Project design document form
(Version 10.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	Ciudad Juarez Landfill Gas to Energy Project.
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	Document version 7.0
Completion date of the PDD	08/05/2019
Project participants	Biogas de Juarez S.A. de C.V. BELEKTRON d.o.o
Host Party	Mexico
Applied methodologies and standardized baselines	ACM0001 Version 15: "Large-scale Consolidated Methodology: Flaring or use of landfill gas."
Sectoral scopes linked to the applied methodologies	Scope number linked to applied methodology: 13 Sectoral scope: Waste handling and disposal Scope number conditioned to the power plant component : 1 Sectoral scope: Energy industries (renewable - / non-renewable)
Estimated amount of annual average GHG emission reductions	143,095 t CO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Background:
The Ciudad Juarez Landfill Gas to Energy Project (the Project), with UNFCCC reference number 1123, developed by Biogas de Juarez, S.A. de C.V. (the Project Developer) is a landfill gas (LFG) collection and utilization project in the Ciudad Juarez landfill in the state of Chihuahua, Mexico (the Host Country). The project was registered as a CDM project activity on 30 November 2007. The first 7-year renewable crediting period started on 30/11/2007 and ends on 29/11/2014. The project proponent is applying for the renewal of the crediting period from 30/11/2014 to 29/11/2021. The current PDD version is applied in accordance with the UNFCCC "Procedures for Renewal of the Crediting Period of a Registered CDM Project Activity" as provided in Annex 11 of the EB46 Report[1]. This PDD contains the necessary adjustments for the second crediting period.

Purpose:
The Project's purpose is to reduce greenhouse gas (GHG) emissions by capturing and utilizing the methane (CH_4) in the LFG released by the Ciudad Juarez landfill, and avoiding future GHG emissions from the decomposition of municipal solid waste residues. The captured methane is combusted to generate electricity that is fed to the national power grid and used as an alternative source of cheap, indigenous, stable and renewable energy that will reduce dependence on grid power. Thus, in addition to directly eliminating a significant portion of the methane, which is a potent GHG with 25 times the global warming potential of CO_2, the Project also displace fossil fuel-based electricity generation that would have emitted additional CO_2. All landfill gas collected during periods when electricity is not produced is being flared.

Brief history of the project:
The Ciudad Juarez landfill started operating in 1994. The landfill is separated into three main areas consisting of three differentiated cells: A, B, C. The first step of the Project, captures and use the biogas produced in a fraction area of cell A, which was closed in April 2008. This partially closed area extends over an area of approximately 128,000 square meters (m^2), accumulated a total of 2.628 million tons of waste. On April 2013, this area was extended over an area of approximately 196,000 m^2 and contains 5.633 million tons of waste. Final closure of cell A is expected to take place in December 2014 and has accumulated a total of 8.261 million tons of waste to-date. The Project has an electricity component that was designed in two phases. In Phase I, the infrastructure for electricity generation with a capacity of 6.4MW was initially designed, and was planned to start operations in 2008. During the second phase, the installed capacity was expected to increase to a total of 20.8MW in 2011. However the project has experienced delays in the implementation of the electricity generation component due to delays in obtain relevant permits from local and national authorities and for the low biogas captured flow from the landfill which is below than the initial ex-ante estimation. Therefore, phase I only began partially operation on June 15th, 2011 with an installed capacity of 4.8MW (1.6MW X 3 units) after that on September 2013 an extra unit of 1.6MW was installed; therefore the installed capacity is 6.4MW. This is still the actual installed capacity.

The actual captured biogas flow is not enough to justify the addition of a fifth generator to reach the initial designed power capacity for phase I. In the case collected biogas flow rates increase, additional power units will be added to the project. Currently, the biogas collection system encompasses a total of 17 horizontal and vertical wells (eight wells installed during phase I plus another 9 installed during phase II).

Relevant dates for the project activity are provided below in Table 1:

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[1] http://cdm.unfccc.int/Reference/Procedures/reg_proc04.pdf

Table 1: Relevant dates for project activity

Date	Event
12/03/2007	Construction starting date
23/11/2007	Project commissioning
11/06/2009	Legal permits for electricity generation "Permission to generate electricity for self-consumption"- Comisión Reguladora de Energía (CRE)
11/06/2009	Right of way contract – authorization to build interconnection line inside the municipal landfill – Juarez Municipality
26/05/2010	Construction of interconnection line concluded
15/06/2010	Interconnection contract with Comisión Federal de Electricidad (CFE)
25/06/2010	Right of way contract – authorization to operate interconnection line inside the municipal landfill – Juarez Municipality
29/07/2010	Modification of the Permission to generate electricity for self-consumption" – construction end dates extension – Comisión Reguladora de Energía (CRE)
22/03/2011	Installation of the bidirectional power meter device
01/04/2011-14/06/2011	Electricity generation PERIOD OF TESTS
15/06/2011	Power plant OFFICIAL STARTING DATE (flare is turned off)

The estimated total GHG emission reductions (ERs) from the Project are 1,144,759 tCO_2e for the second 7-year crediting period. This is estimated to add up to approximately 2,289,517 tCO_2e for a 21-year crediting period. The capture and combustion of CH_4, which typically makes up 40-60 % of LFG, in an engine generator, and the flaring of LFG convert CH_4 into CO_2 and water.[2] Through this elimination of CH_4, the Project result in a substantial net reduction of GHG emissions that otherwise would have been produced through the Ciudad Juarez landfill's normal operation (the Business-as-Usual Scenario).

In addition to the direct elimination of methane, the Project makes a number of positive environmental contributions:

- Proper collection and destruction of flammable LFG reduce the risks associated with explosions in and around the landfill. This is particularly important as the LFG collection system minimize the potential for LFG migration, which can infiltrate zones outside of the landfill's boundaries and pose dangers to the surrounding population and structures.
- Destruction of the LFG improves the local environment by reducing the amount of noxious air pollution arising from the landfill, resulting in a considerable reduction of health risks and noxious odors associated to these emissions.
- The Project provides a model for sustainable and environmentally friendly approaches for local, state and federal governments to better manage landfills and comply with local regulations and environmental standards, through:
    - The development of viable plans for the proper closure of open dumps and controlled dumpsites, which is a key element in improving landfill management practices throughout the Host Country;
    - The provision of operating capital for sustained maintenance of existing landfills and seed capital for new ones; and,
    - Enhanced environmental compliance that would not occur in the absence of the Project, including process benefits such as mitigation of volatile organic compounds (VOCs), and preventing harmful leachates from entering underground aquifers or waterways. These impacts cannot be controlled with open dumpsites.

[2] CO_2 emissions from solid waste (SW) are not considered to contribute to global climate change because the carbon was contained in recently living biomass, and would be emitted as a result of the natural decomposition process.

In addition to the environmental improvements resulting from upgrading the Ciudad Juárez landfill facilities to higher environmental standards, the Project also contributes to sustainable development by bringing about a range of local social and economic benefits. For example:

- The Project provides for both short- and long-term employment opportunities for local people. Local contractors and labourers were required for construction, and long-term staff is used to operate and maintain the system;
- By bringing economic development to the area around the landfill, the Project makes this area a better and safer place to live and do business;
- The host community in Ciudad Juarez have a healthier environment in general because of improved local air quality, as well as the abatement of water and soil pollution;
- The electricity generated using methane from the landfill provides an indigenous, cheap and renewable source of energy, while displacing electricity that would otherwise be generated by fossil fuel-fired power plants, and diversifying the country's energy sources;
- Financial returns is provided to local entities and to local government; and,
- Proven and reliable renewable energy technology, which also serves as a waste management process to be transferred to local counterparts.
- The estimated amount of annual average GHG emission reductions over the second crediting period is 143,095 t CO2e

A.2. Location of project activity

Host Party:
Mexico, which ratified the Kyoto Protocol on 7 September 2000.

Region/State/Province etc.:
State of Chihuahua.

City/Town/Community etc.:
Ciudad Juárez

Physical/Geographical location:
The Project is located at the Ciudad Juárez Landfill, in the municipality of Ciudad Juárez, state of Chihuahua, Mexico. It is located at kilometer 27.5 of Federal Highway number 45. The project site is located within the coordinates of 31º 33' 35.62'' N - 106º 29' 40.94'' W; 31º 33' 36.80'' N - 106º 29' 18.90'' W; 31º 33' 15.44'' N - 106º 29' 21.62'' W; and 31º 33' 15.29'' N - 106º 29' 39.64'' W. And specifically Phase I of the project is located within the coordinates of 31º 33' 36.42'' N - 106º 29' 32.06'' W; 31º 33' 36.80'' N - 106º 29' 18.90'' W; 31º 33' 25.85'' N - 106º 29' 19.75'' W; and 31º 33' 27.03'' N - 106º 29' 30.86'' W.

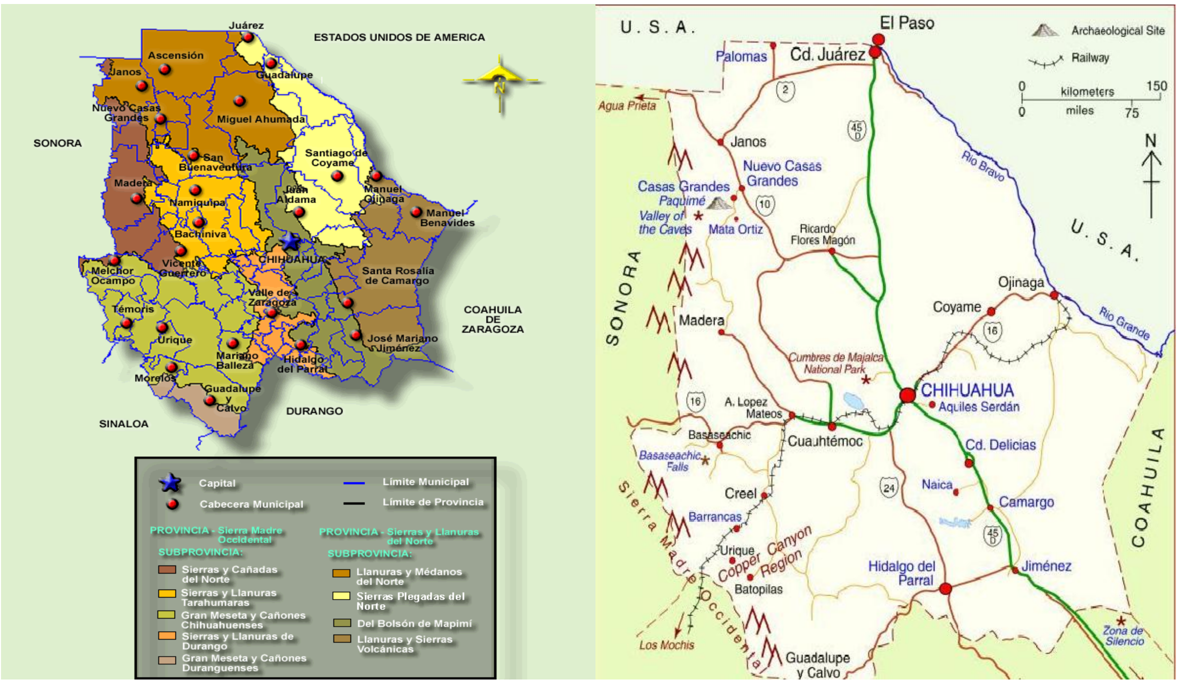

Figure 1: Left: State of Chihuahua / Right: Ciudad Juarez, Chihuahua

Figure 2: Project site

A.3. Technologies/measures

The collection system was installed comprehensively within closed and inactive areas of the landfill. Installations included: 8 horizontal extraction wells, a 1,885 m high density polyethylene pipe (HDPE) to connect the extraction wells with the flare station and LFG control plant, a condensate management system, leachate de-watering pumps in selected extraction wells, a blower and enclosed flaring station. The electricity generation plant includes a generator-set of 6.4 MW installed capacity (comprised of four generator engines), a 13.8 to 115 kVA transformer during phase I, a transmission line that reach the local grid. It was estimated for Phase II an expansion of the installations in 12 more horizontal extraction wells, approximately 2,800 m high density polyethylene pipe (HDPE) more to connect the extraction wells with the flare station and LFG control plant as well as new generator-set of 14.4 MW (comprised of 9 generator engines).

Transformer and transmission line will remain unaltered Measuring and recording equipment will be installed to record LFG flows, flaring, and electricity generation. However as explained above, actual captured biogas flow is not enough to justify the addition of a fourth generator to reach the initial designed power capacity for phase I. In the case collected biogas flow rates increase, additional power units will be added to the project. Currently, the biogas collection system encompasses a total of 17 horizontal wells (eight wells installed during phase I plus another 9 installed during phase II).

A regular operation and maintenance program for the gas collection system was implemented and monitored by experienced project managers employed by the Project Developer in accordance with proven quality control procedures. Experienced workers were employed to ensure that the gas collection system is installed correctly, and a large portion of the plant and labor was be sourced locally. In addition, a comprehensive installation record is maintained to ensure that any required repair works can be located quickly and efficiently and to facilitate future expansion activities.

The project transfers environmentally safe and sound technology to Mexico by:

- Training Mexican labor on operation and maintenance;
- Providing an example of one of the most environmentally beneficial ways of solid waste management;
- Internalizing the financial and technical risks of being the first of its kind of such projects in Mexico, decreasing these risks for similar future projects; and,
- Expanding the knowledge on CDM potential for this type of activity.

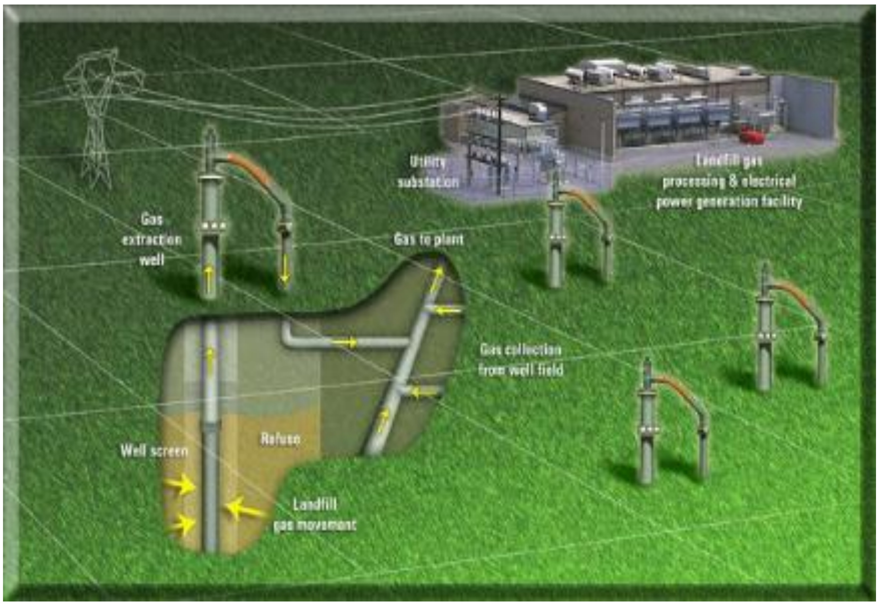

Figure 3: A typical LFG generation plant (*Source: Biogas de Juarez)*

A.4.   Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Mexico (host Party)	Biogas de Juarez S.A. de C.V.	No
Switzerland	BELEKTRON d.o.o.	No

A.5. Public funding of project activity

The Project did not receive any public funding. Biogas de Juarez is a 100% private Mexican company, which assists Ciudad Juarez as the sole developer and shareholder of the Project.

A.6. History of project activity

Hereby, the PP confirms that:

(a) The proposed undergoing 2nd crediting period CDM project activity has not been a former CDM project activity and it neither is nor has been included as a component project activity (CPA) in a registered CDM programme of activities (PoA);
(b) The proposed CDM project activity is not a project activity that has been deregistered.

Hereby, the PP declares that:

(a) The proposed CDM project activity was not a CPA that has been excluded from a registered CDM PoA;
(b) Any registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not applicable

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

The approved methodology used to calculate the project total ERs is:

- Large-scale Consolidated Methodology “Flaring or use of landfill gas” **ACM0001, Version 15.0** as a consolidated methodology for landfill gas project activities[3]

The methodology also refer to the following methodological tools, which have been applied:

- “Tool Project emissions from flaring” Version 2.0.0[4]
- “Tool Emissions from solid waste disposal sites” Version 6.0.1[5]
- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” Version 2.0.0[6]
- “Tool to calculate the emission factor for an electricity system”, Version 4.0[7]
- “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, Version 1[8]

[3] https://cdm.unfccc.int/methodologies/DB/QOU487ZYKBIAU17YHORZXENWDTEPAC

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf/history_view

[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v4.pdf/history_view

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history_view

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view

[8] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view

The tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1[9]) is also applied.

Since this PDD version is for the second crediting period, the "Tool for the demonstration and assessment of additionality" that is referenced to in the baseline methodology does not need to be applied.

The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" is not used either as there are no project or leakage emissions related to the project activity.

B.2. Applicability of methodologies and standardized baselines

The methodology ACM0001 is applicable under the following conditions:

Applicability condition	Project
a) *Install a new LFG capture system in a new or existing SWDS where no LFG capture system was installed prior to the implementation of the project activity; or*	The Ciudad Juarez Landfill project installed a new LFG capture system in an existing SWSD where no LFG capture system was installed prior to the implementation of the project activity.
b) *Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:* - *The captured LFG was vented or flared and not used prior to the implementation of the project activity; and* - *In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available;*	This condition is not applicable for the project activity, since the project installed a new LFG capture system in an existing SWSD where no LFG capture system was installed prior to the implementation of the project activity.
c) *Flare the LFG and/or use the captured LFG in any (combination) of the following ways:* - *Generating electricity;* - *Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or* - *Supplying the LFG to consumers through a natural gas distribution network;* - *Supplying compressed/liquefied LFG to consumers using trucks;*	The capture LFG is used to generate electricity
d) *Do not reduce the amount of organic*	The project activity does not reduce the

[9] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v1.pdf/history_view

waste that would be recycled in the absence of the project activity.	amount of organic waste that would be recycled in the absence of the project activity.

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

a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odor concerns, or for other reasons; and
b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln;

   i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or
   ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary.

The Ciudad Juarez landfill baseline is the partial or total atmospheric release of the biogas generated and the project activity is based on two complementary activities, as follows:

- The collection and flaring or combustion of LFG, thus converting its methane content into CO_2, reducing its greenhouse gas effect; and,
- The generation and supply of electricity to the regional grid, thus displacing a certain amount of fossil fuels used for electricity generation.

