed for the implementation of any LFGE project with some major magnitude.

Changes in the project layout (CTL LFG purchase) do not change the results of the common practice analysis presented in the registered PDD, as the applicable geographical area, measure, output and technologies are the same.

Outcome of Step 4:

The project activity is not a common practice. The project is still additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

Baseline Emissions

Baseline emissions for the proposed project activity are determined according to the following equation:

$BEy = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$ **Equation 1**

Where,

BE_y = Baseline emissions in year y (t CO_2e/yr)

$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year y (t CO_2e/yr)

$BE_{EC,y}$ = Baseline emissions associated with electricity generation in year y (t CO_2/yr)

$BE_{HG4,y}$ = Baseline emissions associated with heat generation in year y (t CO_2/yr)

$BE_{NG,y}$ = Baseline emissions associated with natural gas use in year y (t CO_2/yr)

Baseline emissions associated with heat generation in year y ($BE_{HG,y}$) and natural gas use in year y ($BE_{NG,y}$) are not applicable to the proposed project activity. It is important mentioning that 10 percent discount will be applied in the period from 22/05/2014 to 04/11/2018 baseline emissions due to a conservative approach given a the temporary deviation. Also, a discount factor will be applied based on the equipment accuracy during the project lifetime due to permanent change (appendix 7).

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

Baseline emissions of methane from the SWDS are determined, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account[12].

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

Where,

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

Ex post determination of $F_{CH4,PJ,y}$

During the crediting period, $F_{CH4,PJ,y}$ is to be determined as the sum of the quantities of methane flared and forwarded to the electricity generation plant, considering the following equation:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y}$$ **Equation 3**

Where,

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (tCH_4/yr)
$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (tCH_4/yr)
$F_{CH4,EL,y}$	=	Amount of methane in the LFG which is used for electricity generation in year *y* (tCH_4/yr)
$F_{CH4,HG,y}$	=	Amount of methane in the LFG which is used for heat generation in year *y* (tCH_4/yr)
$F_{CH4,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network in year *y* (tCH_4/yr)

In the case of the project activity, $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ are zero since the proposed project activity neither produces heat nor distributes natural gas through a network. Therefore, $F_{CH4,PJ,y}$ is the sum of $F_{CH4,flared,y}$ *and* $F_{CH4,EL,y}$. As described in appendix 7, a discount factor shall be applied in

$OX_{top-layer}$ is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool "Emissions from solid waste disposal sites". In addition to this effect, the installation of a LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was considered to be very small, as the operators of the SWDS have in most cases an incentive to main a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption.

[12] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

monitored $F_{CH4,PJ,y}$ based on equipment accuracy for all the project lifetime. Then, 1.0% accuracy of methane analyzer and 1% gas flow to generators shall be discounted to calculate $F_{CH4,EL,y}$; 1.0% accuracy of methane analyzer and analyzer and 1.5% discount on gas flow to flares shall be applied to calculate $F_{CH4,flared,y}$.

According to ACM0001, $F_{CH4,EL,y}$ shall be determined using *TOOL08* and monitoring the working hours of the power plant(s), boiler(s), air heater(s), glass melting furnace(s) and kiln(s), so that no emission reduction are claimed for methane destruction during non-working hours. This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year y (Opj,h,y).

Furthermore, the following requirements apply:

- As per the gaseous stream tool, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detectors records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices. The destruction efficiency of the least efficient among the destruction devices shall be used as the destruction efficiency for all destruction devices monitored by this flow meter. If there are any periods for which one or more destruction devices are not operational, paragraph 5 (a) and (b) of the Appendix of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" tool shall be followed;
- CH_4 is the greenhouse gases for which the mass flow should be determined;
- The flow of the gaseous stream should be measured on continuous basis;
- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 or 17 in the tool); and
- The mass flow will be summed to a yearly unit basis (tCH_4/yr).

For calculating $F_{CH4,EL,y}$, **Option A** of the Tool has been selected (*i.e.*, volume flow measured in dry basis and volumetric fraction measured in dry basis). The demonstration that the gaseous stream is dry follows alternative *b)* of the tool is used since it is forecasted that the temperature of the gaseous stream (T_t) is less than 60°C (333.15 K) at the flow measurement point.

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

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

With

$$\rho_{i,t} = (P_t \times MM_i) / (R_u \times T_t)$$ **Equation 5**

Where,

$F_{i,t}$	=	Mass flow of CH_4 in the gaseous stream (gas sent to electricity generation facility) in time interval *t* (kg gas/h)
$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h) – of the gas sent to electricity generation facility
$v_{i,t,db}$	=	Volumetric fraction of CH_4 in the gaseous stream in time interval *t* on a dry basis (m^3 gas *i*/m3 dry gas)
$\rho_{i,n}$	=	Density of CH_4 in the gaseous stream in time interval t (kg gas *i*/m^3 gas *i*)
P_t	=	Absolute pressure of the gaseous stream in time interval t (Pa)

T_t = Temperature of the gaseous stream in time interval t (K)

MM_i = Molecular mass of CH_4 (kg/kmol)

R_u = Universal ideal gases constant (Pa.m^3/kmol.K)

The flow meters installed convert automatically the volumetric flow of the gaseous stream from actual conditions to normal conditions of temperature and pressure.

It is important mentioning that the amount of LFG and methane from CTL will be discounted from the emission reduction calculation in order to avoid double counting. Therefore, the total methane measurement sent to flares and engines will be discounted proportionally to the measurement of methane collected by CTL. Please refer to section B.7.3 for details of the monitoring plan and Appendix 7 for PRC due to CTL's LFG inclusion.

Amount of methane destroyed by flaring ($F_{CH4,flared,y}$)

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

$$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}}$$ **Equation 6**

Where,

$F_{CH4,flared,y}$ = Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH_4/yr)

$F_{CH4,sent\_flare,y}$ = Amount of methane in the LFG which is sent to the flare in year *y* (t CH_4/yr)

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year *y* (t CO_2e/yr)

GWP_{CH4} = Global warming potential of CH_4 (t CO_2e/t CH_4)

$F_{CH4,sent\_flare,y}$ is determined directly using *TOOL08* and will be performed separately for each flare, which the sum will be used for emission reductions calculation.

Similarly to the option used to determine $F_{CH4,EL,y}$, $F_{CH4,sent\_flare,y}$ is calculated using **Option A** of the Tool has been selected (*i.e.*, volume flow measured in dry basis and volumetric fraction measured in dry basis). Hence, the mass flow of greenhouse gas *i* ($F_{i,t}$) is determined using Equation 4 and Equation 5 presented above considering the flow of gas sent to the enclosed flares.

Project Emissions from flaring:

Project emissions are related to the amount of methane not destroyed in the flares and will be calculated following the procedures of *TOOL06* as follows. As LFG is flared through more than one flare, $PE_{flare,y}$ is the sum of the emissions for each flare.

The project has installed enclosed flares and efficiency will be calculated from monitored data. The calculation of flare efficiency will be made by the following steps:

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

The mass flow of methane in the residual gaseous stream in the minute *m* ($F_{CH4,m}$) will be determined using the procedures set out by *TOOL08* and the following requirements apply:

- The gaseous stream tool shall be applied to the residual gas;
- The flow of the gaseous stream shall be measured continuously;

- CH_4 is the greenhouse gas *i* for which the mass flow should be determined;
- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool); and
- The time interval *t* for which mass flow should be calculated is every minute *m*.

$F_{CH4,m}$ which is measured as the mass flow during minute *m*, shall then be used to determine the mass of methane in kilograms fed to the flare in minute *m* ($F_{CH4,RG,m}$). $F_{CH4,m}$ shall be determined on a dry basis. Please note that this parameter corresponds to $F_{CH4,sent\_flare,y}$. Therefore, the same methodological approaches apply to both parameters (Option A of the tool). Data is collected in a 1-minute interval as required by the tool.

The tool also requires that <u>low height flares</u> shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency. According to definitions from the tool, a low height flare is an enclosed flare for which the flame enclosure has a height between 10 and two times the diameter of the enclosure.

Since the project flares have 2,069m diameter and 8,126 m height, its height is between the indicated range (2 x 3,098m = 6,196m and 10 x 3,098m = 30,980m). Therefore, the project flares are classified as low height flares and efficiency to be used is 80%, *i.e.* 90% by default minus 10% discount for low height flares.

<u>STEP 2</u>: *Determination of flare efficiency*

The project has installed enclosed flares and Option A will be used to determine efficiency as follows:

The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

(1) The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m; and
(2) The flame is detected in minute m ($Flame_m$).

Otherwise $\eta_{flare,m}$ is 0%.

<u>STEP 3</u>: *Calculation of project emissions from flaring*

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

$$PE_{flare,y} = GWP_{CH_4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \cdot \left(1 - \eta_{flare,m}\right) \times 10^{-3} \quad \textbf{Equation 7}$$

Where,

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

Step A.1.1: Ex ante estimation of $F_{CH4,PJ,y}$

It is determined as follows:

$$F_{CH4,PJ,y} = \eta_{PJ} \cdot BE_{CH4,SWDS,y} / GWP_{CH4}$$ **Equation 8**

Where,

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (t CO_2e/yr)
η_{PJ}	=	Efficiency of the LFG capture system installed in the project activity, this is considered as 50% considering the default value provide in the methodology.
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool *"Emissions from solid waste disposal sites"*. The following guidance should be taken into account when applying the tool:

- f_y in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in $\boldsymbol{F_{CH4,BL,y}}$;
- In the tool, x begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and
- Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies (obtained from data from ECOURBIS – landfill operator).

Application A of the Tool is used (i.e., the project activity mitigates methane emissions from a specific existing SWDS-solid waste disposal site). A yearly selection has been chosen as the São João landfill started receiving wastes in January 1992.

The amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site ($BE_{CH4,SWDS,y}$) is calculated with a multi-phase model. The calculation is based on a first order decay (FOD) model.

$$BE_{CH_\$,SWDS,y} = \varphi y \times (1 - f_y) * GWP_{CH_4} * (1 - OX) * \frac{16}{12} * F * DOC_{f,y} * MCFy * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j \times e^{-k_j (y-x)} * \left(1 - e^{-k_j}\right)$$ **Equation 9**

Where,

$BE_{CH4,SWSD,y}$	=	Baseline methane emissions occurring in year y generated from waste disposal at the solid waste disposal site (SWDS) during a period ending in year y (tCO_2e/y)
φ	=	Model correction factor to account for model uncertainties (default value of 0.75), Option 1 in the Tool has been selected, value as per Table 3 of the Tool (Application A and humid wet conditions).
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y. As this is already accounted for in $\boldsymbol{F_{CH4,BL,y}}$, "f" in the Tool shall be assigned a value of 0.
GWP_{CH4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the

soil or other material covering the waste) (default Tool value 0.1)

F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)
$DOC_{f,y}$	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWSD for year y (weight fraction). Default value of 0.5 used as per page 65 of the Tool.
MCF_y	=	Methane correction factor for year y (1)
$W_{j,x}$	=	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year *x* (t)
DOC	=	Fraction of degradable organic carbon (by weight fraction) in the waste type *j*
k_j	=	Decay rate for the waste type *j (1/yr)*
j	=	Type of residual waste or types of waste in the MSW
x	=	Years in the time period in which waste is disposed at the SWSD, extending from the first year in the time period (x=1) to year (x = y)
y	=	Year for which methane emissions are calculated (considering a consecutive period of 12 months)

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

NBR 13896/97, consisting of the technical standard published by ABNT (Brazilian Association of Technical Standards - *Associação Brasileira de Normas Técnicas*), sets out the requirements for the development of the design, implementation and operation of landfills aiming at minimizing gaseous emissions and promoting its capture and correct management. However, its use is not mandatory and the norm neither specifies the amount of methane to be destroyed nor the system that shall be put in place. In addition, there is no federal/state/local law requiring the destruction of the methane.

Previously to the implementation of the proposed CDM Project Activity there was a passive system and methane was burned in an uncontrolled manner (Figure 5). Hence, in the case of the São João Landfill Project *Case 3* is applicable (*i.e.*, There is no technical requirement to destroy methane and there was an existing LFG capture and destruction system).

Figure 5 – Project site previously to the implementation of the CDM Project Activity.

In accordance with the ACM0001 methodology, *Case 3* is applicable to the project. Since there is no monitored or historical data on the amount of methane that was captured in the year prior to the implementation of the project, the following equation applies:

$$F_{CH4,BL,sys,y} = 0.2 \times F_{CH4,PJ,y}$$ **Equation 10**

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

The baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) shall be calculated using *TOOL05*. When applying the tool:

- The electricity sources *k* in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and
- $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year *y* ($EG_{PJ,y}$).

Taking into account the approach provided by the tool, baseline emissions are then calculated using the generic approach based on the quantity of electricity dispatched into the National Grid, an emission factor for electricity generation and a factor to account for transmission losses, as follows

$$BE_{EC,y} = \sum EC_{BL,k,y} \times EF_{EL,,k,y} \times \left(1 + TDL_{k,y}\right)$$ **Equation 11**

Where,

$EC_{BL,k,y}$ = Net amount of electricity generated using LFG in year *y* (MWh/yr)

$EF_{EL,k,y}$ = Emission factor for electricity generation for source *k* in year *y* (tCO_2/MWh)

$TDL_{k,y}$ = Average technical transmission and distribution losses for providing electricity to source *k* in year *y*

k = Sources of electricity generated in the baseline

The Emission Factor is calculated according to *TOOL07.* The Tool considers the determination of the emission factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. Thus, $EF_{EL,k,,y} = EF_{grid,CM,y}$.

The Emission Factor is calculated as the *Combined Margin (CM)*, comprised by two components: the *Built Margin (BM)* and the *Operation Margin (OM)*. The BM evaluates the contribution of the power plants which would have been built if the project plant would not have been implemented. The OM evaluates the contribution of the power plants which would have been dispatched in the absence of the project activity.

TOOL07 presents the following steps to calculate the Emission Factor:

- **STEP 1** - Identify the relevant electricity systems

According to the tool, "*If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD*".

The Brazilian DNA published Resolution #8, issued on 26th May, 2008, defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence this figure is used to calculate the baseline emission factor of the grid.

- **STEP 2 –** Choose whether to include off-grid power plants in the project electricity system (optional).

Option I of the tool is chosen, which is to include only grid power plants in the calculation.

- **STEP 3 -** Select a method to determine the operating margin (OM).

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

The simple operating margin can only be used where low-cost/must-run resources[13] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normalities for hydroelectricity production. Figure 6 shows the share of hydroelectricity in the total electricity production for the Brazilian interconnected system. The results show the non-applicability of the simple operating margin to the proposed CDM Project Activity.

Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

[13] [14] The climatic conditions were taken from CEPAGRI – *Centro de Pesquisas Meteorológicas e Climáticas Aplicadas a Agricultura* -, available at http://www.cpa.unicamp.br/outras-informacoes/clima_muni_565.html.

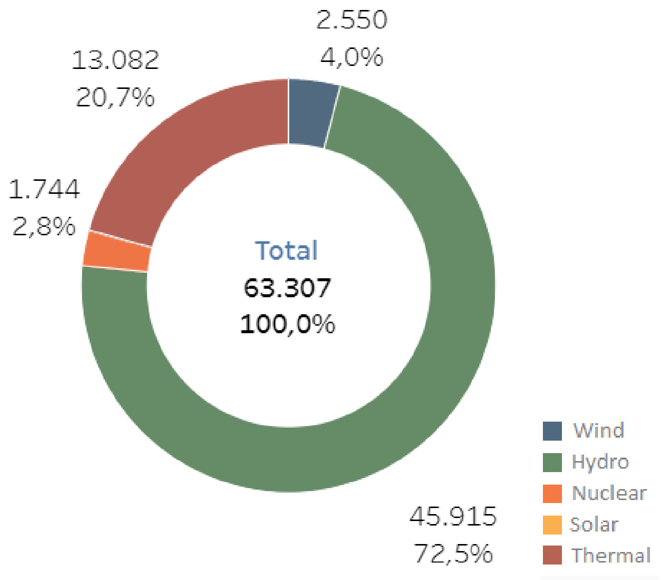

Figure 6 – Electricity generation in the Brazilian interconnected system by source, 2013 to 2017 (GWh).

Source: *ONS: Histórico da Operação. Available at* <http://www.ons.org.br/Paginas/resultados-da-operacao/historico-da-operacao/geracao_energia.aspx>*.*

The fourth alternative, an average operating margin, is an oversimplification and does not reflect in any way the impact of the project activity on the operating margin. The use of the dispatch data analysis method requires hourly monitoring of electricity and, in order to reduce data demand, the simple adjusted operating margin was chosen to determine the grid emission factor for the project activity, option b) of the tool.

The Brazilian DNA made available the operating margin emission factor calculated following *TOOL07*, approved by the CDM Executive Board. Therefore, the *ex-post* data vintage is considered.

- **STEP 4** - Calculate the operating margin emission factor according to the selected method

The simple adjusted OM shall be calculated based on the following equation:

$$EF_{grid,OM-adj,y} = (1-\lambda_y)\cdot\frac{\sum_m EG_{m.y}\times EF_{EL,m,y}}{\sum_m EG_{m.y}} + \lambda_y\cdot\frac{\sum_k EG_{k,y}\times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$ **Equation 12**

Where,

$EF_{grid,OM\text{-}adj,y}$	=	Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
λ_y	=	Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year *y*
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{EL,k,y}$	=	CO_2 emission factor of power unit *k* in year *y* (tCO_2/MWh)

m = All grid power units serving the grid in year *y* except low-cost/must-run power units

k = All low-cost/must run grid power units serving the grid in year *y*

y = The relevant year as per the data vintage chosen in Step 3

The $EF_{grid,OM\text{-}adj,y}$ parameter is calculated and annually updated by the Brazilian DNA. The resulted value is presented in section B.6.3.

- **STEP 5** - Calculate the build margin (BM) emission factor

The sample group of power units *m* used to calculate the build margin was determined following the procedure provided by the tool and BM emission factor shall be calculated based on the equation below:

$$EF_{grid,BM,y} = \frac{\sum mEG_{m,y} \times EF_{EL,m,y}}{\sum mEG_{m,y}}$$ **Equation 13**

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m.y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m = Power units included in the build margin

y = Most recent historical year for which electricity generation data is available

In terms of vintage of data, Project Participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The option chosen by the Project Participants is option 1, *i.e.* the *ex-ante* data vintage based on the build margin emission factor made available by the Brazilian DNA.

- **STEP 6** – Calculate the combined margin (CM) emissions factor

The calculation of the combined margin (CM) emission factor is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

Since power grid is not located in LDC/SIDs/URC and the weighted average CM method (option A) is the preferred option, this method was considered. The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$ **Equation 14**

Where,

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh);

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh);

w_{OM} = Weighting of operating margin emissions factor (%);

w_{BM} = Weighting of build margin emissions factor (%).

According to TOOL07, values adopted for w_{OM} and w_{BM} in the second crediting period are 0.25 and 0.75, respectively.

Steps (C) and (D) of ACM0001 methodology are not applicable since there won't be either heat generation or natural gas distribution through a network in the project activity.

Project Emissions

Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y}$$ **Equation 15**

Where,

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year *y* (t CO_2/yr);

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

$PE_{DT,y}$ = Emissions from the distribution of compressed/liquefied LFG using trucks, in year y (t CO_2/yr);

$PE_{SP,y}$ = Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y (t CO_2/yr).

$PE_{FC,y}$, $PE_{DT,y}$ and $PE_{SP,y}$ are not applicable to the proposed project activity. During the crediting period, electricity from the diesel generator may be consumed for the operation of the active LFG collection and destruction systems whenever the electricity generation facility stops and for emergency purposes. Therefore, $PE_{EC,y}$ is applicable to the project and will be calculated as follows.

It is important mentioning that 10 percent increase will be applied in the period from 22/05/2014 to 04/11/2018 project emissions due to a conservative approach given a the temporary deviation that will be requested at the time of the project verification.

