Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Monterrey I LFG to Energy Project
Version number of the PDD	Version 9
Completion date of the PDD	15 October 2015
Project participant(s)	**Mexico:** Bioenergía de Nuevo León, S.A. de C.V. **Denmark:** International Bank for Reconstruction and Development (IBRD) as a Trustee of Danish Carbon Fund (DCF); Danish Ministry of Climate, Energy and Building/Danish Energy Agency; DONG Naturgas A/S; Nordjysk Elhandel A/S; Aalborg Portland A/S; Maersk Olie og Gas A/S. **Belgium:** Electrabel SA. **Italy:** Enel Trade S.p.A. **Sweden:** Swedish Energy Agency. **Germany:** Statkraft Markets GmbH.
Host Party	**Mexico:** Bioenergía de Nuevo León, S.A. de C.V.
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	**Sectoral Scope 13:** Waste handling and disposal **Selected methodology(ies):** ACM0001 **"**Consolidated baseline and monitoring methodology for landfill gas project activities"- Version 11 "Tool for the demonstration and assessment of additionality" -Version 05.2 "Tool to determine project emissions from flaring gases containing methane"- EB28, Annex 13 "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" - Version 05 "Tool to calculate the emission factor for an electricity system" – Version 02 "Tool to calculate baseline, project and/or leakage

	emissions from electricity consumption" – Version 01
Estimated amount of annual average GHG emission reductions	209,273 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The purpose of the proposed CDM project activity is to maintain, expand and improve the landfill gas (LFG) collection system and electricity generation facilities operated by Bionergia de Nuevo Leon S.A. de C.V (BENLESA) at Monterrey I in Mexico.

The scenario existing prior to the start of the implementation of the CDM project activity is a demonstration project that received grant financing from the Global Environment Facility (GEF). The objective of the GEF project was to develop a demonstration project consisting in the capture of 1million tons of CO2e and was fulfilled in 2007.

The landfill received waste from 1991-2004 (demonstration project) and will receive waste from 2011 to 2013 (landfill expansion). The proposed CDM project activity will maintain, improve and extend the capture of the landfill gas and use it as a fuel for power generation which would otherwise be released to the atmosphere. Furthermore, the proposed project activity will sustain (7.42 MW) and expand (to 8.48 MW) the power generation supplied to the national grid and displace fossil fuel based generation. The process for collection and utilization will consist of a landfill gas extraction and collection system using wells connected to vacuum pumps, a gas cleaning system and gas engines.

Under the baseline scenario, BENLESA will shut down the demonstration phase, sale the existing assets (generators, flares, etc.) and return to the uncontrolled release of LFG in the atmosphere. The proposed CDM project activity includes: the overhaul of the existing biogas engines, the expansion of the landfill site, digging new extraction wells and expanding the electricity generation system.

As demonstrated using financial analysis in Section B.5 of this PDD, this project is not financially attractive without CDM compared to the baseline scenario. The continuation of the current situation is not technically feasible without the additional financing for the overhaul of the engines (required as per the manufacturing specifications), and hence, the most attractive scenario in absence of CDM revenues is the sale of the assets.

The proposed CDM project is expected to reduce greenhouse gases emissions by 209,273 tCO2e per year (on average) during the first crediting period compared to the baseline scenario (i.e., the sale of the engines and release of the LFG to the atmosphere).

The project will contribute to improve solid waste management practices through remediation program for closure of landfills. The main social and environmental benefits from improved landfill gas management practices will be a positive effect on health and local environment. The project will also create employment in the local area and will supply renewable energy to the grid.

The project will contribute to host country’s goals of promoting sustainable development and more specifically:

- Transfer clean and efficient technologies;
- Generate clean renewable energy;
- Create employment opportunities; and
- Improve waste management practices and prevent environmental pollution.

A.2. Location of project activity

A.2.1. Host Party

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Mexico

A.2.2. Region/State/Province etc.

>>
State of Nuevo Leon

A.2.3. City/Town/Community etc.