The Project therefore fulfils the conditions of Option (c) above**,** (i.e., where captured LFG is used to produce electricity and reductions are claimed for displacing electricity generation from other sources), and thus ACM0001 was considered the most appropriate methodology for the Project.

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

According to ACM0001 baseline methodology, the project boundary is the site of the project activity where the gas will be captured and destroyed and/or used.

Table 2: Project Activities and Emission Sources within the Project Boundaries

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative
		CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity
	Emissions from electricity generation	CO_2	Yes	Major emission source since power generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emission from heat generation	CO_2	No	No heat generation is included in the project activity
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	No supply of LFG through a natural gas distribution network is included in the project activity
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	No	The project activity is not expected to combust any fossil fuel.
		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 electricity consumption due to the project activity	CO_2	Yes	The electricity consumed on-site is taken into consideration as Project Emissions
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Emissions from flaring	CO_2	No	Emissions are considered negligible
		CH_4	Yes	Included as main component of LFG
		N_2O	No	Emissions are considered negligible
	Emissions from distribution of LFG using trucks	CO_2	No	No distribution of LFG using trucks is included in the project activity
		CH_4	No	No distribution of LFG using trucks is included in the project activity

	Source	GHG	Included?	Justification/Explanation
		N_2O	No	Emissions are considered negligible

Project emissions thus include:

- CH_4 from LFG that is generated by the landfill but not captured and flared. It is estimated that 50 % of CH_4 is destroyed, leaving 50% still released as fugitive emissions; and,
- CH_4 from the incomplete combustion of landfill gas in flares and in generator engines accounted for as project emissions[10].

Emissions do not include:

- CO_2 resulting from the conversion of CH_4 into CO_2 as a consequence of flaring. As this CO_2 is originally contained in the biomass held within the landfill, it is considered to be carbon neutral; hence, long-term CO_2 emissions are counted as zero.

Electricity required for the operation of the project activity (primarily pumps, blowers, measuring equipment and controls) is estimated to be less than 150 kW in the initial project implementation and less than 500 kW after the foreseen expansion, and this electricity consumption is deducted from the gross level of electricity produced by the project and is not included in electricity sales to the grid.

B.4. Establishment and description of baseline scenario

The baseline scenario defined during the registration process of the Ciudad Juarez Landfill project activity, has been the continued uncontrolled release of landfill gas to the atmosphere, similarly to most landfills in the Host Country.

The renewal of the crediting period requires validating that “the original project baseline is still valid or has been updated taking account of new data where applicable” ("Procedures for Renewal of the Crediting Period of a Registered CDM Project Activity" (version 06.0), paragraph A.1).

In order to assess the validity of the original baseline, the “Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period” was used:

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

As described in the original approved PDD, there are no regulatory requirements to collect or treat biogas produces in closure landfills in Mexico.

The baseline scenario as described in the PDD is the atmospheric release of the methane gas generated in the landfill.

Therefore, in order to determine whether or not this baseline scenario still complies with all relevant mandatory national and/or sectoral policies, which have come into effect since validation, an examination must be conducted in order to determine whether or not any current regulations require the Ciudad Juarez landfill – a closure landfill – to prevent the atmospheric release of the methane gas.

In order to do so, the project participants check the following government web pages:
http://www.semarnat.gob.mx/leyes-y-normas
http://www.juarez.gob.mx/

[10] Per the Methodological Tool, *Project Emissions from Flaring,* issued at the 68th meeting of the CDM Meth Panel in December 2012.

Furthermore, it should be noted that changes to the regulatory requirements (or to be more accurate, the lack thereof) have been monitored and verified throughout the monitoring periods.

Therefore, current baseline complies with all relevant mandatory national policies.

In addition, a careful review of the EB's stance on the issue of national and/or sectoral policies and regulations and their effect on baseline scenarios indicates that NOM-083-SEMARNAT-2003 should not be taken into account in the establishment of a baseline scenario for similar projects in Mexico. Specifically, the 16th meeting of the EB (EB 16) held in October 2004 agreed on clarifications to the treatment of national and/or sectoral policies and regulations in determining a baseline scenario. In Annex 3 of the EB 16 Report, the EB differentiated the ways to address four types of national and/or sectoral policies that are to be taken into account when establishing a baseline scenario11. The policy defined as "Type L-" in paragraph 1 (c) applies to NOM-083-SEMARNAT-2003 described above. Specifically, Type L- policies are defined as: "Sectoral mandatory regulations adopted by a local or national public authority motivated by the reduction of negative local environmental externalities and/or energy conservation and which would incidentally also reduce GHG emissions".

However, further clarification on Type L- policies has not been provided. Nevertheless, these policies have similar impacts on hypothetical baseline scenarios as would "Type E-" policies[12], for which further clarification has been provided, and which are not to be taken into account in the establishment of a baseline scenario because the regulation was promulgated following the adoption by the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP) Decision 17/CP.7, dated 11 November 2001. Moreover, further clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios issued at the 22nd meeting of the EB in November 2005 indicate that the economic situation of the project sector should be taken into account in the determination of the baseline scenario. In the case of landfills in Mexico, municipalities simply do not have the resources to pay for LFG collection and flaring or utilization projects

Step 1.2: Assess the impact of circumstances

As required by the "Procedures for Renewal of the Crediting Period of a Registered CDM Project Activity" (version 06.0), paragraph B.3:

> *"The demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario,* ***but rather an assessment of the emissions which would have resulted from that scenario".***

It is important to note that emission reductions in the project are granted ex-post for the actual amount of methane which has been collected and destroyed. Yet, as previously described, in accordance with the requirements of ACM0001 (version 15), the estimation of the annual emission reductions for the second crediting period was based on the LandGEM EPA model.

In order to comply with the requirements of ACM0001 (version 15), the annual estimation of emission reductions for the second crediting period has been calculated as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 6.0.1).

The detailed calculation is described in section B.6.3 of this document.

[11] "Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45(e) of the CDM Modalities and Procedures) in determining a baseline scenario", Annex 3, Report of the 16th Meeting of the CDM Executive Board, 22 October 2004.

[12] Type E- ("E minus") includes National and/or sectoral policies or regulations that give positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs).

It should be noted that the updated annual estimation of emission reduction was calculated based on the same raw data (for instance, historic waste quantity) that were used in the original PDD, were approved by the DOE during validation, and were approved by the CDM EB at registration.

Therefore, the original baseline scenario is still valid, and the emission that results from this scenario has been aptly reassessed.

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

Not applicable. There was no “baseline equipment” in the Ciudad Juarez Landfill project, as the project itself included the installation of new equipment (bio-gas collection and treatment system) and did not include a retrofit or a switch of any old equipment.

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

In this step, it should be assessed whether data and parameters that were determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated.

For the applied updated values and further information, see step 2.2.

Step 2: Update the current baseline and the data and parameters

This step is applicable since step 1.4 showed that data and parameters fixed ex-ante need to be up-dated.

Step 2.1: Update the current baseline

As explained before there are no sectoral policies or specific circumstances that required a reassessment of the baseline scenario. Therefore this step does not apply for the project activity.

Step 2.2: Update the data and parameters

For the second crediting period the ex-ante data and fixed ex-ante parameters were updated as per the latest version of the methodological tools used for baseline calculation. (See section B.6.2)

Furthermore, both the operating margin and the build margin are reassessed in accordance with the “Tool to calculate the emission factor for an electricity system” and the most recent data is applied for the relevant parameters (see section B.6.2 and annex 3).

B.5. Demonstration of additionality

This section is not modified for the renewal of the crediting period, as this is no requirement. Therefore the same analysis is included as in the approved PDD of the first crediting period.

ACM0001 states that the Project’s additionality should be demonstrated and assessed using the *Tool for the Demonstration and Assessment of Additionality*, version 03 issued at the 29th meeting of the CDM Executive Board (EB) in February 2007. This tool includes the following steps:

- Step 1: Identification of alternatives to the project activity consistent with current laws and regulations.
- Step 2: Investment analysis.
- Step 3: Barriers analysis.
- Step 4: Common practice analysis.

Step 5: Impact of CDM registration.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations:

Sub-step 1a. Define alternatives to the project activity:

The output or service of the project activity is solid waste management (SWM). Following the *Tool for the Demonstration and Assessment of Additionality*, the identified realistic and credible alternatives available to the project participants or similar developers that provide outputs or services comparable to the proposed CDM project activity are:

1. Implementing the project activity **without** CDM assistance, i.e. the landfill operator would invest in a LFG collection system, a high efficiency flaring system, as well as a LFG power generation equipment and necessary equipment to supply electricity to the grid;
2. Capturing the LFG and encapsulating it for sale;
3. Building a fossil fuel-fired electricity generation plant (most likely a natural gas-fired turbine); or,
4. Continuing the business-as-usual scenario, i.e. using a passive simple venting system, and not implementing the project activity or any other alternative activities. This is, in fact, considered to be the most likely alternative to the project.

The first three of the above alternatives all involve capital investments that would result in revenues, and are thus credible as business propositions. However, LFG flaring alone, without the electricity generation component, is not considered by the project participants to be a credible alternative since it only involves cost but no revenues, whereas the Project Developer is a private company seeking financial benefits. The final alternative, i.e. business-as-usual, would clearly be attractive to the Project Developer should all other available alternatives fail to provide adequate returns or pose undue risks.

These alternatives are also considered realistic in terms of technological feasibility and consistent with the Project Developer's core business objectives of SWM to recover methane gas, produce energy and reuse organic waste materials in landfills. Other types of alternatives that do not involve the treatment of solid waste in landfills (i.e. building a waste incineration facility to produce energy) were not considered realistic and credible alternatives available to the project participants since they are not within the scope of the Project Developer's core business and not in line with its business objectives.

While alternatives to the Project exist, and are consistent with current laws and regulations, none except for the business-as-usual scenario is currently viable in the absence of CDM revenues.

Sub-step 1b. Consistency with mandatory laws and regulations:

The proposed project activity complies with all the applicable laws and regulations. Basic environmental regulation in Mexico (federal, state, and local), such as *General Law for the Prevention and Management of Waste*[13] of 8 October 2003, and particularly *NOM- 083-SEMARNAT-2003*,[14] define the specifications of environmental protection related to the selection, design, construction, operation, monitoring and closure of final disposal sites for municipal and hazardous solid waste. This comprehensive regulation provides guidelines for the construction and operation of landfills, as well as guidance on the collection, utilization and/or flaring of the LFG. As such, the regulation does not specify minimum requirements regarding the amount of gas to be

[13] Ley General para la Prevención y Gestión de los Residuos.

[14] This is a Technical Regulation dated 20 October 2004.

collected and utilized or flared. The regulation notwithstanding, common practice demonstrates that existing landfills in the country do not capture and flare or utilize their LFG, as seen below in Step 4.

In addition, a careful review of the EB's stance on the issue of national and/or sectoral policies and regulations and their effect on baseline scenarios indicates that NOM-083-SEMARNAT-2003 should not be taken into account in the establishment of a baseline scenario for similar projects in Mexico. Specifically, the 16th meeting of the EB (EB 16) held in October 2004 agreed on clarifications to the treatment of national and/or sectoral policies and regulations in determining a baseline scenario. In Annex 3 of the EB 16 Report, the EB differentiated the ways to address four types of national and/or sectoral policies that are to be taken into account when establishing a baseline scenario15. The policy defined as "Type L-" in paragraph 1 (c) applies to NOM-083-SEMARNAT-2003 described above. Specifically, Type L- policies are defined as: "Sectoral mandatory regulations adopted by a local or national public authority motivated by the reduction of negative local environmental externalities and/or energy conservation and which would incidentally also reduce GHG emissions".

However, further clarification on Type L- policies has not been provided. Nevertheless, these policies have similar impacts on hypothetical baseline scenarios as would "Type E-" policies[16], for which further clarification has been provided, and which are not to be taken into account in the establishment of a baseline scenario because the regulation was promulgated following the adoption by the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP) Decision 17/CP.7, dated 11 November 2001. Moreover, further clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios issued at the 22nd meeting of the EB in November 2005 indicate that the economic situation of the project sector should be taken into account in the determination of the baseline scenario. In the case of landfills in Mexico, municipalities simply do not have the resources to pay for LFG collection and flaring or utilization projects.

Furthermore, the *Tool for the Demonstration and Assessment of Additionality* clearly states that only laws that are enforced need to be considered in the determination of the baseline scenario. Neither *the General Law for the Prevention and Management of Waste* nor *NOM-083-SEMARNAT-2003* provide specific requirements on the levels of LFG collection or flaring that are required, and neither is enforced in Mexico. As a result, these two laws have not been taken into account in the establishment of a baseline scenario for LFG projects in Mexico.

The aforementioned three project alternatives are also in compliance with other existing laws that govern SWM and energy production in Mexico[17]. These are:

- *The Federal Law of Parastatal Agencies* ("Ley Federal de Entidades Paraestatales") Articles 8, 10, 17, 18, 56 and 58; and *Internal Regulations of the Ministry of Energy* ("Reglamento Interior de la Secretaría de Energía");
- *Law of the Energy Regulatory Commission* ("Ley de la Comisión Reguladora de Energía"), and the *Manual of Regulations Related to the Supply and Sale of Electricity for Public Service* ("Manual de Disposiciones Relativas al Suministro y Venta de Energía Eléctrica Destinada al Servicio Público");
- *General Law for the Prevention and Integral Management of Wastes* ("Ley General para la Prevención y Gestión Integral de los Residuos"), which establishes guidelines to be followed in solid waste management and the creation of the National Program for the

[15] "Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45(e) of the CDM Modalities and Procedures) in determining a baseline scenario", Annex 3, Report of the 16th Meeting of the CDM Executive Board, 22 October 2004.

[16] Type E- ("E minus") includes National and/or sectoral policies or regulations that give positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs).

[17] *Pre-feasibility Study for Landfill Gas Recovery and Utilization at the Chihuahua Landfill*, Chihuahua, Mexico. p. 5-9. The World Bank, June, 2005.

Prevention and Integral Management of Waste and the Remediation of Polluted Sites. According to its article 97, official Mexican standards will establish the conditions for site selection, design, construction and operation of installations intended for the final disposal of municipal solid waste and hazardous wastes in sanitary landfills or in controlled sites. Moreover, this General Law will determine in which cases it would be possible to capture and use landfill gas;

- *Draft Regulations for the General Law for the Prevention and Integral Management of Wastes,* which establish that systems for the management and disposal of non-hazardous solid waste are subject to state and municipal authorization and legislation, and designates sanitary landfills as the final disposal for non-hazardous waste;
- *General Law for Ecologic Equilibrium and Environmental Protection Regulations* ("Ley General del Equilibrio Ecológico y la Protección al Ambiente"), and associated regulations[18], which establish that the Ministry of Environment (SEMARNAT) will formulate and implement the National Program for the Prevention and Integral Management of Waste and conduct the initial studies on integrated waste management;[19]
- *General Health Law,* which establishes the specifications for public health services and the standards and measures to protect human health and improve quality of life;
- *Mexican National Standards* ("Normas Oficiales Mexicanas"), which establish the form and procedures related to energy efficiency, environment and the power sector;
- *State Constitutions*, with articles stipulating that municipalities put in place adequate facilities for providing public sanitation services;
- *State Laws for Environmental Protection*, which refer to the obligation of each state to prevent, conserve and restore ecological equilibrium, as well as to manage and dispose of non-hazardous solid waste; and,
- *Cleaning Regulations,* which regulate administrative, technical, legal and environmental aspects of public services related to cleaning.

Since alternatives to the Project that are consistent with current laws and regulations have been identified, the Project is considered to be additional under Step 1.

<u>Step 2: Investment analysis</u>

Per the *Tool for the Demonstration and Assessment of Additionality*, there are three options that can be used for investment analysis: 1) simple cost analysis (where no benefits other than CDM income exist for the Project; 2) investment comparison analysis (where comparable alternatives to the Project exist); or 3) benchmark analysis.

Sub-step 2a – Determine appropriate analysis method. As the Project has potential to generate revenues from electricity sales even in the absence of CER income, the *Tool for the Demonstration and Assessment of Additionality* specifies that either investment comparison analysis (Option II) or benchmark analysis (Option III) is appropriate. Both methods have been applied in this PDD, comparing the capital cost requirements of the Project against likely alternatives, as well as comparing the Project's Internal Rate of Return (IRR) against an established benchmark.

Sub-step 2b and 2c – Option II. Apply investment analysis/calculation/comparison of indicators

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[18] These regulations have not yet been published.

[19] Also, Environmental Impact Study Regulation ("Reglamento de Impacto Ambiental"), which provides a list of high-risk activities for inflammability and explosives, and a list of high-risk activities for toxicity.

Capital Cost Comparison: The cell of the Ciudad Juarez landfill that will be developed under this project activity will be closed in 2008. However, its potential to generate additional revenues other than CERs is through electricity generation using the biogas produced by the decomposed organic material already contained in the landfill cell[20]. Thus, a comparison with viable alternatives that are likely to be implemented in the Mexican context, whether by the Project Developer or other developers, would have to take as an indicator the capital cost of the electricity generation equipment itself. As stated in the *Prospectiva del Sector Electrico, 2006 – 2015* prepared by the Ministry of Energy (SENER), the Mexican electricity sector is now strongly focused on utilizing natural gas for electricity generation[21]. Consequently, the cost of a natural gas turbine would be the indicator used for comparison with the cost of the generation equipment required by the Ciudad Juarez Landfill Gas to Energy Project.

Investment costs associated with LFG-fired power plants are higher than those of conventional gas-fired thermal power plants. Despite their use of an otherwise unutilized fuel source, LFG-fired energy plants have fewer economies of scale and tend to be one-off investments, as well as being more expensive to maintain and more sensitive to variations in fuel supply and output, compared to conventional gas-fired systems. Furthermore, the Project Developer does not have business experience with other power generation alternatives, such as gas or diesel-fired independent power producer (IPP) generator systems. In either case, these alternatives would not utilize the available LFG and are therefore, not of interest to the Project Developer.

The table below shows the turnkey[22] costs per MW of the comparison technologies[23], demonstrating that conventional gas-fired power generation systems emerging in Mexico are more financially viable on an investment basis than small LFG generators.

