CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Bandeirantes Landfill Gas to Energy Project (BLFGE)
Version 03
March 01st, 2012.

A.2. Description of the project activity:

BLFGE is a project designed to explore the landfill gas produced in Bandeirantes Landfill, one of the biggest landfill in Brazil. This landfill is located in the metropolitan region of São Paulo, Brazil's biggest city and financial centre of the country. With population of more than 12 million citizens in 2000, São Paulo generates nearly 15.000 tons of waste daily.

BLFGE's goal is to explore the gas produced in Bandeirantes landfill, using it to generate electricity. The environmental agency – CETESB (Companhia de Tecnologia de Saneamento Ambiental) classified the state´s landfill according to technology used, management techniques and other criteria in its Landfill Quality Index (*IQR – Índice de Qualidade de Aterros de Resíduos*). BLFGE was qualified with an IQR of 8.8 (range 0 to 10) in CETESB's 2005 assessment of state's landfills[1].

However, the designed solution for the landfill gas in 1979 was to collect it through passive venting, occasionally flaring it at the head of the wells, which is not favourable in terms of methane destruction, since this operation is very inefficient.

Aiming to avoid environmental problems related to methane emissions, including also global warming, BLFGE was the designed solution created by Biogás Energia Ambiental S/A – the winner company of a public bid from the municipality of São Paulo. It's goal has been not only to generate renewable energy through 24 engines of 925kW capacity (total installed capacity equals to 22.2MW), but also find an environmental, social, and financial solution to avoid landfill gas release into the atmosphere. Such solution is, at the end of the day, very replicable in a country like Brazil, where there was no landfill capturing methane under the three bottom-lines (social, environmental and financial), mentioned in this paragraph, by the time of the project's development.

The energy generation capacity has been exploited by Itau–Unibanco (the second largest Brazilian private bank) through Biogeração, the owner of the electricity generation equipment which leases such facilities to Itau–Unibanco. The bank established an agreement with Biogás and shares the emission reductions generated by this project activity, but is not a project participant. Itau–Unibanco was the first Brazilian financial institution to join the "Equator Principles", a framework for financial institutions to manage social and environmental issues in project financing, established by the International Finance Corporation and the World Bank.

BLFGE greatly contributes towards sustainable development. First of all, the project makes use of biogas – a renewable energy source – to generate electricity, which is financially and socially desirable. Second, it aims to flare a great amount of methane that would be released to the atmosphere, which is socially and environmentally desirable. That means not only the project avoids global warming, but also provides an environmentally sound solution to minimize explosion risks at the landfill site. Third, it was the first

[1] Available at: CETESB - Companhia de Tecnologia de Saneamento Ambiental. *Inventário Estadual de resíduos Sólidos Domiciliares, 2005.*

landfill gas to energy project to be implemented in Brazil, and considering the replicability potential was tremendous in the country by the time of the project's implementation, due mainly to the waste's high organic content, a great positive impact was brought by the initiative, which showed the technology for landfill gas capture and destruction – either through flaring only or through electricity generation – was proven. Forth, emission reduction revenues are shared (50:50) with the municipality of São Paulo, which invest the money from the CERs sale into the landfill's surrounding area, like the construction of public parks and squares, sewage collection, etc. Fifth, many job positions were created during project implementation and operation, highlighting that some of them are low-skilled technical positions, which contributes to a better income distribution. Last but not least, state-of-the-art on LFG collection and power generation technology was transferred to the project, since most of the necessary equipment could not be found in Brazil by the time of the project's implementation; additionally there were no skilled personnel trained to operate the main equipments and monitoring instruments, therefore capacity building was put in place for the project's implementation and operation.

It is also important to notice that the project is integrated with other economic sectors in the region, as regular maintenance and calibration is necessary in the facilities.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	• Prefeitura Municipal de São Paulo (the Municipality of São Paulo) (Brazilian Public Entity) • Biogás Energia Ambiental S.A. (Brazilian Private Entity)	No
Germany	• KfW Bankegruppe (German Private Entity)	No
Netherlands	• Fortis Bank N.V./S.A. (Dutch Private Entity)	No
Switzerland	• Mercuria Energy Trading SA (Swiss Private Entity)	No

Biogás is a company created in the year 2000, with the objective to explore landfill gas potentials in Brazil. Since its creation, the company won 3 public bids to exploit the LFG generated in the Bandeirantes Landfill (core of this project), São João Landfill (the other landfill owned by the municipality of São Paulo, which objective is to generate power) and Gramacho Landfill (landfill owned by the municipality of Rio de Janeiro, which objective is to sell the LFG and replace the natural gas consumption of a final consumer). Among Biogás shareholders are Arcadis Logos Energia S.A, a company part of the Arcadis group – Dutch engineering, project management and consultancy company; Heleno & Fonseca Construtécnica S.A, Brazilian construction firm; and Van der Wiel, another Dutch company acting in the fields of transport, infrastructure and environmental technique.

The municipality of São Paulo has under its administration the responsibility of caring for the biggest city in Brazil. São Paulo had around 12 million inhabitants by the time of the project implementation, with around 12 million more leaving in its surroundings, forming one of the world's biggest urban areas – the metropolitan region of São Paulo. Counting on good infrastructure in telecom and transport, with a downtown airport connecting major cities in Brazil, São Paulo is the heart of the industrial and financial activities in Brazil, though industries have been leaving the city since the early and mid-1990's.

São Paulo is also the richest city – in absolute terms – in Brazil. Nevertheless, the city is heavily indebted. Being in such a situation, the administrations have been seeking partnerships and new ways to boost investment and improve life quality in the area. One of such initiatives is being a participant in BLFGE. The municipality will receive revenues to be earned through emissions reductions commercialization, an income to be used for new investments in landfill installations and rubbish dumps recovery.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil

A.4.1.2. Region/State/Province etc.:

State of São Paulo

A.4.1.3. City/Town/Community etc.:

São Paulo

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

Bandeirantes Landfill is located between km 25 and km 26 at Bandeirantes highway, which connects the city of São Paulo with Campinas Metropolitan Region, the richest area from the state of São Paulo. The landfill covers an area of approximately 1.35 million m^2, having Perus urban area (a São Paulo district) as north border; São Paulo – Jundiai old road as east border; to the south lies the connection between this road and Bandeirantes highway; and finally to the west by Bandeirantes highway.

S 23°25´11.13''
W 45°45'21.69''

The Picture below presents the detailed location of the landfill

Figure 1. Location of the BLFGE

A.4.2. Category(ies) of project activity:

The BLFGE is categorized in the following Sectoral Scopes:

- Sectoral Scope 13 – *Waste Handling and Disposal*: used to calculate emission reductions due to the production of methane from the decomposition of municipal solid waste to the atmosphere; and

A.4.3. Technology to be employed by the project activity:

Roughly, the whole degasifying system, gas treatment and gas use can be described through Figure 2.

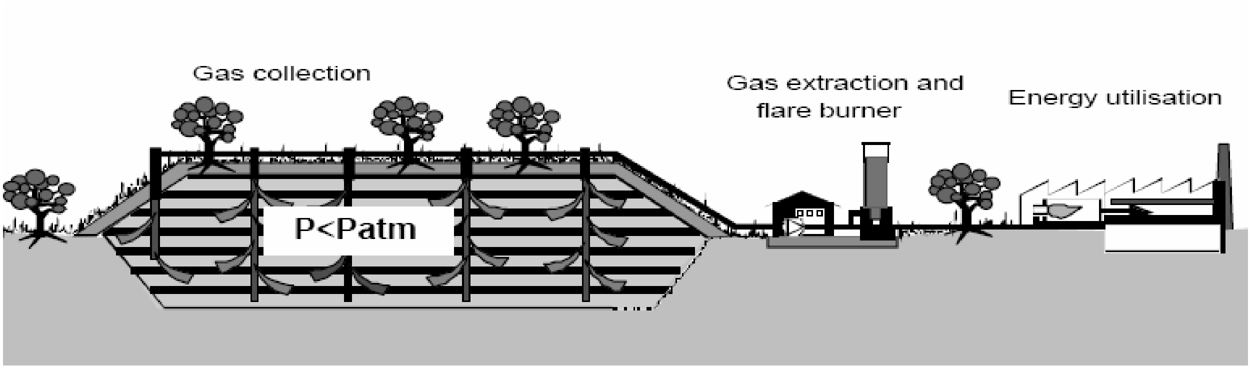

Figure 2. Degasifying and energy utilization scheme for a landfill gas to energy project.

Bandeirantes landfill is divided into 5 cells, named AS-1, AS-2, AS-3, AS-4 and AS-5. The landfill received waste from 1979 to 2007, when it was closed. An amount of more than 37 million tons of waste were disposed in the landfill's area. The collection system encompasses mostly the cells AS-4 and AS-5

More technically, BLFGE project can be seen as displayed in Figure 3.

Figure 3. Biogas treatment plant and electricity power plant

From Figure 3, two main units can be detached: the degassing station (A) and the power plant (B).

The degassing station is responsible for extracting the landfill gas from the landfill and transports it to the gas engines in the power plant. During the transportation, the gas goes through a treatment to allow its use as fuel for energy generation. Other functions of the degassing station are: drying landfill gas by gas coolers; and measuring and analysing the quantity and quality of the landfill gas for safety, process and operating purposes.

The landfill gas cools down when transported from the landfill, resulting in a condensate. This is drained to condensate shafts, placed nearby the gas pipes. Once in the degassing stations, the landfill gas has to be cooled again to remove moisture. This is a very important step in the gas treatment process, since the condensate, which contains silicium components, could block the gas pipes and also damage the gas engines, due to the silicium. After this step, the gas is heated again 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.

Considering demoisturing is fundamental for the energy generation, as per the reasons mentioned in the previous paragraph, a demister has been installed for extra-safety reasons. The demister is a stainless steel high density filter which separates liquid particles (small amounts of condensate) from the landfill gas. This liquid is to be drained off to a condensate shaft as well.

The blowers are used for transportation of the landfill gas from the landfill to the gas engines, under correct suction and pre-pressure. Capacity and pressure are adjusted through frequency controlled electromotors. Moreover, the blowers are equipped with all the necessary safety equipment, including a noise reducing housing.

On the pressure side of the degassing station, all kinds of gas analyzing and gas measuring instruments are present. These instruments are very important for safety, process and operating purposes.

After the described treatment, analyzing and measurement, the landfill gas is transported as a fuel to the gas engines. These drive electrical generators in order to generate electrical power. An occasional surplus of the landfill gas can be burned off by the flares – the project has 2 units “High temperature flare HOFGAS – Efficiency 2500” (manufactured by Hofstetter) installed at the site, with the following characteristics:

DIMENSIONS	Height: 8.126 m Diameter: 2.069 m
GAS FLOW CAPACITY	Min: 500 Nm^3/h Max: 2,500 Nm^3/h
COMBUSTION TEMPERATURE	1,000°C – 1,200°C
RETENTION TIME	> 0.3sec

The whole process is controlled by an electrical control system. This control system is provided with a PLC (Programmable Logical Controller). All the measured process signals are processed by the PLC to output signals for the gas-coolers, blowers, flares and gas-engines. Also the system counts on a SCADA system (process visualization on a personal computer). With this system it is possible to control and monitor the installation at a distance, including through the internet.

For the electricity generation, a total of 24 Caterpillar engines, nominal capacity of 925 kW, model 3516A were installed (achieving a total installed capacity equals to 22.2MW). They burn the gas and generate energy, which is sent to Eletropaulo’s – the electricity distributor supplying São Paulo metropolitan region – grid. This electricity is in fact not commercialized directly; it is supplied to Itau–Unibanco’s branches over São Paulo state. The connection point between the project and the Brazilian National Grid is within the landfill’s boundary as presented in the picture below:

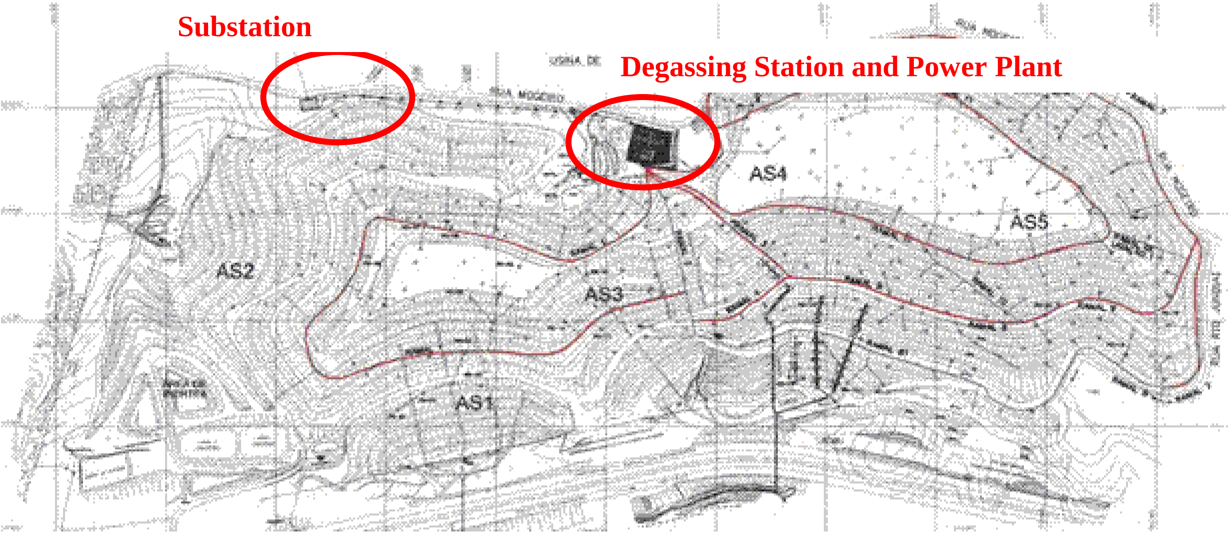

Figure 4. Location of the Degassing Station / Power Plant, the Substation and the 5 cells from the Bandeirantes Landfill

BLFGE was the biggest biogas power plant by the time of the project's implementation and lead to the development of similar projects, like the São João Landfill Gas to Energy Project (also owned by Biogás).

In Brazil, this kind of project has never been fully accepted by the time of the project's implementation, since technology was not considered to be proven, legislation does not require landfill gas to be destroyed. Moreover, and maybe more important, the country electricity culture was focused on big hydropower plants.

Therefore, one would not think such a landfill gas to energy initiative would happen if there were no technology transfer in place. This means not only supplied equipment, but also training engineers on how to implement such projects and how they could, in turn, train operators to take care of the various meters and software necessary for project operation. In the case of BLFGE, project implementation and operation capabilities were part of the work of Van der Wiel – worldwide known Dutch firm acting in the transport, infrastructure and environmental technique – and Arcadis, engineering, project management and consultancy Netherlands-based firm with a branch in Brazil (Arcadis Logos), responsible for landfill gas capture engineering design. Equipment used in this project is mainly imported – engines for electricity generation, flow meters, gas analyzer, and flares are all imported.

Both companies have been working under strict environmental regulations, and project's implementation and operation happen under such circumstances. Thus, it can be clearly seen a very important environmentally safe technology transfer operation has been put in place with BLFGE.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emissions reductions in tons of CO_2e
2010*	9,534
2011	361,517
2012	307,960
2013	267,353

Years	Annual estimation of emissions reductions in tons of CO_2e
2014	235,791
2015	210,627
2016	190,054
2017**	169,040
Total estimated reductions (tons of CO_2e)	**1,751.876**
Total numbers crediting years	**7**
Annual average over the crediting period of estimated reductions (tons of CO_2e)	**250,268**

*   from 23/12/2010 to 31/12/2010
** from 01/01/2017 to 22/12/2017

A.4.5. Public funding of the project activity:

There is no public funding involved in BLFGE project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

BLFGE applies the following methodology and tools:

- Version 11 of ACM0001 – Consolidated methodology for landfill gas project activities;
- Version 06.0.0 of the Tool for the demonstration and assessment of additionality;
- Version 06.0.0 of the Emissions from solid waste disposal site.
- Version 01 of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption.
- Version 01 of the Tool to determine project emissions from flaring gases containing methane.
- Version 02.2.1 of the Tool for calculation of emission factor for electricity systems.
- Version 02 of the Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.
- Version 03 of the Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period.

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

a) ACM0001

Applicability conditions:

METHODOLOGY	PROJECT
This methodology is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include situations such as:	This condition is applicable, because the main objective of the project is to capture the LFG produced in the Bandeirantes Landfill and, as demonstrated on item B.4, the baseline scenario is the continuation of the landfill's operation, with total emission of the landfill gas generated to the atmosphere.
a) The captured gas is flared; and/or	This condition is applicable. The project will install flare(s) to destroy the surplus LFG collected, after the power plant comes into operation.
b) The captured gas is used to produce energy (e.g. electricity/thermal energy) Emission reductions can be claimed for thermal energy generation, only if the LFG displaces use of fossil fuel either in a boiler or in an air heater. For claiming emission reductions for other thermal energy equipment (e.g. kiln), project proponents may submit a revision to this methodology	This condition is applicable. The main objective of the project is to collect the LFG generated in the Bandeirantes Landfill and use it to generate electricity. No thermal energy will be generated.

c) The captured gas is used to supply consumers through natural gas distribution network. If emissions reductions are claimed for displacing natural gas, project activities may use approved methodology AM0053.	This condition is not applicable as the LFG collected will be used to generate electricity and not be sold to a natural gas distribution grid network.

B.3. Description of the sources and gases included in the project boundary:

The project boundary is limited to the area occupied by the Bandeirantes Landfill Gas to energy and all power plants connected to the Sistema Interconectado Nacional – SIN (Brazilian Electric Grid). The table below summarizes the sources of gases included within the project boundary:

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from electricity consumption	***CO_2***	***Yes***	***According with the methodology ACM0001, "Electricity may be consumed from the grid or generated onsite/offsite in the baseline scenario".*** ***In the baseline scenario, electricity is consumed to operate the landfill and is assumed to be very small, compared with the project's consumption. For simplification, this source will be excluded from baseline emissions.***
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Emissions from thermal energy generation	CO_2	No	This emission source was neglected because the project activity won't consume/generate thermal energy
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Emissions from decomposition of waste at the landfill site	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted.
		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 landfills. Exclusion of this gas is conservative.
Project Activity	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	No	This source of project emissions will be neglected as no fossil fuel will be used on-site.
		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 on-site electricity use	***CO_2***	***Yes***	***An emergency diesel - generator was installed to supply electricity to the project in cases of grid-supply interruption.***
		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.