>>
Monterrey

A.2.4. Physical/Geographical location

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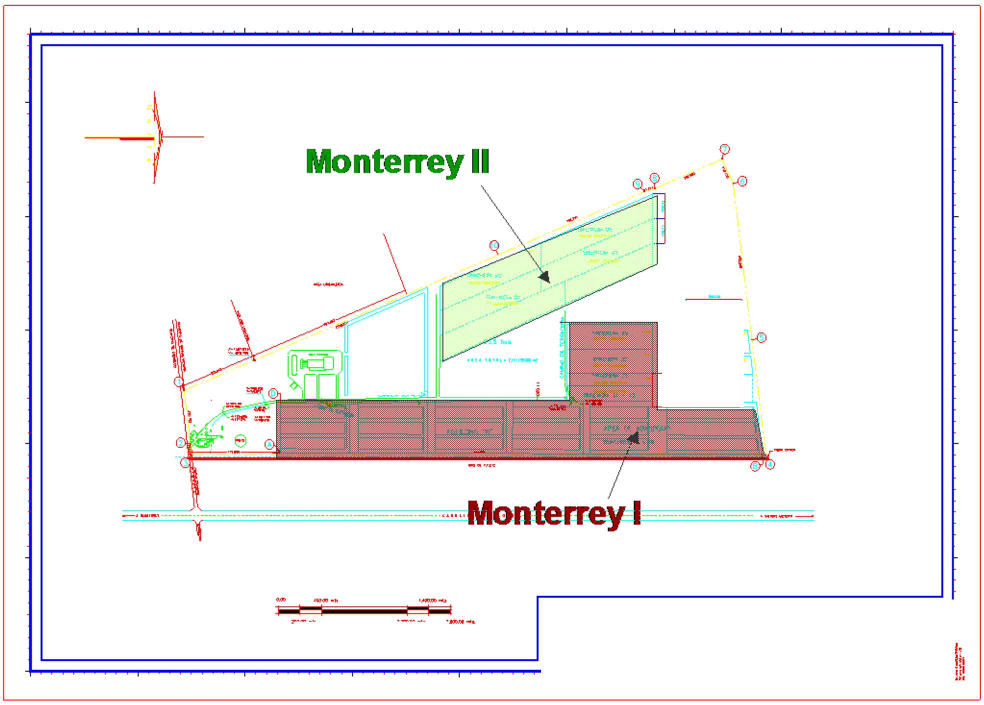
The Monterrey I landfill is located in the north side of Salinas Victoria, Nuevo Leon in the district of Salinas Victoria.

Coordinates of the Monterrey I Project:

Latitude + 25.858611, Longitude - 100.296944



A.3. Technologies and/or measures

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Proposed project activity:

The proposed CDM project activity involves the expansion of the landfill to receive fresh waste, maintenance of the current system (include engine overhaul) and expansion of the landfill gas collection systems and electricity generation facilities at the Monterrey I landfill.

Baseline scenario:

As identified later in sections B.4 and B.5, the baseline scenario consists in the expansion of the landfill to receive fresh waste, shut down of the demonstration phase, sale the existing assets (generators, flares, etc.) and return to the uncontrolled release of LFG in the atmosphere. This is the most attractive scenario given the fact that the overhaul of the engines is necessary for safe operations and thus necessitate further investment. Furthermore, the extraction system needs to be modified for the landfill expansion.

Current situation:

The current facilities for gas extraction, flaring and electricity production were installed in 2003 with financing from the GEF (47% GEF equity financing (grant) and 53% financing from a private investor)[1].

The project was intended to demonstrate the application of the technology and institutional framework necessary for the operation of methane "capture and use" plant in Mexico[2].

[1] Ref: World Bank. January 30, 2007. Implementation Completion and Results Report. Report no: 37925 – ME.

In 2007 the project fulfilled its obligations under the GEF[3] and since then BENLESA has tried to secure CDM revenues[4] in order to sustain, improve and expand its operations. As substantiated in section B.5 of this PDD, the proposed project activity is not financially attractive without CDM revenues compared to the baseline scenario. The continuation of the current situation without further investment is not technically viable[5].

Landfill site:

The demonstration project covers an area of 44 ha. It is estimated that the landfill received a total of 9,623,713 tons of waste from 1991 to 2004[6] of the following composition: 38.42% organic, 15.35% paper and paper board, 2.1% wood waste, 6.53% tissue, 10.01% plastic, 4.28 % glass and 23.31% other[7].

As part of the expansion, the landfill will receive waste deposit from 2011 to 2013 (estimated at 2,250,000 Tons)[8]. The fresh waste will be added on the existing area and thus the delimitation of the landfill area will remain the same (44 ha)[9].

Extraction system:

The gas is extracted and used to generate electricity since 2003. The landfill gas is collected via vertical gas wells (248 wells[10]), located through a modeling process and vacuum pumps.

In order to improve the performances of the actual recovery system, gas field maintenance has been undertaken (i.e., cleaning of gas wells and replacement of valves and manifolds) as per the technical recommendations' of expert[11].

Under the project activity, new wells (approximately 198 wells)[12] will be required to capture the gas following the expansion of the landfill (fresh waste).

The landfill will be covered with clay to prevent the biogas to come out through the landfill surface. Consequently, the conservative value for the LFG collection efficiency has been estimated to be 75%[13].

Landfill gas filtration system:

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[2] Ibid.

[3] Ibid.

[4] Ref: A Project Idea note was prepared in March 2007; a Letter of Intent to develop a CDM project was signed on March 14, 2008. The PDD was published for global stakeholder consultation on January 16, 2008. See detailed project timeline in section B.5.

[5] Overhaul is required after 60,000 hours, ref.: Maintenance Program for JGC 320 GS-L.L issued by Jenbacher for Simeprodeso landfill and E-mail_FW Long Block or Short Block ENGINE CHANGES 2010.doc.

[6] Historic volume of waste.doc, provided by BENLESA and Case studies of CDM-Landfill Gas Projects, Monterrey, Mexico (BENLESA), Presented at Workshop in the World Bank, 19th April 2007.

[7] Ref: Waste characteristic.doc and Simeprode Letter 2010/09/10.

[8] See PDD previously published for historic references to the expansion http://cdm.unfccc.int/

[9] Ref: Simeprode Letter 20100910.

[10] World Bank. January 30, 2007. Implementation Completion and Results Report. Report no: 37925.

[11] Ref: Carbon Trade Ltd., Report of Site Visit, May 2008.