Table 3: Installed Cost Comparison by Technology (per MW)

Technology Cost Comparison							
	Natural Gas Combined Cycle	Simple Cycle Gas Turbine		Diesel Engine		Landfill Gas Engine (Reciprocating)	C. Juarez Gas to Energy Project
	(World Bank)[1]	(Boyce)[2]	(World Bank)[1]	(Boyce)[2]	(World Bank)[1]	(U.S. EPA)[3]	(Project costs estimation)[4]
Size Range (MW)	300	0.5 – 450	50	0.02-25	5	1-15	6.4
Turnkey Cost ($/MW)	510,000 to 690,000	300,000 to 650,000	380,000 to 520,000	200,000 to 500,000	470,000 to 650,000	1,200,000	1,800,000

1. Source: The World Bank "Technical and Economic Assessment: Off-grid, Mini-grid, and Grid Electrification Technologies Summary Report", Discussion Paper, World Bank Energy Unit, Energy and Water Department. November 2005, p. 72
2. Source: Meherwan P. Boyce, Ph.D, P.E. (2002): Gas Turbine Engineering Handbook, p. 8. http://books.google.com/books?id=nEc2OxxT_uMC&pg=PP1&ots=BabjrDlliM&dq=Gas+Turbine+Engineering+Handbook,&sig=nYek3zXtcJ2umNXkhWXQvlBxd9I#PPA4,M1
3. Source: Report on U.S. Methane Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions (EPA 430-R-99-013) (September 1999). http://www.epa.gov/methane/reports/02-landfills.pdf
4. Source: (i) MAQSA equipment nt cost estimation and (ii) Signed contract between SmartSoil Energy and Biogas de Juarez.

[20] Tipping fees are not considered to be part of the Ciudad Juarez landfill project activity since Biogas de Juarez will only operate the LFG collection and utilization.

[21] *Prospectiva del Sector Electrico, 2006 – 2015*, (SENER), page 90, graph 32.

[22] Turnkey refers to the investment needed to put a power plant in operation.

[23] Excluding coal, which is being substituted in Mexico by others sources of energy, as demonstrated in *the Prospectiva del Sector Electrico, 2006 – 2015.*

In the above comparison, a turbine option that utilizes the LFG directly for electricity generation would be even more expensive than the indicated reciprocating engine, and the former are considered to be too complex to operate and maintain in the current Mexican setting. For example, LFG may have significant variations in pressure, energy content, moisture content, and often contains corrosive contaminants, adding to the operational complexities and fuel processing requirements, as compared with centrally distributed gas. Regardless, building a conventional gas-fired generation facility or utilizing a diesel generator would neither be compatible with the Project Developer's core line of business or capabilities, nor would it meet their objective of effectively utilizing the LFG.

Therefore, the project activity is not the most financially attractive.

Sub-step 2b and 2c – Option III. Apply benchmark analysis/calculation/comparison of indicators.

In addition to an investment comparison analysis, a benchmark analysis was also calculated for comparison.

The project IRR was calculated in order to provide a comparison with established norms and expectations in Mexico for comparable investment projects. The assumptions used in this analysis include:

- Total Investment Cost: USD 11.7 million (phase I) to USD 29 million (phase II) [24]
- Landfill 0&M costs: USD 200,000 to USD 731,581[25]
- Power plant 0&M costs: USD 0.015 per kWh[26]
- Cost escalation: 3.5 %[27]
- Capacity factor: 90 %[28]
- Self consumption rate: 150 kW (phase I) to 488 kW (phase II) [29]
- Tariff: USD 0.077 per kWh (average) [30]
- Wheeling fee: USD 0.035 per kWh[31]

Under the assumptions above and in the absence of CDM revenues, investment in the LFG collection system and generation capacity results in an IRR of 2.12 % or less[32]. This return is not considered by the Project Developer to be adequate to compensate for the risks and uncertainties of the Project. Furthermore, this IRR compares very poorly to a comparative IRR hurdle rate for the country. In this case, the rate of 28 day Mexico Treasury Certificates ("Certificados de Tesoreria de la Federacion a 28 dias")[33] was selected. To this hurdle rate of 7.03%, a country risk

[24] Source: MAQSA equipment cost estimation and (ii) Signed contract between SmartSoil Energy and Biogas de Juarez

[25] Source: ibidem

[26] Source: MAQSA O&M cost estimates

[27] Source: Latin American Consensus Forecast. The World Bank - http://library.worldbankimflib.org/Restricted/Journals/Ejournals/Confor/2007/lasep07.pdf

[28] Source: MAQSA O&M cost estimation

[29] Source: MAQSA O&M cost estimation

[30] Source: Comisión Federal de la Electricidad (CFE) - http://aplicaciones.cfe.gob.mx:80/aplicaciones/ccfe/tarifas/tarifas/Tarifas.asp?Tarifa=HM

[31] Source: no official source was available. CFE personal communication

[32] A significant factor contributing to this low IRR is the high rate charged for wheeling power, which gives the Project a very low effective electricity tariff.

[33] Banco de Mexico, official statistics as of 14 February 2007, www.banxico.org.mx.

rate premium of 3%[34] was added, contributing to a IRR hurdle rate of 10.03% for Mexico. In this comparison, the Project's returns compare quite unfavorably.

Therefore, according to the benchmark analysis, the project activity is not financially attractive.

A sensitivity analysis was also applied to the IRR calculation to measure the impact, positive or negative, of changes in the indicated parameters.

Table 4. Sensitivity Indicators

Sensitivity Indicator	+10% investment	-10% investment	+10% tariff	-10% tariff	+10% production	-10% production	+10% O&M	-10% O&M
Resulting IRR	0.82 %	3.64 %	5.47 %	-2.13 %	2.33 %	1.91 %	-0.42 %	4.23 %

The sensitivity analysis shows that even significant beneficial changes across a range of project performance parameters does not result in the Project's IRR surpassing the stated IRR benchmark rate. The sensitivity on the pessimistic side of the same parameters results in very low returns. As a result of project volatility, where these performance expectations cannot be definitive, but rather only estimated at the investment decision point, these results would clearly lead to a no-invest decision by the Project Developer.

Note, therefore, that the country risk premium is not critical to demonstrate the project additionality since, as it is shown in the sensitivity analysis in table 4, the IRR resulting from all the different scenarios considered is always lower than the selected benchmark even without considering the country risk.

The prospect of CDM revenues provides the only significant mitigating factor against the above-mentioned investment barriers in front of the Project. CDM revenues help the Project overcome these investment barriers by:

a. Offsetting the plant turnkey cost, including both the generation equipment and the landfill gas collection system that provides the fuel source, which are in this case heavily front-load the project economics;

b. Improving the financial characteristic of the Project, including an improved debt coverage ratio, and strengthening project cash flows with more liquid, international hard currency; and,

c. Using the CDM future revenues to collateralize loan, thus providing the necessary capitalization for investing in the Project. The combination of energy revenues and CER sales, along with the use of ERPA revenues as collateral, is key to making overall project financing viable.

<u>Step 3: Barrier analysis:</u>

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity:

The following categories of barriers: (a) Investment Barriers, (b) Technological Barriers, (c) Prevailing Practice, and (d) Institutional and Regulatory Barriers were used in the analyses as explained below:

(a) Investment Barriers:

[34] Source: country risk spread based on the last years' trends of the JP Morgan's index EMBI for Mexico. http://www.latinfocus.com/latinfocus/countries/mexico/mexembisprd.htm

LFG systems, in general, have a difficult time securing financing. This investment barrier is also accentuated by the relatively high cost of capital, high financial risks, and a relatively unsophisticated capital market in Mexico. Coupled with relatively limited access to international capital markets, which are, in any case, more attracted to investments in different types of electricity generation rather than LFG to energy projects, it is difficult for such alternative plants in Mexico to attract adequate capital. External financing for LFG to energy projects is difficult to access as most local banks lack knowledge in this technology, and therefore, perceive LFG projects to have high risks.

The current open dumpsite waste disposal method for mixed municipal waste is considered standard operating practice for municipal solid waste treatment in Mexico and in the region, and is also the lowest cost option, the only cost being the opportunity cost of alternative land use. The inclusion of carbon revenues has, therefore, become an important part of the Project Developer's implementation and financing strategy.

(b) Technological Barriers:

The predominant and most well-known technology for solid waste disposal in Mexico is open dumping. The market for municipal and industrial solid waste management equipment and services is one of the least developed environmental market segments in Mexico. Although the country generates over 80,000 metric tons of municipal waste each day, only about 83 % of this waste is collected and only half of the solid waste receives proper handling, confinement, or treatment. Inadequate solid waste treatment is due to lack of infrastructure and low levels of recycling. Despite the estimated recycling potential of close to 30 %, only an estimated 6 % of the total volume of municipal waste is recaptured daily. Solid waste collection in Mexico depends heavily on personnel with no technical training and the separation of the waste is carried out by an ever-increasing number of scavengers. In addition, industrial solid waste is treated together with municipal solid waste.

While even managed landfills may appear to be "low-tech", the reality is that advanced management of waste disposal requires a deliberate and holistic approach to site control, careful attention to waste intake, placement, compaction and cover layers, protection of membrane systems, control of leacheates, venting and flaring (which, in well-sealed landfills can result in dangerous conditions if not monitored carefully and managed accordingly), and steady operation of a collection system (which, if off-line, requires rapid attention to dangerous methane buildup). Gas supply and quality can also vary significantly year-to-year and even day-to-day, posing additional uncertainties in investment decisions on increments of generating capacity.

Improper solid waste management is a universal problem in Mexico, affecting air, water, and soil. As mentioned above, the change from open landfills to managed systems, particularly in developing countries, requires particular care in accommodating the needs and expectations of local people who have become accustomed to making a living from the landfill ('picking') and effectively transitioning to "managed sorting" and "recycling". If managed effectively, this transition can benefit both the operator and the local community in terms of operational stability, sustainability, and health. But if mishandled, it can result in a significant loss of site control that undercuts the overall operation of the landfill and its ancillary products of methane flaring and energy production. These operational challenges are collectively very significant, and while at face value they may not appear to pose a technological barrier, they account for risks that require a significant increase in return on investment in order to make the project attractive.

Furthermore, local governments often lack the financial resources and technical expertise to develop modern solid waste management systems, and very few have acquired experience with LFG projects. Therefore, the Ciudad Juarez Landfill Gas to Energy Project would be among the "first of its kind" in Mexico with subsequent technological challenges and new implementation techniques required for the local Project Developer. The lack of available knowledge of and confidence in the technology, especially among local governments which own and operate most dumpsites, makes it difficult to develop such projects. As a result, operators view this technology as risky and prefer to maintain their waste disposal systems in the traditional fashion.

Overall, the project scenario involves higher perceived risks due to performance uncertainty and a low market share of the new technology.

(c) Prevailing Practice:

As stated above, the LFG technology utilized in the project activity is not common practice in Mexico, and represents a higher risk alternative to the business-as-usual scenario. From the operator's perspective, the open dump system is a cheap and sufficient way to dispose of municipal waste. To date, there has been very limited development of LFG projects in Mexico, where landfills either have: (i) no system for collecting, venting or flaring LFG; (ii) a passive system for venting LFG only (no flaring); (iii) a passive system for venting and flaring LFG; or (iv) a system to actively collect and flare or utilize the LFG. With the exception of the Prados de la Montaña in Mexico City, and the first phase of Simeprodeso in Monterrey, Nuevo Leon, none of the other landfills have proper LFG collection and flaring systems. In addition, only two LFG to energy projects are registered in Mexico under the CDM: (i) Santa Maria Chiconautla landfill in the Municipality of Ecatepec; and (ii) the San Nicolas and Cumbres landfills in the city of Aguascalientes.

(d) Institutional and Regulatory Barriers:

The Mexican electricity system, operated and organized primarily around two state-owned enterprises, Comisión Federal de Electricidad (CFE) and Luz y Fuerza del Centro (LFC), serves 95 % of the population, but is strained by under-investment and limited private sector participation. In Mexico, the Constitution designates power generation and distribution as exclusive rights of the State (except for "auto-generators" with less than 20 MW of capacity, which can sell power to the grid). This exclusivity implies a special project structure where cross-shareholding with the final user is required in order to qualify for auto-generation. Under such arrangements, municipalities and companies can purchase a share in a renewable project and thus qualify as auto-generators. Nonetheless, the auto-generator is still obliged to use CFE as an intermediary for the sales of electricity, having to pay a wheeling charge at CFE's discretion. Consequently, the transaction and structuring costs of such auto-generation projects are high and some uncertainties remain in the regulatory and wheeling arrangements, which limit the potential of these projects to form the critical mass of a sustainable market. Internal risks also remain high, as cross- shareholdings between partners make legal recourse difficult if one party fails to perform.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed activity):

The barriers identified in Sub-step 3a do not prevent the implementation of at least one of the alternatives projects identified.

Alternative 1. The implementation of the project activity without CDM assistance would be subject to all of the significant investment, technological, and financial barriers described in 3a. This approach fails to diversify the Project and does not provide an adequate revenue stream to compensate for the significant capital investments and risks. As noted in the investment analysis, an LFG energy project without CDM revenues provides too low a return to justify investment, therefore, the Ciudad Juarez Landfill Gas to Energy Project would not be undertaken as such.

Alternative 2. The implementation of a project that captures and encapsulates the LFG for sale would, in the absence of CDM revenues, also face all of the significant investment, technological, and financial barriers described in 3a, being an expensive and technologically challenging solution. In addition, such a project would have further difficulties, including the absence of a developed market or distribution system for this application. Moreover, it would not be economically justifiable at current energy prices for a project of this size. Without CDM revenues, alternative 2 also represents an unattractive business proposition and would not occur as such.

Alternative 3. The identified barriers would not prevent the implementation of a small fossil-fuel plant such as a natural gas turbine. Electricity generation utilizing natural gas as fuel went up from 16.6% of the total Mexican electricity production in 1995 to 43.2% of the total production in 2005[35]. Both the CFE and IPPs continue to build natural gas-fired plants for servicing the grid as well as for auto-generation projects. Therefore, based on the historical trends in the energy sector, this alternative would not be prevented by the barriers described, but it also would not be implemented by the Project Developer as it would not utilize the gas resource from the landfill.

Alternative 4: This alternative consists of the business-as-usual scenario, i.e. not implementing the Project or any other alternative activities. This is now, in fact, the most common practice in Mexico and would likely occur in the absence of the proposed project activity. Obviously, business-as-usual would not be prevented by the barriers identified, but rather, it would occur in the absence of CDM revenues precisely because of the identified barriers. However, while it is possible and likely for this alternative to occur in Mexico, similar to Alternative 3, this also would not utilize the available LFG, nor would it mitigate the GHG potential of the methane.

Step 4: Common practice analysis:

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

Projects that capture and/or utilize LFG are very few and limited in Mexico. So far, only a few landfills in the country have been designed to partially collect and flare the generated LFG. The table below presents information on a representative sample of landfills. Nowadays, no LFG collection and flaring or utilization systems are being developed in Mexico without considering carbon revenues.

Table 5: A Sample List of Landfills in Mexico

Landfill	Location	Comments
Aguascalientes LFG to energy project	City of Aguascalientes	Registered under CDM
Ecatepec LFG to energy project	Municipality of Ecatepec	Registered under CDM
Puerto Vallarta LFG to energy project	Puerto Vallarta	Pending registration under CDM
Prados de la Montaña	Mexico City	System to actively collect and partially flare the LFG
Simeprodeso (phase I)	Monterrey, Nuevo Leon	LFG collection and utilization project, funded with support from the Global Environment Facility (GEF) as a demonstration project
Durango	Durango City, Durango	No system for collecting, venting or flaring LFG
Culiacan	Culiacan, Sinaloa	Passive system for venting of LFG only (no flaring)
Socavon San Jorge	Metepec, State of Mexico	Passive system for venting and flaring LFG
El Verde	Leon, Guanajuato	Passive system for venting and flaring LFG

[35] *Prospectiva del Sector Eléctrico, 2006 – 2015* (SENER), page23, graph 23.

Bordo Neza	State of Mexico	No system for collecting, venting or flaring LFG
Chiltepeque	Puebla City, Puebla	No system for collecting, venting or flaring LFG
Bordo Poniente	Mexico City	No system for collecting, venting or flaring LFG

Source: *Project 0425. Aguascalientes – EcoMethane Landfill Gas to Energy Project*

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

As mentioned above in sub-step 4a, only five landfills in Mexico have collection and flaring or utilization schemes on them, and the conditions for the development of each of these systems were very unique. Furthermore, three of them have been or are being developed under the CDM context.

Step 5: Impact of CDM registration:

As shown through the previous steps, the Project faces a wide range of barriers, both real and perceived, which make it very unlikely for it to be undertaken without the benefits that CDM revenues can bring.

From an investment decision perspective, the adding of revenues from the sale of CERs provides a significant improvement to the return on investment, making it an acceptable business proposition despite the remaining risks of future waste supply, operational challenges, durability of a power purchase contract and tariff/wheeling levels, and other barriers. As shown in the Investment Analysis in Step 2 above, the IRR for the Project as a landfill/generation project without CDM revenues falls below 2.1 %, which is well below the threshold required for the Project Developer. Even the introduction of more optimistic assumptions in the sensitivity analysis fails to bring the IRR up to the established benchmark, which is an investment hurdle rate of 10.03 %. In the same sensitivity analysis, more pessimistic assumptions also reveal significant downsides resulting from a range of variables, over which the Project Developer has little control. These include the waste stream to the landfill, the actual gas output of the landfill, assurance of payment for power, and the level of electricity tariffs. However, if the revenues from the sale of the CERs are taken into consideration (considering a price of USD 8 per tCO_2e)[36], the Project's IRR rises to 10.22%, which is above the established benchmark.

Addressing Investment Barriers: In financial terms, the injection of CDM revenues enables the Project to bear the large upfront investment costs, significantly increasing cash flow and improving debt service coverage ratio. The existence of this revenue stream strengthens the likelihood of finding creditors and equity providers willing to invest in the Project against the guarantee of future CDM revenues. The potential future CDM revenue stream can also be used as collateral to raise debt to expand the Project in the future, enabling the Project Developers to maximize the ERs that can be generated from the Project.

CDM registration is, therefore, vital for the Project's financial viability since the flaring component with CDM yields no revenues and there is, otherwise, no incentive to collect and flare the LFG. The approval and registration of the Project as a CDM activity, coupled with collateralization of CER revenues to satisfy loan terms, will enable the Project to reach closure on the financing required in order for the Project to be undertaken. If the carbon market extends beyond 2012 such that CDM revenues for the two renewed crediting periods of 2013-2019 and 2020-2026 are realized, the impact of these revenues on the project returns could be even greater, depending on the future price of CERs. However, residual uncertainty on post-2012 ERPA contracts remains a potentially significant project risk.