The following diagram presents the boundaries of the project:

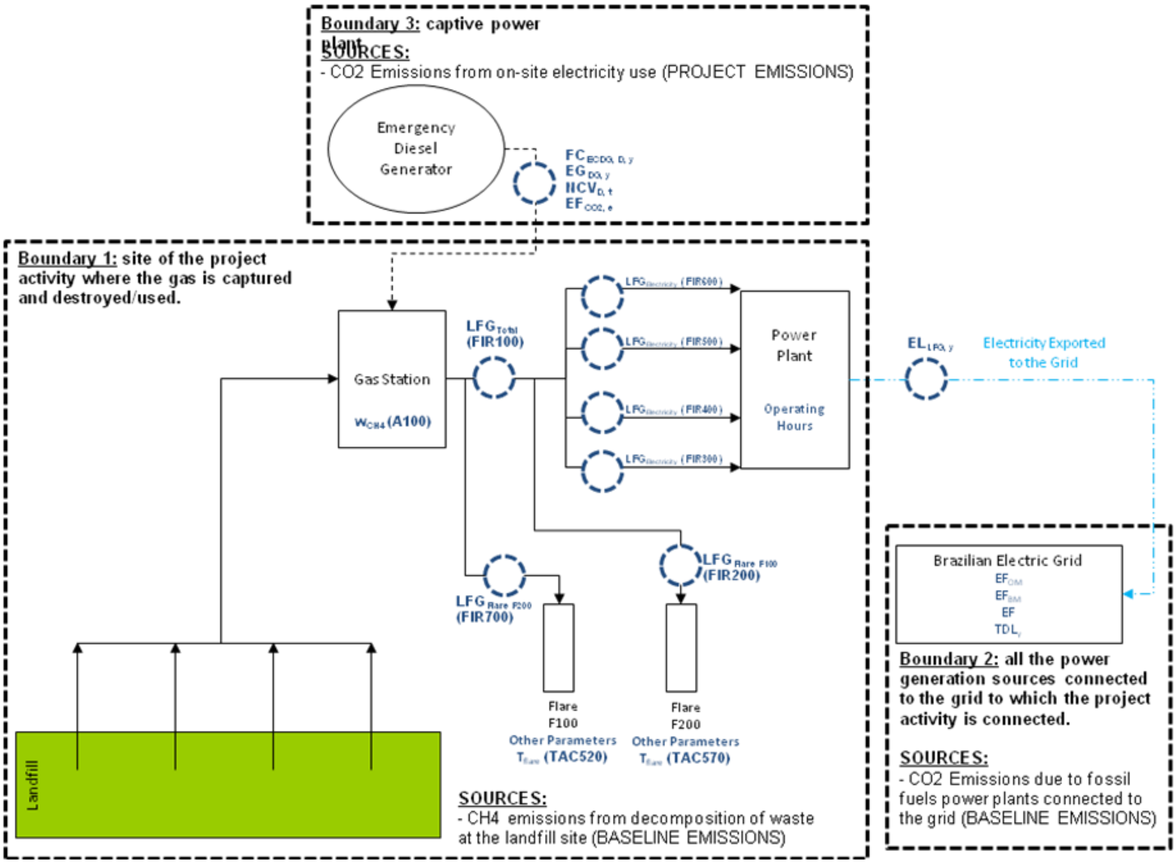

Figure 5. Boundaries of the Project

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

ACM0001

According with ACM0001, the procedure to select the most plausible baseline scenario is:

STEP 1: Identification of alternative scenarios.

The following realistic and credible alternatives are identified to the project, according with the *Version 06.0.0 of the Tool for the demonstration and assessment of additionality:*

a) Project Activity undertaken without being registered as a CDM Project Activity

b) Continuation of the landfill operation (Business as Usual – BAU scenario);

In Brazil, there are no policies regarding mandatory landfill gas capture or destruction requirements due to safety issues or local environmental regulations nor policies which promote the productive use of landfill gas such as those for the production of renewable energy, or those that promote the processing of organic waste.

In the beginning of 2010, the *Política Nacional de Resíduos Sólidos* (National Solid Waste Policy), under discussion since 2000, was approved. One of the scopes of this policy is to enforce the adequate environmental final destination of the solid waste. However, the Policy does not foreseen neither obligation of landfill gas destruction and the promotion of the landfill gas use such as those for the production of renewable energy, or those that promote the processing of organic waste[2].

In 2002, the *PROINFA – Programa de Incentivo a Fontes Alternativas* was created, in order to incentive the generation of 3,300 MW of renewable sources to generate electricity, divided in three groups: wind-energy (1,100 MW), small-hydro power plants (1,100 MW) and biomass (1,100 MW, including bagasse, wood, solid waste, rice husk, etc.). Despite of achieving the goals, no landfill-gas-to-energy project was implemented due to the low price paid for the MWh produced.

The following table presents an analysis of the compliance of the alternatives listed previously with the local/national regulation.

Alternative	Compliance with Local / National Policies	Observations
Project Activity undertaken without being registered as a CDM Project Activity	✓	▪ There is no law which obligates the landfill do destroy the gas produced nor due to local environmental regulations, nor due to GHG reductions; ▪ There are no policies to promote the use of LFG to produce electricity;
BAU scenario	✓	▪ Bandeirantes Landfill Gas to Energy has an authorization to operate, emitted from the environmental authority;

As will be explained ahead, Bandeirantes Landfill does not have any legal/contractual obligation on destroying the methane generated; however, there is no landfill gas burned inefficiently at some well's heads as used to be in the first crediting period, anyway BLFGE will keep the Adjustment Factor applied for the first crediting period: AF = 20%.

In order to identify the most plausible baseline scenario, it's necessary to demonstrate:

- What would happen with the LFG;
- What would happen with the power generation; and
- What would happen with the heat generation in the absence of the project activity?

The table below presents the alternatives to the LFG and the conclusions for each alternative:

SCENARIO	OBSERVATIONS
LFG1 The project activity (i.e. capture of landfill gas and its flaring and/or its use) undertaken without being registered as a CDM project activity.	This alternative is ***applicable***, as the incomes from the electricity sale could make the project economically attractive (as will be presented in STEP 2 of the Additionality Assessment, despite of the incomes from the electricity sale, the project is not financially attractive and the CERs revenues are

[2] PROJETO DE LEI - Institui a Política Nacional de Resíduos Sólidos e dá outras providências; Available at http://www.camara.gov.br/sileg/integras/501911.pdf, accessed on 10/04/2010.

	an additional income which amortizes the investments in the LFG collection system and electricity generation).
LFG2 Atmospheric release of the landfill gas or partial capture of landfill gas and destruction to comply with regulations or contractual requirements, or to address safety and odor concerns.	This alternative is ***applicable*** because without the project activity the LFG generated would continue to be emitted to the atmosphere in an uncontrolled manner as there are no legal/contractual obligations to destroy the gas.

Concerning the power generation, the table below presents the realistic and credible alternative(s) and the observations:

SCENARIO	OBSERVATIONS
P1 Power generated from landfill gas undertaken without being registered as CDM project activity.	This alternative is **applicable**, as the incomes from the electricity sale make the project economically attractive (as will be presented in STEP 2 of the Additionality Assessment, despite of the incomes from the electricity sale, the project is not financially attractive and the CERs revenues are an additional income which amortizes the investments in the LFG collection system and electricity generation).
P2 Existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant.	This alternative is **not applicable** because using fossil fuel is not the best alternative, once LFG is available and in abundance in the landfill. Moreover, BLFGE core business is energetic use of the landfill gas.
P3 Existing or construction of a new on-site or off-site renewable based cogeneration plant.	This alternative is **not applicable** because LFG can be fired directly to generate electricity and there is no need for heat in BLFGE. Moreover, BLFGE core business is energetic use of the landfill gas.
P4 Existing or construction of a new on-site or off-site fossil fuel fired captive power plant.	This alternative is **not applicable** because LFG can be fired directly to generate electricity and there is no need for heat in Bandeirantes Landfill. Moreover, BLFGE core business is energetic use of the landfill gas.
P5 Existing or construction of a new on-site or off-site renewable based captive power plant.	This alternative is **not applicable** because Bandeirantes Landfill has enough gas to generate more electricity than is consumed internally.
P6 Existing and/or new grid-connected power plants.	This alternative is **applicable** to the project activity. Electricity could be consumed from the grid if no power generation occurred.

No heat scenarios will be analyzed as the project does not foreseen the heat generation/consumption.

STEP 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable.
This step is not applicable as no fossil fuel is consumed in the baseline by the Bandeirantes Landfill Gas to Energy - BLFGE.

STEP 3: Step 2 and/or step 3 of the latest approved version of the "Tool for demonstration and assessment of Additionality" shall be used to assess which of these alternatives should be excluded

from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).
The Step 2 of the additionality tool is presented in item B.5. The financial analysis was undertaken for both landfill's operation and power generation. The conclusions are:

LFG1: this alternative is not economically attractive;
LFG2: this is the most economic attractive alternative, as involves only the landfill's operation, without investments in a LFG capturing and flaring/power generation systems;

P1: this alternative is not economically attractive;

Alternatives **P2** to **P5** are not applicable because:

- There is no heat demand neither in the landfill not in the neighborhood that justifies the cogeneration;
- There aren't, in the baseline, an on-site fossil fuel or renewable fuel cogeneration unit or a captive fossil fuel or renewable fuel power plant (inside the landfill's limits);
- The consumption of electricity to operate the landfill is very small, therefore an investment in a new on-site or off-site fossil fuel or renewable fuel power plants does not make sense. As will be show below, the landfill is connected to the electric grid;

P6: this alternative is applicable because in the absence of the project, power would be consumed by the landfill through the electric grid which it is connected;

STEP 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or contractual requirements should be taken into consideration.
According with *Step 2* and *Step 3* of the *Version 06.0.0 of the Tool for the demonstration and assessment of additionality*, the only alternative remaining, among those presented in *STEP1*, is the BAU scenario (please, refer to B.5).

As per methodology ACM0001, Bandeirantes Landfill Gas to Energy - BLFGE refers to Scenario 1.

Scenario	Baseline			Description of the situation
	Landfill gas	Electricity	Heat	
1	LFG2	P6	N/A	The atmospheric release of landfill gas or landfill gas is partially captured and subsequently flared. The electricity is obtained from the grid.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

In order to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period, the steps from Annex 1 of the "Procedures for Renewal of the Crediting Period of a Registered CDM Project Activity - version 06" (EB63 – Annex 29) are assessed:

Step 1: Assess the validity of the current baseline for the next crediting period

As demonstrated on Section B.4, the current baseline scenario is the continuation of the landfill operation, with partial destruction of the LFG collected passively via the gas wells (Business as Usual – BAU scenario);

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The operation of the landfill must be in compliance with the state environmental legislation. In the State of São Paulo, the inspection of potential pollution sources, including installation and operation of landfills, is made by CETESB (the State Environmental Agency), which is the responsible for issuing the Operational Environmental Licences. As the Bandeirantes Landfill has all relevant Operational Licences, it can be concluded that the current baseline scenario is in compliance with the relevant local legislation.

Outcome: the current baseline is in compliance with the relevant local legislation

Step 1.2: Assess the impact of circumstances

The only relevant circumstance by the time of the renewal of the crediting period was the approval of the *Política Nacional de Resíduos Sólidos*[3] (National Solid Waste Policy) in the beginning of 2010. One of the scopes of this policy is to enforce the adequate environmental final destination of the solid waste. The Bandeirantes Landfill was granted with an Operational Environmental License, which confirms that it is indeed an adequate site for final waste destination. Therefore, this circumstance has no impact over the current baseline.

Outcome: the current baseline is in line with the relevant local legislation

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) is technically possible

This step is not applicable because the project is a Greenfield project, i.e. there were no baseline equipments as the baseline scenario is the continuation of the landfill´s operation.

Outcome: as there are no baseline equipments in the baseline scenario, this step is not applicable.

Step 1.4: Assessment of the validity of the data and parameters

According with the registered PDD, the only parameter which needs to be updated at the renewal of the crediting period is the electric grid emission-factor. Other values, such as GWP of the methane remained as the validated value (21tCO_2/tCH_4).

Outcome: the only parameter which needs to be updated is the electric grid emission-factor. For more details on the updated value, please refer to section B.6.1.

FINAL OUTCOME: the current baseline is still valid for the renewal of crediting period and the only parameter that needs to be updated is the electric grid emission-factor.

Version 11 of ACM0001 requires the use of the "Tool for demonstration and assessment of additionality" to show the project is not the baseline scenario. This tool is applied as follows.

[3] PROJETO DE LEI - Institui a Política Nacional de Resíduos Sólidos e dá outras providências; Available at http://www.camara.gov.br/sileg/integras/501911.pdf, accessed on 10/04/2010.

STEP 1. Identification of alternatives to the project activity consistent with current laws and Regulations

Sub-step 1a. Define alternatives to the project activity:
All alternatives to the project activity were presented in the Item B.4.

Sub-step 1b. Enforcement of applicable laws and regulations:
All alternatives are in accordance with mandatory laws and regulations, as presented in the Item B.4.

STEP 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method
Option III – benchmark analysis – is chosen.

Sub-step 2b – Option III. Apply benchmark analysis
Brazilian businesses were usually analyzed through the internal rate of return to the equity invested in project initiatives. In the case of BLFGE, this was the financial indicator picked. This indicator is to be compared with government bond rates, since such bonds are considered risk-free investments, and moreover are considered the opportunity cost of capital in Brazil.

Sub-step 2c. Calculation and comparison of financial indicators
Brazilian entrepreneurs usually evaluate investment opportunities through the Internal Rate of Return projects are able to deliver. This is common sense considering the Brazilian economy is highly volatile, and therefore the opportunity cost of capital – government bonds interest rate – tends to vary quite often.

Initially, it is important to clarify that the project was basically structured in two distinct sub-units: the gas collection and treatment plant; and the power plant. Considering the gas plant is owned and operated by Biogás, and the power plant is owned and operated by Bioenergia, the investment analysis was divided in two, one for each sub-unit.

For the methane capture investment, Biogás calculated the IRR and compared to the 23,3% interest government bond rates were paying by the time the project was starting operation, at the end of 2003. As will be shown ahead, this was much higher than the 13% expected for the project activity without CER's revenues. For the IRR calculation in Biogás the input numbers used are the biogas price, fixed cost, variable cost, VAT (ICMS = 12%, COFINS + PIS = 4,65%), insurance (2%), depreciation, income tax and the cost of capital. All the numbers were presented to the DOE and some of them were confidential.

The following cash-flow result is provided:

Table 1. Cash flow for BLFGE's landfill gas extraction plant

Year	Gross Revenue	Sales Tax (COFINS + PIS)	Sales Tax (ICMS)	Net Revenue	Fixed Costs	Variable Costs	Insurance	Total Costs
2003	R$0	R$0	R$0	R$0	R$0	R$0	R$0	R$0
2004	R$6.646.575	R$309.066	R$753.244	R$5.584.265	R$866.180	R$593.642	R$44.242	R$1.504.064
2005	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.576.161	R$176.970	R$2.953.131
2006	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.836.161	R$176.970	R$3.213.131
2007	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2008	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2009	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2010	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2011	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2012	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2013	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2014	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131
2015	R$8.848.476	R$411.454	R$1.061.817	R$7.375.205	R$1.200.000	R$1.896.161	R$176.970	R$3.273.131

Formula: Net Revenue = Gross Revenue - Sales Tax
Total Costs = Fixed Costs + Variable Costs + Insurance
EBTA = Net Revenue - Total Costs - Depreciation - Interest
Net Income = EBTA - Income Tax
Shareholders Cash-flow = Equity Required + Dividends
Cash Generation = Net Income + Depreciation - Investment + Debt
Cash Available = accrued Cash Generation + Equity Required

Year	Depreciation	Interest	EBTA	Income Tax	Net Income	Investment	Cash Generation	Equity Required
2003	R$0	R$0	R$0	R$0	R$0	(R$8.771.990)	(R$2.771.990)	R$3.000.000
2004	R$932.060	(R$1.176.865)	R$1.971.276	R$192.715	R$1.778.561	(R$8.430.026)	R$880.595	R$0
2005	R$1.870.202	(R$1.777.603)	R$774.270	R$270.825	R$503.445	(R$4.000.000)	(R$4.776.353)	R$4.500.000
2006	R$2.232.702	(R$1.287.230)	R$642.143	R$239.114	R$403.029	(R$2.500.000)	(R$3.014.270)	R$3.355.413
2007	R$2.370.202	(R$796.856)	R$935.016	R$309.404	R$625.612	R$0	(R$154.186)	R$154.186
2008	R$2.370.202	(R$306.483)	R$1.425.389	R$427.093	R$998.296	R$0	R$218.497	R$0
2009	R$2.370.202	R$0	R$1.731.872	R$500.649	R$1.231.223	R$0	R$3.601.425	R$0
2010	R$2.370.202	R$0	R$1.731.872	R$500.649	R$1.231.223	R$0	R$3.601.425	(R$823.353)
2011	R$2.370.202	R$0	R$1.731.872	R$500.649	R$1.231.223	R$0	R$3.601.425	(R$2.370.202)
2012	R$2.370.202	R$0	R$1.731.872	R$500.649	R$1.231.223	R$0	R$3.601.425	(R$2.370.202)
2013	R$2.370.202	R$0	R$1.731.872	R$500.649	R$1.231.223	R$0	R$3.601.425	(R$2.370.202)
2014	R$2.075.641	R$0	R$2.026.433	R$571.344	R$1.455.089	R$0	R$3.530.730	(R$2.075.641)
2015	R$0	R$0	R$4.102.074	R$1.069.498	R$3.032.576	R$0	R$3.032.576	(R$1.000.000)

Obs: Equity Required is positive for shaholders cash in and negative for shareholders capital withdraw.