[12] 80% of the existing surface will be used for new waste and thus 198 new wells will be required. Ref: Simeprode Letter 20100910.

[13] Consistent with: US EPA, LFG Outreach program, 2009.

After the extraction, the LFG goes through a cleaning process that dewaters the gas via cooling system and filters. There are three independent cleaning systems.

Additionally, the LFG is sent to a gas filtration system which is a complete activated carbon and dry gas filtration system that minimize the presence of siloxanes and dust particles larger than 3 micron in the landfill gas prior to utilization in gas engines. The siloxane removal system removes silicon organic compounds (siloxanes) and halogen-organic compounds by activated carbon technique from the gas for further utilization in a gas engine. According to the Manufacturer Operation Manual the methane concentration and LFG flow rate are not affected[14].

Electricity generators, grid connection and flare

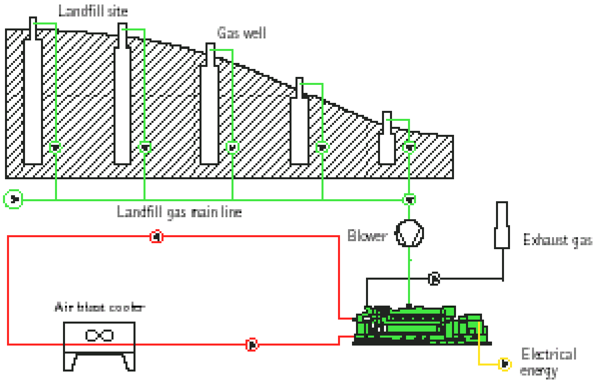
The clean gas is sent to internal combustion gas engines (Jenbacher-GE), consisting in 7 units with a total capacity of 7.42 MW (each unit having a capacity of 1.06 MW).

The gas engines are fitted with air and water coolants, designed to operate at the maximum ambient summer temperature. They are also auto-regulated.

The electricity is generated at 480 volts and 60 Hz. A triphasic transformer station takes the potential to 34,500 volts for delivery to the transmission line.

A remote station provides information on power on line, voltage delivered and frequency to CFE (*Comision Federal de Electricidad* / Electricity Federal Commission), according to regulations.

An on line sensor delivers information of methane burned, equivalent CO_2 abated and electricity generated to the plant site.



The electricity production declined since 2003, with the exception of 2008 due to gas field maintenance (i.e., cleaning of gas wells and replacement of valves and manifolds) [15],[16].

The overhaul of the 7 engines is necessary after 60,000 hours as per the manufacturer manual and recommendations of equipment providers[17]. Thus, the continuation of the current situation is only possible with additional investment.

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14 As per Hofstetter Operating Manual: Siloxane Removal System.

15 As per the technical recommendation of Carbon Trade Ltd., Report of Site Visit, May 2008. Recommendations have been implemented at the exception of the new wells installation and replacement.

16 Ref for declining electricity production: Power production of each Genset from the project starting date to actual date. Power Production (2003-2010).xls.

17 Ref: Overhaul is required after 60,000 hours, ref.: Maintenance Program for JGC 320 GS-L.L issued by Jenbacher for Simeprodeso landfill and E-mail_FW Long Block or Short Block ENGINE CHANGES 2010.doc.

Under the proposed project activity, the current electricity system (7.42 MW) will be expanded to 8.48 MW (adding one engine of 1.06 MW).

The flare system will be open (1 unit) and the maximum capacity will be 3,000 Nm^3/hr[18]. Due to the declining LFG production, the flare system is not expected to be of any use except in case of shutdown of the electricity generating units.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Mexico (host)	Bioenergía de Nuevo León, S.A. de C.V.	No
Denmark	International Bank for Reconstruction and Development as a Trustee of Danish Carbon Fund	Yes
Denmark	Danish Ministry of Climate, Energy and Building/ Danish Energy Agency	Yes
Denmark	DONG Naturgas A/S	Yes
Denmark	Nordjysk Elhandel A/S	Yes
Denmark	Aalborg Portland A/S	Yes
Denmark	Maersk Olie og Gas A/S	Yes
Belgium	Electrabel SA	No
Italy	Enel Trade S.p.A	No
Sweden	Swedish Energy Agency	No
Germany	Statkraft Markets GmbH	No

A.5. Public funding of project activity

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No public funding is involved in this project.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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[18] Ref: Gas Booster Skids.pdf

- ACM0001 **"**Consolidated baseline and monitoring methodology for landfill gas project activities"- Version 11
- "Tool for the demonstration and assessment of additionality" -Version 05.2
- "Tool to determine project emissions from flaring gases containing methane"- EB28, Annex 13
- "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" - Version 05
- "Tool to calculate the emission factor for an electricity system" – Version 02
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" – Version 01

B.2. Applicability of methodology and standardized baseline

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ACM0001-"Consolidated baseline methodology for landfill gas project activities"---Version 11 is applicable to landfill gas capture project activities, where the baseline scenarios are the partial or total atmospheric release of the gas and the project activities include situations the following:

a) The captured gas is flared; and/or
b) The captured gas is used to produce energy (e.g. electricity/thermal energy). Emission reductions can be claimed for thermal energy generation, only if the LFG displaces use of fossil fuel either in a boiler or in an air heater. For claiming emission reductions for other thermal energy equipment (e.g. kiln), project proponents may submit a revision to this methodology;
c) The captured gas is used to supply consumers through natural gas distribution network.