[36] According to the World Bank Market Study "State and Trends of the Carbon Market 2006", p. 36, European Union buyers paid between US$ 8 and US$ 24 per CER upon delivery.

The prospect of CDM revenues provides the only significant mitigating factor against the above-mentioned investment barriers faced by the Project. CDM revenues help the Project overcome these investment barriers by:

a. Offsetting the plant turnkey cost, including both the generation equipment and the LFG collection system that provides the fuel source, both of which in this case are heavily front-loaded;

b. Improving the financial attributes of the Project, including an improved debt coverage ratio, and increased cash flows with more liquid, international hard currency; and,

c. Collateralizing loans, thus providing the capitalization required for the realization of the Project. The combination of energy and CDM revenues, along with the use of the ERPA as collateral, make the Project financially viable.

Addressing Technological Barriers: The transition from simple open dumping to managed landfills, and in particular the addition of controlled methane capture to generate electricity and achieve global benefits, requires careful attention to a wide range of challenges in terms of site control, protection of membranes, waste deposition, leachate control, gas management, management of electrical generation, continued field expansion, and operations and maintenance. In Mexico, where a complete operational track record in dealing with these issues is yet to be established, these technical challenges complicate the decision to invest. While revenues from CDM are typically viewed in terms of their impact on investment returns, the existence of these revenues also provides confidence that the Project will have adequate resources to properly address all of its technical requirements. With regard to the generation component, electricity revenues alone without CDM would not be sufficient to overcome financing challenges and provide adequate incentive to take on the technical risks. The collective income stream composed of CDM revenue combined with electricity sales, on the other hand, provides sufficient diversification and mitigation of risks such that the investment in the Project can proceed and the technology transfer to the host country can take place.

Addressing Barriers Due to Prevailing Practice: The disposing of mixed municipal waste in open dumpsites is considered standard operating practice in Mexico for municipal solid waste treatment. This prevailing practice represents the lowest cost option, where the only cost incurred is the opportunity cost of alternative land use. The highest priority for most municipalities is compliance with federal and state regulations on waste disposal. While municipalities have an inherent interest in minimizing local environmental and social impacts, they are also keen on minimizing their disposal costs. At the present time, they are not required to address global environmental impacts such as methane. By facilitating experience with LFG recovery and power generation, CDM registration for the Project will help build awareness of actions that can be taken at the local level but have global results, which in turn will translate into multiple benefits to other landfill developers and Mexico in general. The Project is poised to have a positive global impact, both in terms of contributing to the penetration of renewable energy technologies into the Mexican energy market and reducing GHG emissions.

Addressing Institutional and Regulatory Barriers: As with the technological barriers discussed above, the financial impact of CDM registration and revenues enables the Project Developer to not only accept institutional and regulatory risks, but also to manage them effectively to build a positive experience in LFG collection and power generation. Even though the Project's CDM registration may have little immediate impact on the existing preferences for certain generation technologies and fuels in the Mexican power sector, successful implementation of such projects will at a minimum contribute to much needed diversification in the sector. Similarly, municipal and provincial governments' experiences with the Project, as well as subsequent CDM-linked projects, will build broader understanding of landfill to energy operations and the importance of providing clear signals on regulatory and enforcement issues, which in turn will ensure ongoing investment in this area.

Summary: The above-mentioned impacts of CDM registration positively influence the decision by the Project Developer to proceed with its investment in a large, high-risk, but highly beneficial project. CDM registration provides critical financial and other benefits that secure the Project's viability and help it overcome a range of barriers.

As all of the above steps have been satisfied, the CDM Project activity is not considered to be the baseline scenario, i.e. the Project is additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

Baseline emissions

The baseline emission was calculated according to the following formulas from the methodology ACM0001ver.15.0:

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad (1)$$

Where:

BE_y	= Baseline emissions in year y (t CO_2e/yr)
$BE_{CH4,y}$	= Baseline emissions of methane from the SWDS in year y (t CO_2e/yr)
$BE_{EC,y}$	= Baseline emissions associated with electricity generation in year y (t CO_2/yr)
$BE_{HG,y}$	= Baseline emissions associated with heat generation in year y (t CO_2/yr)
$BE_{NG,y}$	= Baseline emissions associated with natural gas use in year y (t CO_2/yr)

As the project only aims flare LFG and generate electricity, the $BE_{HG,y}$= 0 and $BE_{NG,y}$ = 0.

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

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

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

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

Where:

$BE_{CH4,y}$	= Baseline emissions of methane from the SWDS in year y (t CO_2e/yr)
OX_{top_layer}	= Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)[37]

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

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH_4/yr)

$F_{CH4,BL,y}$ =Amount of methane in the LFG that would be flared in the baseline in year y (t CH_4/yr)

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

Step A.1: Ex post determination of $F_{CH4,PJ,y}$

During the crediting period, $F_{CH4,PJ,y}$ is determined as the sum of the quantities of methane flared and used in power plant(s), boiler(s), air heater(s), glass melting furnace(s), kiln(s) and natural gas distribution network, as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y} \quad (3)$$

Where:

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH_4/yr)

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

$F_{CH4,EL,y}$ = Amount of methane in the LFG which is used for electricity generation in year y (t CH_4/yr)

$F_{CH4,HG,y}$ = Amount of methane in the LFG which is used for heat generation in year y (t CH_4/yr)

$F_{CH4,NG,y}$ = Amount of methane in the LFG which is sent to the natural gas distribution network in year y (t CH_4/yr)

Given that there is no heat, or NG replacement, then equation (3) is reduced to the following:

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

Amount of methane destroyed by flaring ($FCH_{4,flared,y}$)

$FCH_{4,flared,y}$ is determined as the difference between the amount of methane supplied to the flare(s) and any methane emissions from the flare(s), as follows:

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

Where:

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

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

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

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

$F_{CH4,sent\_flare,y}$ is determined directly using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, applying the requirements described above where the gaseous stream the tool shall be applied to is the LFG delivery pipeline to the flare(s).

The project emissions from flaring of the residual gas stream (**$PE_{flare,y}$**) are estimated using the *Methodological Tool to determine project emissions from flaring ver.02.0.0.*

$$PE_{flare,y} = GWP_{CH4} * \sum_{m=1}^{525600} F_{CH4,RG,m} * (1 - \eta_{flare,m}) * 10^{-3}$$

Where:

$PE_{flare,y}$	= Project emissions from flaring of the residual gas stream in year y (t CO_2e/yr)
GWP_{CH4}	= Global warming potential of CH_4 (t CO_2e/t CH_4)
$F_{CH4,RG,m}$	= Mass flow of methane in the residual gas in the minute m (kg)
GWP_{CH4}	= Global warming potential of CH_4 (t CO_2e/t CH_4)
$\eta_{flare,m}$	= Flare efficiency in minute m

For the *ex-ante* calculation, the flare efficiency is considered to be 97 % based on the flare supplier specifications. However, the actual minute flare efficiency will be monitored according to the monitoring methodology stated in the *Methodological Tool project emissions from flaring* and taken into account for the ex-post project emissions calculation.

As per used methodology ACM0001, version 15.0, parameter $F_{CH4,EL,y}$ is determined using the *"Tool to determine the mass flow of a greenhouse gas in gaseous stream", version 2.0.0.* Option A will be used. The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad (5)$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad (6)$$

Where:

$F_{i,t}$	= Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$	= Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m³ dry gas/h)
$v_{i,t,db}$	= Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m³ gas *i*/m³ dry gas)
$\rho_{i,t}$	= Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m³ gas *i*)
P_t	= Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i	= Molecular mass of greenhouse gas *i* (kg/kmol)
R_u	= Universal ideal gases constant (Pa.m³/kmol.K)
T_t	= Temperature of the gaseous stream in time interval *t* (K)

In terms of the project activity and the parameters:

$$F_{CH4,EL,y} = \left(LFG_{electricity,y}\right) * \left(W_{CH4}\right) * \left(\rho_{CH4}\right)$$

$$\rho_{CH4} = \frac{P * MM_{CH4}}{(T + 273.15) * Ru}$$

From the above equations parameters $LFG_{electricity}$, W_{CH4}, *P, T* are monitored according to section B.7.1 below.

For the following parameters the values are stated in the mentioned tool:

MM_{CH4} = *16.04 kg/kmol*

R_u = 8,314 Pa m^3/kmol °K

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

An ex ante estimate of $F_{CH4,PJ,y}$ is required to estimate baseline emission of methane from the SWDS (according to equation 2 in ACM0001) in order to estimate the emission reductions of the proposed project activity in the CDM-PDD. It is determined as follows:

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

Where:

$F_{CH4,PJ,y}$	= Project emissions from flaring of the residual gas stream in year y (t CO_2e/yr)
η_{PJ}	= Efficiency of the LFG capture system that will be installed in the project activity
$BE_{CH4,SWDS,y}$	= Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y (t CO_2e/yr)
GWP_{CH4}	= Global warming potential of CH_4 (t CO_2e/t CH_4)

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

• *fy* in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation 2 of this methodology;
• In the tool, *x* begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and
• Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

To calculate the methane generation potential, the following formula from Tool “Emissions from solid waste disposal sites” should be used:

$$\left\langle \begin{matrix} BE_{CH4,SWDS,y} \\ PE_{CH4,SWDS,y} \\ LE_{CH4,SWDS,y} \end{matrix} \right\rangle =$$

$$\varphi_y (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{i=1}^{m} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j})$$

Where:

$BE_{CH4,SWDS,y}$	= Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y (t CO_2e/yr)
φ_y	= Model correction factor to account for model uncertainties for year y
f_y	= Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	= Global warming potential of CH_4 (t CO_2e/t CH_4)
OX	= Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	= Fraction of methane in the SWDS gas (volume fraction)
$DOC_{f,}$	= Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)

MCF_y	= Methane Correction Factor for year y
$W_{j,x}$	= Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
$DOC_{j,}$	= Fraction of degradable organic carbon in the waste type j (weight fraction)
k_j	= Decay rate for the waste type *j* (1 / yr)
j	= Type of residual waste or types of waste in the MSW
x	= Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (*x* = 1) to year y (*x* = *y*).
y	= Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months)

Step A.1.2: Determination of $F_{CH4,BL,y}$

This step provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, or to address safety and odour concerns (collectively referred to as requirement in this step). The four cases in Table 2 are distinguished. The appropriate case should be identified and the corresponding instructions followed.

Table 3: Cases for determining methane captured and destroyed in the baseline

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1	No	No
Case 2	Yes	No
Case 3	No	Yes
Case 4	Yes	Yes

The proposed project activity corresponds to case 1: *No requirement to destroy methane exists and no existing LFG capture system.*

This selection is justified based on the fact that the regulatory requirements do not indicate any specific amount of gas collection and destruction or utilization and that in practice, no amounts of LFG are actually collected and flared in the Ciudad Juarez landfill. Therefore, $\mathbf{F_{CH4,BL,y}}$ will be equal to zero for the *ex-ante* ER calculation. Nevertheless, laws and regulations will be periodically, and at least once a year, reviewed and the $\mathbf{F_{CH4,BL,y}}$ will be modified accordingly in case any law or regulation requires a minimal amount of methane to be captured and/or destroyed.

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

The baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) is calculated using the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption".* When applying the tool:

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

Scenario A described in the Tool applies for the calculation in the following equation:

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

Where:

$BE_{EC,y}$	= Baseline emissions from electricity consumption in year y (tCO2/yr)
$EC_{BL,k}$	= Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y (MWh/yr)
$EF_{EL,k,y}$	= Emission factor for electricity generation for source k in year y (tCO2/MWh)
$TDL_{k,y}$	= Average technical transmission and distribution losses for providing electricity to source k in year y

Following the option A1 of the scenario A, the $EF_{EL,k,y}$ will be determined by following the "*Tool to calculate the emission factor for an electricity system*" (which will be described later in this section), which is the calculation of a combined emission factor of the applicable electricity system ($EF_{EL,k,y}$ = $EF_{grid,CM,y}$). As stated in the Tool to calculate baseline, project and/or leakage emissions from electricity consumption, the default value of 3% will be used for $TDL_{k,y}$.

Project emissions:

Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y}$$

Where:

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

It is not foresee any use of fossil fuels on Ciudad Juarez landfill due to the implementation of the project activity ($PE_{FC,y}$=0); hence, the project emissions are equivalent to emissions from electricity consumption and will be calculated as follows:

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

The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) shall be calculated using the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption":*

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

Where:

$PE_{EC,y}$	= Are the project emissions from electricity consumption by the project activity in the 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)
$EF_{EL,j,y}$	= 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* (%)

Following the option A1 of the scenario A, the $EF_{EL,j,y}$ will be determined by following the "*Tool to calculate the emission factor for an electricity system*" (which will be described next in this section). As stated in the Tool to calculate baseline, project and/or leakage emissions from electricity consumption, the default value of 20% will be used for $TDL_{j,y}$.

From the "Tool to calculate the emission factor for an electricity system"

The tool is employed since it has been identified that the emission factor for the electricity generation for source *k* and *j* would be from the interconnected national grid ($EF_{EL,k,y}$ and $EF_{EL,j,y}$).

The steps to following for calculate emission factor are:
1. Identify the relevant electric system.
2. Choose whether to include off-grid power plants in the project electricity system (optional).
3. Select a method to determine the operating margin (OM).
4. Calculate the operating margin emission factor according to the selected method.
5. Calculate the build margin emission factor.
6. Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electric system.
The regions in the Mexican grid are interconnected; for this, the relevant electric power system is the entire Mexican grid (Source: SENER "Electricity Sector Outlook 2008-2017"), moreover the public information of the Mexican Energy Ministry "SENER" is for type of fuel for consumption and fuel share and technology for gross generation and power share, not for regions.

Step 2 - Calculate the Operating Margin (OM) emission factor(s) (EFOM,y)
As per the mentioned tool, dispatch data analysis should be the first methodological choice. However due to lack of data availability 'Dispatch Data Analysis' is not selected. According to the used tool, the "Simple OM" method is applicable to any project activity connected to the project electricity system (grid) where the low cost/must run resources constitute less than 50% of the total grid generation. This is the situation presented by the Ciudad Juarez Landfill Gas to Energy Project, hence the Simple OM method is applicable. The OM can be calculated *ex-ante,* using the full generation weighted average for the most recent 3 years for which data are available at the time of PDD submission.

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

Where:

$EF_{OM,y}$	= Simple OM emission factor
$F_{ij,y}$	= is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*;
$COEF_{i,j}$	= is the CO2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*
$GEN_{j,y}$	= is the electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission coefficient $COEF_i$ is obtained as:

$COEF_i = NCV_i * EF_{CO2,i} * OXID_i$

Where:

NCV_i	= is the net calorific value (energy content) per mass or volume unit of a fuel i

$EF_{CO2,i}$	= is the CO2 emission factor per unit of energy of the fuel i
$OXID_i$	= is the oxidation factor of the fuel.

STEP 2. Calculate the Build Margin emission factor (EFBM,y) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} * COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

Where:

$EF_{BM,y}$	= Build Margin emission factor
$F_{im,y}$	= is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *m* in year(s) *y*;
$COEF_{i,m}$	= is the CO2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *m* and the percent oxidation of the fuel in year(s) *y*
$GEN_{m,y}$	= is the electricity (MWh) delivered to the grid by source *m*.

The Build Margin emission factor $EF_{BM,y}$ *ex-ante* is based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

STEP 3. Calculate the baseline emission factor EFy as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

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

The weighting of operating and build margin is done as indicated in the tool for the second crediting period, i.e. w_{OM} = 0.25 and w_{BM} = 0.75.

Leakage:

Per ACM0001, no leakage effects correspond to the project activity of LFG capture and flaring.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	= Emission reductions in year y (t CO2e/yr)
BE_y	= Baseline emissions in year y (t CO2e/yr)
PE_y	= Project emissions in year y (t CO2/yr)

B.6.2. Data and parameters fixed ex ante

As per the methodology ACM0001 v.15

Data/Parameter	**GWP_{CH4}**
Data unit	tCO_2e/tCH_4
Description	Global warming potential of CH_4
Source of data	IPCC Fourth Assessment Report: Climate Change 2007 http://www.ipcc.ch/publications_and_data/ar4/wg1/en/errataserrata-errata.html#table214
Value(s) applied	25
Choice of data or measurement methods and procedures	According to EB 69, annex 3, all emission reductions achieved in the second commitment period shall be calculated using the GWP as applied by decision 4/CMP. 7
Purpose of data	Calculation of baseline emissions
Additional comment	NA

Data/Parameter	$\eta_{p,j}$
Data unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	Technical specifications of the LFG capture system to be installed (if available) or a default value of 50%.
Value(s) applied	A default value of 50% is taken
Choice of data or measurement methods and procedures	NA
Purpose of data	NA
Additional comment	NA

As per "Tool to calculate the emission factor for an electricity system", version 4.0

Data/Parameter	**Operating Margin Emission Factor ($EF_{OM,y}$)**
Data unit	Tons of CO_2/MWh
Description	CO_2 emissions intensity factor of the electricity displaced
Source of data	Official statistics. Department of Energy
Value(s) applied	0.6484 (2010/2011/2012 average value)
Choice of data or measurement methods and procedures	The $EF_{OM,y}$ is calculated according to the equations in the tool to calculate the emission factor for an electricity system, based on fuel consumption and electricity generation data for plants connected to the grid, provided by Mexican Official Statistics. See file Grid EF Mexico_Second crediting period Detailed information is also included in Annex 3.
Purpose of data	Calculation of Baseline emissions Calculation of Project emissions
Additional comment	Fixed value for the second crediting period

Data/Parameter	Build Margin Emission Factor ($EF_{BM,y}$)
Data unit	Tons of CO_2/MWh
Description	CO_2 emissions intensity factor of the electricity displaced
Source of data	Official statistics. Department of Energy
Value(s) applied	0.3157
Choice of data or measurement methods and procedures	The $EF_{BM,y}$ is calculated according to the equations in the tool to calculate the emission factor for an electricity system, based on fuel consumption and electricity generation data for plants connected to the grid, provided by Mexican Official Statistics. See file Grid EF Mexico_Second crediting period Detailed information is also included in Annex 3.
Purpose of data	Calculation of Baseline emissions Calculation of Project emissions
Additional comment	Fixed value for the second crediting period