Year	Debt	Amortization	Dividends	Cash Available	Shareholders Cash-flow	Carbon Revenue	Total Expected Shareholders Cash	IRR
2003	R$6.000.000	R$0	R$0	R$228.010	(R$3.000.000)	R$0	(R$3.000.000)	#NÚM!
2004	R$6.600.000	R$0	R$0	R$1.108.606	R$0	R$0	R$0	#NÚM!
2005	R$0	(R$3.150.000)	R$0	R$832.252	(R$4.500.000)	R$0	(R$4.500.000)	#NÚM!
2006	R$0	(R$3.150.000)	R$0	R$1.173.396	(R$3.355.413)	R$0	(R$3.355.413)	#NÚM!
2007	R$0	(R$3.150.000)	R$0	R$1.173.396	(R$154.186)	R$0	(R$154.186)	#NÚM!
2008	R$0	(R$3.150.000)	R$0	R$1.391.893	R$0	R$0	R$0	#NÚM!
2009	R$0	R$0	R$3.993.318	R$1.000.000	R$3.993.318	R$0	R$3.993.318	#NÚM!
2010	R$0	R$0	R$2.778.071	R$1.000.000	R$3.601.425	R$0	R$3.601.425	-7,69%
2011	R$0	R$0	R$1.231.223	R$1.000.000	R$3.601.425	R$0	R$3.601.425	0,33%
2012	R$0	R$0	R$1.231.223	R$1.000.000	R$3.601.425	R$0	R$3.601.425	5,35%
2013	R$0	R$0	R$1.231.223	R$1.000.000	R$3.601.425	R$0	R$3.601.425	8,72%
2014	R$0	R$0	R$1.455.089	R$1.000.000	R$3.530.730	R$0	R$3.530.730	11,04%
2015	R$0	R$0	R$3.032.576	R$0	R$4.032.576	R$0	R$4.032.576	12,94%

For the energy generation part, the same analysis was carried out. For this sub-unit, the IRR calculated was 15,6%, far from Brazilian bonds interest rate paid in December 2003 of 23,3%. This IRR was calculated according to a fixed income resulted from leasing agreement Biogeração signed with UNIBANCO. The inputs used in this calculation were gross revenues, VAT, fixed and operational costs, depreciation and amortization, capital expenditure and weighted average cost of capital (WACC). The cash flow result is shown in the following table.

Table 2. Cash flow for BLFGE's energy generation sub-unit

Biogeração	1 2003	2 2004	3 2005	4 2006	5 2007	6 2008	7 2009	8 2010	9 2011	10 2012	11 2013	12 2014	13 2015	14 2016
EBIT		5,8	5,9	6,4	6,5	6,2	6,7	6,7	6,3	5,2	4,3	6,7	8,6	8,8
Não operacional														
Depreciação e amortização	0,0	2,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	3,9	1,5	0,7	0,7
Variação capital de giro	0,0	0,3	(0,0)	0,1	(0,0)	(0,0)	(0,2)	0,0	(0,0)	(0,0)	(0,0)	0,0	0,0	0,0
Caixa gerado pela Atividade	0,0	8,9	9,8	10,3	10,4	10,0	10,3	10,5	10,2	9,1	8,2	8,2	9,3	9,5
Receita financeira	0,0	0,1	0,4	0,6	0,8	1,0	0,6	0,6	0,7	0,5	0,4	0,2	0,1	0,0
Investimentos	(36,8)	(11,1)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Dividendos	0,0	(2,9)	(2,7)	(2,8)	(3,0)	(3,1)	(3,1)	(3,4)	(3,4)	(2,8)	(2,2)	(4,7)	(6,7)	(7,2)
Geração de caixa após investimentos	(36,8)	(4,9)	7,5	8,1	8,2	8,0	7,8	7,8	7,5	6,9	6,3	3,7	2,7	2,3
Liberações	26,0	11,2	6,6	6,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Amortizações (Amort FINIMP)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(2,7)	(2,7)	(2,7)	(2,7)	(2,7)	(2,5)
Juros desembolsados (Amort FINIMP)	0,0	(0,0)	(0,5)	(1,2)	(1,6)	(1,6)	(1,6)	(1,6)	(1,5)	(1,2)	(0,9)	(0,7)	(0,4)	(0,1)
Amortizações (BNDES)	0,0	0,0	(1,5)	(1,7)	(1,8)	(1,9)	(2,0)	(2,1)	(0,2)	0,0	0,0	0,0	0,0	0,0
Juros desembolsados (BNDES)	0,0	0,0	(0,3)	(0,3)	(0,3)	(0,2)	(0,2)	(0,1)	(0,0)	0,0	0,0	0,0	0,0	0,0
Amortizações (Importação)	0,0	(3,3)	(6,6)	(6,3)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Juros desembolsados (Importação)	0,0	(0,8)	(0,5)	(0,2)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Amortizações (IGPM)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,2)
Juros desembolsados (IGPM)	0,0	(0,6)	(0,8)	(0,8)	(0,8)	(0,8)	(0,8)	(0,8)	(0,7)	(0,6)	(0,5)	(0,3)	(0,2)	(0,1)
Geração de caixa após financiamentos	(10,8)	1,5	3,8	3,9	3,7	3,5	3,2	3,2	0,9	1,0	0,9	(1,4)	(2,0)	(1,6)
Imposto de renda	0,0	(0,7)	(0,8)	(0,9)	(0,9)	(0,9)	(0,9)	(0,9)	(0,9)	(0,8)	(0,7)	(0,7)	(0,8)	(0,8)
Contribuição Social	0,0	(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)
Aumento de capital	14,0	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
Redução de capital									(3,9)	(4,0)	(4,2)	(4,4)	(4,5)	
Geração de caixa líquida	3,2	0,5	2,7	2,7	2,5	2,3	2,0	2,0	(4,1)	(4,1)	(4,3)	(6,7)	(7,6)	(2,7)
EBIT	0	6	6	6	6	6	7	7	6	5	4	7	9	9
Tax	0,0	(1,0)	(1,1)	(1,2)	(1,2)	(1,2)	(1,2)	(1,2)	(1,2)	(1,1)	(1,0)	(1,0)	(1,1)	(1,1)
Depreciação e amortização	0	3	4	4	4	4	4	4	4	4	4	1	1	1
CAPEX	(37)	(11)	0	0	0	0	0	0	0	0	0	0	0	0
Carbono	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
Total Projeto	(36,80)	(3,45)	8,65	9,03	9,15	8,88	9,30	9,30	8,97	8,04	7,20	7,20	8,21	8,41
TIR Projeto	15,6%													

Sub-step 2d. Sensitivity analysis

In the case of the degasification sub-unit, the sensitivity analysis was carried out considering the cost factor. In fact, one could consider Biogás could be more efficient using its resources, reducing fixed costs. In that case, if such costs were reduced by 30%, the internal rate of return would be slightly increased, to 15,88% yearly. This is still below the 23,3% benchmark. A reduction of 50% would bring the IRR to 17,19%, still behind the benchmark. On the other hand, costs could also go higher, and an increase in 30% would cause the IRR to decline to 10,6%. In the other scenario, with costs up 50%, the IRR would be 8,85%, much lower than the benchmark.

For the energy sub-unit, sensitivity analysis was carried out considering earnings increase. In this case, IF earnings were considerably increased, becoming 25% bigger, project's IRR would not even reach 20%, being 19,87%. This is not enough to surpass the benchmark threshold of 23,3%, as previously considered. And, if by any means earnings declined by 25%, IRR would then be 11,1%, not attractive comparing with the benchmark. Therefore, even in a situation where cash generation is increased, the energy sub-unit is not expected to provide an attractive IRR if carbon revenues are not considered.

STEP 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

There were no other activities similar to BLFGE implemented or underway in Brazil outside the CDM as there were no regulatory incentives and the sale of electricity alone does not cover the additional costs of a biogas capture, flaring, and electricity generation system. Those that were implemented have been installed due to incentives of the CDM.

Sub-step 4b. Discuss any similar options that are occurring

Considering that there were no similar activities being developed outside of the CDM, it is not possible to perform an analysis at this point. Similar projects were implemented only with the support of reductions emissions revenues within the CDM.

STEP 5. Impact of CDM registration
The approval and registration of the project activity as CDM activity had alleviated the economic and financial hurdles for both projects' sub-units, overcoming the government bond rate threshold of 23,3%, and thus making the whole initiative attractive to their investors. As benefit derived from the Project activity, the anthropogenic greenhouse gas emission reduction were indeed a very important one.

Furthermore this project as being the first of its kind in Brazil attracted new players to implement similar projects activities.

In addition to the above paragraph, methane capture technology transfer is worth to highlight in this project activity, as the shareholder from The Netherlands – Van der Wiel – is a well-known company in this type of technology.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

ACM0001

a) Baseline Emissions

Version 11 of ACM0001 states that greenhouse gas baseline emissions during a given year *"y"* (BE_y) are estimated according with the below equation:

$$BE_y = (MD_{project,y} - MD_{BL,y}) \times GWP_{CH4} + EL_{LFG,y} \times CEF_{elect,BL,y} + ET_{LFG,y} \times CEF_{ther,BL,y} \qquad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year *y* (tCO_2e);
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during the year *y* (tCH_4) in project scenario
$MD_{BL,y}$	The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tons of methane (tCH_4)
GWP_{CH4}	Global Warming Potential of Methane (tCO_2e/tCH_4)
$EL_{LFG,y}$	Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours (MWh).
$CEF_{elec,BL,y}$	CO_2 emissions intensity of the baseline source of electricity displaced (tCO_2e/MWh), estimated using the *"Version 02.2.1 of the Tool for calculation of emission factor for electricity systems"*
$ET_{LFG,y}$	The quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler, during the year *y* in TJ.
$CEF_{ther,BL,y}$	CO2 emissions intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation (tCO2e/TJ)

As the BLFGE does not replace the heat generation by fossil fuel:

$ET_{LFG,y} = 0$

The net quantity of electricity produced using LFG will be calculated deducting the internal electricity consumption from the total electricity produced.

The equation is updated to:

$$BE_y = \left(MD_{project,y} - MD_{BL,y}\right) \times GWP_{CH4} + EL_{LFG,y} \times CEF_{elect,BL,y} \qquad \textbf{(2)}$$

As presented in B.4, the BLFGE does not have any contractual obligations to burn methane and there is no national/sectoral regulation obligating the landfill gas destruction. However, as per Version 11 of ACM0001, in cases where regulatory or contractual requirements do not specify $MD_{BL,y}$ or no historic data exists for LFG captured and destroyed an “Adjustment Factor” (AF) shall be used and justified, taking into account the project context.

$$MD_{BL,y} = MD_{project,y} \times AF \qquad \textbf{(3)}$$

Where AF is the baseline adjustment factor.

The baseline adjustment factor is estimated according with the “guidance on estimating AF” as per Version 11 of ACM0001:

METHODOLOGY GUIDANCE	ASSESSMENT
In cases where a **specific system for collection and destruction of methane** is mandated by regulatory or contractual requirements or is undertaken for other reasons, the ratio of the destruction efficiency of the baseline system to the destruction efficiency of the system used in the project activity shall be used.	As presented in items B.4 and B.5, there are no regulatory requirements to collect and destroy the LFG collected in Brazil. Additionally, there are no contractual obligations to destroy the LFG collected. Therefore, the adjustment factor will be estimated based on the actual practice of the landfill (BAU Scenario, as demonstrated in item B.5) which is the passive venting of the gas to the atmosphere, with partial destruction on the top of the wells to address safety and operational issues.
Step 1 – Estimation of the Destruction Efficiency of the system 3 options are provided:	
a) situations where the baseline specific system for collection and destruction of methane installed and operating prior to implementation of the project activity and measurements of the amount of methane that is destroyed are available	This option does not reflect the baseline situation for the project. The LFG generated is passively vented to the atmosphere and partially combusted in an uncontrolled manner on the top of the wells, without being measured/monitored.

b) In cases, where the baseline system for collection and destruction of methane is not installed prior to project implementation and/or measurements of the amount of methane that is destroyed are not available	This option **reflects** the baseline situation, regarding that "measurements of the amount of methane that is destroyed are not available" – the LFG generated is passively vented to the atmosphere and partially combusted in an uncontrolled manner on the top of the wells, without being measured/monitored.
c) In cases where a specific percentage of the "generated" amount of methane to be collected and destroyed is specified in the contract or mandated by regulations	This option does not reflect the baseline situation for the project. There are no contracts which stipulate that a specific percentage of the "generated" amount of methane must be collected and destroyed.
Step 2 – Estimation of the destruction efficiency of the system used in the project activity 2 options are provided:	
a) The destruction efficiency of the system used in the project activity is estimated once and remains fixed for the whole crediting period	***This option will be applied by the project participants.***
b) The destruction efficiency of the system used in the project activity is estimated every year	This option will NOT be applied by the project participants.

Step 3: Estimation of the adjustment factor (AF)
As Option 1 from Step 2 was applied, AF will be calculated as:

$$AF = \frac{\varepsilon_{BL}}{\varepsilon_{PR}}, \text{ and} \quad (4)$$

$$\varepsilon_{BL} = \frac{MD_{Hist}}{MG_{Hist}}; \varepsilon_{PR} = \frac{MD_{project,1}}{MG_{PR,1}} \quad (5)$$

Where:

AF	Adjustment factor
ε_{BL}	Destruction efficiency of the baseline system (fraction)
MD_{Hist}	Amount of methane destroyed historically measured for the previous year before the start of project activity (tCH4)
MG_{Hist}	Amount of methane generated historically for the previous year before the start of project activity, estimated using the actual amount of waste disposed in the landfill as per Version 06.0.0 of the Emissions from solid waste disposal site(tCH_4)
ε_{PR}	Destruction efficiency of the system used in the project activity that will remain fixed for the whole crediting period
$MD_{project, 1}$	Amount of methane destroyed by the project activity during the first year of the project activity (tCH_4)
$MG_{PR, 1}$	Amount of methane generated during the first year of the project activity estimated using the actual amount of waste disposed in the landfill as per Version 06.0.0 of the Emissions from solid waste disposal site

As there are no historical records of the amount of LFG collected and destroyed in the landfill's wells, the following approach will be applied to determine the parameter MD_{Hist}, as per Step 1 – option b):

- Percentage of methane exhausted through passive systems

The BLFGE counts with a passive venting system. This system is composed by several PDR wells (concrete rings rounded by a rocks) distributed over the landfill's area as part of the landfill's regular operation. This passive system is way less efficient than an active system because of the gas pressure inside the landfill (in the passive system, landfill gas is emitted to the atmosphere due to variation of the barometric pressure). As per measurements made in 11 Dutch landfills, an average collection efficiency of passive system was equal to 37%[4].

- Percentage of methane destroyed in the passive systems

The PDR wells installed operates just like an open flare, where there is no control of the combustion temperature and of the air flow. As per the Version 01 of the Tool to determine project emissions from flaring gases containing methane, a maximum efficiency to be adopted in open flares is equal to 50%; thus an efficiency of 50% is adopted in the AF estimative. a

- Percentage of methane actually being destroyed in the passive systems

According with Biogás Energia Ambiental, the Bandeirantes Landfill had 328 PDR wells by the time of the project implementation, which only an average of 143 were burning the methane (Please Refer to Annex 3).

Therefore, the following rationale is presented:

- From a certain amount of LFG generated, only 37% are collected by the 328 existing wells in a passive system and the gas-flow for each well is assumed to be the same;
- from the 328 existing wells, only 143 were burning the LFG collected which represents a ratio of 143/328 = 43.6% of destruction of the total LFG collected;
- as the wells operate like an open flare, the combustion efficiency is assumed as 50%;

MD_{Hist} is then calculated as follows:

$$MD_{Hist} = MG_{Hist} \times \eta_{closed landfills} \times \eta_{open flares} \times \frac{N_{wells bunring gas}}{N_{wells total}} \quad \textbf{(6)}$$

Where:

MG_{Hist}	Amount of LFG generated according with Version 06.0.0 of the Emissions from solid waste disposal site
$\eta_{closed\ landfills}$	Collection efficiency of passive systems in closed landfills (37%)
$\eta_{open\ flares}$	Efficiency of methane destruction in open flares (50%)
$N_{wells\ burning\ gas}$	Number of PDR which were burning the landfill gas collected in the passive system by the time of validation (143 wells)
$N_{wells\ total}$	Total number of PDR actually installed in the Bandeirantes Landfill by the time of the validation (328 wells)

$$MD_{Hist} = MG_{Hist} \times 37\% \times 50\% \times \frac{143}{328} = MG_{Hist} \times 8.07\% \quad \textbf{(7)}$$

[4]Available at: http://www.mnp.nl/ipcc/Archive/AR4FOD/ExpRevFOD/FODrev/FOD_AChapter10.doc

And

$$\varepsilon_{BL} = \frac{MD_{Hist}}{MG_{Hist}} = \frac{MG_{Hist} \times 8.07\%}{MG_{Hist}} = 8.07\%$$

The project was implemented on 23/12/2003, but records of the amount of LFG measured were made available from 01/01/2004 on. Therefore, ε_{PR} will be calculated for the year 2004 and will remain fixed for the whole crediting period. The following data were applied:

Amount of Methane destroyed in flares and in the power plant collected in 2004 (as provided in the 1st periodic verification, from 23/12/2003 to 28/02/2006)	43,417,990 Nm^3CH_4
Amount of methane generated in 2004, according with Version 06.0.0 of the Emissions from solid waste disposal site	102,891,281 Nm^3CH_4

Therefore:

$$\varepsilon_{PR} = \frac{MD_{project,1}}{MG_{PR,1}} = \frac{43,417,990}{102,891,281} = 42.20\% \quad \textbf{(8)}$$

And:

$$AF = \frac{\varepsilon_{BL}}{\varepsilon_{PR}} = \frac{8.07\%}{42.20\%} = 19.11\% \quad \textbf{(9)}$$

In order to be conservative, the AF of 20% applied for the 1st crediting period will remain the same and equation **(2)** is updated to:

$$BE_y = 0.80 \times MD_{project,y} \times GWP_{CH4} + EL_{LFG,y} \times CEF_{elect,BL,y} \quad \textbf{(10)}$$

The sum of the quantities fed to the flare(s), to the power plant(s), to the boiler(s), to the electricity generator(s) and to the natural gas distribution network, estimated using equation **(10)** will be compared annually with the total quantity of methane generated. The lowest value of the two will be adopted as $MD_{project,y}$.

$$MD_{project,y} = MD_{flare,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y} \quad \textbf{(11)}$$

Where:

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH_4)
$MD_{electricity,y}$	Quantity of methane destroyed by generation of electricity (tCH_4)
$MD_{thermal,y}$	Quantity of methane destroyed for the generation of thermal energy (tCH_4)

$MD_{PL,y}$	Quantity of methane sent to the gas distribution grid (tCH_4)

Right Hand Side of the equation **(11)** is sum over all the points of captured methane use. The project counts with 2 flares (Flare F100 and Flare F200). According with the methodology, there should be one flow-meter installed for each flare.