Emissions from consumption of electricity due to the project activity ($PE_{EC,y}$)

Project emissions from electricity consumption ($PE_{EC,y}$) will be calculated following the procedures set out by *TOOL05*. Project emissions from consumption of electricity from the diesel generator are calculated based on the electricity consumed by the project activity and, in the case of the project activity, a conservative default value for the emission factor (1.3tCO_2/MWh), adjusted for transmission losses as follows:

$$PE_{EC,grid,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times \left(1 + TDL_{j,y}\right)$$ **Equation 16**

Where,

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

Electricity sources *j* corresponds to all the sources of electricity consumed for the operation of the LFG capture system and transportation of the LFG to the flares. Since the diesel generator is located inside BLFGE, there are no transmission losses and, therefore, $TDL_{j,y}$ is zero, unlike baseline emissions which TDL is based on the power utility losses. For the *ex-ante* estimation of electricity consumed, amount of electricity consumed from the diesel generator during the last monitored period is considered.

Leakage

According with ACM0001 there is no need to account for leakage.

Emission reductions

Emission reductions will be calculated using the formula below:

$ER_y = BE_y - PE_y$

Equation 17

Where,

ER_y	=	Emission reductions during the year *y* (tCO_2e)
BE_y	=	Baseline emissions in year *y* (tCO_2e)
PE_y	=	Project emissions in year *y* (tCO_2e)

B.6.2. Data and parameters fixed ex ante

"ACM0001 Methodology"

Data/Parameter	OX_{top_layer}
Data unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in *TOOL04*
Value(s) applied	0.1
Choice of data or measurement methods and procedures	As per the applicable tool
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$F_{CH4,BL,y}$
Data unit	t CH_4/yr
Description	Amount of methane in the LFG that would be flared in the baseline in year *y*
Source of data	Information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns as well as records of the project site previously to the implementation of the proposed CDM Project Activity
Value(s) applied	902 (average during the crediting period)
Choice of data or measurement methods and procedures	There was no regulatory and/or contractual requirement to destroy methane and there was a LFG capture and destruction system installed prior to the implementation of the project activity.
Purpose of data	Calculation of baseline emissions
Additional comment	In the case of the proposed project activity Case 3 is applicable. For details please refer to section B.6.1. above.

Data/Parameter	GWP_{CH4}
Data unit	tCO_2e/tCH_4
Description	Global Warming Potential of CH_4
Source of data	IPCC
Value(s) applied	25 for the second commitment period. Shall be updated according to any future COP/MOP decisions.
Choice of data or measurement methods and procedures	As per the applicable methodology
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	η_{PJ}
Data unit	Dimensionless
Description	Efficiency of the LFG capture system installed in the project activity
Source of data	-
Value(s) applied	50%.
Choice of data or measurement methods and procedures	Default value provided by the applicable methodology
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step A.1.1

TOOL04: "Tool Emissions from solid waste disposal sites"

Data/Parameter	$\varphi_{default}$
Data unit	-
Description	Default value for the model correction factor to account for model uncertainties
Source of data	-
Value(s) applied	0.75
Choice of data or measurement methods and procedures	As per *TOOL04*. This parameter is used to determine the baseline emissions following the procedures related to *Application A*. Further, the project is located at São Paulo state (southeast region of Brazil) which possesses tropical weather conditions[14]: MAT > 20ºC MAP > 1,000mm Therefore, the value correspondent to this condition as presented in Table 3 of the methodology is chosen.
Purpose of data	Calculation of baseline emissions
Additional comment	As per Table 3 since the project participants have chosen to apply Option 1 to determine this parameter.

[14] The climatic conditions were taken from CEPAGRI – *Centro de Pesquisas Meteorológicas e Climáticas Aplicadas a Agricultura* -, available at http://www.cpa.unicamp.br/outras-informacoes/clima_muni_565.html.

Data/Parameter	f_y
Data unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*
Source of data	ACM0001
Value(s) applied	0
Choice of data or measurement methods and procedures	In accordance with the ACM0001 methodology this value is to be assigned since the amount of LFG that would have been captured and destroyed is already accounted for in Equation 2. As per *TOOL04*, for application A, this parameter is determined once for the crediting period ($f_y = f$).
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	***OX***
Data unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0
Choice of data or measurement methods and procedures	As per *TOOL04*
Purpose of data	Calculation of baseline emissions
Additional comment	When methane passes through the top layer, part of it is oxidized by methanotrophic bacteria to produce CO_2. The oxidation factor represents the proportion of methane that is oxidized to CO_2. This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS. For ex-ante calculations this effect was accounted for when determining emission reductions as per ACM0001 formulae. Please refer to AM_CLA_0259. Although clarification refers to ACM0001 (version 15.0) and *TOOL04* (version 6.0.1), it is also applied to the project since equations do not change in the updated version of methodology and tool.

Data/Parameter	***F***
Data unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or measurement methods and procedures	As per *TOOL04*
Purpose of data	Calculation of baseline emissions
Additional comment	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide.

Data/Parameter	$DOC_{f,default}$
Data unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories”
Value(s) applied	0.5
Choice of data or measurement methods and procedures	The proposed project activity corresponds to *Application A* described in *TOOL04*. Therefore, in accordance with the requirements set out by tool, the default value was chosen.
Purpose of data	Calculation of baseline emissions
Additional comment	This factor reflects the fact that some of the degradable organic carbon does not degrade, or degrades very slowly, in the SWDS.

Data/Parameter	$MCF_{default}$
Data unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1
Choice of data or measurement methods and procedures	The proposed project activity matches *Application A* described in *TOOL04*. The São João Landfill meets the criteria of managed SWDS. Hence, the value corresponding to **anaerobic managed solid waste disposal sites** is chosen.
Purpose of data	Calculation of baseline emissions
Additional comment	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

<table>
<tr><th>Data/Parameter</th><th>DOC_j</th></tr>
<tr><td>Data unit</td><td>-</td></tr>
<tr><td>Description</td><td>Fraction of degradable organic carbon in the waste type j (weight fraction)</td></tr>
<tr><td>Source of data</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>DOC_j (% wet waste)</th><th>Waste type j</th></tr>
<tr><td>43%</td><td>Wood and wood products</td></tr>
<tr><td>40%</td><td>Pulp, paper and cardboard</td></tr>
<tr><td>15%</td><td>Food, food waste, beverages and tobacco</td></tr>
<tr><td>24%</td><td>Textiles</td></tr>
<tr><td>20%</td><td>Garden, yard and park waste</td></tr>
<tr><td>0%</td><td>Glass, plastic, metal, other inert waste</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>Values for MSW, as per Table 6 of TOOL04.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

<table>
<tr><th>Data/Parameter</th><th>k_j</th></tr>
<tr><td>Data unit</td><td>1/yr</td></tr>
<tr><td>Description</td><td>Decay rate for the waste type j</td></tr>
<tr><td>Source of data</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th colspan="2">Waste type j</th><th>k_j</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.40</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>As per Table 7 of TOOL04.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>The project is located at São Paulo state (Southeastern region of Brazil) which possesses tropical weather conditions[14]:
MAT > 20ºC
MAP > 1,000mm</td></tr>
</table>

Data/Parameter	***W_x***
Data unit	T
Description	Total amount of waste disposed in a SWDS in year *x*
Source of data	ECOURBIS
Value(s) applied	Large amount of data. Please refer to the CERs calculation spreadsheet
Choice of data or measurement methods and procedures	ECOURBIS is the landfill operator. This company recorded the amount of waste deposited at the project site and still today manages the landfill area.
Purpose of data	Calculation of baseline emissions
Additional comment	This parameter does not need to be monitored during the crediting period since the landfill was closed in 2009.

TOOL06: "Project emissions from flaring"

Data/Parameter	***$SPEC_{flare}$***
Data unit	Temperature - ºC Flow rate or heat flux – kg/h or m^3/h Maintenance schedule – number of days
Description	Manufacturer's flare specification for temperature and flow rate and maintenance schedule
Source of data	Flare manufacturer
Value(s) applied	Not used for *ex-ante* calculations
Choice of data or measurement methods and procedures	The flare specifications set by the manufacturer for the correct operation of the flare for the selected parameters are: *(a) Minimum and maximum inlet flow rate, if necessary converted to flow rate at reference conditions or heat flux:* Min. – 500Nm^3/h / Max. 5,000Nm^3/h *(b) Minimum and maximum operating temperature:* 1,000ºC – 1,200ºC *(c) Maintenance schedule: every 365 days*
Purpose of data	Calculation of project emissions
Additional comment	-

TOOL08: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

Data/Parameter	***Ru***
Data unit	Pa.m^3/kmol.K
Description	Universal ideal gases constant
Source of data	As per the applicable tool
Value(s) applied	8,314
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	***Pn***
Data unit	Pa
Description	Atmospheric pressure at normal conditions
Source of data	As per the applicable tool
Value(s) applied	101,325
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	***Tn***
Data unit	K
Description	Temperature at normal conditions
Source of data	As per the applicable tool
Value(s) applied	273.15
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of project emission
Additional comment	-

Data/Parameter	***MMi***
Data unit	kg/kmol
Description	Molecular mass of greenhouse gas *i*
Source of data	Tool
Value(s) applied	16.04 (for methane)
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of project emissions
Additional comment	-

TOOL07: “Tool to calculate the emission factor for an electricity system”

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor in year *y*
Source of data	The Brazilian DNA. Official source of data
Value(s) applied	0.1370 based on the most recent information available (2018 year)
Choice of data or measurement methods and procedures	According to TOOL07.
Purpose of data	Calculation of baseline emissions
Additional comment	For methodological choices details, please refer to section B.6.1.