Data/Parameter	Fuel Quantity ($F_{i,y}$)
Data unit	Tera Joules
Description	Amount of each fossil fuel consumed by each power source / plant
Source of data	Official statistics. Department of Energy
Value(s) applied	288,522
Choice of data or measurement methods and procedures	Based on fuel consumption for plants connected to the grid, provided by Mexican Official Statistics. See file Grid EF Mexico_Second crediting period Detailed information is also included in Annex 3.
Purpose of data	Calculation of Baseline emissions Calculation of Project emissions
Additional comment	The value applied corresponds to total fuel consumption of the latest plants built were used since their electricity generation in 2012 accounts for just over the 20% of the Mexican System generation in 2012 (47,629 GWh)

Data/Parameter	Emission Factor Coefficient (COEF_i)
Data unit	tC/TJ
Description	emission coefficient of each fuel type i
Source of data	IPCC Default values
Value(s) applied	Oil-based: 20.2 Natural gas: 15.3 Coal: 25.8
Choice of data or measurement methods and procedures	According to the applied tool to calculate the emission factor for an electricity system, IPCC Default values have been chosen. See file Grid EF Mexico_Second crediting period Detailed information is also included in Annex 3.
Purpose of data	Calculation of Baseline emissions Calculation of Project emissions
Additional comment	NA

Data/Parameter	Electricity Quantity ($GEN_{i,}$)
Data unit	Mwh

Description	Electricity generation of each power source / plant
Source of data	Official statistics. Department of Energy
Value(s) applied	See file Grid EF Mexico_Second crediting period
Choice of data or measurement methods and procedures	Based on electricity generation of plants connected to the grid, provided by Mexican Official Statistics. Detailed information is attached to Annex 3.
Purpose of data	Calculation of Baseline and project emissions
Additional comment	NA

Data/Parameter	**Carbon Emission Intensity Factor ($CEF_{electricity,y}$)**
Data unit	Tons of CO_2/MWh
Description	CO_2 emissions intensity factor of the electricity displaced
Source of data	Official statistics. Department of Energy
Value(s) applied	0.3989
Choice of data or measurement methods and procedures	The $CEF_{electricity,y}$ is calculated according to the equations in the tool to calculate the emission factor for an electricity system, based on fuel consumption and electricity generation data for plants connected to the grid, provided by Mexican Official Statistics. Detailed information is attached to Annex 3.
Purpose of data	Calculation of Baseline and project emissions
Additional comment	NA

As per the Methodological tool “Emissions from solid waste disposal sites” v. 06.0.1

Data/Parameter	**Regulatory requirements relating to landfill gas projects**
Data unit	Review
Description	The regulatory requirements will be checked once a year and in case of changes, necessary adjustments will be made.
Source of data	National legislation and mandatory regulations
Value(s) applied	Current regulation. Further information can be found in Section B.5
Choice of data or measurement methods and procedures	Although the methodology only requires recording the data at the renewal of the crediting period, the information will be recorded annually, to use it for changes to the adjustment factor (AF) or directly to $MD_{reg,y}$ at renewal of the credit period.
Purpose of data	Calculation of Baseline emissions
Additional comment	NA

Data/Parameter	$\Phi_{default}$
Data unit	Dimensionless
Description	Default value for the model correction factor to account for model uncertainties
Source of data	Methodological Tool Emissions from solid waste disposal sites" Version 6.0.1 default value.
Value(s) applied	0.75
Choice of data or measurement methods and procedures	The value of this parameter (0.75) is the one recommended in the **"**Methodological Tool Emissions from solid waste disposal sites"**.** Table 3. Default values for the model correction factor. Application A, wet conditions.
Purpose of data	Calculation of Baseline emissions
Additional comment	NA

Data/Parameter	**OX**
Data unit	Dimensionless
Description	Oxidation factor (reflecting the amount of methane from solid waste disposal site (SWDS) that is oxidized in the soil or other material covering the waste)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.1
Choice of data or measurement methods and procedures	Managed solid waste disposal site not covered with oxidizing material, such as soil or compost.
Purpose of data	Calculation of Baseline emissions
Additional comment	NA

Data/Parameter	$MCF_{default}$
Data unit	Dimensionless
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1.0
Choice of data or measurement methods and procedures	The Ciudad Juarez landfill is an anaerobic, managed SWDS.

Purpose of data	Calculation of Baseline emissions
Additional comment	The 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	**K_j**
Data unit	1/yr
Description	Decay rate for the waste type j
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value(s) applied	<table><tr><th>Waste type</th><th>K_j</th></tr><tr><td>Pulp, paper and cardboard</td><td>0.040</td></tr><tr><td>Wood & Straw (excl. lignin)</td><td>0.020</td></tr><tr><td>Garden/Park Waste (organic putrescibles)</td><td>0.050</td></tr><tr><td>Food, food waste, beverages and tobacco</td><td>0.060</td></tr></table>
Choice of data or measurement methods and procedures	As per IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Purpose of data	Calculation of Baseline emissions
Additional comment	Long-term averages based on statistical data obtained from the EIA study for the project activity.

Data/Parameter	**F**
Data unit	Dimensionless
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or measurement methods and procedures	As per IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Purpose of data	Calculation of Baseline emissions
Additional comment	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.

Data/Parameter	$DOCf_{,default}$
Data unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of Baseline emissions

Additional comment	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS.

Data/Parameter	**TDL_k**
Data unit	%
Description	Average technical transmission and distribution losses for providing electricity to the grid
Source of data	“Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, version 1
Value(s) applied	3%
Choice of data or measurement methods and procedures	Default value provided by the applied tool.
Purpose of data	Calculation of baseline emissions
Additional comment	NA

Data/Parameter	**TDL_j**
Data unit	%
Description	Average technical transmission and distribution losses for the electricity consumption from the grid
Source of data	“Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, version 1
Value(s) applied	20%
Choice of data or measurement methods and procedures	Default value provided by the applied tool.
Purpose of data	Calculation of project emissions
Additional comment	NA

B.6.3. Ex ante calculation of emission reductions

ACM0001 is used for the ex-ante calculation of ERs from the Project, specifically using Option (c) of the Consolidated Methodology, where the gas captured is used for electricity generation and ERs are claimed for displacing or avoiding energy from other sources. This *ex-ante* estimate is for illustrative purposes, as ERs will be monitored *ex-post*, according to the methodology.

Baseline emissions

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

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

Ex ante estimation of $F_{CH4,PJ,y}$

Next, in order to estimate the ex-ante baseline emissions of methane from SWDS for the CDM-PDD, the following equation is applied:

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

Where:

Parameter	Description	Value used for ex-ante purposes
η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity	97%
GWP_{CH4}	Global warming potential of CH_4 (t CO_2e/t CH_4)	25
$BE_{CH4,SWDS,y}$	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y (t CO_2e/yr)	Results for each year in Table 9

The quantity of LFG ($BE_{CH4,SWDS,y}$) that would have been destroyed or combusted by the Project is estimated using the *Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site.* The calculation is based on a multi-phase first order decay (FOD) model, where the amount of methane produced in the year *y* ($BE_{CH4,SWDS,y}$) is calculated as follows:

$$\langle BE_{CH4,SWDS,y} \rangle =$$

$$\varphi_y (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{i=1}^{m} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j})$$

Input values to the multiphase model are specified in the table below:

Table 6: Multi-phase Model Input Values

Parameter	Note	Value used	
φ	model correction factor	0.75	
f	fraction of methane captured at the SWDS and flared, combusted or used in another manner	0.0	
GWP	Global Warming Potential of methane	25	
OX	oxidation factor	0.1	
F	fraction of methane in the SWDS gas	0.5	
DOC_f	fraction of degradable organic carbon	0.5	
MCF	methane correction factor	1	
$W_{j,x}$	amount of organic waste type *j* prevented from disposal in the SWDS in the year *x*	As per waste profile	
		Waste type	**DOC_j**

DOC_j [1]	fraction of degradable organic carbon	Pulp, paper and cardboard	44
		Wood & Straw (excl. lignin)	50
		Garden/Park Waste (organic putrescibles)	49
		Food, food waste, beverages and tobacco	38
		Textiles	30
k_j [1]	decay rate for the waste type	**Waste type**	**K_j**
		Pulp, paper and cardboard	0.040
		Wood & Straw (excl. lignin)	0.020
		Garden/Park Waste (organic putrescibles)	0.050
		Food, food waste, beverages and tobacco	0.060
j	waste type category	-	
MAT [2]	mean annual temperature	19.7 centigrade	
MAP [2]	mean annual precipitation	223.8 mm	
PET [2]	potential evapo-transpiration	2420 mm	

(1) Source: Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site.
(2) Source: Project EIA.

Table 7: Waste Content by Type

Waste type	**Percentage (%)**
Pulp, paper and Cardboard	15.16
Wood & Straw (excl. lignin)	1.44
Garden/Park Waste (organic putrescibles)	3.6
Food, food waste, beverages and tobacco	43.48
Total	**63.68**
Inorganic	**36.32**

Determination of $F_{CH4,BL,y}$

For the amount of methane destroyed in the baseline scenario ($F_{CH4,BL,y}$), was determined according to the procedure included in ACM0001. As explained in Step A.1.2 above, the proposed project activity corresponds to case 1: *No requirement to destroy methane exists and no existing LFG capture system.* This selection is justified since the current regulatory requirements do not indicate any specific amount of gas collection and destruction or utilization and that in practice, no amounts of LFG are actually collected and flared in the Ciudad Juarez landfill. Therefore, $F_{CH4,BL,y}$ is equal to zero for the *ex-ante* ER calculation. Nevertheless, laws and regulations will be periodically, and at least once a year, reviewed and the $F_{CH4,BL,y}$ will be modified accordingly in case any law or regulation requires a minimal amount of methane to be captured and/or destroyed.

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

The ERs from the displacement of fossil fuel-based grid electricity generation are determined using the grid emission factor calculated in detail in Annex 3 (Baseline Information) and an estimation of the net quantity of electricity displaced by the Project. For the purposes of *ex-ante* calculations, the current installed capacity of 6.4 MW was used. Any electricity consumed on-site for project operations will be deducted from gross generation, thus, ERs will only be claimed for the net electricity supplied to the grid. However, the actual electricity exported to the grid will be monitored and taken into account for the ex-post project emissions calculation.

According to the used tool, the electricity baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$) where the weights is done as indicated in the tool for the second crediting period, i.e. w_{OM} = 0.25 and w_{BM} = 0.75. This is presented below.

Mexican Grid OM Ex Ante (tCO2/MWh)	**0.6484**
Mexican Grid BM Ex Ante (tCO2/MWh)	**0.3157**
Mexican Grid CM Ex Ante (tCO2/MWh)	**0.3989**

Against this combined margin emission factor, the annual baseline emissions generated by the Project as a result of displacing fossil fuel-based electricity generation in the second crediting period are summarized in table 9.

Then, baseline emissions are determined according to equation 1 and comprise a) methane emissions from the SWDS in the absence of the project activity; and b) the electricity generation using the captured LFG from the project activity;

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

Results for these variables are shown in Table 9 below.

Table 9: Annual ERs from electricity displaced during the second crediting period

Year	Baseline emissions of methane from the SWDS	Baseline Emissions associated with electricity generation (tCO2e)
2014[1]	13,544	1,791
2015	157,060	21,491
2016	151,774	21,491
2017	146,665	21,491
2018	141,728	21,491
2019	136,958	21,491
2020	132,348	21,491
2021[2]	117,235	19,700
Total	**997,312**	**150,439**

[1] November 30 to December 31-2014

[2] January 01 to November 29-2021

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

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
2014[1]	15,335	41	0.0	15,295
2015	178,552	471	0.0	178,081

2016	173,265	455	0.0	172,810
2017	168,156	440	0.0	167,716
2018	163,219	425	0.0	162,794
2019	158,449	411	0.0	158,038
2020	153,839	397	0.0	153,442
2021[2]	136,935	352	0.0	136,584
Total	**1,147,751**	**2,992**	**0.0**	**1,144,759**
Total number of crediting years	7			
Annual average over the crediting period	**143,469**	**374**	**0.0**	**143,095**

[1] November 30 to December 31-2014

[2] January 01 to November 29-2021

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

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

Data/Parameter	**$OP_{j,h}$**
Data unit	Hours
Description	Operating hours of the equipment that consumes the LFG (energy plant)
Source of data	Electricity Generation records/Control Room
Value(s) applied	N.A
Measurement methods and procedures	Data are continuously measured and recorded by the internal memory of each generator. Information is reported and displayed in the control room of the energy plant
Monitoring frequency	Data are continuously measured
QA/QC procedures	QA/QC is not required according to the applied methodology. This parameter is monitored to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
Purpose of data	Baseline emissions calculation

Additional comment	NA

Data/Parameter	**$EG_{PJ,y}$**
Data unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year *y*
Source of data	Electricity meter
Value(s) applied	**47,142 Average Value**
Measurement methods and procedures	To be measured from electrical meters installed at the plant. The proportion of data to be monitored is 100% and the data will be archived electronically.
Monitoring frequency	Continuous
QA/QC procedures	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company
Purpose of data	Baseline emissions Calculation
Additional comment	NA

Data/Parameter	**$EG_{EC,y}$**
Data unit	MWh
Description	Amount of electricity consumed by the project activity in year y
Source of data	Electricity meter
Value(s) applied	1.23
Measurement methods and procedures	To be measured from electrical meters installed at the plant. The proportion of data to be monitored is 100% and the data will be archived electronically.
Monitoring frequency	Continuous
QA/QC procedures	The amount of electricity consumed will be matched with electricity invoices.
Purpose of data	Project emissions Calculation
Additional comment	Average value since June 2011. Data taken from CFE invoices (see files: internal energy consumption.pdf)

As per the Methodological Tool “Project emissions from flaring” v.02.0.0

Data/Parameter	$T_{EG,m}$
Data unit	°C
Description	Temperature in the exhaust gas of the enclosed flare in minute *m*.
Source of data	Measurements by the Project Developer.
Value(s) applied	NA
Measurement methods and procedures	Measured continuously. Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple.
Monitoring frequency	Continuously.
QA/QC procedures	Thermocouple will be periodically calibrated according to the manufacturer’s recommendation.
Purpose of data	Project emissions Calculation
Additional comment	NA

Data/Parameter	$V_{i,RG,m}$
Data unit	-

Description	Volumetric fraction of component *i* in the residual gas in the hour *h* where *i* = CH_4, N_2,
Source of data	Project Developer
Value(s) applied	NA
Measurement methods and procedures	Continuously. Values to be averaged hourly or at a shorter time interval. 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
Monitoring frequency	Continuously. Values to be averaged hourly or at a shorter time interval.
QA/QC procedures	Analyzers will be periodically calibrated according to the manufacturer's recommendation.
Purpose of data	Baseline and project emissions calculation
Additional comment	As a simplified approach, project participants may only measure the methane content of the residual gas and consider the remaining part as N_2.

Data/Parameter	$V_{RG,m}$
Data unit	m^3/h
Description	Volumetric flow rate of the residual gas on a dry basis at reference conditions in the minute *m*
Source of data	Project Developer using a flow meter
Value(s) applied	NA
Measurement methods and procedures	Measured continuously. Values to be averaged hourly or at a shorter time interval. 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.
Monitoring frequency	Continuously. Values to be averaged on a minute basis.
QA/QC procedures	Flow meters will be periodically calibrated according to the manufacturer's recommendation.
Purpose of data	Project emissions Calculation
Additional comment	NA

Data/Parameter	$V_{O2,EG,m}$
Data unit	-
Description	Volumetric fraction of O_2 in the exhaust gas on a dry basis at reference conditions in the minute *m*
Source of data	Measurements by project participants using a continuous gas analyzer.
Value(s) applied	NA
Measurement methods and procedures	Measured continuously. Values to be averaged on a minute basis. Extractive sampling analyzers with water and particulates removal devices or in situ analyzers for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). 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.
Monitoring frequency	Continuously. Values to be averaged hourly or at a shorter time interval.
QA/QC procedures	Analyzers must be periodically calibrated according to the manufacturer's recommendation.
Purpose of data	Project emissions calculation
Additional comment	NA

Data/Parameter	**$LFG_{flared,y}$**
Data unit	m^3
Description	Amount of LFG flared at operating conditions
Source of data	Project developer
Value(s) applied	742,369
Measurement methods and procedures	Data will be measured continuously by the Project Developer using a flow meter. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 3%. Data to be aggregated monthly and yearly.
Monitoring frequency	Data will be measured continuously
QA/QC procedures	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of baseline emissions
Additional comment	10% methane captured

Data/Parameter	**$LFG_{total,y}$**
Data unit	m^3
Description	Total amount of LFG captured at operating conditions
Source of data	Project Developer
Value(s) applied	7,423,693 (average over the second crediting period)
Measurement methods and procedures	Data will be measured continuously by the Project Developer using a flow meter. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 3%. Data to be aggregated monthly and yearly.
Monitoring frequency	Data will be measured continuously
QA/QC procedures	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of baseline emissions
Additional comment	NA

Data/Parameter	**$LFG_{electricity,y}$**
Data unit	m^3
Description	Amount of LFG combusted in power plant at operating conditions
Source of data	Project developer
Value(s) applied	6,681,324
Measurement methods and procedures	Data will be measured continuously by the Project Developer using a flow meter. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 3%. Data to be aggregated monthly and yearly. In order to comply with request for clarification: : "AM_CLA_0252", with tittle: "Clarification for the ex-post determination of $F_{CH4,EL,y}$ by taking into account particular monitoring requirements as defined in item "33 a)" of ACM0001 ver. 15", please refer to permanent deviation of the monitoring of this parameter in section B.7.3 below.
Monitoring frequency	Data will be measured continuously
QA/QC procedures	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.

Purpose of data	Calculation of Baseline emissions
Additional comment	90% methane captured.