The degassing station was projected with a main control pipeline to measure the total LFG collected and with two additional lines to measure the LFG sent to the flares and the LFG sent to the power plant. The flares were built next to each other and a control valve was installed between them. However, during the 1st crediting period the design of the degassing station had to be modified in order to increase the gas collection capacity from 14,500Nm^3/h to 17,000 Nm^3/h: a secondary collection line was installed to drive part of the gas collected exclusively to the Flare F200 (this gas flow was measured by the flow-meter FIR700) and the control valve between the two flares was closed. Therefore, for a certain period the project was in line with the requirements from Version 11 of ACM0001. This modification in the lay-out was presented as an Annex in the monitoring report from the 4th verification (from 01/01/2007 – 30/06/2007). The figure below illustrates such modification:

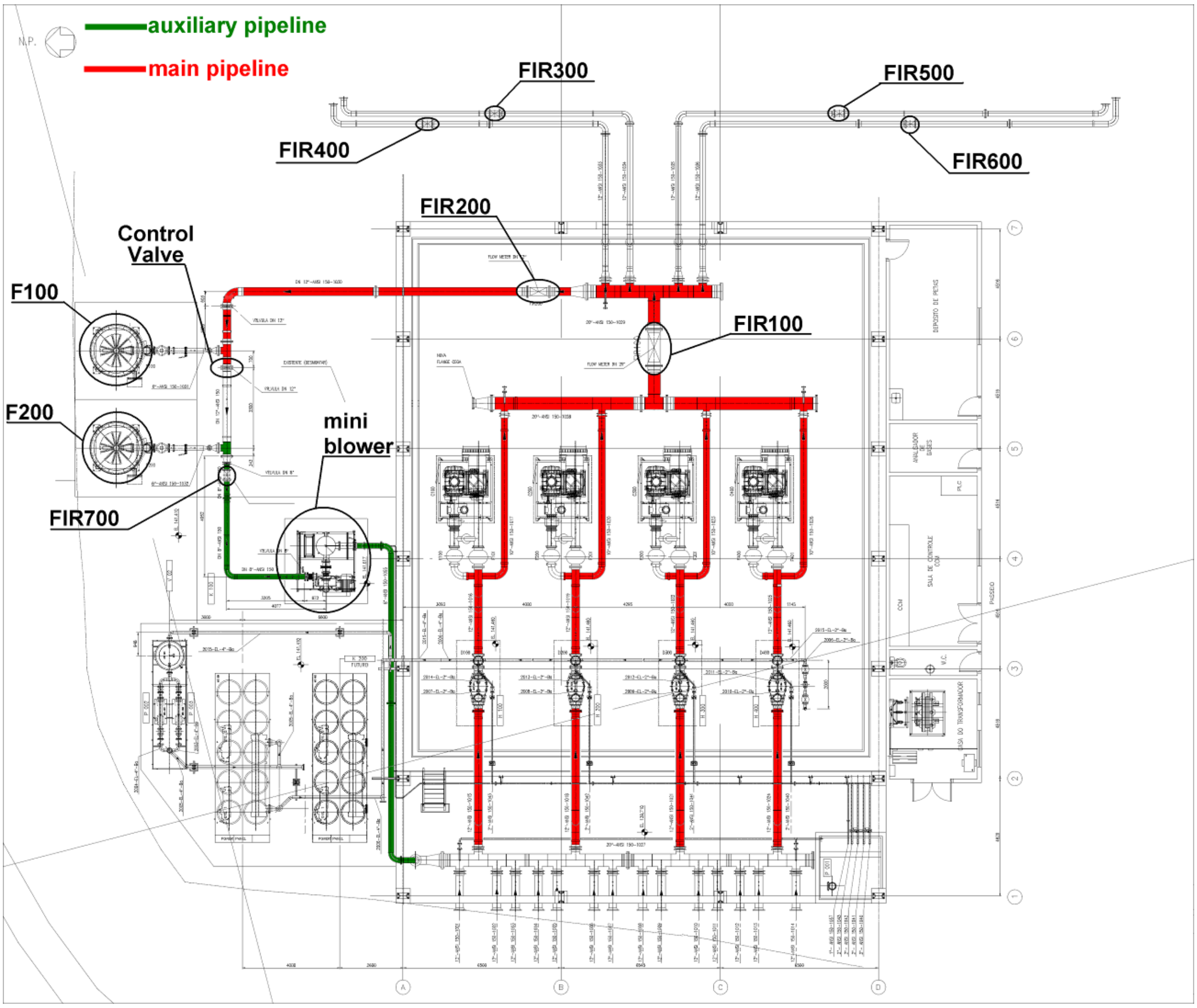

Figure 6. Modification in the lay-out of the Degassing Installation

Due to the lack of LFG available at Bandeirantes Landfill, this secondary collection line was deactivated still during the 1st crediting period. In order to comply with the requirements from the methodology, Biogás will re-activate this secondary line and close the control valve between the 2 flares. Both flares are unlikely to operate at the same time due to the low LFG generation; however during interruption of the power generation the gas will be collected and flared in the two equipments to avoid the increase of pressure inside the landfill.

Therefore:

- FIR700 will measure the LFG collected and sent exclusively to the flare F200; and
- FIR200 will measure the LFG collected and sent exclusively to the flare F100.

The power plant has 4 flow-meters connected (FIR300, FIR400, FIR500 and FIR600). As the project will not inject purified methane in the gas distribution grid nor use the LFG collected to generate heat,

$MD_{PL,y} = 0$
$MD_{thermal,y} = 0$

And the equation **(11)** is updated to:

$$MD_{project,y} = MD_{flare,y} + MD_{electricity,y} \quad \textbf{(12)}$$

As the project will have 2 lines installed at the degassing installation, equation **(12)** is updated to:

$$MD_{project,y} = MD_{main\ line,y} + MD_{secondary line,y} \quad \textbf{(13)}$$

Where:

$MD_{main\ line,y}$	Quantity of methane destroyed in the main line (tCH_4)
$MD_{secondary\ line,y}$	Quantity of methane destroyed in the secondary line (tCH_4)

$MD_{main\ line,y}$ is calculated as the sum of the amount of LFG destroyed in the flare F100 (measured by the flow-meter FIR200) and in the power plant (measured by the flow-meters FIR300, FIR400, FIR500 and FIR600):

$$MD_{main\ line,y} = MD_{flare\ F100,y} + MD_{electricity,y}$$

$$\Rightarrow MD_{flare\ F100,y} = \left(LFG_{FIR200,y} \times w_{CH4,y} \times D_{CH4}\right) - \left(\frac{PE_{flare\ F100,y}}{GWP_{CH4}}\right) \quad \textbf{(14)}$$

$$\Rightarrow MD_{electricity,y} = LFG_{electricity,y} \times w_{CH4,y} \times D_{CH4}$$

$$\Rightarrow LFG_{electricity,y} = LFG_{FIR300,y} + LFG_{FIR400,y} + LFG_{FIR500,y} + LFG_{FIR600,y}$$

Where:

$MD_{flare\ F100,y}$	Quantity of methane destroyed in the flare F100 (tCH_4)
$MD_{electricity,y}$	Quantity of methane destroyed in the power plant (tCH_4)
$LFG_{FIR200,y}$	Quantity of landfill gas fed to the flare F100 during the year measured in cubic meters

	(m^3)
$LFG_{electricity, y}$	Quantity of landfill gas sent to the power house (m^3)
$LFG_{FIR300, y}$	Quantity of landfill gas sent to the power house, measured by the flow-meter FIR300 (m^3)
$LFG_{FIR400, y}$	Quantity of landfill gas sent to the power house, measured by the flow-meter FIR400 (m^3)
$LFG_{FIR500, y}$	Quantity of landfill gas sent to the power house, measured by the flow-meter FIR500 (m^3)
$LFG_{FIR600, y}$	Quantity of landfill gas sent to the power house, measured by the flow-meter FIR600 (m^3)
$w_{CH4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3CH_4/m^3_{LFG})
D_{CH4}	Methane density expressed in tons of methane per cubic meter of methane (tCH_4/m^3CH_4)
$PE_{flare\ F100,y}$	Project emissions from flaring of the residual gas stream in flare F100 in year *y* (tCO_2e) determined following the procedure described in the *Version 01 of the Tool to determine project emissions from flaring gases containing methane*.

$MD_{secondary\ line,\ y}$ is calculated as the amount of LFG destroyed in the flare F200 (measured by the flow-meter FIR700):

$$MD_{secondary line,y} = MD_{flare\ F200,y}$$

$$MD_{flare\ F200,y} = \left(LFG_{FIR700,y} \times w_{CH4,y} \times D_{CH4}\right) - \left(\frac{PE_{flare\ F200,y}}{GWP_{CH4}}\right) \quad (15)$$

Where:

$MD_{flare\ F200, y}$	Quantity of methane destroyed in the flare F200 (tCH_4)
$LFG_{FIR700, y}$	Quantity of landfill gas fed to the flare F200 during the year measured in cubic meters (m^3)
$w_{CH4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3CH_4/m^3_{LFG})
D_{CH4}	Methane density expressed in tons of methane per cubic meter of methane (tCH_4/m^3CH_4)
$PE_{flare\ F200,y}$	Project emissions from flaring of the residual gas stream in flare F200 in year *y* (tCO_2e) determined following the procedure described in the *Version 01 of the Tool to determine project emissions from flaring gases containing methane*.

a.1) Methane emissions calculation

The *ex-ante* estimative of the amount of methane that would have been destroyed/combusted during year *y* is calculated using the *Version 06.0.0 of the Emissions from solid waste disposal site*:

$$MD_{project,y} = \frac{\varphi \times (1-f) \times GWP_{CH_4} \times (1-OX) \times \frac{16}{12} \times F \times DOC_f \times MCF \times \sum_{x=1}^{y} \sum_{j} W_{x,j} \times DOC_j \times e^{-k_j(y-x)} \times \left(1-e^{-k_j}\right)}{GWP_{CH_4}} \quad \textbf{(16)}$$

Where:

MD$MD_{project,y}$	Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
ϕ	Model correction factor to account for model uncertainties (0,9)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
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)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year *x* (tons)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type *j*
k_j	Decay rate for the waste type *j*
j	Waste type category (index)
x	Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year *y* for which avoided emissions are calculated (x = y)
y	Year for which methane emissions are calculated

According with USEPA[5], collection efficiency for energy recovery between 75% and 85% sounds reasonable "because each cubic foot of gas will have a monetary value to the owner/operator". Having this statement in mind, a collection efficiency of 85% was adopted once each cubic meter of LFG will have monetary value to generate electricity. Thus equation **(16)** is updated to:

$$MD_{project,y} = 85\% \times \frac{\varphi \times (1-f) \times GWP_{CH_4} \times (1-OX) \times \frac{16}{12} \times F \times DOC_f \times MCF \times \sum_{x=1}^{y} \sum_{j} W_{x,j} \times DOC_j \times e^{-k_j(y-x)} \times \left(1-e^{-k_j}\right)}{GWP_{CH_4}} \quad \textbf{(16)}$$

Where $W_{x,j}$ represent the different waste types *j* which are prevented from disposal on year *x*, which is . determined through sampling and calculated as the mean from the samples, as follows:

[5] **USEPA**; *Turning a Liability into an Asset: A Landfill Gas-to-Energy Project Development Handbook*; September 1996

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^{z} P_{n,j,x}}{z}$$

Where:

$W_{j,x}$	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)
W_x	Total amount of organic waste prevented from disposal in year *x* (tons)
$P_{n,j,x}$	Weight fraction of the waste type *j* in the sample *n* collected during the year *x*
z	Number of samples collected during the year *x*

a.2) Grid-emission factor calculation
$CEF_{elec,\ BL,\ y}$ will be calculated according with the *Version 02.2.1 of the Tool for calculation of emission factor for electricity systems* ($EF_{CM,\ y}$ in the tool). The tool considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario.

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.

The CM calculation must be based in data from an official source, preferable the dispatch authority. The capacity additions and the values generated from the power plants registered as CDM project activities must be excluded from the calculation. The calculation of the emission factor will be in charge of the CIMGC – Comissão Interministerial de Mudança Global do Clima (Brazilian DNA).

The OM values will be presented in an hourly basis and the values will be updated every month. The BM values will be updated every year.

According with 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"*. The CIMGC published Resolução nº 8[6], which makes official the use of a single Electric Grid for CDM project activities applying the tool.

All steps from the most recent version from the tool were applied by the CIMGC and the results were made available in their web-site (http://www.mct.gov.br/index.php/content/view/74689.html).

The combined margin emissions factor will be calculated as follows:

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6 CIMGC – Comissão Interministerial de Mudança Global do Clima; "Resolução nº 8, de 26 de maio de 2009, que adota, para fins de atividade de projeto de MDL, um único sistema como definição de sistema elétrico do projeto no Sistema Interligado Nacional", available at < http://www.mct.gov.br/upd_blob/0024/24719.pdf >, accessed on 10/04/2010.

$$EF_{Grid,CM,y} = EF_{Grid,OM,y} \times w_{OM} + EF_{Grid,BM,y} \times w_{BM}$$ **(178)**

Where:

$EF_{Grid, CM, y}$	Emission factor for the Brazilian electric grid in year *y* (tCO_2/MWh)
$EF_{Grid, OM, y}$	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{Grid, BM, y}$	Build 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 with the Tool, values adopted for w_{OM} and w_{BM} were 0.25 and 0.75, respectively, for the 2nd crediting period.

b) Project Emissions

Project emissions are related to the amount of methane not destroyed in the flares and due to any amount of electricity consumed from the grid or from the emergency captive diesel generator installed inside the landfill, which will operate only when grid-supply is interrupted.

b.1) Project emissions due to the amount of methane not destroyed in the flares

The amount of methane not destroyed will be calculated as per the *Version 01 of the Tool to determine project emissions from flaring gases containing methane*. The project will install enclosed flares and BLFGE will make continuous monitoring of methane concentration. The calculation of flare efficiency will be made by the following steps:

STEP 1: Determination of the mass flow rate of the residual gas that is flared

$$FM_{RG,h} = \frac{P_n}{\frac{R_n}{\sum\left(fv_{i,h} \times MM_i\right)} \times T_n} \times FV_{RG,h}$$ **(18**

Where:

$FM_{RG, h}$	Mass flow rate of the residual gas in hour *h* (kg/h)*;*
P_n	Atmospheric pressure at normal conditions (101,325 Pa)
R_n	Universal ideal gas constant (8,314 Pa.m^3/kmol.K)
T_n	Temperature at normal conditions (273.15 K)
$fv_{i, h}$	Volumetric fraction of component i in the residual gas in the hour *h*
MM_i	Molecular mass of residual gas component *i* (kg/kmol)
$FV_{RG, h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h* (m^3/h)
i	The components CH_4, CO, CO_2, O_2,H_2, N_2

As a simplified approach, BLFGE will only measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N_2).

Step 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

$$fm_{j,h} = \frac{\sum fv_{i,h} \times AM_j \times NA_{j,i}}{\sum \left(fv_{i,h} \times MM_i \right)} \quad \textbf{(19)}$$

Where:

$fm_{j,h}$	Mass fraction of element j in the residual gas in hour *h*
$fv_{i,h}$	Volumetric fraction of component i in the residual gas in the hour *h*
AM_j	Atomic mass of element *j* (kg/kmol)
$NA_{j,i}$	Number of atoms of element *j* in component *i*
j	The elements carbon, hydrogen, oxygen and nitrogen
MM_i	Molecular mass of residual gas component *i* (kg/kmol)
i	The components CH_4, CO, CO_2, O_2,H_2, N_2

STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis
Step 3 is not applicable as the project will apply the default value of 90% Flare Efficiency, through monitoring of the flare temperature and other parameters (i.e. compliance with the manufacturer's specifications).

STEP 4: Determination of methane mass flow rate in the exhaust gas on a dry basis
Step 4 is not applicable as the project will apply the default value of 90% Flare Efficiency, through monitoring of the flare temperature and other parameters (i.e. compliance with the manufacturer's specifications).

STEP 5: Determination of methane mass flow rate in the residual gas on a dry basis

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH_4,FG,h} \times \rho_{CH_4,n} \quad \textbf{(20)}$$

Where:

$TM_{FG,h}$	Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h* (kg/h)
$FV_{n,RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h* (m^3/h))
$fv_{CH4,FG,h}$	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour *h* (mg/m^3)
$\rho_{CH4,n}$	Density of methane at normal conditions (0.716 kg/m^3)

STEP 6: Determination of the hourly flare efficiency
As the BLFGE have enclosed flares and the default value of flare efficiency will be adopted, the flare efficiency in the hour *h* ($\eta_{flare,h}$) is

- 0% if the temperature of the exhaust gas of the flare (T_{flare}) is below 500 °C during more than 20 minutes during the hour *h*.
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h*, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h.

- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.

STEP 7. Calculation of annual project emissions from flaring
Project emissions from flaring are calculated as the sum of emissions from each hour *h*, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour *h* ($\eta_{flare,h}$), as follows:

$$PE_{flare,\,y} = \sum_{h=1}^{8,760} TM_{RG,\,h} \times \left(1 - \eta_{Flare,\,h}\right) \times \frac{GWP_{CH_4}}{1,000} \qquad \textbf{(21)}$$

Where:

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

b.2) Project Emissions due to the consumption of electricity
Project emissions from grid electricity consumption are calculated according with the *Version 01 of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption*. The project will consume electricity from a captive diesel generator, by the times of power plant generation interruption.