TOOL05: "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

Data/Parameter	$EF_{EL,j,,y}$
Data unit	tCO_2/MWh
Description	Emission factor for electricity generation for source *j* in year
Source of data	Default value from *TOOL05*
Value(s) applied	1.3
Choice of data or measurement methods and procedures	Conservative default value provided by Option B2 of the tool.
Purpose of data	Calculation of project emissions due to electricity consumption from the diesel generator
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

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

Year	$BE_{CH4,SWSD,y}$ (t_{CO2})	$F_{CH4,PJ,y}$ (t_{CH4})	$F_{CH4,BL,y}$ (t_{CH4})	$BE_{CH4,y}$ (t_{CO2})	$BE_{CH4,y}$ (t_{CO2}) after discount	*Reference*
From 22/05/2014	202,507	4,050	810	72,902	64,883	PDD, appendix 7: i) Discount of 10 per cent in baseline emissions due to temporary deviation up to November 2018; ii) Discount of 1 per cent in methane generation due to permanent change.
2015	285,177	5,704	1,141	102,664	91,371	
2016	250,920	5,018	1,004	90,331	80,395	
2017	224,012	4,480	896	80,644	71,773	
2018	202,294	4,046	809	72,826	64,815	
2019	184,301	3,686	737	66,348	65,685	PDD, appendix 7: i) Discount of 1 per cent in methane generation due to permanent change.
2020	169,033	3,381	676	60,852	60,243	
Up to 21/05/2021	60,520	1,210	242	21,787	21,569	
TOTAL	**1,578,764**	**31,575**	**6,315**	**568,355**	**520,735**	-
Average	**225,538**	**4,511**	**902**	**81,194**	**74,391**	-

The following data was used to calculate the *ex-ante* methane estimative (as per TOOL04):

- *MFC (Methane Conversion Factor):* MCF value is adopted according with the type of SWDS. The São João Landfill is a managed SWDS; thus, the MCF adopted is equal to 1
- Model correction factor to account for model uncertainties: 0.75 (default value as per the Tool Application A and wet conditions)
- W_x (Total amount of organic waste prevented disposed in year x, in tons):
- The amount of the solid waste entering in the São João Landfill has been monitored by ECOURBIS, as presented in the table below:

The Oxidation factor, reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste, was considered when determining baseline emissions using formulae provided by the methodology ACM0001.

Table 3 – Historical deposited solid waste at the site.

Year	Deposited waste (tons)	Year	Deposited waste (tons)
1992	5,500	**2001**	2,157,783
1993	768,591	**2002**	2,292,821
1994	862,211	**2003**	2,120,943
1995	1,516,727	**2004**	2,008,528
1996	1,841,783	**2005**	2,200,000
1997	1,971,480	**2006**	2,421,714
1998	2,046,081	**2007**	1,523,096
1999	2,126,986	**2008**	348,428
2000	2,034,546	**2009**	295,271

The composition of the solid waste used to calculate *ex-ante* estimative of methane generation was based in an historical data prepared by ECOURBIS. The historical average of each type of waste concentration is presented in the table below, which is comparable to municipal solid waste - MSW- (heterogeneous mix of different solid waste types collected by the municipality of São Paulo, including household waste, garden/park waste and commercial/institutional waste):

Table 4 – Waste types historically disposed at the project site.

Category	% (wet basis)
Wood and wood products	0.60%
Pulp, paper and cardboard	10.30%
Food, food waste, beverages and tobacco	64.40%
Textiles	2.20%
Garden, yard and park waste	0.00%
Glass, plastic, metal, other inert waste	21.50%

As $BE_{CH4,y}$ estimation is based on waste disposed in the SWDS of São João landfill, $BE_{CH4,y}$ does not consider LFG purchased from PA5947.

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

$EG_{PJ,y}$ is equal to the electricity produced by the proposed CDM Project Activity. For *ex-ante* estimative purposes, it was assumed that 90% of LFG generated was used for electricity generation; the other 10% was considered to be flared. Electricity effectively dispatched into the

national grid is measured at AES Eletropaulo's substation. Transmissions losses are estimated as 5.2%[15].

The calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows the steps established in *TOOL07*. According to data published by the Brazilian DNA, the CO_2 operating margin and build margin emission factors of 2018 year are as follows:

$$EF_{grid,OM,2018} = 0.3932\ tCO_2e/MWh$$

$$EF_{grid,BM,2018} = 0.1370\ tCO_2e/MWh$$

While using the applicable w_{OM} and w_{BM}, the CO_2 combined margin emission factor is as follows:

$$EF_{grid,CM,2018} = 0.2011\ tCO_2e/MWh$$

Applying these figures to Equation 11, we have the following results:

Table 5 – Baseline emissions due to electricity generation.

Year	*$EG_{PJ,y}$ (MWh/yr)*	*$BE_{EC,y}$ (tCO_2/yr)*	*$BE_{EC,y}$ (tCO_2/yr) after discount*	*Reference*
From 22/05/2014	20,127	4,257	3,777	PDD, appendix 7: i) Discount of 10 per cent in baseline emissions due to temporary deviation up to November 2018; ii) Discount of 1 per cent in methane generation due to permanent change; iii) 1 per cent in LFG flow to electricity generation
2015	28,343	5,995	5,910	
2016	24,939	5,275	5,200	
2017	22,264	4,709	4,642	
2018	20,106	4,252	4,192	
2019	18,317	3,874	3,819	PDD, appendix 7: i) Discount of 1 per cent in methane generation due to permanent change; ii) 1 per cent in LFG flow to electricity generation
2020	16,800	3,553	3,503	
Up to 21/05/2021	6,015	1,272	1,254	
Total	**156,911**	**33,187**	**32,298**	-
Average	**22,416**	**4,741**	**4,614**	-

As $BE_{EC,y}$ estimation is based on LFG generated in the SWDS of São João landfill, $BE_{EC,y}$ does not consider electricity generated with the LFG purchased from CTL.

c) Project emissions due to electricity consumption from the diesel generator

This source of emissions is considered when there is the use of the diesel generator. As diesel is used only for emergency purposes (when the electricity generation facility is not operational), for the *ex-ante* estimation information presented in the last available monitoring period by the time of current PDD development is used. The total electricity consumed from the diesel generator from

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** [21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

01/06/2011 up to 15/05/2012 (349days) was 35.34MWh. Therefore, the proportional consumption of diesel oil for an entire year is of 37MWh/yr.

Transmission losses can be neglected since the generator is next to the LFG facility. Therefore, $TDL_{j,y}$ = $TDL_{k,y}$ = 0%. The default conservative value of emission factor provided by Option B.2 of the tool is used, which is 1.3tCO_2/MWh. While applying values on Equation 18, project emissions due to electricity consumption are as follows:

Table 6 – Project emissions due to electricity consumption.

Year	**Electricity Consumed (MWh)**	**CO_2 Emission Factor (tCO_2e/MWh)**	***$PE_{EC,j,y}$ (tCO_2/yr)***	***$PE_{EC,j,y}$ (tCO_2/yr)) after correction*** [†]	***Reference***
From 22/05/2014	22	1.3	28.2	31	PDD, appendix 7: i) Increase of 10 per cent in project emissions due to temporary deviation up to November 2018; ii) Increase of 1 per cent in methane generation due to permanent change; iii) Increase of 1 per cent in LFG flow to generators (conservative - electricity meters have 0.2% accuracy)
2015	35		45.9	51	
2016	35		45.9	51	
2017	35		45.9	51	
2018	35		45.9	51	
2019	35		45.9	47	PDD, appendix 7: i) Increase of 1 per cent in methane generation due to permanent change; ii) Increase of 1 per cent in LFG flow to generators (conservative - electricity meters have 0.2% accuracy)
2020	35		45.9	47	
Up to 21/05/2021	14		17.8	18	
Total	**247**	**1.3**	**322**	**348**	-
Average	**35**		**46**	**50**	-

d) Project emission due to flaring

The calculation of the *ex-ante* methane emissions from flaring of vented gas has been estimated considering 10% of the LFG collected. It is assumed that all the methane not used to generate electricity is to be flared in the enclosed flares.

As described in section B.6.1. above, Project Participants have opted to consider the default value for flare efficiency using Option B.2. of *TOOL08*. Then the project emissions due to flaring gases have been estimated as:

Table 7 – Project emissions from flaring.

Year	***$PE_{flare,y}$ (tCO_2e/year)***	***$PE_{flare,y}$ (tCO_2e/year) after correction***	***Reference***
From 22/05/2014	2,025	2,268	PDD, appendix 7: i) Increase of 10 per cent in project emissions due to temporary deviation up to November 2018; ii) Increase of 1 per cent in methane generation due to permanent change; iii) Increase of 1.5 per cent in LFG flow to flares
2015	2,852	3,194	
2016	2,509	2,810	
2017	2,240	2,509	
2018	2,023	2,265	
2019	1,843	2,064	PDD, appendix 7: i) Increase of 1 per cent in methane generation due to permanent change; ii) Increase of 1.5 per cent in LFG flow to flares
2020	1,690	1,893	
Up to 21/05/2021	605	678	
Total	**15,788**	**17,679**	-
Average	**2,255**	**2,526**	-

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
From 22/05/2014	68,660	2,299	0	66,361
2015	97,281	3,245	0	94,036
2016	85,595	2,861	0	82,734
2017	76,416	2,560	0	73,856
2018	69,007	2,317	0	66,691
2019	69,504	2,110	0	67,394
2020	63,746	1,939	0	61,807
Up to 21/05/2021	22,823	696	0	22,128
Total	553,033	**18,027**	**0**	535,005
Total number of crediting years	7			
Annual average over the crediting period	79,005	2,575	0	76,429

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

"ACM0001 Methodology"

Data/Parameter	Management of SWDS
Data unit	-
Description	Management of SWDS
Source of data	Use different sources of data: – Original design of the landfill; – Technical specifications for the management of the SWDS; – Local or national regulations
Value(s) applied	-
Measurement methods and procedures	Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Monitoring frequency	Annually
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$Op_{j,h}$
Data unit	-
Description	Operation of the equipment that consumes the LFG
Source of data	Project participants
Value(s) applied	Not used for *ex-ante* calculations.

Measurement methods and procedures	In the context of the proposed project activity, equipment unit *j* using *the LFG* consists of the LFG upgrading facility and flares. Hence, the following parameters are to be used to ensure that the plant is operating in hour *h*: *For the electricity generation facility* • Products generated. Monitoring of electricity dispatched to the grid according to local utility. *For the flaring system* • Temperature: according to the manufacturer's technical record, the combustion temperature varies from 1,000 to 1,200°C. Temperature shall varies between this range. $Op_{j,h}$=0 when: • No products are generated in the hour *h* • Flame is not detected continuously in hour *h* (instantaneous measurements are made at least every minute); Otherwise, $Op_{j,h}$=1
Monitoring frequency	Hourly
QA/QC procedures	Flow meters and flame detectors shall be subject to a regular maintenance and testing regime to ensure accuracy. Calibration shall be according to manufacturers' specifications. Accuracy of the electricity meters and flame detectors are described in the monitoring tables of respective parameters.
Purpose of data	Calculation of baseline emissions
Additional comment	This is monitored to ensure methane destruction is claimed for methane used to generate electricity when the power plant is operational.