Data/Parameter	**w_{CH4}**
Data unit	m^3 CH4 / m^3 LFG
Description	Methane fraction in the Landfill Gas
Source of data	Project Developer
Value(s) applied	50%
Measurement methods and procedures	Methane content will be measured continuously with a fixed gas analyzer by the project developer. The gas analyzer will be maintained and calibrated regularly in line with the manufacturer's requirements in order to ensure that factory standards of accuracy are maintained.
Monitoring frequency	Data will be measured continuously
QA/QC procedures	The gas analyzer should be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Baseline and project emissions calculation
Additional comment	NA

Data/Parameter	**FE**
Data unit	Number
Description	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)
Source of data	Project Developer
Value(s) applied	97%
Measurement methods and procedures	An enclosed flare will be used subject to the following requirements: 1) The flare operation shall be continuously monitored by continuous measurement of operation time of flare using a run time meter connected to a flame detector or a flame continuous temperature controller, irrespective of whether the flare efficiency is monitored. (2) Periodic measurement of methane content of flare exhaust gas. If this cannot be carried out, a default efficiency of 90% will be used.
Monitoring frequency	Data will be measured continuously
QA/QC procedures	Regular maintenance should ensure optimal operation of flares. The enclosed flare shall be operated and maintained as per the specifications prescribed by the manufacturer.
Purpose of data	Baseline and project emissions calculation
Additional comment	Value applied for *ex-ante* calculations according to flare supplier specifications. For *ex-post* calculations actual hourly flare efficiency will be monitored according to the monitoring methodology stated in the *Tool "Project emissions from flaring" Version 2.0.*

Data/Parameter	MD_{reg} or $\mathbf{F_{CH4,BL,y}}$
Data unit	% or tones
Description	Methane destroyed due to regulatory or other requirements
Source of data	Local and/or national authorities
Value(s) applied	0%

Measurement methods and procedures	Changes in regulatory requirements, relating to the baseline landfill(s) need to be monitored This is done at the beginning of each crediting period.
Monitoring frequency	This is done at the beginning of each crediting period.
QA/QC procedures	N.A
Purpose of data	Baseline emissions calculation
Additional comment	The $\mathbf{F_{CH4,BL,y}}$ was set at 0%. This value is justified based on the fact that the regulatory requirements do not indicate any specific amount of gas collection and destruction or utilization and that in practice, no amounts of LFG are actually flared.

Data/Parameter	$PE_{flare,y}$
Data unit	tCO2e
Description	Project emissions from flaring of the residual gas stream in year *y*
Source of data	Project Developer
Value(s) applied	374 (Yearly average second crediting period)
Measurement methods and procedures	The parameters used for determining the project emissions from flaring of the residual gas stream in year y ($PE_{flare,y}$) will be monitored as per the *Tool “Project emissions from flaring” Version 2.0*
Monitoring frequency	Data will be measured continuously
QA/QC procedures	NA
Purpose of data	Project emissions Calculation
Additional comment	For the *ex-ante* calculation, the flare efficiency used is the one provided by the flare supplier specifications. The value applied for the purpose of calculating expected emission reductions in section B.5 is the average Project emissions from flaring of the residual gas stream in year *y* for the second crediting period

Data/Parameter	$fc_{CH4,EG,h}$
Data unit	mg/m^3
Description	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the minute *m*
Source of data	Measurements by project developer using a continuous gas analyzer.
Value(s) applied	NA
Measurement methods and procedures	Measured continuously. Values to be averaged hourly or at a shorter time interval. Extractive sampling analyzers with water and particulates removal devices or in situ analyzer for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). 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.
Monitoring frequency	Continuously. Values to be averaged on a minute basis.
QA/QC procedures	Gas analyser will be periodically calibrated according to the manufacturer’s recommendation.
Purpose of data	Project emissions calculation
Additional comment	

Data/Parameter	**T**

Data unit	°C
Description	Temperature of LFG
Source of data	Temperature transmitter, data extracted from PLC records
Value(s) applied	NA
Measurement methods and procedures	Data are continuously measured by a temperature transmitter, aggregated every minute and averaged hourly for the calculation means. Value is converted to °K for calculation means.
Monitoring frequency	Continuously
QA/QC procedures	Temperature transmitter is subject to a regular maintenance and testing regime to ensure accuracy. Standard Operating Procedure for Calibration and Maintenance SOP-A-en-002.
Purpose of data	Calculation of baseline emissions
Additional comment	NA

Data/Parameter	**P**
Data unit	Pa
Description	Pressure of LFG
Source of data	Absolute pressure transmitter, data extracted from PLC records
Value(s) applied	NA
Measurement methods and procedures	Data are continuously measured by an absolute pressure transmitter, aggregated every minute and averaged hourly for the calculation means.
Monitoring frequency	Continuously
QA/QC procedures	Absolute pressure transmitter is subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of baseline emissions
Additional comment	NA

Data/Parameter	$\boldsymbol{\rho_{CH4} = D_{CH4}}$
Data unit	tCH_4/m^3CH_4
Description	Density of methane in the gaseous stream (LFG) at operating conditions
Source of data	Calculated as per formula 6 of the “Tool to determine the mass flow of a greenhouse gas in gaseous stream”, version 2.0.0 above indicated in section B.6.1
Value(s) applied	NA
Measurement methods and procedures	The methane density is calculated every hour taking into account the following parameters: P = Pressure of LFG, data as per above details T = Temperature of LFG, data as per above details MM_{CH4} = Molecular mass of methane, value 16.04 kg/kmol Ru = Universal ideal gases constant, value 8314 Pa m^3/kmol°K
Monitoring frequency	Parameters T and P are continuously measured, aggregated every minute and averaged hourly, from this data the density is hourly calculated.
QA/QC procedures	Temperature transmitter and absolute pressure transmitter are subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Option A in page 5 of the mentioned tool is being used, since it is demonstrated that the temperature in the gaseous stream is less than 60°C at the flow measurement point, as required in way (b) of the tool.

B.7.2. Sampling plan

This section is not applicable to the proposed project activity.

B.7.3. Other elements of monitoring plan

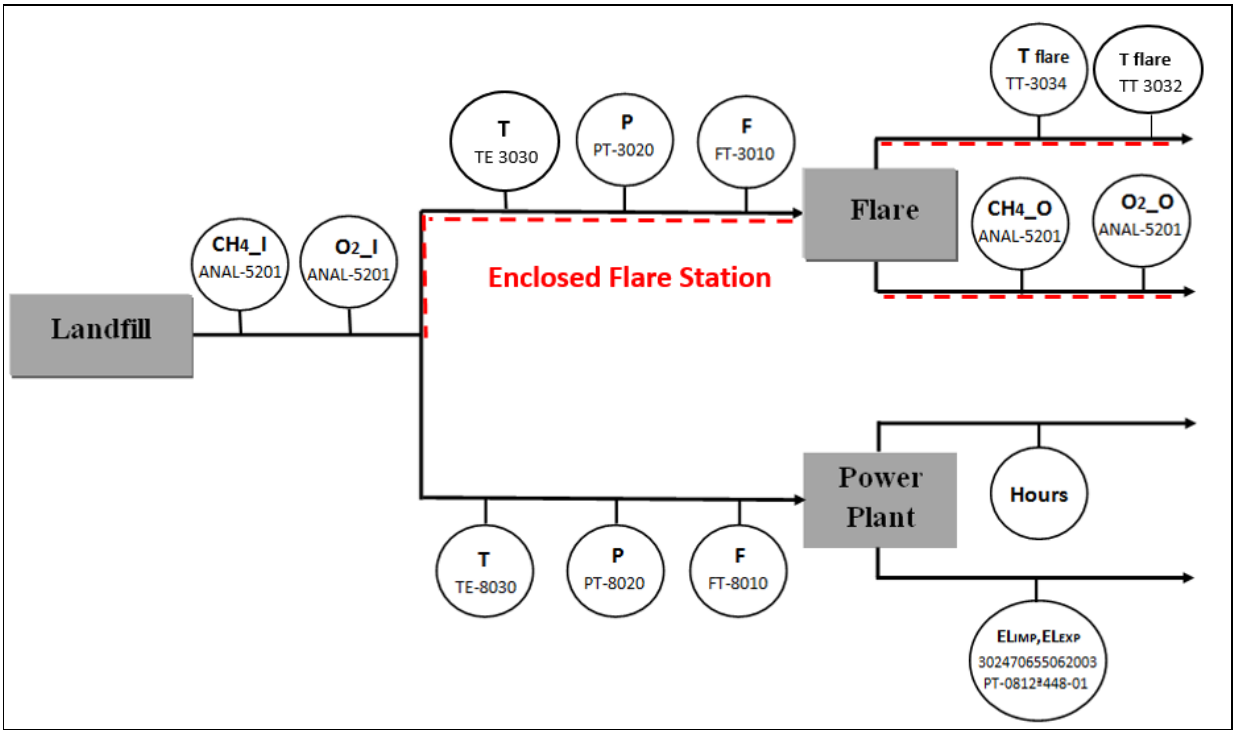
Permanent deviation of monitoring from the applied methodology

Since the project activity follows the methodology ACM0001, version 15, the requirement of the request for clarification **AM_CLA_0252**, with tittle: "Clarification for the ex-post determination of $F_{CH4,EL,y}$ by taking into account particular monitoring requirements as defined in item "33 a)" of ACM0001 ver. 15", is applicable, specifically in the following statement:

"The Methodologies Panel (Meth Panel) of the Executive Board of the clean development mechanism (CDM) agreed to clarify that the monitoring plan of a project activity applying ACM0001 version 15.0 shall be designed in such a way that landfill gas flow to each engine generator is monitored by installation and operation of an individual mass flow meter for each engine generator set."

Regarding the project activity, the monitoring equipment placed in site is described in the diagram below:

Diagram 1: Monitoring points



Taking into account that the flaring system is off since the engine system entered into operation we omit details regarding flaring, then from the above diagram it can be noticed that:

- TE-8030: measures temperature in the LFG feeding all four 1.6 MW generators
- PT-8020: measures pressure in the LFG feeding all four 1.6 MW generators

- FT-8010: measures LFG flow fed to all four 1.6 MW generators
- ANAL-5201: measures fraction of methane content in LFG feeding all four 1.6 MW generators

Thus, there is only 1 mass flow meter, 1 gas analyser, 1 temperature transmitter and 1 absolute pressure transmitter which is used for all four 1.6 MW generators.

Since the project monitoring plan was successfully renovated on 17 Jun 2015 counting with the above mentioned monitoring equipment and has been correctly working since then, and provided that the Meth Panel also noted that under some circumstances the requirement to meter landfill gas supply to each electrical or thermal equipment may impose significant cost and/or technical challenges, the PP decided to propose an alternative monitoring for the project activity.

According to the "CDM project standard for project activities", version 01.0 the post-registration change in which our project will be matching is paragraph 239, i.e. to comply with the mentioned clarification, our monitoring would permanently deviate from the applied methodology.

The PP assessed two alternatives to apply the permanent deviation:

Alternative 1. Based on the mentioned clarification “AM_CLA_0252”, the PP assumed that the Meth Panel aims for a higher level of accuracy on the LFG flow measurements; then approach of alternative 1 is based on Appendix 1 of the Project Standard (PS) version 9.0, paragraph 4 in which it is stated that:

“If the monitoring equipment actually installed has a lower accuracy level than the one stipulated in the applied methodology, where applicable, the applied standardized baseline and/or the registered monitoring plan, and the monitoring equipment is under the control of the project participants or the coordinating/managing entity, prior approval by the Board is not required if project participants or the coordinating/managing entity adjust the value measured with the equipment as follows:

(a) If the parameter is used for calculating baseline GHG emissions, the difference between the accuracy level of the installed monitoring equipment and the accuracy prescribed by the applied methodology, where applicable, the applied standardized baseline and/or the registered monitoring plan is deducted from the measured value.”

According to manufacturer´s specifications of the installed Foxboro Model 83F Flanged Body Vortex Flowmeter, by Schneider Electric, for gases and steam the accuracy is ±1% of reading for flow rates.

The applied methodology ACM0001, version 15.0 and required: “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, version 2.0.0 do not stipulate a specific accuracy level. The registered monitoring plan state that the accuracy of the measurement equipment can be assumed to be <3%, and the monitoring equipment is under complete control of the PP.

In this alternative, the discount factor to the baseline emissions of methane from SWDS calculations (BE_{CH4}) will then be **1%**

Alternative 2. The PP also analysed to take into account the methane destruction devices efficiency, i.e. the destruction efficiency of the energy generators. Provided that all the energy generators are the same model, type and have the same installed capacity, the destruction efficiency taken into account for all the four generators is the one specified by the Manufacturer for the specific model CATERPILLAR G3520C, which is:[38]

[38] Please refer to attached evidence on the calculation of the destruction efficiency of the mentioned engines.

	LOAD		
CATERPILLAR G3520C	**100%**	**75%**	**50%**
Methane destruction efficiency	99.33%	99.27%	99.16%
Discount factor	0.67%	0.73%	0.84%

In this alternative, the discount factor to the baseline emissions of methane from SWDS calculations (BE_{CH4}) will then be **0.84%**, taking into account the least efficient scenario from the above.

In order to comply with par. 240 of the PS, version 01.0, in which it is stated that:

"The project participants shall apply conservative assumptions or discount factors to the calculations in the proposed alternative monitoring to the extent required to ensure that GHG emission reductions or net anthropogenic GHG removals will not be over-estimated as a result of the permanent change or deviation";

the PP dismissed alternative 2 and opted for alternative 1.

Therefore, in order to apply conservative discount factor to the baseline emissions of methane from SWDS calculations (BE_{CH4}) to the extent required to ensure that GHG emissions reductions will not be over-estimated as a result of the permanent deviation, the adjustment of the flowmeter values is based on the deduction of the accuracy level (**1%**) of the installed monitoring equipment.

Furthermore, the PP considers the alternative 1 approach as appropriate, based on the following considerations:

1. All the measurement equipment shown in the mentioned diagram (flaring and engines system) complies with the correct calibration procedures. In the case of the temperature transmitters, the absolute pressure transmitters and the mass flow meters, calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months. In the case of the gas analyser the calibration shall be done in a quarterly basis as per manufacturer specifications, however, a stricter practice which is to perform a manual calibration at least once a month has been implemented. Automatic Zero on CH_4 and a span on O_2 are performed every day.

2. Since the initial operation of the project, all data is continuously measured, raw data is extracted from PLC records and aggregated every minute. Data is archived on a daily basis.

3. With the above, it is clear that the monitoring equipment is working at its optimal conditions, keeping the gathered data traceable and reliable; and thus the emission reductions calculation real, measurable and verifiable.

The Monitoring Plan (MP) details the actions necessary to record all the variables and factors required by the ACM0001, version 15, as explained in section B.7.1 above. All data will be archived electronically, and backed up regularly. Moreover, this information will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

The full version of the MP is attached to this PDD as Annex 5.

Project staff will be trained regularly in order to satisfactorily fulfil their monitoring obligations. The authority and responsibility for project management, monitoring, measurement and reporting will be agreed between the project participants and formalized. Procedures for calibration of monitoring equipment, maintenance of monitoring equipment and installations, and for records handling will be

established. As the Project construction proceeds, the monitoring protocol will be finalized to be ready for implementation at the start of project operation.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

15/02/2007

C.2. Expected operational lifetime of project activity

The project is expected to have an operational lifetime of 21 years

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable crediting period.
The project was registered on 30 November 2007, with a 7-year renewable crediting period. The first 7-year renewable crediting period started 30/11/2007 and ends on 29/11/2014. The second crediting period will start on 30/11/2014 and ends on 29/11/2021.

C.3.2. Start date of crediting period

30/11/2014 (Second crediting period)

C.3.3. Duration of crediting period

7 years and 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The objectives of the Project are to minimize the environmental impact of current waste disposal practices, to introduce proper waste handling in Mexico, and to set an example of GHG reduction at landfills through LFG collection systems.

The Environmental Impact Study (EIA) for the Project was completed in December 2006, and is expected to be approved by SEMARNAT shortly. The EIA includes the following: (1) detailed descriptions of the project phases, such as pre-construction, construction, and operations; (2) baseline environmental parameters, such as topography, land use, soil, geology, hydrology, meteorology, air quality, noise, and biological environment, i.e. terrestrial and aquatic plants; (3) assessment of potential environmental impacts; and (4) the environmental management plan, which designates responsible parties and timetables.

Specific requirements included:

1) The project sponsor should meet the requirements of the Official Mexican Norms referring to: maximum level of emissions from vehicles using gasoline or diesel fuel;

maximum opacity of exhaust gases from vehicles that use diesel; maximum noise levels from motor vehicles; and other associated environmental norms and regulations.
2) Potable water cannot be used for uses other than human consumption.
3) Liquids such as oil, grease or toxic substances cannot be spilled on the ground or in water bodies.
4) No kind of residues may be deposited on the project site or in neighboring zones.
5) No chemical products may be used to strip vegetation from the site prior to construction
6) Water requirements must be performed according to the National Water Commission (Comisión Nacional del Agua) standards or municipal authority resolutions.
7) materials and equipment transportation related to the project must be performed during non-peak traffic times.
8) The project should avoid traffic disruption/road closures, and deploy appropriate signs to prevent accidents.

The EIA will be made available to the DOE.

D.2. Environmental impact assessment

While the potential environmental impacts of the Project were not considered to be significant, they, as well as the recommendations on how they might be mitigated by the Project Developer, are listed below by project phase:

(1) Construction Phase:

Machinery: Noise generated by the movement of machinery in the construction phase could be disturbing to the local community. To avoid unnecessary noise, mufflers will be installed in the vehicles that transport the equipment and configure the site. Additionally, vehicle motors will not be permitted to be left on for unnecessarily long periods of time, both in and outside the landfill site. Transportation of the construction equipment will follow a schedule that will minimize disturbances to the nearby population.

Drilling for LFG capture: Workers will be provided with adequate personal protection equipment and training on how to wear it properly. Vehicle motors will be turned off and be far away from the drilling wells during drilling. Optimal operational condition of the drilling machinery will be checked and verified by drilling staff prior to the start of operations.

Installation of the LFG capture-equipment: Optimal operational conditions of the equipment and adequate programming of the drilling works will be ensured. Wells will be sealed immediately after the drilling. Appropriate masks will be worn by workers to minimize their exposure to bad odours.

(**2) Operations Phase:**

Condensation of liquids: Mechanical equipment involved in the transportation and storage of liquids after their condensation will be periodically checked and maintained. Infrastructure built for the transportation of liquids will be supervised continuously.

LFG utilization equipment: Disturbing noises will be minimized. All machinery involved will be kept in optimal operational condition.

Noise: Machinery will be maintained periodically to mitigate the impact of noise on health and safety during operations. Plant personnel will use sound protection devices in the event that noise levels exceed limits imposed by local regulations.

Condensate liquids: Periodic maintenance checks will be performed on all installations used by condensate liquids, including valves, tubes, traps, and capturing wells, in order to avoid negative impacts on soil and groundwater at the project site. Workers will be instructed to wear appropriate clothing and protective gear, such as overalls, plastic boots, gloves, and masks.

Workers' health: Appropriate training will be provided to all workers on their roles and responsibilities so as to mitigate potential impacts of plant operations on personnel health and safety.

Risk of accidents and contamination: Training will be provided to workers on what to do in case of accidents, such as accidental inhalation of the LFG or swallowing of the condensate liquids. In addition, management will supervise staff on use of appropriate clothing and protective gear.