According with the tool, BLFGE will correspond to Scenarios B:

- Scenario B (operation of the emergency captive diesel generator): *One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid*.

b.2.1) Project Emissions Calculation in Scenario B
For the calculation of project emissions in Scenario B, the following equation will be used:

$$PE_{EC,\,Scenario\,B,\,y} = \sum_{j} EC_{PJ,\,j,y} \times EF_{EL,\,j,\,y} \times \left(1 + TDL_{j,\,y}\right) \qquad \textbf{(22)}$$

Where:

$PE_{EC,\,Scenario\,B,\,y}$	Project emissions from electricity consumption in Scenario B, in year y (tCO_2/yr)
$EC_{PJ,\,j,\,y}$	Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{EJ,\,j,\,y}$	Emission factor for electricity generation for source *j* in year *y* (tCO_2/MWh)
$TDL_{j,\,y}$	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*

The project will apply option B1 to calculate the emission factor, with the following assumptions:

- $TDL_{j,\ y}$ = 0, as there are no loses in the electricity transmission once the diesel generator is located inside BLFGE;

- Index *j* corresponds to the Emergency Captive Diesel Generator (ECDG); and

- $EF_{EL,\ j,\ y} = EF_{EL,\ DG,\ y}$ is calculated according as follows:

$$EF_{EL,\ ECDG,\ y} = \frac{\sum_{j}\sum_{j} FC_{n,i,t} \times NCV_{i,\ t} \times EF_{CO2,i,\ t}}{\sum_{n} EG_{n,t}} \quad \textbf{(23)}$$

Where:

$EF_{EL,\ ECDG,\ y}$	Emission factor for the Emergency Captive Diesel Generator (ECDG) in year *y* (tCO_2/MWh)
$FC_{n,\ i,\ t}$	Quantity of fossil fuel type *i* fired in the captive power plant *n* in the time period *t* (mass or volume unit)
$NCV_{i,\ t}$	Average net calorific value of fossil fuel type *i* used in the period *t* (GJ/mass or volume unit)
$EF_{CO2,\ i,\ t}$	Average CO_2 emission factor of fossil fuel type *i* used in the period *t* (tCO_2/GJ)
$EG_{n,\ t}$	Quantity of electricity generated in captive power plant *n* in the time period *t* (MWh)
J	Sources of electricity consumption in the project (ECDG = Emergency Captive Diesel Generator)
n	Fossil fuel fired captive power plants installed at the site of the electricity consumption source *j*. For BLFGE, *n* corresponds to Diesel (D);
t	Time period for which the emission factor for electricity generation is determined. For BLFGE, *t* corresponds to the monitoring period (e.g. the year *y*)

Thus, the two above equations are updated to:

$$PE_{EC,\ Scenario\ B,\ y} = EC_{PJ,\ ECDG,\ y} \times \frac{FC_{ECDG,\ D,\ y} \times NCV_{D,\ y} \times EF_{CO2,D,\ y}}{EG_{ECDG,\ y}} \quad \textbf{(24)}$$

Where:

$PE_{EC,\ Scenario\ B,\ y}$	Project emissions from electricity consumption in year y (tCO_2/yr)
$EC_{PJ,\ ECDG,\ y}$	Quantity of electricity consumed from the Emergency Captive Diesel Generator (ECDG) in year *y* (MWh/yr)
$FC_{ECDG,\ D,\ y}$	Quantity of Diesel fired in the Emergency Captive Diesel Generator (ECDG) in the time period *t* (mass or volume unit)
$NCV_{D,\ y}$	Average net calorific value of the Diesel used in the period *t* (GJ/mass or volume unit)
$EF_{EJ,\ j,\ y}$	Emission factor for the Diesel in year *y* (tCO_2/MWh)
$EG_{ECDG,\ y}$	Electricity Generated by the Emergency Captive Diesel Generator (ECDG) in the time period *t* (MWh)

As the all electricity produced by the Emergency Captive Diesel Generator will used only to supply the project,

$EC_{PJ, ECDG, y} = EG_{ECDG, y}$

And the equation is updated to:

$$PE_{EC, Scenario B, y} = FC_{ECDG, D, y} \times NCV_{D, y} \times EF_{CO2, D, y} \quad \textbf{(25)}$$

Project emissions from electricity consumption are equal to:

$$PE_{EC, y} = PE_{EC, Scenario B, y} \quad \textbf{(26)}$$

For the purpose of estimating ERs in item B.6.3, electricity consumption from the diesel generator will not be estimated as it will be used only during emergency situations (procedures for monitoring the parameters related to this source of emission are presented in B.7.1):

As the project does not consume any kind of fossil fuel, total project emissions are equal to:

$$PE_{y} = PE_{EC, y} \quad \textbf{(27)}$$

c) Leakage
According with *Version 11 of ACM0001*, no leakage needs to be accounted.

d) Emission Reductions
Emission Reductions will be calculated according with the equation below:

$$ER_{y} = BE_{y} - PE_{y} \quad \textbf{(28)}$$

Where:

ER_y	Emission Reductions in year *y* (tCO_2e)
BE_y	Baseline Emissions due to the natural emissions of methane to the atmosphere and due to the displacement of grid-fossil fuel electricity generation in year *y*, discounting the emissions due to flare inefficiency as per equation 8 (tCO_2e)
PE_y	Project Emissions from electricity consumption from the grid and from the captive diesel generator in year *y* (tCO_2e)

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**Regulatory requirements relating to landfill gas projects**
Data unit:	% or m^3
Description:	Regulatory requirements relating to landfill gas projects
Source of data used:	Publicly available information of the host country’s regulatory requirements relating to landfill gas.
Value applied:	0, as there are neither regulatory requirements nor legal obligations to destroy the LFG.
Justification of the choice of data or description of measurement methods	Explained above.

and procedures actually applied :	
Any comment:	The information though recorded annually, is used for changes to the adjustment factor (AF) or directly $MD_{reg,y}$ at renewal of the credit period – variable ***updated at renewal of each credit period***. The DNA was contacted and provided information that there are no federal laws/regulations which obligates the destruction of methane in landfills. A conservative value of 20% was adopted as the AF, as presented in item B.6.1.

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of Methane
Source of data used:	IPCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	According with table 2.14 from the IPCC Fourth Assessment Report, the GWP of the methane remained the same value as applied during the 1st crediting period of the Kyoto Protocol). Shall be updated according to any future COP/MOP decisions.
Any comment:	The IPCC Fourth Assessment Report is available at http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf, accessed on 10/02/2011

Data / Parameter:	**D_{CH4}**
Data unit:	t_{CH4}/m^3_{CH4}
Description:	Methane Density
Source of data used:	-
Value applied:	0.0007168
Justification of the choice of data or description of measurement methods and procedures actually applied :	At standard temperature and pressure (0°C and 1.013 bar)
Any comment:	-

Data / Parameter:	**$BE_{CH4,SWDS,y}$**
Data unit:	tCO_2e
Description:	Methane generation from the landfill in the absence of the project activity at year *y*
Source of data used:	Calculated as per the *“Version 06.0.0 of the Emissions from solid waste disposal site”*
Value applied:	

Year	**$BE_{CH4, SWDS}$ (tCO_2e)**	**Year**	**$BE_{CH4, SWDS}$ (tCO_2e)**

1979	7,415	**2004**	1,548,802
1980	50,577	**2005**	1,483,213
1981	81,528	**2006**	1,515,863
1982	119,999	**2007**	1,247,523
1983	149,329	**2008**	964,088
1984	171,511	**2009**	764,685
1985	204,563	**2010**	622,383
1986	306,561	**2011**	519,058
1987	422,459	**2012**	442,492
1988	558,594	**2013**	384,440
1989	596,418	**2014**	339,319
1990	671,642	**2015**	303,344
1991	731,366	**2016**	273,934
1992	833,033	**2017**	249,322
1993	882,080	**2018**	228,290
1994	967,927	**2019**	209,992
1995	1,073,122	**2020**	193,833
1996	1,180,714	**2021**	179,389
1997	1,265,061	**2022**	166,355
1998	1,358,943	**2023**	154,505
1999	1,462,288	**2024**	143,669
2000	1,472,667	**2025**	133,716
2001	1,500,954	**2026**	124,545
2002	1,533,475	**2027**	116,071
2003	1,543,202	**2028**	108,225

Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the *"Version 06.0.0 of the Emissions from solid waste disposal site"*
Any comment:	Used for ex-ante estimation of the amount of methane that would have been destroyed/combusted during the year

Data / Parameter:	**MD_{Hist}**
Data unit:	t_{CH4}
Description:	Amount of methane destroyed historically for the previous year before the start of project activity
Source of data used:	Project Proponent
Value applied:	8.07% of MG_{HIST}
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according with equation **(6)**, based on the Collection efficiency of passive systems in closed landfills (37%), Efficiency of methane destruction in open flares (50%), Number of PDR which were burning the landfill gas collected in the passive system by the time of validation (143 wells) and Total number of PDR actually installed in the Bandeirantes Landfill by the time of the validation (328 wells)

Any comment:	-

Data / Parameter:	**MGHist**
Data unit:	tCH4
Description:	Amount of methane generated historically for the previous year before the start of project activity
Source of data used:	Project Proponent
Value applied:	N/A
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of MDHist is irrelevant to estimate the adjustment factor because the parameter “Destruction efficiency of the baseline system” was calculated according with equation (6), based on the Collection efficiency of passive systems in closed landfills (37%), Efficiency of methane destruction in open flares (50%), Number of PDR which were burning the landfill gas collected in the passive system by the time of validation (143 wells) and Total number of PDR actually installed in the Bandeirantes Landfill by the time of the validation (328 wells)
Any comment:	**-**

Data / Parameter:	**$MD_{Project, 1}$**
Data unit:	Nm^3CH_4
Description:	Amount of methane destroyed by the project activity during the first year of the project activity
Source of data used:	Project Proponent
Value applied:	43,417,990
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value sourced from the data logger of BLFGE, for the year 2004
Any comment:	**-**

Data / Parameter:	**$MG_{PR, 1}$**
Data unit:	Nm^3CH_4
Description:	Amount of methane generated during the first year of the project activity (Nm^3CH_4)
Source of data used:	Project Proponent
Value applied:	102,891,281
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated using the actual amount of waste disposed in the landfill as per the “Version 06.0.0 of the Emissions from solid waste disposal site”
Any comment:	Value calculated for the year 2004

Version 06.0.0 of the Emissions from solid waste disposal site

Data / Parameter:	**φ**
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the *"*Version 06.0.0 of the Emissions from solid waste disposal site*"*
Any comment:	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.

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 used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value applied as the Bandeirantes landfill is a managed solid waste disposal site which uses soil as cover material
Any comment:	

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose

Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Standard value applied by IPCC
Any comment:	

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	According with the 2006 IPCC Guidelines, the Bandeirantes Landfill does meet the criteria of managed SWDS and have depths of greater than or equal to 5 meters (50 meters) and/or high water table at near ground level.
Any 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.

Data / Parameter:	**DOC_j**
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the waste type *j*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	According with the version of the Version 06.0.0 of the Emissions from solid waste disposal siteapplied for the project.
Any comment:	

Value applied:

DOC_j (% wet waste)	**Waste type *j***
43	Wood and wood products
40	Pulp, paper and cardboard
15	Food, food waste, beverages and tobacco
24	Textiles
20	Garden, yard and park waste
0	Glass, plastic, metal, other inert waste

Data / Parameter:	**W_x**
Data unit:	Tons
Description:	Total amount of organic waste prevented from disposal in year *x* (tons)
Source of data used:	Landfill's weight bridge.
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Values taken from the weight bridge, located in the entrance of the landfill. The bridge measures the truck weight before and after the waste unload. The difference is equal to the amount of waste.
Any comment:	-

Year	Waste Disposed (tons)	Year	Waste Disposed (tons)
1979	37,450	**1994**	1,616,710
1980	229,040	**1995**	1,823,170
1981	231,408	**1996**	1,971,651
1982	313,633	**1997**	1,992,386
1983	321,956	**1998**	2,142,325
1984	325,585	**1999**	2,305,464
1985	408,887	**2000**	1,964,424
1986	801,366	**2001**	2,043,617
1987	1,017,866	**2002**	2,082,855
1988	1,283,852	**2003**	1,993,371
1989	977,852	**2004**	1,965,347
1990	1,206,964	**2005**	1,594,350
1991	1,224,954	**2006**	1,974,799
1992	1,508,817	**2007**	489,627
1993	1,377,148		

Data / Parameter:	**$p_{n,j,x}$**
Data unit:	-
Description:	Weight fraction of the waste type *j* in the sample *n* collected during the year *x*
Source of data used:	FRAL CONSULTORIA LTDA., Caracterização dos Resíduos Sólidos Domiciliares do Município de São Paulo – Agrupamento Noroeste – Quadrimestre nov/dez/2008/jan/feb/2009 – 2009
Value applied:	(see table below)

Type of Waste	% (wet basis)
Wood and wood products	0.66%
Pulp, paper and cardboard	12.32%
Food, food waste, beverages and tobacco	60.62%
Textiles	3.14%
Garden, yard and park waste	3.21%
Glass, plastic, metal, other inert waste	18.79%

Justification of the choice of data or description of measurement methods and procedures actually applied :	The study was based on a local standard for the characterization of municipal solid waste (Stech, P.J., Resíduos Sólidos: Caracterização, Resíduos Sólidos Domésticos: Tratamento e Disposição Final, 1 São Paulo, CETESB, 1990;)
Any comment:	-

Data / Parameter:	$\mathbf{k_j}$
Data unit:	-
Description:	Decay rate for the waste type *j*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	Those values were adopted considering the climate of the São Paulo: - $MAT_{historical}$ = 20.7 °C (data from Centro de Pesquisas Meteorológicas e Climáticas Aplicadas a Agricultura – CEPAGRI [7]); - $MAP_{historical}$ = 1,376.2 mm (Centro de Pesquisas Meteorológicas e Climáticas Aplicadas a Agricultura – CEPAGRI [7]);
Any comment:	OBS: data for PET was not sourced as it was not applied to estimate the value of k_i.

Value applied:

Waste type *j*		$\mathbf{k_j}$
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.070
	Wood, wood products and straw	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.4

Version 01 of the Tool to determine project emissions from flaring gases containing methane

Parameter	**Description**	**Value**
MM_{CH4}	Molecular mass of carbon methane	16.04 kg/kmol
MM_{CO}	Molecular mass of carbon monoxide	28.01 kg/kmol
MM_{CO2}	Molecular mass of carbon dioxide	44.01 kg/kmol
MM_{O2}	Molecular mass of oxygen	32.00 kg/kmol
MM_{H2}	Molecular mass of hydrogen	2.02 kg/kmol
MM_{N2}	Molecular mass of nitrogen	28.02 kg/kmol
AM_{C}	Atomic mass of carbon	12.00 kg/kmol
AM_{H}	Atomic mass of hydrogen	1.01 kg/kmol

[7] Available at: http://www.cpa.unicamp.br/outras-informacoes/clima_muni_565.html

AM_O	Atomic mass of oxygen	16.00 kg/kmol
AM_N	Atomic mass of nitrogen	14.01 kg/kmol

B.6.3 Ex-ante calculation of emission reductions:

As per item B.6.1:

a) Emission Reduction

Equation 28:

$$ER_y = BE_y - PE_y$$

b) Project Emissions:

Equation 27:

$$PE_y = PE_{EC,\,y}$$

Equation 26:

$$PE_{EC,\,y} = PE_{EC,\,Scenario\,B,\,y}$$

Equation 25:

$$PE_{EC,\,Scenario\,B,\,y} = FC_{ECDG,\,D,\,y} \times NCV_{D,\,y} \times EF_{CO2,\,D,\,y}$$

For the purpose of estimating ERs, Project Emissions from the usage of the diesel generator was assumed to be equal to zero, the this equipment will only enter into operation during emergency situations.

c) Baseline Emissions

Equation 10:

$$BE_y = 0.8 \times MD_{project,y} \times GWP_{CH4} + EL_{LFG,\,y} \times CEF_{elect,\,BL,\,y}$$

Equation 12:

$$MD_{project,y} = MD_{flare,\,y} + MD_{electricity,\,y}$$

Equation 13:

$$MD_{project,y} = MD_{main\,line,y} + MD_{secondaryline,y}$$

Equation 14:

$$MD_{main\ line,y} = MD_{flare\ F100,y} + MD_{electricity,y}$$

$$\Rightarrow MD_{flare\ F100,y} = \left(LFG_{FIR200,y} \times w_{CH4,y} \times D_{CH4}\right) - \left(\frac{PE_{flare\ F100,y}}{GWP_{CH4}}\right)$$

$$\Rightarrow MD_{electricity,y} = LFG_{electricity,y} \times w_{CH4,y} \times D_{CH4}$$

$$\Rightarrow LFG_{electricity,y} = LFG_{FIR300,y} + LFG_{FIR400,y} + LFG_{FIR500,y} + LFG_{FIR600,y}$$

And Equation 15:

$$MD_{secondaryline,y} = MD_{flare\ F200,y}$$

$$MD_{flare\ F200,y} = \left(LFG_{FIR700,y} \times w_{CH4,y} \times D_{CH4}\right) - \left(\frac{PE_{flare\ F200,y}}{GWP_{CH4}}\right)$$

The following assumptions were applied for BE estimative:

- w_{CH4} = 50%;
- D_{CH4} = 0.0007168 tCH_4/Nm^3;
- $PE_{flare,\ y}/GWP_{CH4}$ = 1% from the value of $LFG_{rlare,\ y}$;
- $EL_{LFG,\ y}$ was estimated as per item B.7.1.;
- $CEF_{Elec,\ BL,\ y}$ = 0.121 tCO_2e/MWh;
- $MD_{Project,\ y}$ was estimated applying the latest version of the Version 06.0.0 of the Emissions from solid waste disposal siteand the results are presented in Annex 3. To convert the results of $MD_{project,\ y}$ from tCO_2e to Nm^3CH_4, the calculated values in tCO_2e were divided by the GWP_{CH4} (21 tCO_2e/tCH_4) and divided by the methane density at STP (0.0007168 tCH_4/Nm^3), as presented in item B.7.1.;
- $MD_{Flare\ F200}$ was estimated equal to zero because the Flare F200 is expected to operate only during emergency situations, like power supply interruption;
- $LFG_{Electricity}$ and $LFG_{Flare\ F100}$ were estimated as follows:
  - the available capacity due to the combustion of the LFG in the engines was calculated based on the electric efficiency of the engines (35%) and the NCV of the LFG assuming a 50% methane concentration (4,150 $kcal/Nm^3$);
  - the project had installed 24 engines of 0.925 MW each, achieving a total installed capacity of 22.2 MW;
  - if the installed capacity is higher than the available capacity, then all LFG collected will be sent to the power plant and no surplus gas will be flared;
  - if the installed capacity is lower than the available capacity, it means that the project is collecting more gas than the capacity of the engines and a surplus gas must be flared. This surplus gas will be calculated as the difference between the total LFG collected and the LFG collected / 35% (electric efficiency) / NCV x conversion factor (860 kcal/kWth) x 1,000.