Data/Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Net amount of electricity generated using LFG in year *y*
Source of data	PLC data records
Value(s) applied	22,416 (average during the crediting period)
Measurement methods and procedures	The data is measured by electricity meters installed at the project site and local substation. Data is continuously monitored and hourly recording. AES Eletropaulo sends the registered data for the project participants. Double-check of electricity dispatched is conducted between SJ's PLC data records and AES Eletropaulo's system in order to identify major discrepancies. However, data from AES Eletropaulo is always used for invoice purposes and, therefore, it is considered for calculation of emission reductions. In order to determine the SJ's electricity generation and dispatch to the grid, AES Eletropaulo readings will be proportionally accounted based on the CH_4 mass balance from CTL and SJ. No emission reductions will be claimed (neither in flaring nor in power generation) from the use of LFG purchase from CTL.
Monitoring frequency	Continuous
QA/QC procedures	Electricity meters are subjected to regular maintenance and testing to ensure accuracy following the procedures from the National Electric System Operator ("ONS" from the Portuguese Operador Nacional do Sistema Elétrico), sub-module 12.3. Currently, calibration is conducted at every 5 years and will be changed in case of any future revisions from ONS. The accuracy of the equipment, as per the manufacturer specification is 0.2S (accuracy class 0.2%).

Purpose of data	Calculation of baseline emissions
Additional comment	In accordance with ACM0001, this parameter is equivalent to $EC_{BL,k,y}$ in the tool. For ex-ante estimative, the amount of LFG collected and forwarded to the power plant was used to calculate the electricity generated during the crediting period. During periodic verifications, this parameter is to be directly measured using electricity meter.

<u>Note:</u> the depth and height of the water table in the SWDS is not monitored as the MCF has been selected as a default value as per Application A of the methodological tool *"Emissions from solid waste disposal sites"*.

TOOL08: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

Data/Parameter	$V_{t,db}$
Data unit	m^3 dry gas/h
Description	Volumetric flow of the gaseous stream in time interval *t* on a dry basis
Source of data	PLC data records
Value(s) applied	Not used for *ex-ante* calculations.
Measurement methods and procedures	Data is continuously measured by flow meters located in flares and generators. Measurements of the flow are recorded electronically by PLC for each minute and aggregated for control and ER purposes. Flow meters are detailed below. In case of any failure, flow meters will be replaced.
Monitoring frequency	In accordance with the methodology it is monitored on a minute basis, monthly aggregated and reported.

Meter	*Measurement*	*Manufacturer*	*Accuracy (%)*	*Calibration freq.*
FIT 524	*Flow flare F520*	*Endress+Hauser*	*1.5*	*5 years*
FIT 544	*Flow flare F540*	*Endress+Hauser*	*1.5*	*5 years*
FIT 564	*Flow flare F560*	*Endress+Hauser*	*1.5*	*5 years*
FIT 500	*Total gas to flares – cross check*	*Incontrol*	*1.0*	*5 years*
FIR 800	*Total gas to engines*	*Incontrol*	*1.0*	*5 years*
FIR 600	*Total gas to engines*	*Incontrol*	*1.0*	*5 years*
FIT 910	*Incontrol*	*CTL flow – principal*	*1.0*	*5 years*
FIT 901	*Incontrol*	*CTL flow – backup*	*1.0*	*5 years*

QA/QC procedures	Flow meters are subjected to a regular maintenance and testing regime to ensure accuracy in compliance with national laws. Regular maintenance is made following general guidelines from the manufacturer. - Monitoring under responsibility of the BLFGE Manager; - Automatic readings of temperature and pressure are made by sensors/transmitters connected to the flow-meter; data is used to convert the gas-flow to Nm^3, thus no separate monitoring of pressure and temperature is necessary; - In case of frequent failure or high discrepancy readings, equipment will be displaced. Periodic calibration provided by an independent accredited laboratory and according to manufacturers' recommendations. In order to determine the amount of LFG generated, CTL's landfill gas will be discounted from the total LFG based on meter flow measurements. No emission reductions will be claimed (neither in flaring nor in power generation) from the use of LFG purchase from CTL. Also, discount factors will be adopted as determined in Appendix 7. Invoices can be used for cross checking purposes, if applicable.
Purpose of data	Calculation of baseline emissions
Additional comment	This parameter is used to determine the flow of methane in the LFG sent to the electricity generation facility ($F_{CH4,EL,y}$) and sent to the enclosed flares ($F_{CH4,flared,y}$).

Data/Parameter	$v_{i,t,db}$
Data unit	m^3 gas *i*/m^3 dry gas
Description	Volumetric fraction of greenhouse gas *i* in a time interval *t* on a dry basis
Source of data	PLC data records
Value(s) applied	Not used for *ex-ante* calculations.

<table>
<tr><td>Measurement methods and procedures</td><td>There are three methane analyzers: CTL, SJ and CTL+SJ. CTL’s methane analyzer is under CTL’s responsibility, including its maintenance and calibration as established in its monitoring plan. Methane measurement equipment of SJ (GEM2000) and CTL+SJ (A100) are under SJ’s responsibility as well as their calibration.
<table>
<tr><td>Meter</td><td>Manufacturer</td><td>Measurement</td><td>Accuracy (%)</td><td>Calibration freq.</td></tr>
<tr><td>GEM2000</td><td>Landtec</td><td>Gas analyzer (SJ)</td><td>3.0</td><td rowspan="2">Weekly by the project developer
Yearly by a third party company</td></tr>
<tr><td>A100</td><td>Rosemount – NUK</td><td>Gas analyzer (SJ + CTL)</td><td>1.0</td></tr>
<tr><td>FAU-TDL</td><td>Landtec</td><td>Gas analyzer (CTL)</td><td>1.0</td><td>Yearly by CTL</td></tr>
</table>
GEM2000 is not a fixed meter and, therefore, SJ’s methane is measured by sampling: conducted 3 times a day and daily average is considered for cross-checking purposes. Also, uncertainty of GEM2000 is higher (+/-3.0%) when compared to A100 analyzer (1.0%). Therefore, GEM2000 will be used for cross-checking purposes only and A100 will be used for emission reductions calculation. Both A100 from SJ and CTL’s analyzer measurements are continuous and integrated once per minute.
In order to determine baseline emissions from the SWDS, only SJ’s methane will be accounted based on the flow and concentration measurements (mass balance). No emission reductions will be claimed (neither in flaring nor in power generation) from the use of LFG purchase from CTL. Additionally, discount factors will be adopted as determined in Appendix 7.</td></tr>
<tr><td>Monitoring frequency</td><td>Continuous for CTL and CTL+SJ methane analyzers
Sampling for cross-checking SJ methane analyzer</td></tr>
<tr><td>QA/QC procedures</td><td>Gas analyzers are subjected to a regular maintenance and testing regime to ensure accuracy. In case of frequent failure or high discrepancy readings, they will be replaced.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>This parameter is used to determine the flow of methane in the LFG sent to the electricity generation facility ($F_{CH4,EL,y}$).</td></tr>
</table>

Data/Parameter	***Tt***
Data unit	°C
Description	Temperature of the gaseous stream in time interval t
Source of data	PLC data records
Value(s) applied	Not used for *ex-ante* calculations.
Measurement methods and procedures	Instruments with recordable electronic signal (analogical or digital).
Monitoring frequency	Continuous
QA/QC procedures	During verification, it will be confirmed that all parameters are converted to normal conditions during the monitoring process.
Purpose of data	Calculation of baseline emissions.
Additional comment	Applicability condition while applying option b) of *TOOL08* (gaseous stream flow temperature below 60ºC).

Data/Parameter	***Status of LFG destruction device***

Data unit	-
Description	Operational status of LFG destruction devices
Source of data	PLC data records
Value(s) applied	-
Measurement methods and procedures	Monitoring and documenting is undertaken by recording the energy production from methane captured or the operation of the flare by means of a flame detector and thermocouples to demonstrate the actual destruction of methane. Emission reductions will not accrue for periods in which the destruction device is not operational.
Monitoring frequency	Continuous
QA/QC procedures	Thermocouples calibration will be provided during verification in order to demonstrate that flares are operating properly.
Purpose of data	Calculation of project emissions
Additional comment	For Flame detector devices refer to *TOOL06*

TOOL06: "Project emissions from flaring"

Data/Parameter	$T_{EG,m}$
Data unit	^{o}C
Description	Temperature in the exhaust gas of the enclosed flare in minute *m*
Source of data	PLC data records
Value(s) applied	Not used for *ex-ante* calculations.
Measurement methods and procedures	Data is measured by thermocouples installed in each flare and the reading frequency is continuously. Measurements of the temperature of the exhaust gas are recorded electronically by PLC at least each minute. Data is archived electronically. In case of frequent failure or high reading discrepancy, it will be displaced.
Monitoring frequency	Continuous
QA/QC procedures	Temperature measurement equipment should be replaced or calibrated in accordance with their maintenance schedule. Thermocouple respects the demands from Standard EN 60584. In case of failure, they will be replaced accordingly.
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	$Flame_m$
Data unit	Flame on or Flame off
Description	Flame detection of flare in the minute *m*
Source of data	PLC data records
Value(s) applied	Not used for *ex-ante* calculations.
Measurement methods and procedures	According to the operating manual from the flare manufacturer, there is a UV sensor and a burner control unit for automatic ignition and flame monitoring. The UV-sensor detects the flame and gives a signal to the automatic control burner. As soon as the flame has been burning for a given retention time, the automatic burner control opens the main gas valve. Then, valve that controls the flow of gas sent to flare enclosure automatically closes whenever no flame is detected by sensors.
Monitoring frequency	Once per minute. Detection of flame recorder as a minute that the flame was on, otherwise recorded as a minute that the flame was off depending on the flow of gas inside the flare enclosure.