(3) Landfill closure phase:

De-commissioning of the infrastructure and machinery: The potential impacts in this phase are similar to those identified in the construction phase, hence their mitigation will also be as described above. One particular risk to take into account here is bad odours and fumes released during the de-commissioning of the equipment, which can be prevented through the use of masks.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The stakeholder consultation took place on 22 February 2007 at the Instituto Nacional de Investigación y Planeación at 4185 Benjamin Franklin St. and Estocolmo Circuito, PRONAF in Ciudad Juarez, Chihuahua. The event allowed stakeholders to understand the basic concepts related to climate change, its consequences and the objectives of the Kyoto Protocol, as well as the most important features and benefits of the Project. The consultation was conducted by local and state authorities, as well as the Project Developer.

The consultation was properly announced in the main local newspaper *Diario de Juarez*. In addition, invitations were sent directly to government officials, NGOs, academia and local private companies. The consultation was well-attended, with more than 50 members of the community participating, and it lasted approximately 2 hours. Most of the participants represented in the event were local and state officials, and others from local communities. Participants filled out registration forms, which were kept in the Project Developer's files. These, as well as the minutes of the meeting are available to the DOE upon request.

The stakeholder consultation included a brief presentation of the Project and its benefits by the Project Developer, as well as presentations by the local and state authorities on topics such as climate change, the CDM, and a question and answer session with the stakeholders.

Figure 5: Local Stakeholder Consultation, 22 February 2007

E.2. Summary of comments received

As of date, no formal comments have been submitted by the stakeholders. However, during the above-mentioned consultation, stakeholders raised various questions regarding the Project and the benefits it may bring to the community. The Project Developer and local officials provided the following answers to those questions and comments:

1) The first question raised was on the benefits to the community from to the electricity bill discount for the municipality. The Project Developer explained that the electricity bill discount will be 10%, and although it was not possible to obtain a higher discount because of the wheeling fee to be paid to CFE, the municipality would receive numerous other benefits as part of the Project itself.
2) Stakeholders inquired about the possibility of the Project being implemented by the municipality, rather than by private investors. Local officials discarded this possibility due to the lack of a municipal budget to carry out such an investment and also pointed out that no additional benefits would accrue to the municipality through public investment, mainly because of the high wheeling fees charged by CFE. They briefly explained the generation costs and income, as well as the project risks avoided by the municipality under the existing project structure.
3) Community members also showed interest in technical aspects of the Project. Specifically, they asked about the composition of the gas that is flared. The Project Developer explained that the gas flared was biogas, mainly made of methane and carbon dioxide, and not previously processed. The Project Developer also explained that the gas used for the generators to produce electricity was methane obtained from the biogas after a cleaning process.
4) Some concerns were voiced about the continuity of the Project and possible conflicts between Government and private developers, which could result in its termination. The Project Developer responded that this was a win-win project where all parties involved would receive some benefits. Specifically, the local community, the environment and the Project Developer are all beneficiaries of the Project.
5) Lastly, stakeholders wanted to know about potential risks the Project could pose to the community. The Project Developer reassured them that there was only an insignificant amount of methane accumulated in the landfill, and therefore, the Project did not constitute a risk to the community. However, if it were not for the Project, any accumulated methane would otherwise be released to the atmosphere causing environmental impacts.

The consultation was closed by the Secretary of Environment and Urban Development of the State of Chihuahua, who emphasized the importance of feedback from the community for the continuation of the Project and underlined the environmental benefits of this Project over economic benefits.

E.3. Consideration of comments received

As of date, no formal comments have been submitted by the stakeholders. Specific questions related to benefits for the community, potential environmental risks, and implications of the Project were all addressed at the stakeholder consultation. Overall, the consultation was regarded by the local stakeholders as a positive event where they gathered valuable information on the project activity and the CDM.

SECTION F. Approval and authorization

For the PP Biogas de Juarez S.A. de C.V.:
The Letter of Approval for the proposed project activity was issued by the Mexican DNA on March 08, 2007.

For the PP BELEKTRON d.o.o.:
The Letter of Approval for the proposed project activity was issued by the Swiss DNA on August 25, 2017.

Appendix 1. Contact information of project participants

Organization name	Biogas de Juarez, S.A. de C.V
Country	Mexico
Address	Periférico Ortiz Mena #3403, Col. Quintas del Sol. 31250 Chihuahua. Mexico
Telephone	+526566375000
Fax	+526566375001
E-mail	hector.rangel@biogasdejuarez.com
Website	www.biogasdejuarez.com
Contact person	Mr. Hector Rangel

Organization name	BELEKTRON d.o.o.
Country	Slovenia
Address	Cvetkova ulica 25, 1000 Ljubljana
Telephone	+38616208853
Fax	+38616208855
E-mail	bostjan.bandelj@belektron.eu
Website	https://belektron.eu
Contact person	Bostjan Bandelj

Appendix 2. Affirmation regarding public funding

The Project has not received, and will not receive, any public funding.

Appendix 3. Applicability of methodologies and standardized baselines

Not applicable since information regarding applicability of the selected methodology was presented in section B.

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

BASELINE INFORMATION

Determination of the CO2 emission factor

The project activity displaces electricity from other grid-connected sources. The emission factor for the displacement of electricity should thus correspond to the grid emission factor (*EFelectricity,y = EFgrid,y*) and *EFgrid,y* is determined as a combined margin (CM), following the guidance in the "Tool to calculate the emission factor for an electricity system", version 4.0.

Step 1 - Calculate the Operating Margin (OM) emission factor(s) ($EF_{OM,y}$)

As per the mentioned tool, dispatch data analysis should be the first methodological choice. However due to lack of data availability 'Dispatch Data Analysis' is not selected. According to mentioned tool, the "Simple OM" method is applicable to any project activity connected to the project electricity system (grid) where the low cost/must run resources constitutes less than 50% of the total grid generation. This is the situation presented by the Ciudad Juarez Landfill Gas to Energy Project, hence the Simple OM method is applicable. The OM can be calculated *ex-ante,* using the full generation weighted average for the most recent 3 years for which data are available at the time of PDD submission.

	2010	2011	2012
	GWh	GWh	GWh
Thermal conventional	40,570	47,869	53,918
Dual	10,649	11,547	11,214
CC	115,865	119,978	119,300
Turbogen + int. combustion	4,638	5,257	7,416
Coal	21,414	22,008	22,744
Hydropower	36,738	35,796	31,317
Nuclear	5,879	10,089	8,770
Geothermal	6,618	6,507	5,817
Wind	166	106	1,398
Imports	397	596	2,166
Total	**242,934**	**259,753**	**264,060**

Source: Prospectiva 2012, table 23, pg. 113, Electric Sector Prospective 2011-2025, Page 88, Chart 11

Table A3-2: Carbon Emission Factors by Fuel Source

C Emission Factor (tC/TJ)	
Oil-based	20.2
Natural gas	15.3
Coal	25.8

Fraction of C oxidized	
Oil-based	0.99
Natural gas	0.995
Coal	0.98

Source: IPCC values *Source: IPCC Values*

Mexican Grid OM Ex Ante (tCO_2/MWh)	0.6484

Step 2 - Calculate the Build Margin (BM) emission factor ($EF_{BM,y}$)

As per the Baseline Methodology, the BM emission factor ($EF_{BM,y}$) is calculated as the generation weighted average emission factor (tCO_2/MW) of a sample of power plants. The project activity calculates the BM emission factor $EF_{BM,y}$ *ex ante* based on the most recent information available for plants already built for the sample group, *m*, at the time of PDD submission.

The sample group *m* consists of either:

a) The five power plants that have been built most recently; or,

b) The power that comprise 20% of the country's total power system generation and that have been built most recently.

As per the baseline information data, option (b) comprises the larger annual generation. Therefore, for the project activity the sample group, *m*, consists of those power plants that comprise 20% of the total power system generation and that have been built most recently. Power plant capacity additions registered as CDM project activities are excluded from the sample group.

Table A3-3: Latest Capacity Additions in Mexico

Plant Name	Year	Electricity Generated in 2012 (MWh)	Fuel consumption in 2012 (GJ)
Zumpimito	2012	52,560	N.A
Manzanillo 1 (Manuel Alvarez Moreno)	2012	7,828,103	54689
Santa Rosalía (Tres Virgenes)	2012	8,760	N.A
La Venta III	2012	901,404	N.A
Oaxaca 1	2012	893,520	N.A
Oaxaca 4	2012	893,520	N.A
Oaxaca 2	2012	893,520	N.A
Oaxaca 3	2012	893,520	N.A
Yuumil iik	2011	13,140	N.A
Aragón	2010	280,320	N.A
Petacalco	2010	3,761,782	26281
Norte Durango	2010	3,788,262	26466
San Lorenzo Potencia	2009	2,932,144	20485
Presidente Juarez	2009	1,252,084	N.A
Iztapalapa	2009	280,320	N.A
Coapa	2009	280,320	N.A
Santa Cruz	2009	280,320	N.A

Plant Name	Year	Electricity Generated in 2012 (MWh)	Fuel consumption in 2012 (GJ)
Magdalena	2009	280,320	N.A
Humeros	2008	41,960	N.A
Ciudad del Carmen	2008	289,080	N.A
La Venta II	2007		N.A
El Cajón (Leonardo Rodríguez Alcaine)	2007	302,220	N.A
Tamazunchale (PIE)	2007	8,431,325	58903
Ecatepec (LFC)	2007	280,320	N.A
Remedio (LFC)	2007	280,320	N.A
Victoria (LFC)	2007	280,320	N.A
Cuautitlan (LFC)	2007	280,320	N.A
Cayotepec (LFC)	2007	560,640	N.A
Vallejo (LFC)	2007	280,320	N.A
Villa de las Flores	2007	280,320	N.A
Río Bravo (Emilio Portes Gil)*	2007	783,705	5475
Valladolid III (PIE)	2006	1,393,497	9735
Tuxpan V (PIE)	2006	3,993,640	27900
Altamira V (PIE)	2006	8,211,374	58588
TOTAL			**288,522**

Note: The latest main 34 plants built were used, since their electricity generation in 2012 accounts for just over the 20% of the Mexican System generation in 2012 (47,629GWh)

Mexican Grid BM Ex Ante (tCO_2/MWh)	**0.3157**

Step 3: Calculate the Electricity Baseline Emission Factor ($EF_{electricity,\ y}$)

Electricity baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$). The weighting of operating and build margin is done as indicated in the tool for the second crediting period, i.e. w_{OM} = 0.25 and w_{BM} = 0.75.

Mexican Grid OM Ex Ante (tCO_2/MWh)	**0.6484**
Mexican Grid BM Ex Ante (tCO_2/MWh)	**0.3157**
Mexican Grid CM Ex Ante (tCO_2/MWh))	**0.3989**

Appendix 5. Further background information on monitoring plan

TABLE OF CONTENTS

I. Background Information

The Baseline and Monitoring Methodology for the Project is in accordance with the approved consolidated baseline methodology, ACM0001, which is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and renewable electricity generation for a grid

The proposed landfill gas to energy project at the Ciudad Juarez Sanitary Landfill in Ciudad Juarez, Chihuahua will capture biogas from the existing landfill. The biogas captured in the landfill will be initially flared, and from January 2008 on, it will fuel an electric power plant with an estimated maximum installed power of 6.4 MW in phase I of the project activity. The Project will have a phase II, where it will encompass the whole landfill cell and likely have an installed capacity of 20.8 MW. The methane captured from the landfill and the electricity generated by the Project, which will displace grid electricity generated from fossil fuels, are together expected to reduce GHG emissions by an average of 143,095 tCO_2e per year for the second crediting period. A total reduction of approximately 1,144,759 tCO2e is projected for the second 7-year crediting period. The project activity, which includes methane capture and either flaring or utilization for electric power production, will all be contained within the waste disposal facility.

The spatial extent of the project boundary is the site of the project activity where the waste is treated. This includes the facilities for processing the waste, on-site electricity generation and consumption, as well as the landfill site. The project boundary does not include facilities for waste collection, sorting and transport to the project site, but it does include the Mexican national power grid, to which the on-site generation plant will be connected.

II. Organizational, Operational and Monitoring Obligations

A. Obligations of the Operator

Monitoring the Project's ER performance requires proper data collection and processing by the Project Operator. The Project Operator has the primary obligation to calculate ERs based on the most recent available information, following the ERs Calculation Procedure (ERCP) presented in this Monitoring Plan (MP), and to abide by the ERCP Organizational Structure as well as the ERCP Quality Control provisions presented in the Annex to this MP.

The ERCP Organizational Structure dictates that the ERCP Manager will be responsible for performing the ERCP (monthly), and the MP Steering Committee will be responsible for supervising the ERCP Manager's monitoring work (monthly). The ERCP Manager will report to the

MP Steering Committee (monthly), and the ERCP Manager and MP Steering Committee will coordinate in reporting to the DOE at Verification.

The ERCP Quality Control provisions in the Annex to this MP offer guidance on how to handle monitoring data to ensure that sufficient and accurate information is made available to the DOE. Specifically, the ERCP Quality Control demonstrates how to trace back the methane avoided from the Ciudad Juarez landfill, as well as the electricity produced by the Project from the off-taker of the surplus power. All data required for the MP will come from the Project Operator's information system, and it is the responsibility of the Project Operator to ensure that this data is made available monthly to the ERCP Manager.

It is believed that the monitoring approach presented in this MP will result in an accurate, yet conservative calculation of ERs. However some uncertainties, especially errors in the data monitoring and processing system, may result in a discrepancy between the monitored ERs and the verified ERs. The Project Operator is expected to prevent such errors, and the verification audits are expected to uncover any potential ones. Given that CERs can only be certified after Verification, there is a significant internal incentive for the Project Operator to perform all steps related to data collection and calculations as accurately as possible.

The ERCP Manager will seek to establish and maintain a positive and efficient relationship with the DOE verifying the Project's ERs so as ensure a dependable and transparent outcome. In doing so, the ERCP Manager will:

- Provide all necessary monitoring information to facilitate the verification work, and cooperate with the DOE in a timely manner on all data requests and questions;
- During the crediting period, always take into account requests by the CDM Executive Board and conduct preparatory work for the verification to obtain high quality and efficient results; and,
- Ensure that all monitoring reports are reviewed by the ERCP Manager and the MP Steering Committee before they are transmitted to the DOE.

Training is an important element in successful monitoring of ERs. The team established in the Emissions Reductions Calculation Procedure (ERCP) Organizational structure, and composed of the monitoring plan steering committee and the ERCP management will be trained appropriately.
The monitoring plan and associated training will build the capability of the monitoring plan steering committee and ERCP management to replicate - on an ex-post basis – an equivalent process that has been demonstrated in the PDD for an ex-ante emissions avoidance calculation as if the plant were in operation in 2007. Training structure and topics shall include: a) accurate monitoring of the performance and output characteristics of the power plant to record and keep accurate data; b) accurate monitoring of the landfill gas collection and utilization and keep accurate data c) collection and integration of utility data for the current year; d) incorporation of these data sets into spread sheets pre-prepared by MGM Innova, and e) consistently calculating verifiable CERs as a function of landfill gas collection and measured power plant output against a current-year emission factor that serves as a recognized proxy for emissions displaced from the grid.

Adequate **equipment** will be defined and procured during project construction, which will be used for monitoring gas flows, flare temperature, and electricity that is generated, consumed on-site, and dispatched to the grid. Procedures for maintenance and installation of equipment, as well as calibration, will be performed according to manufacturer's specifications. All measurements, data gathering, record keeping, and procedures for dealing with possible data adjustments will be performed taking into consideration the specific data gathering requirements of the MP, and will also meet the requirements of ACM0001.

The ERCP is designed for performing quality control on the ER calculation, and provides procedures to guarantee the accuracy of the results. The quality control procedures deal with data

collection, processing, record keeping, and cross-checking. It is therefore, expected that the MP approach presented in this PDD will result in an accurate, yet conservative calculation of ERs.

Table A4-1: Monthly Data Collection: Division of Labor

I. Electricity distributor final client(s) (Data Provider)	- Shall provide the Project Operator with written proof of the Project's hourly generation purchased/sold. Frequency: Monthly
II. Grid Operator (Data Provider)	- Shall provide the Project Operator with written proof of the Project's hourly generation registered. Frequency: Monthly
III. Project Operator (Data Processor)	- Shall directly measure the CH_4 destroyed by flaring and from generation following ACM0001. - Shall estimate ERs for electricity displacement following ACM0001. - Shall estimate the project emissions following the *Tool to determine project emissions from flaring gases containing Methane.* - Shall perform the monthly calculation of ERs following the ERCP. - Shall keep receipt of sales of electricity. - Shall prepare and submit the annual report of the total project ERs to the DOE. - Shall establish the necessary agreements with the Grid Operator and final clients to assure that they all provide a monthly written report of the Project's hourly generation registered/bought.

Source: **ahl**carbono.

II. The ERCP Organizational Structure and the ERCP Quality Control will be attached to the Annex to this MP below.

B. Emissions Reductions Calculation Procedure and Required Spreadsheets

The ERCP is the basic instrument for gathering, recording and processing information that will result in the measured ERs. The Project Operator shall consider the Project's ERCP as a manual. The ERCP should contain: (i) data gathered from the Grid Operator information system, (ii) data processed by the Project Operator, and (iii) data gathered from the meters installed for the monitoring of the CH_4 destroyed. All data processing should be done using Excel software. The ERCP is designed for monthly and yearly calculation, based on final monthly Grid Operator reports and monthly recording and continuous recording of the meters installed. Entering the data monthly in the required spreadsheets will provide the opportunity to review formulas, minimize errors and have data readily available for the DOE at any time during the year.

The Ministry of Energy (SENER) will serve as the data provider for the annual *ex-post* calculation of the Project's ERs. The designated project staff will confirm these data with their own records, which they will crosscheck with sales receipts.

The Project Operator will calculate the ERs based on the MP, following the ERCP. Calculations will follow ACM0001 to calculate ERs from the CH_4 destroyed by the Project, and to calculate the ERs from electricity displacement when the Project provides renewable electricity to the grid.

Data Management: Collection, transfer and processing

The following diagrams show the information flow that conforms the ER calculation, file: "Total ER – XX Verification" (XX is for the MP number).

Diagram 2: Collection of parameters to calculate the Baseline emissions of methane from SWDS "BE_{CH4}"

File: "Segundo Reporte Diario"
Data extracted from: CITECT, which is the interface between the PLC and computer
Aggregation interval: every minute
Measurements obtained:

- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)

Data is downloaded from the PLC daily and stored at the on-site server (Juarez server) and in a remote server located at Chihuahua City (location of MP Committee).