The project activity captures landfill gas and utilizes it for power generation. Therefore, the project activity corresponds to situations a and b. The baseline of proposed project is total release of the landfill gas to the atmosphere.

The "*Tool to determine project emissions from flaring gases containing methane*" EB28, Annex 13 is applicable to projects where residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen and the residual gas to be flared is obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others). The project activity includes the flaring of the residual gas (not used to generate electricity), obtained from decomposition of municipal organic waste and thus the tool is applicable to the project.

The *"Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site"- Version 05* is applicable in cases where the solid waste disposal site where the waste would be dumped can be clearly identified. Under this project activity, the municipal waste (non hazardous) will be deposited in a site that is clearly identified, thus the tool is applicable to the project.

The "*Tool to calculate the emission factor for an electricity system"* - *Version 02* is used to calculate the avoided emissions from grid-connected electricity generation from LFG.

The *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"-Version 01* applied to situations where electricity is consumed in the project, thus this tool is applicable to the project. Furthermore, the Scenario A applied to the project case (i.e., electricity consumption from the grid).

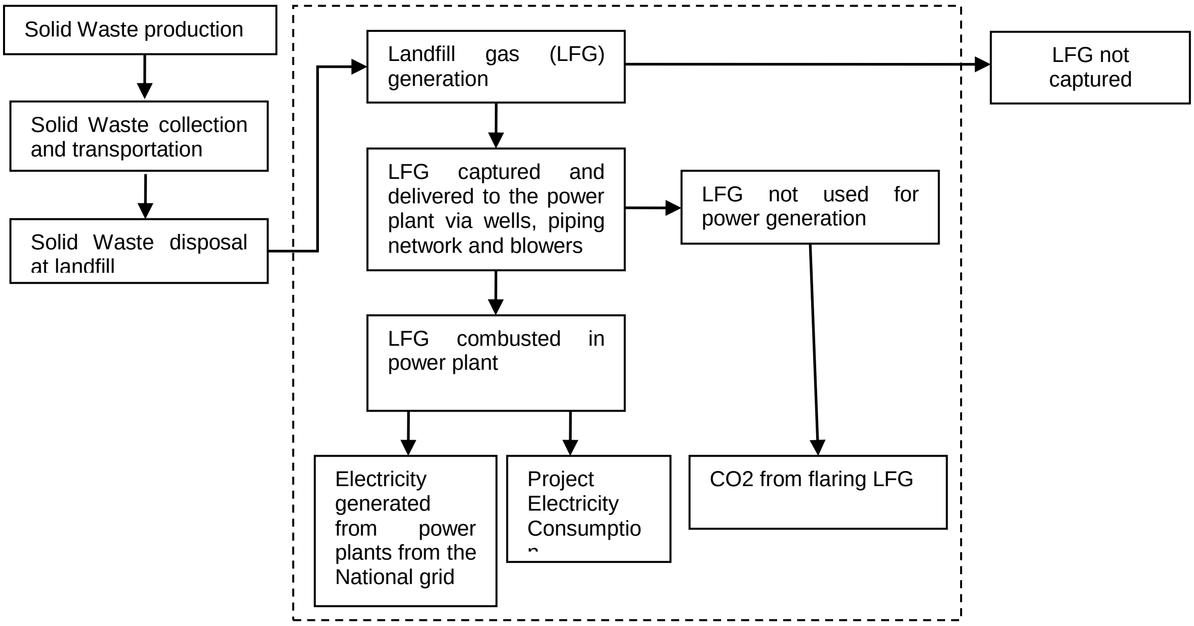
The "*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion"* is not used in this project since no fossil fuel is consumed under the project activity. The "Combined tool to identify the baseline scenario and demonstrate additionality" is not necessary since the additionality is demonstrated using the “Tool for the demonstration and assessment of additionality”.

B.3. Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Emissions from decomposition of waste at the landfill site	CO_2	No	CO_2 emissions from combustion or decomposition of biomass are not counted as GHG emissions.
		CH_4	Yes	Major source of emissions in the baseline.
		N_2O	No	N_2O emissions are small compared to CH4 emissions from landfills. Exclusion of this gas is conservative.
	Emissions from electricity consumption	CO_2	Yes	Electricity generated offsite in the baseline scenario
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Emissions from thermal energy generation	CO_2	No	There is no thermal energy generation included in the baseline scenario.
		CH_4	No	There is no thermal energy generation included in the baseline scenario.
		N_2O	No	There is no thermal energy generation included in the baseline scenario.
Project scenario	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	No	There is no fossil fuel consumed at the site for the extraction, flaring and LFG to energy system, other than for electricity generation
		CH_4	No	N/A
		N_2O	No	N/A
	Emissions from on-site electricity use	CO_2	Yes	Minor - only used when the plant start up in the beginning and after short down period. It has been included (electricity from the grid)
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

The project boundary includes capturing of landfill gas to generate electricity for internal use and for supply to the grid. The project boundary is the site of the project activity where the gas is captured and used. Possible CO_2 emissions resulting from combustion of other fuels than the methane recovered will be accounted as project emissions.