QA/QC procedures	No calibration is required. Nonetheless, due to safety reasons, tests are conducted to ensure the sensor of the valve is functioning well.
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	***$Maintenance_y$***
Data unit	Calendar dates
Description	Maintenance events completed in year *y*
Source of data	Project participants
Value(s) applied	Not used for *ex-ante* calculations.
Measurement methods and procedures	Record the date that maintenance events were competed in year *y*. Records of maintenance logs must include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates.
Monitoring frequency	Annual
QA/QC procedures	Records must be kept in a maintenance log for two years beyond the life of the flare.
Purpose of data	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine the 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 ($SPEC_{flare}$).
Additional comment	-

TOOL07: "Tool to calculate the emission factor for an electricity system"

Data/Parameter	***$EF_{grid,OM,y}$***
Data unit	tCO_2/MWh
Description	Simple adjusted operating margin CO_2 emission factor in year *y*
Source of data	The Brazilian DNA. Official source of data
Value(s) applied	0.3932 based on the most recent data available (2018 year).
Measurement methods and procedures	According to TOOL07.
Monitoring frequency	Annually
QA/QC procedures	Official source of data
Purpose of data	Calculation of baseline emissions
Additional comment	For methodological choices details, please refer to section B.6.1.

TOOL05: "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"

Data/Parameter	***TDLk,y***
Data unit	%
Description	Average technical transmission and distribution losses for providing electricity to source *k* in year *y*

Source of data	Local measurements e Eletropaulo's records
Value(s) applied	5.2
Measurement methods and procedures	Historically measured difference between measurements conducted at the site and in the Eletropaulo substation, or official source of data.
Monitoring frequency	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	Conservatively this figure is also used for $TDL_{j,y}$ when calculation project emissions due to electricity consumption from the diesel generator.

Data/Parameter	$EC_{PJ,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source *j* in year *y*
Source of data	PLC data records
Value(s) applied	35.34 based on the last monitoring period
Measurement methods and procedures	The electricity consumed by the plant is monitored through hours of operation from generator while applying the maximum output capacity of the generator 400kW, as a volume meter is not usual given the little consumption and capacity of generator. While adopting the maximum oil consumption capacity (110,6l/h) from manufacturer's specification, and applying diesel oil NCV and EF, it results in lower project emissions than when considering the installed capacity. Therefore, the approach considered by the PP is very conservative. Manufacturer: ABB Type: MGE 144 Accuracy class: 0.5% Calibration frequency: 5 years
Monitoring frequency	The reading frequency from the electricity meter is continuously and the recording frequency is hourly.
QA/QC procedures	As there is no diesel volume meter, 1.3tCO_2e/MWh default value is used to calculate PE emissions. Calculated as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".
Purpose of data	Calculation of project emissions
Additional comment	The project has one backup diesel generator in case of power supply interruption located at the landfill. Generator is not used for electricity generation to the grid.

B.7.2. Sampling plan

Not applicable. This section is intentionally left blank.

B.7.3. Other elements of monitoring plan

Section B.7.1. above describes the parameters that are to be monitored during the crediting period, as well as, the methods and procedures to be applied. The location of instruments that are installed in the degassing and electricity generation plants is presented in the below diagrams.

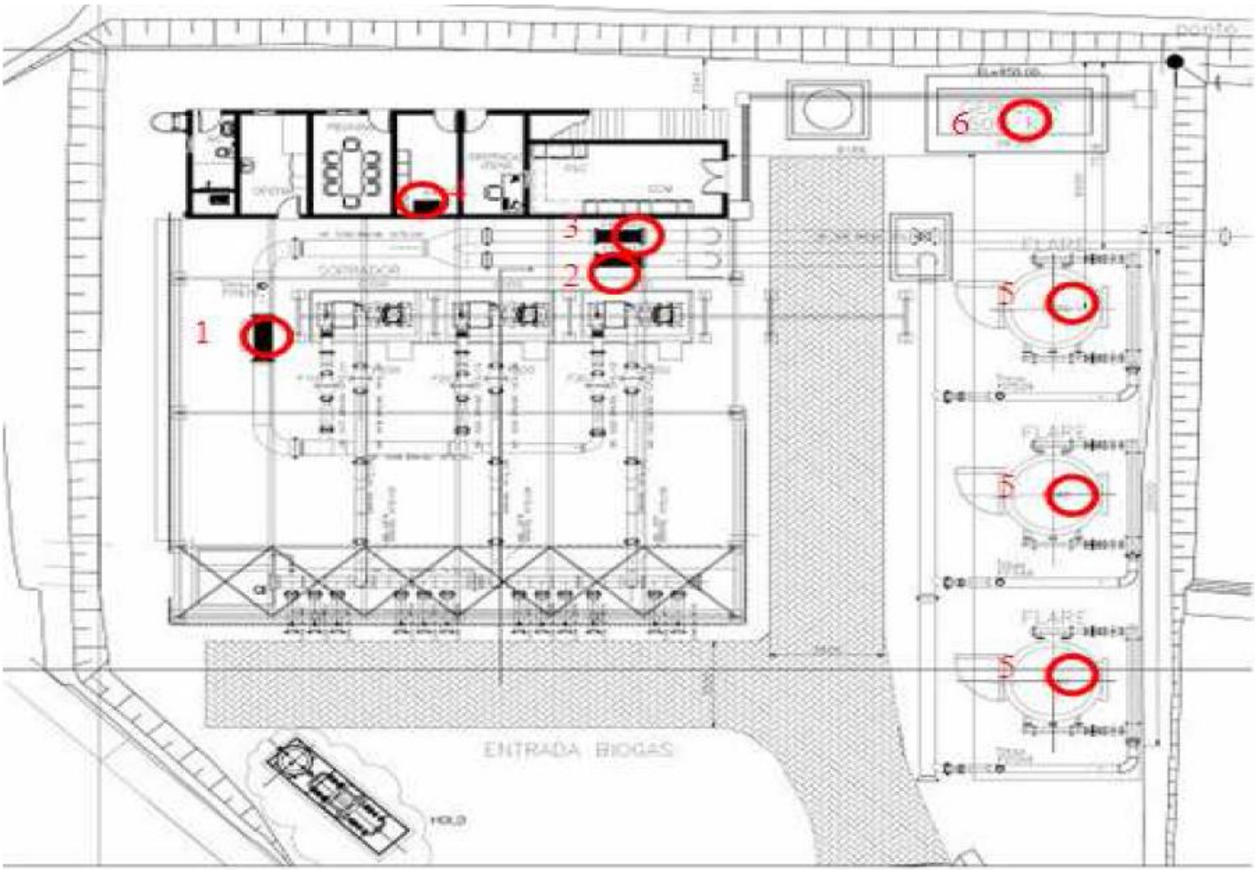

Figure 7 – Layout of the degassing plant.

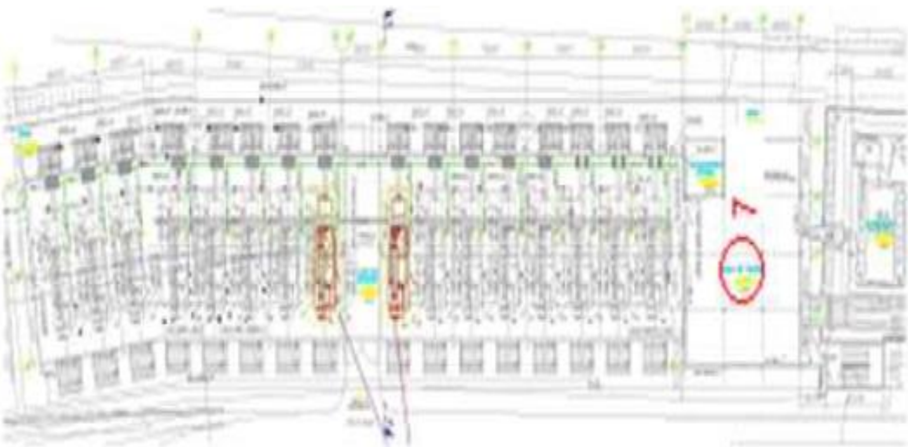

Figure 8 – Lay-out of the Power Plant.

1 **–** FIR600: Flow meter - Register the total amount of landfill gas captured;

2 **–** FIR500: Flow meter - Register the total amount of landfill gas flared;

3 – FIR800: Flow meter - Registered the total amount of landfill gas combusted in the Power plant;

4 – Gas Analyzer: Measure the Methane fraction in the landfill;

5 – FIT524, FIT544 and FIT564: Flow meter, pressure and temperature transmitters;

6 – PLC System Monitoring - Diesel generator[16]

7 - Electricity meter – Substation.

Besides, the procedures described below are also to be taken into account while performing monitoring activities related to the proposed project activity.

A simplified diagram of monitoring equipment is presented as follows:

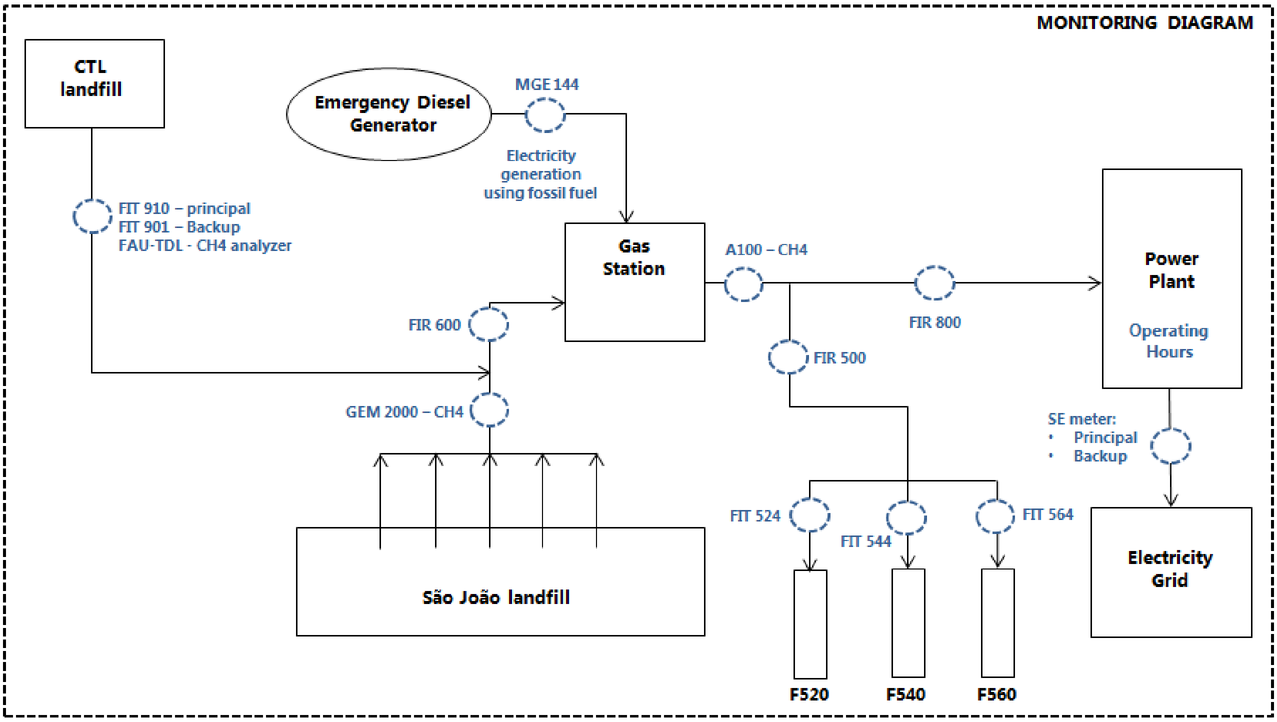

Figure 9 – Simplified diagram of monitoring equipment.