The final result is, for the 2nd crediting period:

	A	B	C	D	E	F	G	H
	LFG Collected	$LFG_{Elecrticity, y}$	$MD_{Electricity, y}$	$LFG_{Flare, y}$	$LFG_{Flare\ F100, y}$ x $w_{CH4, y}$ x D_{CH4}	$PE_{flare\ F100,y}$ / GWP_{CH4}	$MD_{Flare\ F100, y}$	$MD_{Project, y}$ = $MD_{Electricity, y}$ + $MD_{flare\ F100,y}$
	Please, refer to PDD Annex 3		(L x 50% x 0.0007168)		(N x 50% x 0.0007168)	10% x O	O - P	M + R
	Nm^3		tCH_4	Nm^3	tCH_4	tCH_4	tCH_4	tCH_4
2010	70,289,356	70,289,356	25,192	0	0	0	0	25,192
2011	58,620,222	58,620,222	21,009	0	0	0	0	21,009
2012	49,973,244	49,973,244	17,910	0	0	0	0	17,910
2013	43,417,014	43,417,014	15,561	0	0	0	0	15,561
2014	38,321,305	38,321,305	13,734	0	0	0	0	13,734
2015	34,258,414	34,258,414	12,278	0	0	0	0	12,278
2016	30,936,945	30,936,945	11,088	0	0	0	0	11,088
2017	28,157,357	28,157,357	10,092	0	0	0	0	10,092

	I	J	K	L	M = BEy
			$EL_{LFG, y}$	$EL_{LFG, y}$ x $CEF_{elect, BL, y}$	0.80 x $MD_{Project, y}$ x 21 + $EL_{LFG, y}$ x $CEF_{elect, BL, y}$
	Electricity Generated	Electricity Consumed Internally	S - T	U x 0.171	0.80 x R x 21 + L
	MWh	MWh	MWh	tCO_2e	tCO_2e
2010	91,722	4,668	87,054	10,572	433,793
2011	75,137	4,668	70,469	8,558	361,517
2012	62,846	4,668	58,178	7,065	307,960
2013	53,528	4,668	48,860	5,934	267,353
2014	46,285	4,668	41,617	5,054	235,791
2015	40,510	4,668	35,842	4,353	210,627
2016	35,789	4,668	31,121	3,779	190,054
2017	31,838	4,668	27,170	3,300	172,838

	N	O = PEy	ERy
	$EC_{PJ, EG, y}$	$EC_{PJ, EG, y}$ x $EF_{EL, EG, y}$ x (1 + $TDL_{EG, y}$)	BEy - PEy
	Electricity consumed from the grid, while the power plant is not operational	X x 0.171 x (1 + 20%)	W - Y
	MWh	tCO_2e	tCO_2e
2010	0	0	433,793
2011	0	0	361,517
2012	0	0	307,960
2013	0	0	267,353
2014	0	0	235,791
2015	0	0	210,627
2016	0	0	190,054
2017	0	0	172,838

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimations of Project Activity Emissions (tCO_2e/year)	Estimations of Baseline Emissions (tCO_2e/year)	Estimation of Leakage (tCO_2e/year)	Estimation of Emission Reductions (tCO_2e/year)
2010*	0	9,534	0	9,534
2011	0	361,517	0	361,517
2012	0	307,960	0	307,960
2013	0	267,353	0	267,353
2014	0	235,791	0	235,791
2015	0	210,627	0	210,627
2016	0	190,054	0	190,054
2017**	0	169,040	0	169,040
TOTAL	**0**	**1,751,876**	**0**	**1,751,876**

* from 23/12/2010 to 31/12/2010
** from 01/01/2017 to 22/12/2017

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

ACM0001

Data / Parameter:	**$LFG_{Total, y}$**
Data unit:	m^3
Description:	Total amount of landfill gas captured at Normal Temperature and Pressure
Source of data to be used:	Measurements from the flow-meters FIR100 and FIR700.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	see table below
Description of measurement methods and procedures to be applied:	Continuous readings from the flow-meter FIR100 and FIR700 installed. The equipments are connected to a supervisory computer system, which registers continuously the LFG measured. Data to be aggregated daily, monthly and yearly. The supervisory system makes records of instant gas-flow every 5 minutes and

Year	$LFG_{Total, y}$ (Nm^3)
2010	70,289,356
2011	58,620,222
2012	49,973,244
2013	43,417,014
2014	38,321,305
2015	34,258,414
2016	30,936,945
2017	28,157,357

	the accumulated gas-flow every hour. The counter is reseted at 00:00.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy. Regular maintenance will be made along with the calibration, following general guidelines from the manufacturer Regarding the calibration of the instrument, the PPs decided to conservatively adopt a 5-years frequency because: - in compliance with national laws (example in Germany the Netherlands, for turbine meters of this size of FIR100 and FIR700, calibration is never required; - in Brazil there are no requirements on how often flow-meters must be calibrated;). - in Germany, a calibration every 10-years is enforce by law; - the manufacturer states that it's up to the clients to determine the calibration frequency.
Any comment:	- Monitoring under responsibility of the BLFGE Manager - Automatic readings of temperature and pressure will be made by sensors connected to the flow-meter – these data will be used to convert the gas-flow to Nm^3, thus no separate monitoring of pressure and temperature will be necessary; All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; - Represented by instrument 1 in Figure 7. Due to the change in the design of the degassing installation, the measurements of LFG_{Total} are made by two different instruments: FIR100 and FIR700, whereas FIR100 measures the total LFG collected and destroyed in Flare F100 and in the power plant, while FIR700 measures the LFG collected and destroyed only at Flare F200. For the purpose of estimating ERs, the readings from FIR700 were equal to zero because the Flare F200 is expected to operate only during emergency situations, like power supply interruption;

Data / Parameter:	**$LFG_{Flare, y}$**
Data unit:	m^3
Description:	Total amount of landfill gas flared at Normal Temperature and Pressure
Source of data to be used:	Measurements from the flow-meters FIR200 and FIR700.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(see table below)

Year	**LFG_{Flare} (Nm^3)**
2010	0
2011	0
2012	0
2013	0
2014	0
2015	0
2016	0

	2017 | 0
Description of measurement methods and procedures to be applied:	Continuous readings from the flow-meters FIR200 and FIR700 installed. The instruments are connected to a supervisory computer system, which registers continuously the LFG measured. Data to be aggregated daily, monthly and yearly. The supervisory system makes records of instant gas-flow every 5 minutes and the accumulated gas-flow every hour. The counter is reseted at 00:00.
QA/QC procedures to be applied:	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy, in compliance with national laws. Regular maintenance will be made along with the calibration, following general guidelines from the manufacturer Regarding the calibration of the instrument, the PPs decided to conservatively adopt a 5-years frequency because: - in the Netherlands, for turbine meters of this size of FIR200 and FIR700, calibration is never required; - in Brazil there are no requirements on how often flow-meters must be calibrated; - in Germany, a calibration every 10-years is enforce by law; - the manufacturer states that it’s up to the clients to determine the calibration frequency.
Any comment:	- Monitoring under responsibility of the Bandeirantes Landfill Manager - Automatic readings of temperature and pressure will be made by sensors connected to the flow-meter – these data will be used to convert the gas-flow to Nm^3, thus no separate monitoring of pressure and temperature will be necessary; - All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; - Represented by instruments 2 (FIR200) and 12 (FIR700) in Figure 7; Due to the change in the design of the degassing installation, the measurements of LFG_{Flare} are made by two different instruments: FIR200 and FIR700, whereas FIR200 measures the LFG destroyed only in Flare F100, while FIR700 measures the LFG destroyed only in Flare F200. For the purpose of estimating ERs, the readings from FIR700 were equal to zero because the Flare F200 is expected to operate only during emergency situations, like power supply interruption.

Data / Parameter:	$\mathbf{LFG_{Electricity,\ y}}$
Data unit:	m^3
Description:	Amount of landfill gas combusted in power plant at Normal Temperature and Pressure
Source of data to be used:	Measurements from the flow-meter FIR300, FIR400, FIR500 and FIR600.
Value of data applied for the purpose of	

<table>
<tr><td>calculating expected emission reductions in section B.5</td><td>

Year	$LFG_{Electricity, y}$ (Nm^3)
2010	70,289,356
2011	58,620,222
2012	49,973,244
2013	43,417,014
2014	38,321,305
2015	34,258,414
2016	30,936,945
2017	28,157,357

</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Continuous readings from the 4 flow-meters installed (tags FIR300, FIR400, FIR500 and FIR600). The equipments are connected to a supervisory computer system, which registers continuously the LFG measured. Data to be aggregated daily, monthly and yearly.

For each flow-meter, the supervisory system makes records of instant gas-flow every 5 minutes and the accumulated gas-flow every hour. The counter is reseted at 00:00.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy, in compliance with national laws. Regular maintenance will be made along with the calibration, following general guidelines from the manufacturer.
Regarding the calibration of the instrument, the PPs decided to conservatively adopt a 5-years frequency because:
- in the Netherlands, for turbine meters of this size of FIR300, FIR400, FIR500 and FIR600, calibration is never required;
- in Brazil there are no requirements on how often flow-meters must be calibrated;
- in Germany, a calibration every 10-years is enforce by law;
- the manufacturer states that it's up to the clients to determine the calibration frequency</td></tr>
<tr><td>Any comment:</td><td>- Monitoring under responsibility of the Bandeirantes Landfill Manager.
- Automatic readings of temperature and pressure will be made by sensors connected to the flow-meters – these data will be used to convert the gas-flow to Nm^3, thus no separate monitoring of pressure and temperature will be necessary;
- All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later;
- Represented by instruments 6, 7, 8 and 9 in Figure 7</td></tr>
</table>

Data / Parameter:	**$PE_{Flares, y}$**
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data to be used:	Calculated as per the Version 01 of the Tool to determine project emissions from flaring gases containing methane
Value of data applied	

for the purpose of calculating expected emission reductions in section B.5	<table><tr><th>Year</th><th>$PE_{Flares, y}$ (tCO_2e)</th></tr><tr><td>2010</td><td>0</td></tr><tr><td>2011</td><td>0</td></tr><tr><td>2012</td><td>0</td></tr><tr><td>2013</td><td>0</td></tr><tr><td>2014</td><td>0</td></tr><tr><td>2015</td><td>0</td></tr><tr><td>2016</td><td>0</td></tr><tr><td>2017</td><td>0</td></tr></table>
Description of measurement methods and procedures to be applied:	Calculated as per the Version 01 of the Tool to determine project emissions from flaring gases containing methane
QA/QC procedures to be applied:	Calculated as per the Version 01 of the Tool to determine project emissions from flaring gases containing methane
Any comment:	Values calculated were equal to zero because there are no estimated surplus gas collected that won't be consumed by the engines and, therefore, flared.

Data / Parameter:	w_{CH4}
Data unit:	m^3CH4/m^3LFG
Description:	Methane fraction in the landfill gas
Source of data to be used:	Continuous measurement using a certified gas analyzer.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50%
Description of measurement methods and procedures to be applied:	The data is continuously measured by the gas analyzer and recorded electronically by PLC at least each five minutes and once per hour, instantaneously. The reading frequency is continuously and registered by the PLC.
QA/QC procedures to be applied:	- The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy; - The operation team is responsible for the testing/maintenance following the procedure mentioned above; - The operation team performs a daily check list of the instrument to detect leaks and other defects; - The filter replacement is performed when the team deems necessary; - The calibration is also performed weekly using a standard certified gas.
Any comment:	- Monitoring under responsibility of the Bandeirantes Landfill Manager. - All registrations will be kept for 2 years after the end of the crediting period or

	the last issuance of CERs for this project activity, whichever occurs later; - Represented by instruments 3 in Figure 7

Data / Parameter:	$EL_{LFG,y}$
Data unit:	MWh
Description:	Net amount of electricity generated using LFG
Source of data to be used:	Continuous measurements from the electricity meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	**Year** / **$EL_{LFG,y}$ (MWh)**: **2010**: 87,054 **2011**: 70,469 **2012**: 58,178 **2013**: 48,860 **2014**: 41,617 **2015**: 35,842 **2016**: 31,121 **2017**: 27170
Description of measurement methods and procedures to be applied:	Continuous readings from the electricity-meters located in the substation connected to the SIN. The substation has 2 measurement points: one belongs to Biogeração (manager of the power plant) and the other belongs to Eletropaulo (Electric Utility). Each set of meter is connected to the responsible supervisory system, which registers continuously the electricity exported. For sake of conservativeness, both records will be compared in a monthly basis and the lowest one will be applied to calculate ERs.
QA/QC procedures to be applied:	Electricity meters will be subject to regular (every 2-years, according with Network Procedures, from ONS – Operador Nacional do Sistema[8]) maintenance and testing to ensure accuracy.
Any comment:	- All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; - Net Electricity Generated was calculated based on: • the amount of LFG sent to the power plant (provided at $LFG_{Electricity}$); • NCV_{LFG} (4,150 kcal/Nm^3) • electric efficiency of the engines (35%); • Auxiliary Power (5% of power generated) • Transformer Efficiency (97%) • hours of operation (7,600 hours/year); • amount of electricity consumed by the Degassing Station (4,668 MWh/year, calculated as 389 MWh/month, the highest value of consumption from the Degassing Station monitored for a month, multiplied by 12 months/year)
Any comment:	- Monitoring under responsibility of the Biogeração Manager.

[8] OPERADOR NACIONALO DO SISTEMA; **Submódulo 12.3 - Manutenção do sistema de medição para faturamento, Rev 1.1 (18/06/2010)**, available at http://www.ons.org.br/download/procedimentos/modulos/Modulo_12/Submodulo%2012.3_Rev_1.1.pdf, accessed on 01/02/2011

	- All registrations will be kept for 2 years after the end of the crediting period;

Data / Parameter:	**$CEF_{elecy,BL,y}$**
Data unit:	tCO2e/MWh
Description:	Carbon emission factor of electricity
Source of data to be used:	CIMGC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.121
Description of measurement methods and procedures to be applied:	CIMGC will be responsible for calculating the $CEF_{Elec,\ BL,\ y}$. The OM will be updated monthly and the BM will be updated yearly.
QA/QC procedures to be applied:	QA/QC under responsibility of CIMGC
Any comment:	For more information, please refer to the monitoring of OM and BM below.

Data / Parameter:	**Operation of the energy plant**
Data unit:	Hours
Description:	Operation of the energy plant
Source of data to be used:	Readings from the run-time meter installed at each engine.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	Continuous readings from the run-time meter installed in the control room. The equipment is connected to Biogeração's computer system, which registers continuously the quantity of hours the engines operated.
QA/QC procedures to be applied:	N/A
Any comment:	This is monitored to ensure methane destruction is claimed for methane used in electricity plant when it is operational. The value provided above (in hours/year) was applied to calculate the amount of net electricity generated. No value was assigned for this variable as it was not used to estimate ERs – will be only used to calculate monitored ERs case LFG_{Total} is less than LFG_{Flare} + $LFG_{ELectricity}$.

Data / Parameter:	**$PE_{ec,\ y}$**
Data unit:	tCO_2
Description:	Project emissions from electricity consumption by the project activity during

	the year y
Source of data to be used:	Calculated as per Version 01 of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Calculated as per Version 01 of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption. Please, refer to the monitoring of the parameters below.
QA/QC procedures to be applied:	Calculated as per Version 01 of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption
Any comment:	The value applied was equal to zero, as all electricity consumed by the project will be generated by the power plant. The project will have 1 backup system in case of power supply interruption: consumption from a captive diesel generator, located inside the landfill.

Data / Parameter:	**$PE_{fc,y}$**
Data unit:	tCO_2
Description:	Project emissions from fossil fuel combustion during the year y
Source of data to be used:	Calculated as per Version 02 of the Tool to calculate project or leakage CO2 emissions from fossil fuel combustion
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Calculated as per Version 02 of the Tool to calculate project or leakage CO2 emissions from fossil fuel combustion. Please, refer to the monitoring of the parameters below.
QA/QC procedures to be applied:	Calculated as per Version 02 of the Tool to calculate project or leakage CO2 emissions from fossil fuel combustion
Any comment:	The value applied was equal to zero, as all electricity consumed by the project will be generated by the power plant. The project will have 1 backup system in case of power supply interruption: consumption from a captive diesel generator, located inside the landfill.

Version 01 of the Tool to determine project emissions from flaring gases containing methane

Data / Parameter:	**$fv_{i,h}$**
Data unit:	-
Description:	Volumetric fraction of component i in the residual gas in the hour h where *i* = CH_4, CO, CO_2, O_2,H_2, N_2
Source of data to be used:	Continuous measurement using a certified gas analyzer.

Value of data applied for the purpose of calculating expected emission reductions in section B.5	50% of CH_4
Description of measurement methods and procedures to be applied:	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 ºC
QA/QC procedures to be applied:	The gas analyzer is recalibrated every week against a standard certified gas cylinder, according with an internal procedure.
Any comment:	Please, refer to the measurements of $\mathbf{w_{CH4}}$ above. As a simplified approach, only the methane content of the residual gas will be measured and the remaining part will be considered as N_2.

Data / Parameter:	$\mathbf{FV_{RG,h}}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*
Source of data to be used:	Continuous measurements from the flow-meters FIR200 and FIR700.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(see table below)
Description of measurement methods and procedures to be applied:	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ($fv_{i,h}$) when the residual gas temperature exceeds 60 ºC
QA/QC procedures to be applied:	Flow meters are to be periodically calibrated according to the manufacturer's recommendation.
Any comment:	Please, refer to the measurements of $\mathbf{LFG_{Flare\ F100,\ y}}$ **and** $\mathbf{LFG_{Flare\ F200,\ y}}$ above.

Year	$\mathbf{FV_{RG,\ h}}$ **(Nm^3)**
2010	0
2011	0
2012	0
2013	0
2014	0
2015	0
2016	0
2017	0

Data / Parameter:	$\mathbf{T_{flare}}$
Data unit:	^oC
Description:	Temperature in the exhaust gas of the flare

Source of data to be used:	Continuous measurements using thermocouples
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A, as the monitoring this parameter is used to calculate flare efficiency.
Description of measurement methods and procedures to be applied:	. Continuous readings from the thermocouples installed in each flare. The instruments are connected to a supervisory computer system, which registers continuously the combustion temperature measured. For each flare, the supervisory system makes records of instant temperature every 5 minutes and every hour.
QA/QC procedures to be applied:	Thermocouples will be replaced or calibrated every year.
Any comment:	- All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; An excessively high temperature at the sampling point (above 700 ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow. According with the clarification AM_CLA_0047, this issue might not represent a problem provided that the gas-flow to each flare is within the manufacturers specifications. A value of 90% flare efficiency was applied for the purpose of ERs estimations. Represented by instruments 4 and 5 in Figure 7

Data / Parameter:	**Other flare operation parameters**
Data unit:	N/A
Description:	Data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer’s specifications
Source of data to be used:	Flare combustion temperature
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A, as the monitoring this parameter is used to calculate flare efficiency.
Description of measurement methods and procedures to be applied:	Continuous readings from the thermocouples installed in each flare. The instruments are connected to a supervisory computer system, which registers continuously the combustion temperature measured. For each flare, the supervisory system makes records of instant temperature every 5 minutes and every hour.
QA/QC procedures to	Thermocouples will be replaced or calibrated every year.

be applied:	
Any comment:	- All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; A value of 90% flare efficiency was applied for the purpose of ERs estimations. According with the manufacturer, the operation of the flare is out of the specified conditions if the temperature drops below 900^{o}C or above 1,350^{o}C.