Project boundary



B.4. Establishment and description of baseline scenario

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The baseline scenarios are defined in line with the *version 11 of ACM0001* and *version 05.2 of the "Tool for demonstration and assessment of additionality*".

Step 1a: Identification of alternatives scenarios

The plausible alternative scenarios that are available to the project participants and that provide outputs or services (including the operation of the landfill) with comparable quality, properties and application areas as the proposed CDM project activity include, *inter alia*:

- LFG1: The project activity (i.e. capture of landfill gas and its flaring and/or its use) undertaken without being registered as a CDM project activity;

- LFG2: Atmospheric release of the landfill gas or partial capture of landfill gas and destruction to comply with regulations or contractual requirements, or to address safety and odor concerns.

The project activity (i.e. capture of landfill gas and its use) undertaken without being undertaken as a CDM Project activity (LFG1) is not likely to happen because this activity implies high investment costs and is not financially attractive without being registered as CDM project (refer to the investment analysis in section B.5 of the PDD).

The option LFG2 (i.e., atmospheric release of the landfill gas) is the common practice in Mexico. The partial capture or destruction to comply regulation of the LFG does not apply to the project (refer to the Sub-step 1b: Consistency with mandatory laws and regulations, Section B.4 & the Common practices analysis, Section B.5 of the PDD).

The site is located in an industrial zone[19] and thus safety and odor are not a concern. The GEF obligations have been fulfilled and thus there are no contractual requirements to capture the LFG.

[19] Simeprode Letter 20100910 and Proposals of development of the Municipal Plan of Urban Develoment of Salinas Victoria.

The remaining options for consideration as plausible baseline alternatives are:

- LFG1: The project activity (i.e. capture of landfill gas and its use) undertaken without being registered as a CDM project activity;
- LFG2: Atmospheric release of the landfill gas.

For power generation, the realistic and credible alternatives include, *inter alia*:

- P1: Power generated from landfill gas undertaken without being registered as CDM project activity;
- P2: Existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant;
- P3: Existing or construction of a new on-site or off-site renewable based cogeneration plant;
- P4: Existing or construction of a new on-site or off-site fossil fuel fired captive power plant;
- P5: Existing or construction of a new on-site or off-site renewable based captive power plant;
- P6: Existing and/or new grid-connected power plants.

Since thermal energy (heat) generation is not contemplated as part of the proposed project activity, cogeneration plants are not considered as baseline alternatives; therefore P2 and P3 are discarded.

Construction of a new on-site or off-site fossil fuel fired captive power plant is not economically practical. Since the only electricity consumption at the landfill site comes from the staff office, lighting, control and monitoring equipment and blowers, a very small amount of electricity is needed at the site. Hence, it is clearly more profitable to obtain electricity from the grid connection that already exists nearby the landfill site. Beside, power production is not a core business of the landfill operator that provides solid waste services. Therefore, it can be concluded that scenarios P4, P5 are neither feasible nor plausible baseline scenarios; hence these scenarios are being discarded from further analysis.

Construction of a new on-site or off-site renewable (P5) based captive power plant is not a suitable alternative. On-site renewable power generation such as a wind farm requiring facility construction on the landfill surface would not be viable due to safety and security concerns. Again, the power production is not a core business of the landfill operator.

Power generated from landfill without being undertaken as a CDM Project activity (P1) is not likely to happen because this activity implies high investment costs and is not financially attractive without being registered as CDM project (refer to the investment analysis in section B.5 of the PDD).

Utilization of power produced from the power plants connected to the national Mexican grid is the most likely scenario.

The remaining options for consideration as plausible baseline alternatives for landfill and power generation are:

- P1. Power generated from landfill gas undertaken without being registered as a CDM Project activity.
- P6. Existing and/or new grid-connected power plants.

The remaining options can be reorganised in the following two alternatives applicable to the project context:

Alternative 1: The landfill operator would undertake the proposed project activity –maintain, improve and expand the LFG extraction- without the project activity being registered as a CDM project activity (covered under LFG1 and P1).

Alternative 2: The landfill operator would discontinue the LFG capture, flaring and electricity generation and would sell the equipment still having values. The LFG would then be released to the atmosphere (covered under LFG2 and P6).

The continuation of the current scenario (landfill gas extraction and electricity generation) is not technically feasible without further investment because of the risks associated with the operation of engines without the overhaul[20]. This scenario is thus not considered in this analysis.

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

All the alternatives provided above comply with the laws and regulatory requirements of the country.

Regulation NOM-083-SEMARNAT-2003[21] defines the specifications for environmental protection from the selection, design, construction and operation, monitoring and closure of final disposal sites for urban and special solid waste. This comprehensive regulation defines guidelines for the construction and operation of landfills, and also provides guidance regarding LFG, including recommendations for the collection, utilization and/or flaring of the LFG. However, the regulation does not specify minimum requirements regarding the amount of gas to be collected and utilized or flared. NOM-083-SEMARNAT- 2003 is clearly not enforced in Mexico, as outlined below:

- NOM-083-SEMARNAT-2003 has not been enforced since its adoption. Even the earlier norm (NOM-083-SEMARNAT-1996) which NOM-083-SEMARNAT-2003 replaced, and which only required the active venting of LFG for safety reasons, was not enforced.
- Common practices analysis is clearly showing that sites with LFG recovery and flare and energy production are using financial resources such as CDM or grants.