a) Data transmission, processing and storage

The variables described in item B.7.1 are automatically registered in a supervisory computer system. Since all the registered data in the Supervisory System's hard disk is subjected to sabotage and technical failure, the project participant has developed the following actions to protect the monitoring system:

- The PLC is not connected to the Internet, thus the risk of virus is minimized;
- Only authorized persons have access to the data base of the system;

**[21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

- Antivirus programs are installed at the system;
- Data backup:
  - A weekly CD backup of the Supervisory System in external hard disk;
  - A weekly backup of the Supervisory System's hard disk is made by the server;
  - The Operational Environment Unit downloads regularly the primary data for the elaboration of the monitoring report.

Data was previously collected in a 5-minute interval following the previous version of *TOOL06*, but since November 2018, the system was updated to consider 1-minute interval. This update was made since the project is under renewal of the crediting period and 1-minute interval is required by the updated version of *TOOL06*. For this reason, -10% discount will be applied in baseline emissions and +10% in project emissions from 22/05/2014 to 04/11/2018 at the time of the project verification. Detailed information is presented in appendix 7.

On 03/04/2014 onwards, there will be three measurements from CTL, SJ and CTL+SJ for methane measurement. CTL's methane analyzer is under CTL's responsibility, including its maintenance and calibration as established in its registered monitoring plan. Methane measurement equipment of SJ (GEM2000) and CTL+SJ (A100) are under SJ's responsibility as well as their calibration. In spite of GEM2000 measures SJ's methane only, the analyzer to be considered for emission reduction calculation is A100. GEM2000 is not a fixed meter and, therefore, SJ's methane is measured by sampling: conducted 3 times a day and daily average is considered for cross-checking purposes. Also, uncertainty of GEM2000 is higher (+/- 3.0%) when compared to A100 analyzer (1.0%). Therefore, GEM2000 will be used for cross-checking purposes only and A100 will be used for emission reductions calculation. Both A100 from SJ and CTL's analyzer measurements are continuous and integrated once per minute. As we have methane measurement from the CTL+SJ and from CTL, it is possible unequivocally determine the quantity of methane generated in SJ, which is sent to flares[17]. If any loss occurs in the flow from SJ, it will be accounted to São João (because CTL is measured and SJ + CTL is measured). Then, methane from SJ will never be overestimated, but may be conservatively underestimated.

LFG production at PA5947 is not controlled by PA0373, but LFG purchased from PA5947 is fully monitored, and is not accounted in PA0373's CERs calculation. As described in the PDD (sections B.2, B.6.1, B.7.3 and appendix 7), PA0373 emission reductions will be calculated by applying discounts on readings proportionally to CH_4 mass balance from LFG purchased from CTL. Follows an example calculation:

****
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**[21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

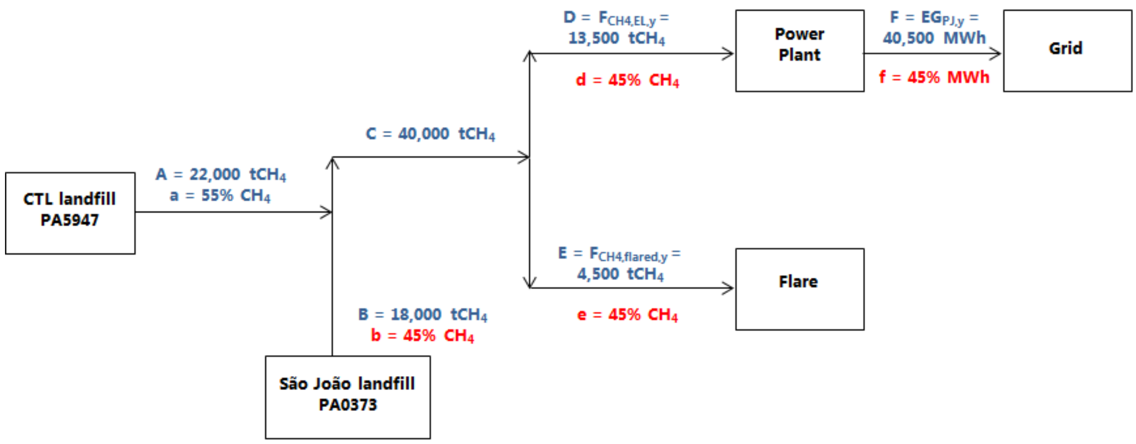

Figure 10 – Example of mass balance.

It is worth mentioning that both landfills - PA0373 and PA5947, are independent and materially separated projects and operate fully segregated cells.

In the case of project emissions from flaring, LFG flow will be measured by FIT524, FIT544 and FIT564 and will be considered for emission reduction purposes if flares operate under adequate operational conditions of temperature and flow as established by the manufacturer, *i.e.* 1,000ºC – 1,200ºC temperature and 500Nm^3/h - 5,000Nm^3/h flow rate. Readings from FIT500 is not used for emission reduction calculations but for cross-checking purposes only. All measurement will be discounted proportionally to the measurement of methane collected by CTL.

In the case of baseline emissions of methane from SWDS, LFG flow will be measured by FIT524, FIT544 and FIT564 (flares), as well as FIR800, which is allowed to use a single flow meter (and not one for each equipment which consumes LFG) as established by ACM0001. All measurement will be discounted proportionally to the measurement of LFG collected by CTL.

In the case of baseline emissions from electricity generation, exported electricity from energy meters – provided by the power utility (AES Eletropaulo) – will be also discounted proportionally to the measurement of LFG collected by CTL.

It is important mentioning that a discount factor based on the equipment accuracy and a conservative approach for emission reductions calculation will be considered following §239 of the CDM Project Standard. Please refer to Appendix 7 for details.

All data monitored and required for verification and issuance be kept and archived electronically for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

b) Responsibilities

From the point of view of the plant operation, positions and roles for this CDM project activity are well defined. Duties, personnel replacement in the case of non-availability of the Operation Manager and O&M Coordinator and hiring requirements for job positions are determined in documented procedures presented in the functional organogram ad responsibility matrix.

c) Quality Assurance & Quality control

All parameters monitored inside LFG Station, including reading, transmitting and registration routine are under the Operation Manager and O&M Coordinator’s responsibility.

Every week, all data registered is downloaded from the PLC and a complete check to identify unconformities, such as unread registrations or troubles with the PLC (this unconformities happens mainly due to electricity blackouts) is made. All unconformities raised are promptly compared with operational events, registered by operators in the Operation Diary. Operators are oriented to perform a “Print-Screen” of the PLC Controlling System Panel every three hours. The picture printed presents all monitoring parameters and is saved in the computer’s hard disk.

The Backup Data Procedure[18] includes the management of the operational system and data record, as well as backup procedures. The Procedure for Calibration of Gases Analyzer Panel – Methane and Oxygen[19] establishes procedures for calibration of the gas analyzer panel and the Operation Manual for the Gas Plant Startup[20] establishes procedures to startup the gas plant after blackouts of power electricity supply from concessionary (Eletropaulo).

d) Training

All training was supplied to operators and technical assistants before the project’s implementation. Before performing its activities, every new operator has performed proper training, including:

- How to operate and start the plant;
- Reading instruments and recording of reports;
- Verification and calibration of gas analyzer;
- Maintenance of equipment.
- Data Protection Measures.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

30/06/2006

C.2. Expected operational lifetime of project activity

21 years, 0 month.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable crediting period.

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***[21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

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[21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

***[21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

C.3.2. Start date of crediting period

22/05/2007

C.3.3. Duration of crediting period

7 years – 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Environmental impacts from project initiatives are to be analyzed by the State Secretary of Environment (SMA – Secretaria de Estado do Meio Ambiente) through its department for environmental impact assessment (DAIA) and state of São Paulo environmental agency (CETESB).

For SJ, a preliminary environmental report (RAP) was prepared, in accordance with state of São Paulo environmental legislation. This has been submitted to SMA for appraisal and questionings. After being analyzed by DAIA, a statement was forwarded to the developer, allowing it to proceed with the project and apply for the installation license. This will be issued by CETESB, after it makes further considerations on the project through the RAP.

SJ has been granted a preliminary environmental license. It attests the project has been assessed by the environmental authorities, with no major impacts predicted. Nevertheless, as seen in figure 2, the license requests the project developers to design more detailed documentation, especially regarding monitoring of gaseous emissions, in order to have the installation license issued. The license is shown in figures 2 and 3.

There will be no transboundary impacts resulting from SJ. All the relevant impacts occur within Brazilian borders and will be mitigated to comply with the environmental requirements for project's implementation. Therefore, SJ has been granted with operating licenses, which attest the project has been assessed by the environmental authorities, to whom no major impacts are predicted.

Both Operation Licenses No. 30007689 and 30007690 both issued by CETESB on May 25th, 2012 and are valid through May 25th, 2017. The renewal of Operation License is under CETESB analysis and receipt of request for renewal submission to CETESB is available with the Project Participant.