Version 02.2.1 of the Tool for calculation of emission factor for electricity systems

Data / Parameter:	**$EF_{OM,}$**
Data unit:	tCO_2e/MWh
Description:	Emission Factor of the Operating Margin for 2009
Source of data to be used:	CIMGC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.2476
Description of measurement methods and procedures to be applied:	This variable will be monitored *ex-post* by the CIMGC and will be updated monthly in their web-site.
QA/QC procedures to be applied:	The CIMGC will calculate the hourly value of EF_{OM}, based on information from the national electric sector.
Any comment:	--

Data / Parameter:	**$EF_{BM,}$**
Data unit:	tCO_2e/MWh
Description:	Emission Factor of the Built Margin of 2009
Source of data to be used:	CIMGC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0794
Description of measurement methods and procedures to be applied:	This variable will be monitored *ex-post* by the CIMGC and will be updated monthly in their web-site.
QA/QC procedures to be applied:	The CIMGC calculates the annual value of EF_{BM}, based on information from the national electric sector.
Any comment:	

Data / Parameter:	**EF**

Data unit:	tCO_2e/MWh
Description:	Electricity Baseline Emission Factor for 2009
Source of data to be used:	CIMGC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.121
Description of measurement methods and procedures to be applied:	This variable will be calculated according with the *ex-post* monitoring of EF_{OM} and EF_{BM} by the CIMGC.
QA/QC procedures to be applied:	The EF will be calculated hourly using the values of hourly values of EF_{OM} and annual value of EF_{BM}. The CIMGC will be responsible to update the values of EF_{OM} and EF_{BM} in their website.
Any comment:	The EF will be calculated every hour, using data from the CIMGC.

Version 01 of the Tool to calculate baseline, project and/or leakage emissions from electricity consumption

Data / Parameter:	$\mathbf{FC_{ECDG, D, y}}$
Data unit:	Mass or volume unit
Description:	Quantity of diesel fired in the emergency captive diesel generator in year *y*
Source of data to be used:	Continuous measurements from the mass/volume meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Weight or volume meters
QA/QC procedures to be applied:	The metered fuel consumption quantities will base on purchased quantities and stock changes.
Any comment:	- All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; For the purpose of estimating ERs, a value equals to 0 was applied, as the emergency captive diesel generator is a backup system and is expected to operate only in cases when the grid supply is interrupted. Represented by instrument 10 in Figure 7

Data / Parameter:	$\mathbf{NCV_{D, t}}$
Data unit:	GJ/mass or volume unit
Description:	Average net calorific value of the diesel used in the period *t*

Source of data to be used:	a) Values provided by the supplier; b) if not available, regional or national default values; c) if not available, default IPCC 2006 values at the upper limit
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	a) and b): The NCV will be obtained for the diesel, from which weighted average values for the year *y* will be calculated For c): Any future revision of the IPCC Guidelines will be taken into account
QA/QC procedures to be applied:	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall out this range, there will be necessary to collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Any comment:	- All registrations will be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later; The diesel generator will be used as a backup from the electricity imported from the grid when the power generation is interrupted. Therefore, the value applied to estimate ERs will be equal to 0.

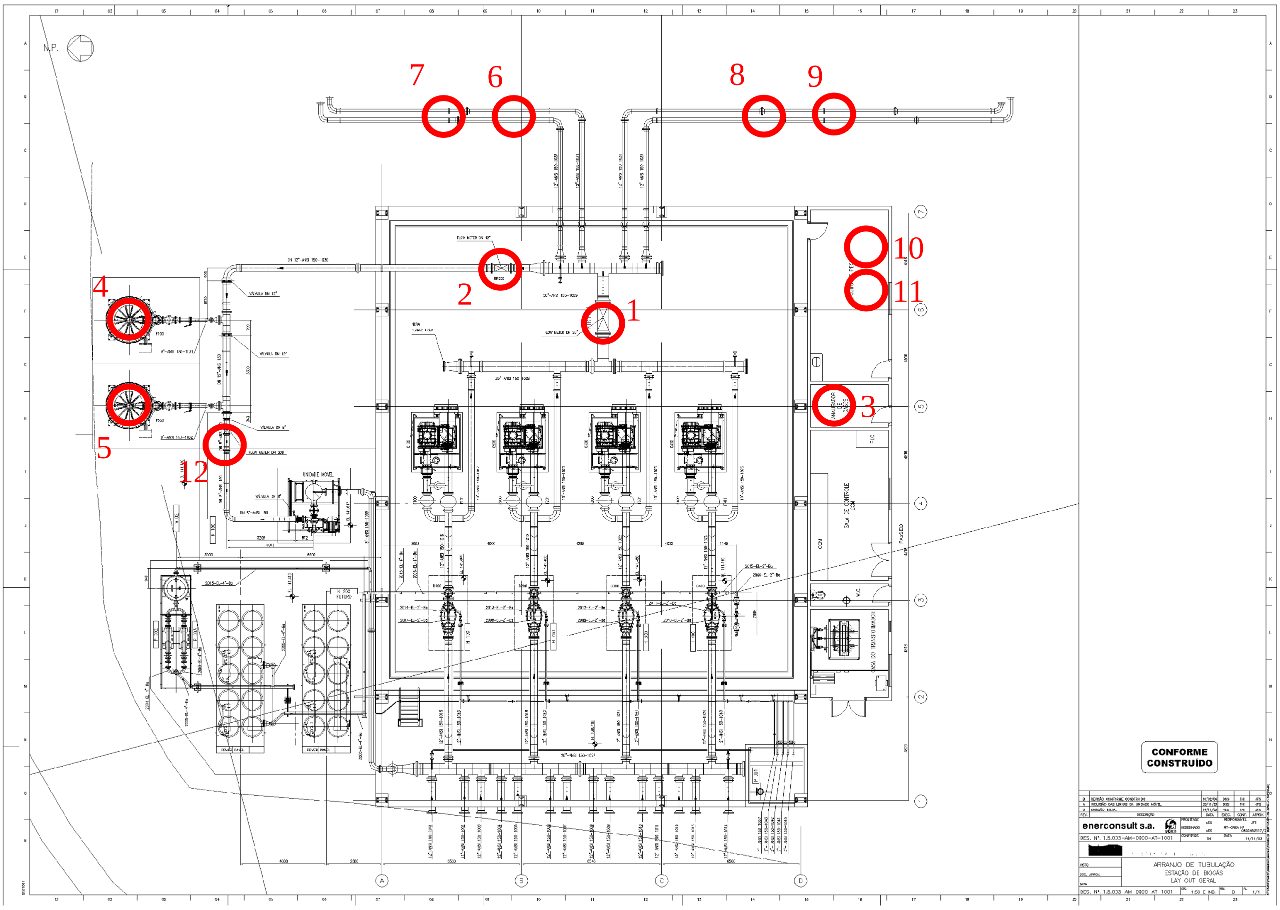
Data / Parameter:	**$EF_{CO2,e}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of the diesel used in the period *t*
Source of data to be used:	a) Values provided by the supplier; b) if not available, regional or national default values; c) if not available, default IPCC 2006 values at the upper limit
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	a) and b): The $EF_{CO2,e}$ will be obtained for the diesel, from which weighted average values for the period *t* will be calculated For c): Any future revision of the IPCC Guidelines will be taken into account
QA/QC procedures to be applied:	a) The supplier shall inform the value of the emission factor in the purchase invoices or shall present the results of laboratory analysis; b) The values listed in the latest BEN (Balanço Energético Nacional) and BESP (Balanço Energético do Estado de São Paulo) will be compared and the higher will be applied; c) The latest revision of the IPCC Guidelines will be taken into account.
Any comment:	- All registrations will be kept for 2 years after the end of the crediting period or

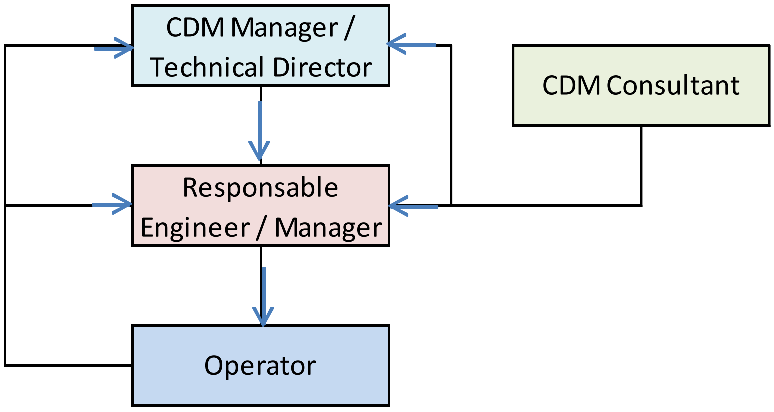
	the last issuance of CERs for this project activity, whichever occurs later; The diesel generator will be used as a backup from the electricity imported from the grid when the power generation is interrupted. Therefore, the value applied to estimate ERs will be equal to 0.

B.7.2. Description of the monitoring plan:

The variables described in item B.7.1 will be measured continuously and the readings will be also registered continuously, in a supervisory computer system. In order to assure conservatism, the standard errors of each equipment will be subtracted from the readings.

The diagram below presents how the monitoring will be made.





The operators will be responsible to assure the correct operation of the project. Their responsibilities will be to document manually all events identified during its turn in an Operation Book (like purchase of fuel, failure of the monitoring system, field maintenance, replacement of equipments or instruments, etc.) and to download the data monitored during the turn into an electronic file. The operators will also make manual records of the main operational parameters.

The Responsible Engineer / Manager will be in charge is to supervise the work of the operators, assuring that the project is operating without failure. It will also check the log records made by the PLC to identify whether the system was functioning accordingly. With data from the PLC, it will prepare regular production reports, which will be presented to the CDM Manager and to the CDM Consultant. It will also be responsible to take the proper actions proposed by the CDM Manager in case data is found to be inconsistent.

The CDM Manager / Technical Director will be responsible to assure that all QA/QC procedures from the project were properly followed, including instruments/equipments maintenance and calibration. Moreover, it will be responsible to prepare regular trainings for the operators. Any external data applied by the project (i.e. electricity exported, electricity consumed from the grid, NCV of fuels consumed, etc) will be double checked by the CDM Manager.

The CDM Consultant is an important figure, as it will be responsible to propose QA/QC procedures for the data logger and will give proper orientation regarding the monitoring of the project.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

The baseline study and monitoring methodology was concluded on April 28th, 2011, by Arcadis Tetraplan Ambiental S/A. Contact information:

ARCADIS Tetraplan S.A.
C/O: Cintia Philippi Salles / Juliana Justi Pedott
cintia.salles@tetraplan.com.br / juliana.justi@tetraplan.com.br
Avenida Nove de Julho, 5960/5966 – Térreo
CEP 01406-200
São Paulo – SP - Brazil

Phone. + 55 11 3060-8457
www.arcadis-global.com | www.tetraplan.com.br

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

23/12/2003

C.1.2. Expected operational lifetime of the project activity:

21 years 0 months

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

Starting Date of the 1st Crediting Period: 23/12/2003
Starting Date of the 2nd Crediting Period: 23/12/2010

C.2.1.2. Length of the first crediting period:

Length of the 1st Crediting Period: 7 years 0 months
Length of the 2st Crediting Period: 7 years 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

N/A, as the project selected a renewable crediting period.

C.2.2.2. Length:

N/A, as the project selected a renewable crediting period.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

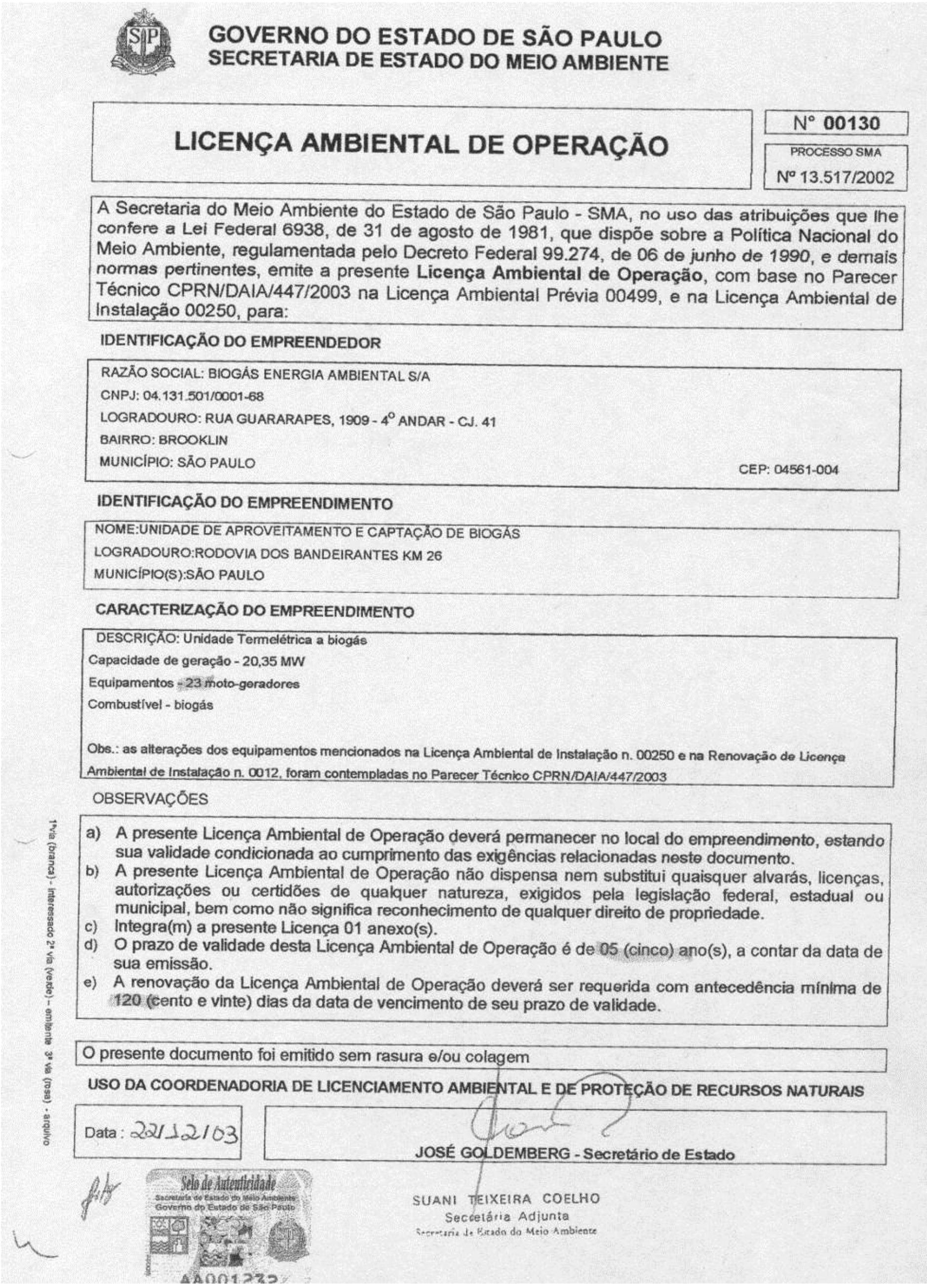
Environmental impacts from project initiatives are to be analyzed by the State Secretary of Environment (*SMA – Secretaria de Estado do Meio Ambiente*) through its department for environmental impact assessment (DAIA) and state of São Paulo environmental agency (CETESB).

For BLFGE, 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 is 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.

BLFGE was granted the working license on December 22, 2003. It attests the project is in compliance with the legislation and has been adjusted as demanded by the environmental authorities. The license is shown in Figure 8.

There will be no transboundary impacts resulting from BLFGE.



GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DE ESTADO DO MEIO AMBIENTE

LICENÇA AMBIENTAL DE OPERAÇÃO

Nº 00130

PROCESSO SMA Nº 13.517/2002

A Secretaria do Meio Ambiente do Estado de São Paulo - SMA, no uso das atribuições que lhe confere a Lei Federal 6938, de 31 de agosto de 1981, que dispõe sobre a Política Nacional do Meio Ambiente, regulamentada pelo Decreto Federal 99.274, de 06 de junho de 1990, e demais normas pertinentes, emite a presente **Licença Ambiental de Operação**, com base no Parecer Técnico CPRN/DAIA/447/2003 na Licença Ambiental Prévia 00499, e na Licença Ambiental de Instalação 00250, para:

IDENTIFICAÇÃO DO EMPREENDEDOR

RAZÃO SOCIAL: BIOGÁS ENERGIA AMBIENTAL S/A
CNPJ: 04.131.501/0001-68
LOGRADOURO: RUA GUARARAPES, 1909 - 4º ANDAR - CJ. 41
BAIRRO: BROOKLIN
MUNICÍPIO: SÃO PAULO CEP: 04561-004

IDENTIFICAÇÃO DO EMPREENDIMENTO

NOME: UNIDADE DE APROVEITAMENTO E CAPTAÇÃO DE BIOGÁS
LOGRADOURO: RODOVIA DOS BANDEIRANTES KM 26
MUNICÍPIO(S): SÃO PAULO

CARACTERIZAÇÃO DO EMPREENDIMENTO

DESCRIÇÃO: Unidade Termelétrica a biogás
Capacidade de geração - 20,35 MW
Equipamentos - 23 moto-geradores
Combustível - biogás

Obs.: as alterações dos equipamentos mencionados na Licença Ambiental de Instalação n. 00250 e na Renovação de Licença Ambiental de Instalação n. 0012, foram contempladas no Parecer Técnico CPRN/DAIA/447/2003

OBSERVAÇÕES

a) A presente Licença Ambiental de Operação deverá permanecer no local do empreendimento, estando sua validade condicionada ao cumprimento das exigências relacionadas neste documento.
b) A presente Licença Ambiental de Operação não dispensa nem substitui quaisquer alvarás, licenças, autorizações ou certidões de qualquer natureza, exigidos pela legislação federal, estadual ou municipal, bem como não significa reconhecimento de qualquer direito de propriedade.
c) Integra(m) a presente Licença 01 anexo(s).
d) O prazo de validade desta Licença Ambiental de Operação é de 05 (cinco) ano(s), a contar da data de sua emissão.
e) A renovação da Licença Ambiental de Operação deverá ser requerida com antecedência mínima de 120 (cento e vinte) dias da data de vencimento de seu prazo de validade.