Given the above, NOM-083-SEMARNAT-2003 has become more of a document outlining policy guidance rather than a regulation to be widely adopted.

In summary, the NOM-083-SEMARNAT-2003 does not indicate a mandatory requirement for LFG capture and flaring, thus the baseline implies LFG venting to the atmosphere, without any active system to capture LFG. Furthermore, there are no financial incentives to support the implementation of LFG capture and sell of electricity to the grid.

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

The project activity sells electricity to the Mexican Grid and therefore the baseline energy source is the electricity produced by the power plants connected to the Mexican grid.

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[20] Overhaul is required after 60,000 hours, ref.: Maintenance Program for JGC 320 GS-L.L issued by Jenbacher for Simeprodeso landfill and E-mail_FW Long Block or Short Block ENGINE CHANGES 2010.doc.

[21] http://www.semarnat.gob.mx/leyesynormas/Normas%20Oficiales%20Mexicanas%20vigentes/NOM-083-SEMAR-03-20-OCT-04.pdf. Accessed in Oct. 2010.

Step 3
Step 2 and/or step 3 of the "Tool for demonstration and assessment of additionality" shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).

An investment analysis is conducted in section B.5 of this PDD on the identified alternatives (*Alternatives 1 and 2*). It is demonstrated that Alternative 2 is the most attractive and thus this is the only remaining alternative.

Step 4
When more than one credible and plausible alternative remains, project participants shall, as conservative assumption, us the alternative baseline scenario that results in the lowest baseline emissions as the most likely scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or contractual requirements should be taken into consideration.

There is only one remaining alternative after Step 3 (i.e., **Alternative 2**), thus Step 4 does not apply.

B.5. Demonstration of additionality

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Starting date of the project activity:

According to the CDM Glossary of term (CDM-Glos-05), the starting date of a CDM project activity is "*the earliest date at which either the implementation or construction or real action of a project activity begins".*

The timeline for this project activity is presented below:

Date	Action	Evidence
21 March 2007	Project idea note reviewed by the Bank	PIN review 2007
2007	GEF obligations fulfilled	Emission reduction report BENLESA, years 2003-2007
16 Jan 08 - 14 Feb 08	Global CDM Stakeholder Consultations[22,23]	UNFCCC website[24]
5 February 2008	Letter of Approval, Mexico	LOA Monterrey 1, 2008.pdf
14 March 2008	Signature of the letter of intent by BENLESA for carbon finance operation	LOI, 2008
29 May 2008	Technical recommendations on gas field maintenance and implementation in May 2008	Visit Notes May 2008.pdf
29 January 2009	purchase order BNL-0758 for an additional GENERATOR	PO BNL-0758.pdf

[22] TUV-SUD was contracted by the World Bank to conduct validation of the Monterrey 1 LFG Energy Project. The validation was put on hold (World Bank communication (email), dated 29 June 2009), until the registration of a similar project (i.e., Jordanian CDM project number 2487, which would also discontinue capture and destruction of LFG and sell equipment in absence of CDM revenues).

[23] PDD was republished for Global CDM Stakeholder Consultations under a new contract with SGS on 05/08/2010.

[24] http://cdm.unfccc.int

	(with reference to CDM) was issued[25]	

Based on the above information, the starting date is established as ***29 January 2009.*** The project is a new project activity (a project activity with a start date on or after 02 August 2008), for which the PDD has been published prior to the start date, therefore the CDM prior consideration does not require further demonstration.

The time of the **investment analysis is established as 2007** based on the above information.

Additionality
The determination of additionality is done using the *"Tool for demonstration and assessment of additionality" - Version 05.2*

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

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

<u>Alternative 1:</u> The landfill operator would undertake the proposed project activity –maintain, improve and expand the LFG extraction- without the project activity being registered as a CDM project activity (covered under LFG1 and P1).

<u>Alternative 2</u>: The landfill operator would discontinue the LFG capture, flaring and electricity generation and would sell the equipment still having values. The LFG would then be released to the atmosphere (covered under LFG2 and P6).

Alternative 2 is the most likely scenario because the landfill owner does have neither the obligations nor financial incentive to continue the current operations, nor to improve and expand the extraction and destruction of LFG. The landfill gas was captured, flared and used to generated electricity in the past due to operator's obligation to the GEF to capture and flare 1 million tons of CO_2e. This obligation was fulfilled in 2007.

The Monterrey I LFG to energy project has been in operation since 2003. The LFG plant was financed with 47% GEF equity financing (grant) and 53% financing from the private investor. The total upfront cost of the project was US$ 11 million for the design and construction of a LFG collection system and a 7.42 MW power plant. Under the terms of GEF grant, the landfill gas operator had an obligation to capture and flare 1 million tons of CO_2e which was fulfilled in 2007. The revenues generated from the sale of the electricity do not cover the costs of the operation and maintenance (refer to the investment analysis). Moreover, there is a need for reinvestment as the generators are due for a major overhaul which would cost around US$ 1,750,000 (see step 2 for details). **There are no other sources of grant financing available neither from the government nor from multinational organizations to absorb some of the reinvestment and operational costs of the project.** Therefore the most likely scenario in the absence of proposed CDM project would be **Alternative 2** where the project sponsor would sell the landfill gas equipment and the generators and the landfill gas would be vented to the atmosphere. The details of financial analysis are provided in the Step 2 below.