D.2. Environmental impact assessment

As already mentioned, Aterro Sanitário Sítio São João, the landfill where the proposed CDM Project Activity is located, has been designed with modern engineering practices that put it as a well-managed landfill under state of São Paulo environmental agency (CETESB) assessment.

Nevertheless, operation of a degasifying unit, with intention to flare the gas, either in flare equipment or in engines for energy generation, may cause gaseous emissions such as volatile organic compounds and dioxins that have to be analysed. This is not expected to happen considering the landfill gas goes through a treatment prior to be flared, and similar conditions have already been successfully applied by the project developer at its other landfill gas to energy project in Brazil.

The project activity operates with its working license in place and after conducted all the necessary studies as required by the environmental agency. All additional requirements will be satisfactorily fulfilled if required by the agency.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

Invitation for comments by local stakeholders is required by the Brazilian Designated National Authority as part of the procedures for analyzing CDM projects and issuing letters of approval. This procedure is the one that will be followed by Biogás to take its GHG mitigation initiative to the public.

In its first resolution, the DNA required project participants to communicate with the public through letters, to be sent inviting for comments to:

- The Brazilian national NGO‟s forum;
- The local attorneys‟ and prosecutors‟ agency;
- The municipality‟s chamber (mayor and assemblymen);
- State‟s and municipal‟s environmental authorities;
- Local communities‟ associations.

The project developers have submitted such letters.

E.2. Summary of comments received

From the above stakeholders, only one provided comments on SJ. This was the state of São Paulo environmental agency, CETESB – Companhia de Tecnologia de Saneamento Ambiental. The letter was signed by Mr. JoãoWagner Alves, manager of CETESB‟s global issues division.

In the letter, Mr. João Wagner makes a brief introduction to climate change and to the potential methane has in enhancing the warming effect in the atmosphere, while also referring to the Brazilian national GHG inventory. Mr. Wagner also provides a definition for LFG, and the methane content in it under different circumstances.

In the letter, Mr. Wagner also points out that the better way to avoid methane emissions is to avoid waste generation, recommending reuse and recycling, pointing also that, if correctly managed, landfill waste deposition is feasible. In the end, he remembers that CETESB has already assessed São João landfill and has qualified it with a 8.3 grade in 2004, meaning the landfill is adequately managed. To finalize, Mr. Wagner makes two suggestions:

- To evaluate plausible alternatives to the energetic use of the LFG that make use of national available technology;
- To evaluate fomenting initiatives such as reuse, recycling and other waste management practices, such as composting, to mitigate global warming.

E.3. Consideration of comments received

Project participants provided a feedback on the letter through an e-mail message. In such message, the participants clarified that equipment selection would be made taking into account the socio-environmental and economic performance of the project, remembering that so far not all the necessary technology for degassing landfills is available through national suppliers. And if this is bad on one hand, on the other hand the so-called technology transfer will necessarily be in place for project implementation and operation, achieving one of the CDM goals.

Regarding waste reuse, recycling and other measures to avoid GHG emissions, project participants stated that such measures must definitely be in place. Participants highlighted that

emission reductions revenues from SJ will be shared equally by the project developers and São Paulo municipality, meaning the environmental authorities will have available resources from the CDM initiative to invest in such “GHG-free” ideas. Finally, project participants also mentioned that, due to the fact that the waste is already disposed in São João landfill, the gas is already being produced, and therefore any measures by the municipality towards reuse, recycling and composting will have no effect on the GHG generation at the site.

Later, Mr. Wagner called Econergy to thank for the feedback.

SECTION F. Approval and authorization

Letters of approval and authorization are available at the UNFCCC’s website: <https://cdm.unfccc.int/Projects/DB/DNV-CUK1145141778.29/view>

Appendix 1. Contact information of project participants

Organization name	Prefeitura Municipal de São Paulo
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Fax	+55 (11) 3372-2200
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Website	http://www.capital.sp.gov.br/
Contact person	Mr. Eduardo de Castro

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Contact person	Mr. Sergio Stacchini

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Fax	+41 (22) 594 39 01
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Website	http://www.mercuria.com/
Contact person	Mr. Jean-François Steels

Appendix 2. Affirmation regarding public funding

No public funding for this project has been obtained.

Appendix 3. Applicability of methodologies and standardized baselines

Not applicable. This section is intentionally left blank. Please refer to sections B.1 and B2.

Appendix 4. Further background information on ex ante calculation of emission reductions

Not applicable. This section is intentionally left blank. Please refer to sections B.6.1 and B.6.3 for details regarding the emission factor of the Brazilian Interconnected Grid calculation.

Appendix 5. Further background information on monitoring plan

Not applicable. This section is intentionally left blank.

Appendix 6. Summary report of comments received from local stakeholders

Not applicable. This section is intentionally left blank.

Appendix 7. Summary of post-registration changes

The history of the project presenting a summary of PRCs and reasons for delays for its renewal of the crediting period is presented in the table below.

Table 8 – Timeline of the project activity

Date	Action
02/07/2006	Registration of the CDM Project Activity.
28/05/2010	1st PRC: EB acceptance of the PRC due to the change in the installed capacity. The registered PDD considered 21 units of 945kW, which resulted in 19.845 MW installed capacity (rounded to 20 MW in the PDD) based on model 3516A. However, the project layout was revised considering 16 generator units of 1.54 MW each based on CAT model G3520C. Although equipment nameplate presents 1.6MW (standard capacity) resulting in 25.60MW installed capacity, the DOE (TUVSUD) requested the PP to consider the 1.54 MW based on standard capacity and site specifications.
15/02/2011	E-mail sent by the UNFCCC CDM RIT requesting to the DOE/PP to include monitoring frequency for the parameter “Regulatory requirements relating to landfill gas projects”.
09/04/2011	2nd PRC: EB acceptance of the revisions of the monitoring plan due to the UNFCCC CDM RIT’s request to change the recording frequency of parameter “Regulatory requirements relating to landfill gas projects”.
30/09/2013	Signature of the contract for the LFG purchase between SJ and Ecourbis Ambiental S.A. (the project participant of CTL landfill).
02/04/2014	Submission of the request for renewal of the crediting period of the project.
03/04/2014	Start of CTL’s LFG supply to São João LFGE Project

Date	Action
12/09/2014	The CDM Executive Board (EB) request for additional clarification during the request for review period of the crediting period renewal. Clarification was required for: a) Compliance of monitoring according to ACM0001 (v.14.0), as there were 3 flares and 16 generators, but only two flow meters (one to monitor LFG sent to flares and another to LFG sent to electricity generators); b) Application of zero for $F_{CH4,BL,y}$, although there was “a passive system and methane was burned in an controlled manner”.
16/10/2014	PPs clarification submission regarding item b) from the request for review received on 12/09/2014 by the CDM EB.
27/10/2014	Withdrawal of the request for renewal of the crediting period.
16-20/03/2015	The CDM EB clarification response of AM_CLA_0265 (item b from the request for review received on 12/09/2014), which indicates that “If there was a capture then the situation to be considered is ‘case 3’ and the adjustment factor needs to be calculated using any of the options provided in the methodology”.
31/07/2015	Signature of the agreement term between SJ and Ecourbis Ambiental S.A. regarding the CERs ownership from CTL landfill required during the post-registration change of CTL project activity (# 5947).
07/01/2016	PPs request for deviation submission due to item a) from the request for review received on 12/09/2014 by the CDM EB.
08/08/2016	The CDM EB approval of the deviation request M-DEV-493 “Deviation from the ACM0001 with regards to the individually monitoring of the LFG flow forwarded to equipment (flare and/or generator) used by the proposed CDM Project Activity”.
28/09/2018	Restart of the validation of the renewal of the crediting period (delays due to non-cash to pay the restart of the validation process – DOE and CDM consultancy).
12/11/2019	3rd PRC: EB acceptance of the PRC due to: Temporary deviations: i) -10% discount factor in baseline emissions and +10% in project emissions shall be applied in the period from 16/05/2012 to 04/11/2018 due to to 5-minute monitoring interval instead 1-minute interval as required by the updated version of TOOL06. Permanent changes: i) corrections in technical equipment data; ii) changes in the project design due to consideration of PA5947’s LFG purchase; iii) voluntary update of methodology due to significant changes since the project registration; iv) changes in the monitoring plan due to application of discounts in monitored data based on monitoring equipment accuracy and adoption of conservative approach since April 2014 onwards (applicable to the entire project lifetime).

As determined in the latest approved PRC of the project (12/11/2019), the following provisions shall be considered:

(a) Temporary deviations from the monitoring plan as described in the registered PDD (hereinafter referred to as the registered monitoring plan), the applied methodologies, standardized baselines or other methodological regulatory documents;

- Application of -10% for the entire baseline emissions and +10% in project emissions during the period from 22/05/2014 to 04/11/2018. A 10 percent discount factor is a very conservative approach, while the maximum permissive equivalent error of equipment is 1.81%[21]. This conservative approach is due to the 5-minute monitoring interval instead of 1-minute as required by TOOL06. A temporary deviation is being submitted together with this PDD.

Following §128 of the PCP-PA (v2.0) and e-mail received on 23/01/2020 by the CDM Team, the temporary deviation of the monitoring plan shall be described in the proposed changes of the monitoring report, as it does not require a revised PDD.

(b) Permanent changes

i) Permanent change to the registered monitoring plan

- Application of the discount factor based on the equipment accuracy as established in manufacturer's specification. Then, discount will be applied twice (methane and flow measurement): 1% discount will be applied on methane measurement (A100) and gas flow sent to generators (FIR 800), and 1.5% discount on gas flow sent to flares (FIT524, FIT544 and FIT564);
- Adopting a conservative approach by using values rounded down (truncated) for data instantaneously generated and registered in the PLC system, then no decimal places of gas flow, for example, will be considered while calculating emission reductions.

In spite of the discounts, baseline emissions generated by the project activity will be calculated according to equations 1, 2 and 3, and project emissions from flaring according to equation 6. Please refer to section B.7 for details of the monitoring plan. The discount above will be applied for period from 22/05/2014 onwards. A permanent change is being submitted together with this PDD.

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.

[21] Equivalent error based on the root of the square sum of equipment accuracy (1% for methane analyzer and 1.5% for gas flow).

Version	*Date*	*Description*
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Version	*Date*	*Description*

Decision Class: Regulatory
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Keywords: project activities, project design document