O presente documento foi emitido sem rasura e/ou colagem

USO DA COORDENADORIA DE LICENCIAMENTO AMBIENTAL E DE PROTEÇÃO DE RECURSOS NATURAIS

Data: 22/12/03

JOSÉ GOLDEMBERG - Secretário de Estado

Selo de Autenticidade
Secretaria de Estado do Meio Ambiente
Governo do Estado de São Paulo

SUANI TEIXEIRA COELHO
Secretária Adjunta
Secretaria de Estado do Meio Ambiente

1ª via (branca) - interessado 2ª via (verde) – emitente 3ª via (rosa) - arquivo

Figure 8. Operational License for BLFGE

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts were not considered significant. Measures have been taken to mitigate gaseous emissions from flares and engines and to reduce the noise.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

Stakeholder's comments were invited during the validation for registration of the BLFGE. 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 has been 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.

Biogás has sent letters to these participants and let a period of 30 days open for them to provide comments.

G.2. Summary of the comments received:

There were no comments received from contacted parties.

G.3. Report on how due account was taken of any comments received:

Considering no comments on the project have been provided, it was not possible to take into account any sort of suggestions or give any feedback.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Biogás Energia Ambietal S/A
Street/P.O.Box:	Rua Guararapes, 1901 – 4th floor – room 41 - Brooklin
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State/Region:	SP
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Country:	Brazil
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FAX:	+55 (11) 3918 4833
E-Mail:	contato@biogas-ambiental.com.br
URL:	www.biogas-ambiental.com.br
Represented by:	Mr. Antônio Carlos Delbin / Mr. Carlos Sasaki
Title:	Technical Director / Financial Director
Salutation:	Mr. / Mr.
Last name:	Delbin / Sasaki
Middle name:	
First name:	Antônio Carlos / Carlos
Department:	Board
Mobile:	
Direct FAX:	+55 (11) 3918 4833
Direct tel:	+55 (11) 3918 4833
Personal e-mail:	delbin@biogas-ambiental.com.br / sasaki@biogas-ambiental.com.br

Organization:	Prefeitura Municipal de São Paulo (the Municipality of São Paulo)
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State/Region:	SP
Postcode/ZIP:	04103-000
Country:	Brazil
Telephone:	+55 (11) 3372-2205
FAX:	+55 (11) 3372-2200
E-Mail:	
URL:	www.prefeitura.sp.gov.br
Represented by:	
Title:	Secretary of Green and Environment
Salutation:	Mr
Last name:	Alves Sobrinho
Middle name:	Martins
First name:	Eduardo Jorge
Department:	Green and Environment Secretary
Mobile:	

Direct FAX:	
Direct tel:	
Personal e-mail:	eduardojorge@prefeitura.sp.gov.br

Organization:	KfW
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City:	Frankfurt am Main
State/Region:	
Postcode/ZIP:	60325
Country:	Germany
Telephone:	+49-69-7431-4218
FAX:	+49-69-7431-4775
E-Mail:	carbonfund@kfw.de
URL:	
Represented by:	
Title:	Senior Project Manager
Salutation:	
Last name:	Rusnok
Middle name:	
First name:	David
Department:	KfW Carbon Fund
Mobile:	
Direct FAX:	
Direct tel:	
Personal e-mail:	david.rusnok@kfw.de

Organization:	Fortis N.V./S.A.
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State/Region:	
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FAX:	+31 (0) 20 527 1943
E-Mail:	patrícia.rosenthal@nl.fortis.com
URL:	www.fortis.com
Represented by:	
Title:	Ms.
Salutation:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved.

Annex 3

BASELINE INFORMATION

1. Grid-Emission Factor Calculation
The calculation of the Built Margin (BM) and Operating Margin (OM) must be developed for each electric system which the CDM project will be implemented. The **project's electric system** is defined by the quantity of power plants which can be dispatched without significant transmission restrictions. Similarly, an **electric connected system** connected to the project's system is defined as an electric system connected by transmission lines to the project's electric system, which the power plants can be dispatched without significant transmission restrictions.

The Version 02.2.1 of the Tool for calculation of emission factor for electricity systems recommends the use the delineation of grid boundaries as provided by the DNA of the host country if available. Initially, the DNA adopted the ONS (National Operator System) division of the national grid in four sub-systems: North (N), Northeast (NE), South (S) and Southeast/Mid-West (SE-CO). However, after a public consultation, analysts of the ONS, MME (Mines and Energy Ministry) and MCT (Science and Technology Ministry) decided to adopt only ***one subsystem***, based that there are no significant loses in the transmission between two proposed subsystems (North-Northeast and South-Southeast/Center West). Simulations appointed that in only 70% of the hours in the year the transmission happened in 90% of more of the full capacity, indicating no significant transmission restrictions.

The unique subsystem is presented in Figure 9.

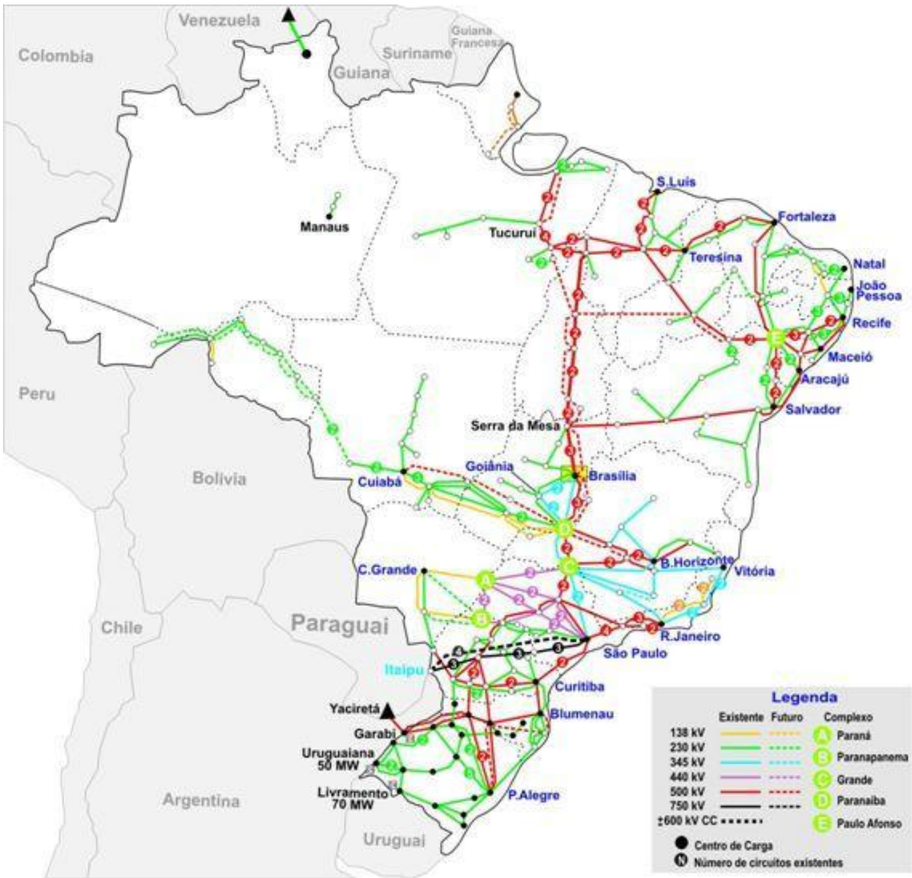


Figure 9. Brazilian Interconnected National System (Source: ONS)

The table below presents the thermoelectric power plants in each sub-market as defined by the ONS, with the type of fuel used.

The most recent data used to calculate the grid emission factor was from 2009 (OM) and 2009 (BM). The factor will be updated every month by the Brazilian DNA, using dispatch data from the ONS:

BUILT MARGIN	
Average Emission Factor (tCO_2/MWh) – **ANNUAL**	
2009	0.0794

OPERATING MARGIN													
Average Emission Factor (tCO_2/MWh) – **MONTHLY**													
2009	MONTH												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**AVG**
	0.2813	0.2531	0.2639	0.2451	0.4051	0.3664	0.2407	0.1988	0.1622	0.1792	0.1810	0.1940	**0.2476**

The Combined Margin (CM) for the BLFGE is calculated as the weighted average of the Build Margin (BM) and Operating Margin (OM), as follows:

$CM_{2007} = 0.25\ OM_{-2009} + 0.75 \times BM_{2008} = \mathbf{0.121\ tCO_2/MWh}$

2. Methane Estimatives

The tables below present the LFG generation estimative and the Figure 10 presents the location of the wells burning and not-burning LFG in the landfill, by the time of the project implementation:

Variable	Value
ϕ	0.9
f	0
GWP	21
OX	0.1
F	50%
DOCf	0.5
MCF	1

	DOCj	$p_{n, j, x}$[9]	k
Wood and wood products	43%	0.66%	0.035
Pulp, paper and cardboard	40%	12.32%	0.07
Food, food waste, beverages and tobacco	15%	60.62%	0.4
Textiles	24%	3.14%	0.07
Garden, yard and park waste	20%	3.21%	0.17
Glass, plastic, metal, other inert waste	0%	18.79%	0

Year	Waste Disposed (tons)
1998	2,142,325
1999	2,305,464
2000	1,964,424
2001	2,043,617
2002	2,082,855
2003	1,993,371
2004	1,965,347
2005	1,594,350
2006	1,974,799
2007	489,627

[9] FRAL CONSULTORIA LTDA, ***"Caracterização dos Resíduos Sólidos Domiciliares do Município de São Paulo – Agrupamento Noroeste"*** of nov-dez/2008 and jan-feb/2009.

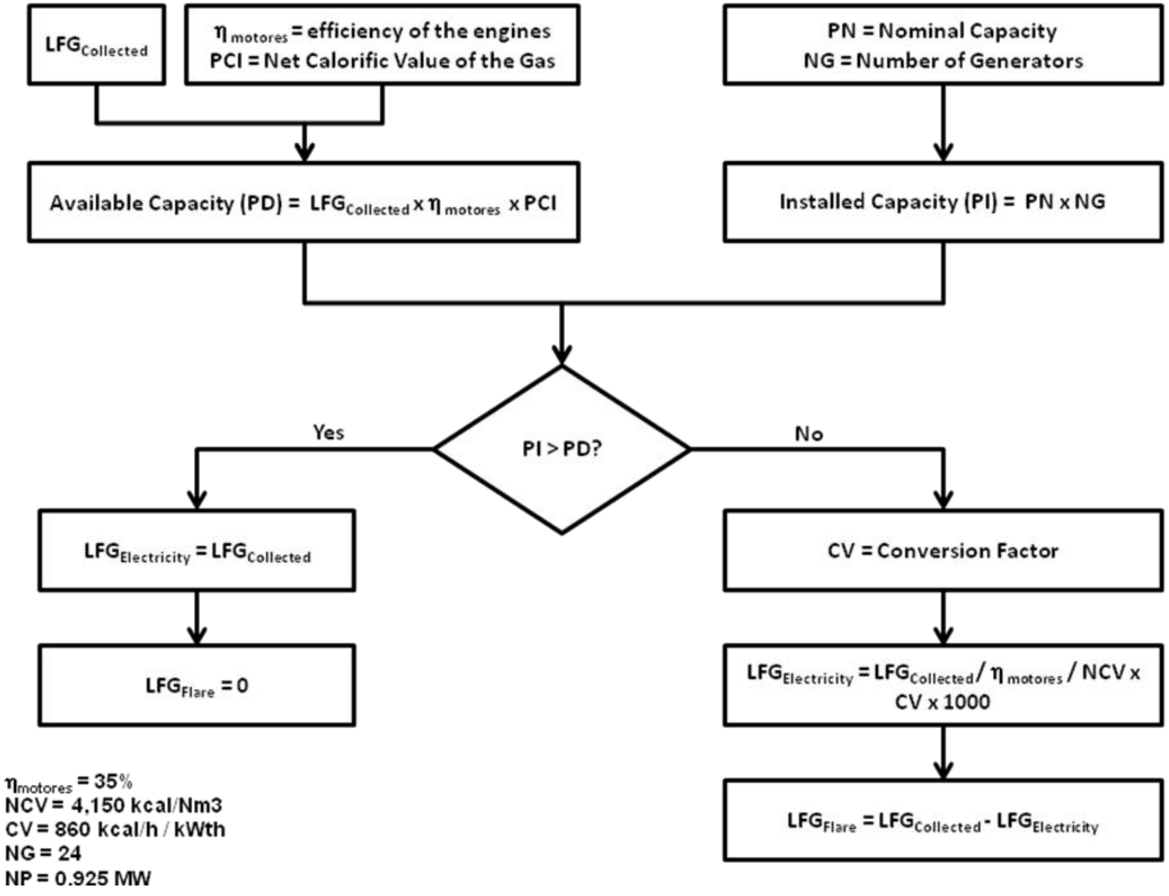
Year	$BE_{CH4, SWDS}$ (tCO_2e/year)	Total Methane Emissions (t/year)	Total Methane Emissions (Nm3/year)	Total LFG Emissions (Nm3/year)
1979	7,415	353	492,600	985,200
1980	50,577	2,408	3,359,946	6,719,892
1981	81,528	3,882	5,416,120	10,832,239
1982	119,999	5,714	7,971,850	15,943,701
1983	149,329	7,111	9,920,320	19,840,641
1984	171,511	8,167	11,393,967	22,787,933
1985	204,563	9,741	13,589,729	27,179,458
1986	306,561	14,598	20,365,709	40,731,417
1987	422,459	20,117	28,065,127	56,130,254
1988	558,594	26,600	37,108,977	74,217,953
1989	596,418	28,401	39,621,762	79,243,524
1990	671,642	31,983	44,619,062	89,238,124
1991	731,366	34,827	48,586,726	97,173,452
1992	833,033	39,668	55,340,728	110,681,455
1993	882,080	42,004	58,599,053	117,198,107
1994	967,927	46,092	64,302,144	128,604,289
1995	1,073,122	51,101	71,290,493	142,580,987
1996	1,180,714	56,224	78,438,134	156,876,268
1997	1,265,061	60,241	84,041,571	168,083,142
1998	1,358,943	64,712	90,278,393	180,556,786
1999	1,462,288	69,633	97,143,931	194,287,862
2000	1,472,667	70,127	97,833,455	195,666,910
2001	1,500,954	71,474	99,712,616	199,425,232
2002	1,533,475	73,023	101,873,049	203,746,097
2003	1,543,202	73,486	102,519,238	205,038,475
2004	1,548,802	73,752	102,891,281	205,782,562

Year	$BE_{CH4, SWDS}$ (tCO_2e/year)	Total Methane Emissions (t/year)	Total Methane Emissions (Nm3/year)	Total LFG Emissions (Nm3/year)
2005	1,483,213	70,629	98,534,052	197,068,104
2006	1,515,863	72,184	100,703,031	201,406,062
2007	1,247,523	59,406	82,876,479	165,752,959
2008	964,088	45,909	64,047,094	128,094,188
2009	764,685	36,414	50,800,165	101,600,329
2010	622,383	29,637	41,346,680	82,693,360
2011	519,058	24,717	34,482,484	68,964,967
2012	442,492	21,071	29,396,026	58,792,052
2013	384,440	18,307	25,539,420	51,078,840
2014	339,319	16,158	22,541,944	45,083,889
2015	303,344	14,445	20,152,008	40,304,017
2016	273,934	13,044	18,198,203	36,396,406
2017	249,322	11,872	16,563,151	33,126,302
2018	228,290	10,871	15,165,946	30,331,893
2019	209,992	10,000	13,950,348	27,900,697
2020	193,833	9,230	12,876,847	25,753,695
2021	179,389	8,542	11,917,320	23,834,639
2022	166,355	7,922	11,051,427	22,102,854
2023	154,505	7,357	10,264,186	20,528,372
2024	143,669	6,841	9,544,324	19,088,647
2025	133,716	6,367	8,883,162	17,766,325
2026	124,545	5,931	8,273,861	16,547,723
2027	116,071	5,527	7,710,898	15,421,797
2028	108,225	5,154	7,189,713	14,379,426
2029	1,483,213	70,629	98,534,052	197,068,104
2030	1,515,863	72,184	100,703,031	201,406,062

Figure 10. Lay-out of the Bandeirantes Landfill, indicating the number of wells which were burning the LFG collected by the time of the project implementation (green coloured)

3. Electricity Generation

The project had installed a capacity of 22.2 MW. To calculate LFG_{Flare} and $LFG_{Electricity}$, the following block-diagram was applied:



The table below presents the consolidated information regarding the LFG collected, sent to flares and to the power plant and the amount of electricity generated, imported and exported.

	A	B	C	D	E	F	G	H	I	J	K	S	T	U
	LFG Collected	**LFG Collected**	**Thermal Power**	**Thermal Power**	**Electric Power**	**Number of Generators**	**Installed Capacity**	**Available Capacity**	**Auxiliary Power**	**Net Power**	**Available Power**	**Electricity Generated**	**Electricity Consumed Internally**	**$EL_{LFG, y}$**
	Please, refer to PDD Annex 3	**A / 24 / 365**	**B x 4,150**	**C x 860**	**D x 35%**		**F x 0.925**	**E/1000**	**G x 5%**	**LOWER (G:H)-I**	**J x 97%**	**K x 7600**		**S - T**
	Nm^3	**Nm3/h**	**kcal/h**	**kWth**	**kWe**		**MWe**	**MWe**	**MWe**	**MWe**	**MWe**	**MWh**	**MWh**	**MWh**
10	70,289,356	8,024	33,299,181	38,720	13,552	24	22.20	13.55	1.110	12.44	12.07	91,722	4.668	87.054
11	58,620,222	6,692	27,770,996	32,292	11,302	24	22.20	11.30	1.110	10.19	9.89	75,137	4.668	70.469
12	49,973,244	5,705	23,674,539	27,529	9,635	24	22.20	9.63	1.110	8.52	8.27	62,846	4.668	58.178
13	43,417,014	4,956	20,568,563	23,917	8,371	24	22.20	8.37	1.110	7.26	7.04	53,528	4.668	48.860
14	38,321,305	4,375	18,154,500	21,110	7,388	24	22.20	7.39	1.110	6.28	6.09	46,285	4.668	41.617
15	34,258,414	3,911	16,229,728	18,872	6,605	24	22.20	6.61	1.110	5.50	5.33	40,510	4.668	35.842
16	30,936,945	3,532	14,656,201	17,042	5,965	24	22.20	5.96	1.110	4.85	4.71	35,789	4.668	31.121
17	28,157,357	3,214	13,339,387	15,511	5,429	24	22.20	5.43	1.110	4.32	4.19	31,838	4.668	27.170

Annex 4

MONITORING INFORMATION

Please, refer to B.7.1