[25] On November 5, 2008 it was established that the investment on a new engine was considered attractive by the additional revenues from CER's (Ref: *Sesion de Consejo de Administracion 20081105.pdf* / Session of the Administration Board 20081105.pdf, page 4).

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

As detailed in section B.4, all the alternatives listed in sub-step 1a comply with the laws and regulatory requirements of the host country.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

As per the *"Tool for the demonstration and assessment of additionality" - Version 05.2*, one of three options must be applied for this step: (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 2b. Option II. Investment Comparison Analysis

Proposed CDM project activity includes revenues (from sale of power to the grid) other than CERs. Therefore, **Option II. Investment comparison analysis** will be used.

An investment comparison is undertaken for **Alternatives 1 and 2**using the Net Present Value (NPV) and the following financial parameters:

Alternative 1: The landfill operator would undertake the proposed project activity –maintain, improve and expand the LFG extraction- without the project activity being registered as a CDM project activity.

- Electricity price: US$ 0.1010 per KWh[26];
- Operating & maintenance costs: US$ 0.06146per KWh[27]
- Administration costs: US$ 880,161 per year[28].
- Upfront investment[29]:
    - Gas collection system: US$ 974,318.
    - Pump, burner, monitoring equipment: US$ 598,904.
    - New engine US$ 640,000[30]
- Engines are sold in 2017 and 2019 due to the declining LFG volume and the fair value after 60,000 hours of use (this is conservative).
- Fair value of the new engine in 2017 : US$368,000; fair value of the remaining assets in 2019: US$628,855[31];
- Overhaul of 7 engines, estimated at US$1,750,000;
- Overhaul is required after 60,000 hours.
- Installation of a Siloxane Removal System in 2014: US$552,809[32]
- Tax rate: 28%[33];
- Discount rate: 15%[34];

[26] Average 2007, source: Electricity price & operational and Administrative Costs. xls & cost description.doc

[27] Average 2007, source: Electricity price & operational and Administrative Costs. xls & cost description.doc

[28] Source: invoices paid by the project developer and provided to the DOE at validation

[29] All costs have been evidenced, refer to the Excel financial analysis

[30] Evidenced with data from PDD published in 2008. This is conservative compared to recent quotes received in 2010 (P.O. BNL-0758.pdf dated from 2010).

[31] Fair value is based on 5% depreciation per year. Source: article 41 of the Mexican law on taxes

[32] Source: invoices paid by the project developer and provided to the DOE.

[33] Ref: Mexican law, Art. 10 LISR.pdf

- Investment analysis is run over **12 years** (until 2019). This is justified by the fact that most engines will reach 120,000 hours of operation and thus the end of their technical lifetime. In addition, the LFG gas is declining and thus the electricity sales are no longer covering the operating and maintenance costs (refer to the **Financial analysis** for alternative 1 provided with this PDD).
- Plan load factor: 80.26% (based on the average load factor for 2003-2007, taking a conservative approach. Data: 79% in 2003; 85% in 2004; 84% in 2005; 80% in 2006 and 73% in 2007).

Alternative 2: The landfill operator would discontinue the LFG capture, flaring and electricity generation and would sell the equipment still having values. The LFG would then be released to the atmosphere (covers under LFG2 and P6).

- Sale value of existing equipment: US$2,791,099 (based on cost of US$3,721,465 and cumulated depreciation of 25%[35]).

Sub-step 2c. Calculation and comparison of financial indicators

The financial analysis was carried out for Alternative 1 (maintains, improves and expands the LFG extraction without CDM registration) and Alternative 2 (discontinues the LFG capture, flaring and electricity generation and would sell the equipment still having values).

For Alternative 1 the NPV calculated is US$1,218,850; for the Alternative 2 the incomes from the sale of the equipment are estimated to be no less than US$2,791,099.

Financial Indicators (NPV): The table below shows the NPV rate for all alternatives including the CDM project scenario.

ITEM	Alternative 1	Alternative 2
TOTAL Investment	US$2,213,222	none
Net present value (US$)	US$1,218,850	US$2,791,099

Sub-step 2d. Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters on Alternative 1 (*The landfill operator would undertake the proposed project activity –maintain, improve and expand the LFG extraction- without the project activity being registered as a CDM project activity)*:

- Increase in project revenue (sale of electricity to the grid): +10%
- Reduction in project investment costs: -10%
- Reduction in project running costs (O&M and Administrative costs): -10%
- Increase the residual value of the investment (Fair value): +10%

These parameters were selected as being the most likely to fluctuate over time. Financial analysis was performed altering each parameter by 10% and assessing what impact on the project NPV would be.

NPV – Alternative 1	NPV
NPV Alternative 1 without variation	US$**1,218,850**
Electricity sale to the grid	

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[34] Based on: 1) government treasury bonds (Certificados de Tesoreria, CETES); and 2) the country risk for Mexico. In 2007 on average, the rate for 28 days treasure certificate was 7.19% per year. This is based on the fact that the decision to secure CDM revenues was taken in 2007 (refer to the PIN submission and approval under project timeline). The country risk for Mexico was 8.4% (Sovereign Risk Ratings, Bloomberg database, October 4, 2007). So taking into consideration the risk of 8.4% and the return of 7.04% the minimum return that investors are seeking is about 15.44%. But for conservativeness, it is assumed at 15%.