↓

File: "RAW DATA"
Data extracted from: file "Segundo Reporte Diario"
Aggregation interval: every 20 minutes
Data obtained:

- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)

File is created daily and stored in a remote server located at Chihuahua City (location of MP Committee).

↓

File: “Treated Data”
Data extracted from: file “RAW DATA”
Aggregation interval: every hour
Data obtained:
- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)

File is created daily, where the 20 minute interval data from the file “RAW DATA” is automatically and continuously averaged and normalized into hourly values. File is stored in a remote server located at Chihuahua City (location of MP Committee).

File: “SIMPLIFIED MDelec MM YY”
Data extracted from: file “Treated Data”
Aggregation interval: every month
Data obtained / calculated:
- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)
- LFGelectrcity
- BE_{CH4}

File is created monthly and stored in a remote server located at Chihuahua City (location of MP Committee).

File: “Total ERy – XX Verification”
Data extracted from: files
- “SIMPLIFIED MDelec MM YY”
- “ITEM 2”
- “Operating Hours”

Aggregation interval: every Monitoring Period
Data calculated:
- BEy
- PEy
- ERy

File is created at the end of each monitoring period and is the main CERs calculation file.

Diagram 3: Collection of parameters to calculate the Baseline emission associated with electricity generation “BE_{EC}” and Project emissions from consumption of electricity due to the project activity “PE_{EC}”

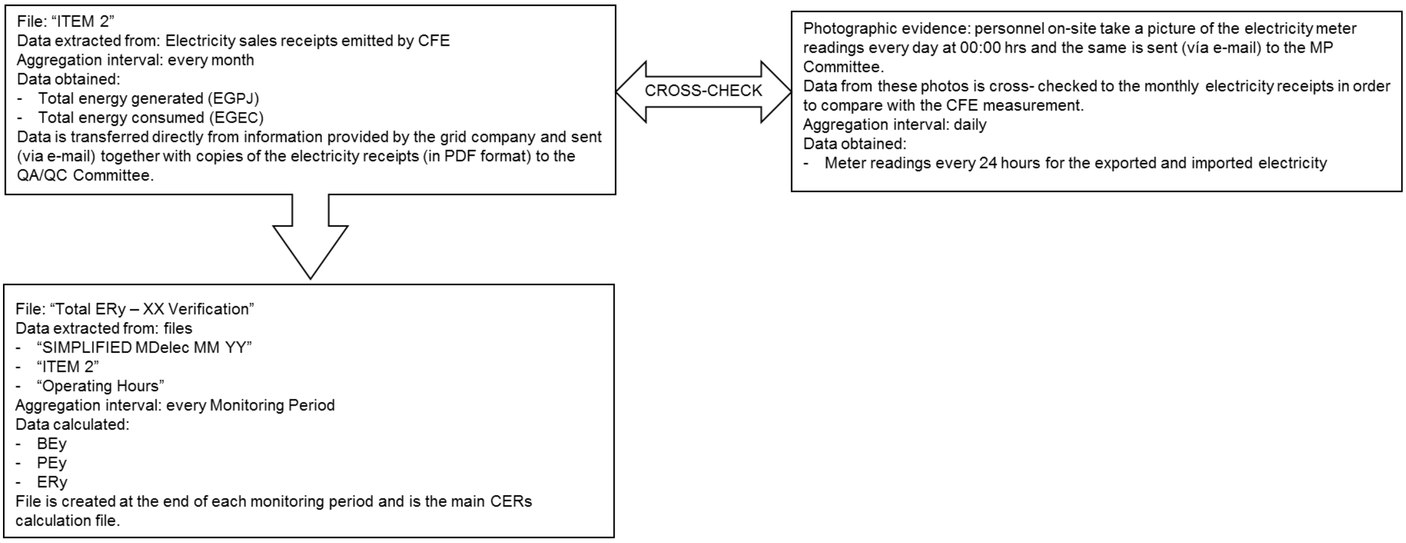
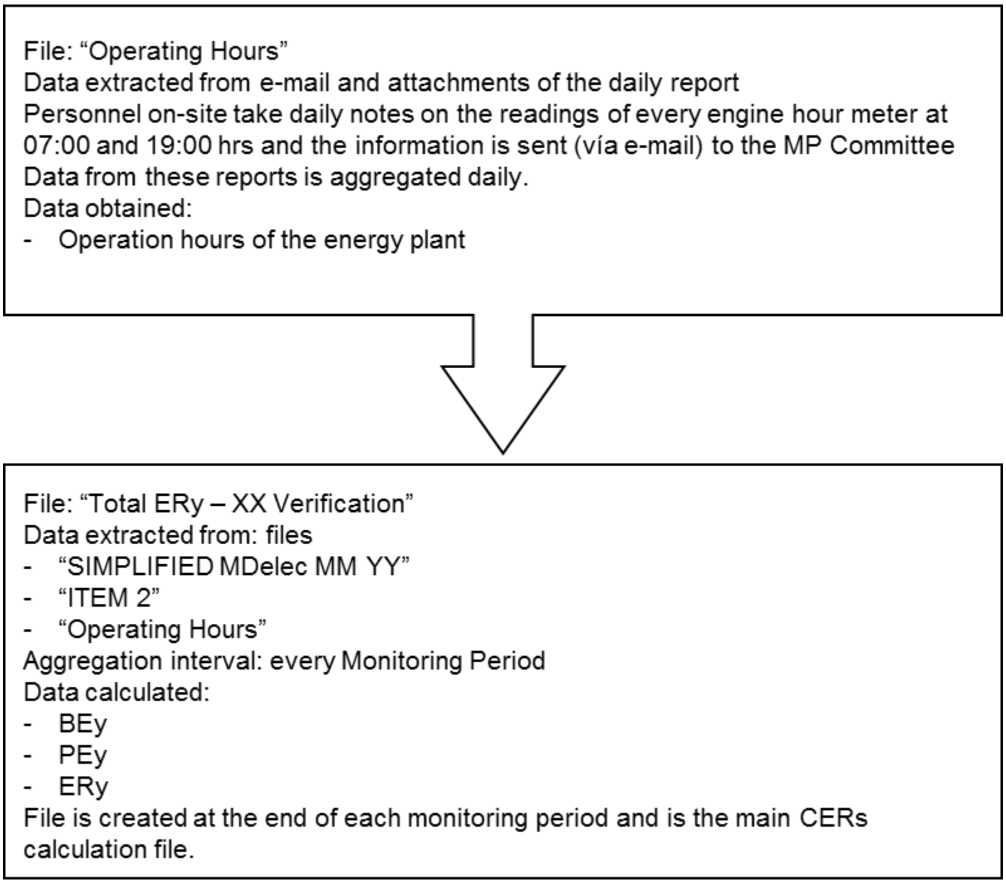


Diagram 4: Collection of parameter Operation hours of the energy plant “OP_j”



Regarding the parameter $\mathbf{MD_{reg}}$ or $\mathbf{F_{CH4,BL}}$, changes related to methane to be destroyed due to regulatory or other requirements are monitored by the MP Committee by means of communication with the relevant authority. Communication is received, confirmed and signed by the authority and

the same is archived at Chihuahua City. The information though recorded annually is used for changes to the parameter $MD_{reg,y}$ at renewal of the credit period.

The ERCP Quality Control and Organizational Structure can be seen below.

Monitoring Plan (MP)

Emissions Reductions Calculation Procedure (ERCP)
Quality Control for Electricity Displacement

Grid Operator

Data:
- Project's monthly generation registered by Grid operator, provided in Excel by Grid Operator via E-mail or CD to the Project Operator.

Project Operator

Data:
Net electricity sold to Grid Operator

The Project Operator will perform monthly recording and check calibration of electric meters periodically. Only one person will be responsible for the ERCP: Mr. Hector Rangel.

Quality of Data Collection:
- Data: Monthly generation from Grid Operator, remaining information from the Project Operator.
- Format: Summarized in Excel.
- Frequency: Monthly

Quality of Data Processing:
- Original Data
- Organized Data
- Entered Data
- Processed Data
- Results

- Monthly calculations involve 5 data points.
- All must be recorded and manipulated in Excel with records of data points and electricity sales receipts.
- Yearly consolidation of monthly calculations.

Quality of Data Storage:
- Prevent Excel version problems by updating Excel software packages every year in PCs used for the ERs calculations
- Keep all data for 2 years after the first crediting period, i.e. for a total of 9 years
- Assign a password to Excel spreadsheets used for the ERCP
- Save the document with the last date in which an alteration was made so that old versions are kept on disc
- Keep all written documentation in a folder that will be provided to the DOE together with the data collected in Excel

Quality of Data Delivery:
- Provide to the DOE the e-mails/CDs through which Data Provider delivered the original data
- Provide to the DOE the sales receipts

Provide to the DOE evidence of all calculations made showing all preliminary versions of spread sheets saved on disc.

Monitoring Plan (MP)

Emissions Reductions Calculation Procedure (ERCP)
Quality Control for Methane Destruction

<u>Flaring Data:</u>

- LFG flared registered by the flow meter (continuous measurement of T and P)
- FE measurement according to the *Tool to determine project emissions from flaring gases containing methane*
- W_{CH4} measured by a continuous gas quality analyzer

<u>Generation Data:</u>

- LFG fed into the electricity generator registered by the flow meter (continuous measurement of T and P)
- W_{CH4} measured by a continuous gas quality analyzer

The Operator will perform monthly recording and check calibration of flow meters periodically. Only one person will be responsible for the ERCP: Mr. Hector Rangel.

Quality of Data Collection:

- Data: All the above from measurement devices.
- Format: Summarized in Excel.
- Frequency: Monthly.

Quality of Data Processing:

- Original Data
- Organized Data
- Entered Data
- Processed Data
- Results

- Monthly calculations involve 5 data points.
- All must be recorded and manipulated in Excel with records of data points.
- Yearly consolidation of monthly calculations.

Quality of Data Storage:

- Prevent Excel version problems by updating Excel software packages every year in PCs used for the ERs calculations
- Keep all data for 2 years after the first crediting period, i.e. for a total of 9 years
- Assign a password to Excel spreadsheets used for the ERCP
- Save the document with the last date in which an alteration was made so that old versions are kept on disc
- Keep all written documentation in a folder that will be provided to the DOE together with the data collected in Excel

Quality of Data Delivery:

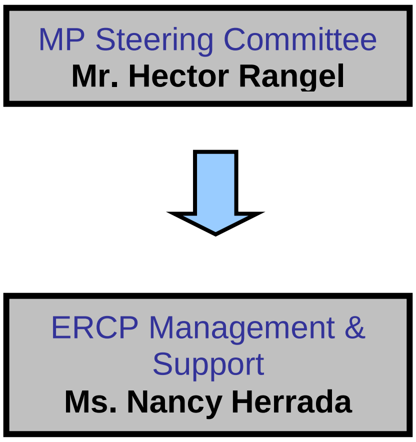
- Provide to the DOE the e-mails/CDs through which Data Provider delivered the original data

Provide to the DOE evidence of all calculations made showing all preliminary versions of spreadsheets saved on disc.

Monitoring Plan (MP)

Emissions Reductions Calculation Procedure (ERCP)

ERCP Organizational Structure:



Appendix 6. Summary report of comments received from local stakeholders

As of date, no formal comments have been submitted by the stakeholders. Specific questions related to benefits for the community, potential environmental risks, and implications of the Project were all addressed at the stakeholder consultation. Overall, the consultation was regarded by the local stakeholders as a positive event where they gathered valuable information on the project activity and the CDM

Appendix 7. Summary of post-registration changes

History of post-registration changes to the project activity that have been approved by the Board before version 5.0 of the PDD:

1. Temporary deviations from registered monitoring plan or applied methodology

A temporary deviation related to the project electricity consumption (ELIMP) was applied and accepted by the Chair of EB on September 09 2011, for the first and second monitoring periods:

A temporary deviation related to the project electricity consumption (ELIMP) was applied and accepted by the Chair of EB for the first and second monitoring periods:

I-DEV0400: Deviation related to the monitoring of the energy consumed for the Cuidad Juarez landfill gas to energy project activity.

I-DEV0401: Deviation related to the monitoring of the energy consumed for the Cuidad Juarez landfill gas to energy project activity.

2. Permanent changes from registered monitoring plan or applied methodology

A post registration change (PRC ref No. PRC-1123-001) was submitted and accepted by the Chair of the EB on September 06 2013[4], which included the following permanent changes from registered monitoring plan:

The Monitoring Plan was updated to include the following parameters:

- Operation hours of the energy plant

3. Corrections

A post registration change (PRC ref No. PRC-1123-001) was submitted and accepted by the Chair of the EB on September 06 2013[39], which included the following correction:

During the transcription of the PDD form version 03 to PDD form version 04.1, was found an inconsistency related to the annual average emissions reduction estimated over the crediting period (tonnes of CO_2e). In the registered PDD on November 30th, 2007, section A.4.4., table 1,

[39] http://cdm.unfccc.int/PRCContainer/DB/prcp686787438/view

stated the annual average emission reductions over the crediting period as 170,499 (tonnes of CO_2e) while on section B.6.4, the same data is reported as 166,912 tCO_2e.

According to the spreadsheet “appendix 4 baseline calculation phase II.xls” public available on http://cdm.unfccc.int/Projects/DB/TUEV-SUED1179241731.11/view, the correct value is 160,361 tCO_2e.

Furthermore, emissions reduction estimation over the second and third crediting period was corrected in section B.6.4 according to the values presented on the registered PDD page 2.

Contact information of project participant was updated as per the updated version of MoC format.

Summary of the post-registration changes proposed in version, 5.0, of the PDD:

Permanent changes:

1. Corrections (under section 8.3.1 of the PS version 01.0)

- To include the recently added PP, BELEKTRON d.o.o. in all relevant sections.
- To delete all the references to the methodology ACM0002, since it is no longer used and applicable to the project activity. As per used ACM0001, version 15, for the second crediting period for the calculation of the emission factor of the grid the methodology ACM0002 has to be changed to the “Tool to calculate emission factor for an electricity system”. All deleted references to ACM0002 came from the initially registered PDD for the first crediting period and could be just deleted since for the second crediting period the mentioned tool completely substitutes this methodology.
- The PP updated the value of GWP of methane, from 21 to 25. According to EB 69, annex 3, all emission reductions achieved in the second commitment period shall be calculated using the GWP as applied by decision 4/CMP. 7. **The increase in the ex-ante ER calculation is due exclusively to this change, specifically in the parameters:**
  “Baseline emissions of methane from the SWDS”, table 9; and
  “Project emissions”, table on section B.6.4.
  Both parameters were recalculated and consequently, ex-ante ER calculations changed all over the document.
- To include further information on how to determine the parameter $F_{CH4,EL,y}$ ex-post. The aim of this inclusion is to add clarity to calculations made in the Monitoring Reports.
- To include parameters $\boldsymbol{\rho_{CH4} = D_{CH4}}$**,** $\boldsymbol{TDL_k}$ and $\boldsymbol{TDL_j}$ in section B.6.2. These parameters are used in the ex-post calculations and are important within the Monitoring Reports; however, they were accidentally not included in this section before.
- To delete the parameter EL_y, which came from the initially registered PDD for the first crediting period, and for this second crediting period is substituted by the parameters: $\boldsymbol{EG_{PJ,y}}$ and $\boldsymbol{EG_{EC,y}}$
- To include monitoring parameters **T**, and **P** in section B.7.1. These parameters are used in the ex-post calculations and are important within the Monitoring Reports; however, they were accidentally not included in this section before.
- In the previous version of the PDD, there were references to files and spreadsheets for the data management, however actually they are no longer in use. The real and actual collection, transfer and processing of data and information is now placed in the PDD. This change is to add accuracy to the actual monitoring process.
- Since the PDD template needs to be updated from version 05.0 to 10.1, the PP included new information requested by the latest PDD template.
- All over the document, changes in the wording and inclusion of further references in order to add clarity to some statements.
- Typo mistakes

2. Permanent deviation of monitoring from the applied methodology (under section 8.3.4 of the PS version 01.0)

- The project applies the methodology ACM0001, version 15, which is tied to clarification AM_CLA_0252, in which it is requested to have one single flow meter for each one of the energy

generators placed in the site. In the case of the project design there is only one flow meter for all the energy generators, i.e. one flow meter measures the total of biogas introduced into the four engines. Therefore, in order to alleviate the lack of flow meters, the PP proposes a permanent deviation from the applied methodology, which consists on the deduction of the accuracy level (1%) of the installed monitoring equipment to the actual measured biogas flow. Please refer to section B.7.3. for the complete explanation and reasons for the change.

SUMMARY of proposed Post-Registration changes in **version 7.0**, of the PDD:

Permanent changes:

1. **Corrections (under section 8.3.1 of the CDM project standard for project activities, version 02.0)**

Parameters: LFG_{total}, LFG_{flared}, $LFG_{electricity}$ and $\rho_{CH4} = D_{CH4}$, have changed in order to comply with the following paragraph of Ruling Note: CDM-PA1123-RULE01:

"(a) The monitoring plan under valid version of the PDD applies standard conditions (STP expressed in Nm3, Normal Cubic Meter unit) for the parameters: LFGtotal, LFGflared, LFGelectricity and DCH4 = ρCH4. However, application of these parameters at standard conditions is not in accordance with the applied version of the methodology and the tool, which require the parameters to be determined at the operating conditions".

Due to an editorial mistake the mentioned parameters are seemed to be applied at standard conditions, however the monitoring is done at operating conditions and further calculations using these parameters are done at operating conditions too, as required by applicable methodology and tool. Therefore the units and conditions are now correctly and accurately indicated in the PDD.

2. **Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents (under section 8.3.4 of the CDM project standard for project activities, version 02.0)**

Also, parameter $\rho_{CH4} = D_{CH4}$ was moved from section B.6.2 Data and parameters fixed ex ante to section B.7.1 Data and parameter to be monitored, in order to fulfil the instructions for completing the PDD form, section B.6.2, specifically: "…Do not include data that are calculated with equations provided in the applied methodologies (tools)…". The parameter was accidentally not included in this section before.

Although the PP is able to implement the registered monitoring plan, and the monitoring plan would not be permanently deviate from applied methodology or tools, the non-conforming is related to the "Instructions for completing the CDM-PDD form" and the alternative is to change the mentioned parameter from section B.6.2 to section B.7.1. Any assumption or discount factor is needed since Emission Reductions will not change due to this permanent change to the registered monitoring plan.

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Document information

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15

Version	*Date*	*Description*
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
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Business Function: Registration
Keywords: project activities, project design document