[35] Annual depreciation rate = 5% (article 41 of the Mexican law on taxes).

+ 10%	US$1,928,642
Investment costs	
-10%	US$1,452,727
O&M, Administrative costs	
-10%	US$2,666,338
Fair value	
+ 10%	US$1,247,449

As provided above, the NPV of Alternative 1 remains lower than the NPV of Alternative 2 (US$2,791,099).

An analysis of the historical evolution of the average price charged by BENLESA to its clients and the evolution of its costs (variable and Fix) between 2004-2007 showed that the variable costs have been increasing every year at a 2% higher rate than the revenues, therefore shrinking the margin over time. That is why the assumption of using the 2007 costs, without increasing the costs over the price over time is a conservative approach. Furthermore, based on the historical analysis is very unlikely that the costs will decrease rather than increase over time.

As for the investment costs, the most recent quotes provided to the DOE shows that the investment costs considered in the Financial Analysis when taking the investment decision were conservative, since they are lower than the recent quotes, making very unlikely the investment costs to decrease in relation to the ones considered in the Financial Analysis.

A sensitivity analysis was also conducted by altering the following parameter on Alternative 2 (*The landfill operator would discontinue the LFG capture, flaring and electricity generation and would sell the equipment still having values).*

- Reduced the selling costs of the equipment: -10%

NPV – Alternative 2	NPV
NPV of alternative 2 without variation	US$ 2,791,099
Fair value	
- 10%	US$ 2,511,989

As provided above, the NPV of Alternative 1 (US$1,218,850) remains lower than the NPV of Alternative 2.

As demonstrated by this sensitivity analysis, the proposed project activity is not the most attractive scenario and without CDM incentive, Alternative 2 would represents the most attractive alternative (selling the equipment and release of gas to the atmosphere).

Step 3 Barrier analysis
Since the additionality is demonstrated using financial analysis, the barrier analysis is not undertaken.

Step 4. Common practice analysis

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

As presented in the table above, there are other LFG recovery projects currently operating in Mexico, but all have been financed through climate change mitigation resources. The common practice for the landfills is thus passive vent of the biogas.

Project name	LFG use	CMD reference
Aguascalientes – EcoMethane Landfill Gas to Energy Project	Landfill to power	0425
Ecatepec – EcoMethane	Landfill to power	0523

Landfill Gas to Energy Project		
Hasars Landfill Gas Project	Landfill to power	1240
Tultitlan - EcoMethane landfill gas to energy project	Landfill to power	1242
Ciudad Juarez Landfill Gas to Energy Project.	Landfill to power	1123
Proactiva Mérida Landfill Gas Capture and Flaring project	Flaring only	1371
Durango - EcoMethane landfill to energy project	Landfill to power	1307
Milpillas Landfill Gas Recovery Project	Flaring	1944
Monterrey II LFG to Energy Project	Landfill to power	2186
Tecamac – EcoMethane Landfill Gas to Energy Project	Landfill to power	2271
Landfill Gas Management Project Puerto Vallarta Landfill site	Flaring	1699
Verde Valle Landfill Gas Project	Flaring	1920

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

As demonstrated above, no similar projects are being developed in the country.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Baseline emissions:

According to the methodology, the following equation should be applied to calculate the baseline emissions:

$$BE_y = (MD_{project,y} - MD_{BL,y}) \times GWP_{CH_4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} + ET_{LFG,y} \times CEF_{ther,BL,y}$$

Where:

BE_y:	=	Baseline emissions in year y (t CO_2e).
$MD_{project,y}$:	=	The amount of methane that would have been destroyed/combusted during the year, n tons of methane (t CH4) in project scenario.
$MD_{BL,y}$:	=	The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tons of methane (t CH4)
GWP_{CH4}:	=	Global Warming Potential value for methane for the first commitment period, 21 t CO_2e/t CH4.
$EL_{LFG,y}$:	=	Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours (MWh).
$CEF_{elecy,BL,y}$	=	CO_2 emissions intensity of the baseline source of electricity displaced, in t CO_2e/MWh.
$ET_{LFG,y}$	=	The quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler/air heater, during the year y, in TJ.

$CEF_{ther,BL,y}$	=	CO2 emissions intensity of the fuel used by boiler/air heater to generate thermal energy which is displaced by LFG based thermal energy generation, in tCO2e/TJ.

The baseline emissions in a given year "y" (BE_y) is the difference between the amount of methane actually destroyed/combusted during the year ($MD_{project,y}$) and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{BL,y}$), times the approved Global Warming Potential value for methane (GWP_{CH4}), plus the net quantity of electricity displaced during the year (EG_y) multiplied by the CO2 emissions intensity of the electricity displaced ($CEF_{electricity,y}$).

The term $MD_{BL,y}$ is equal to zero since the methane would be released to the atmosphere under the baseline scenario (as demonstrated in section B.5). The last term of the equation $ET_{LFG,y} \times CEF_{ther,BL,y}$ is equal to zero since there is no thermal energy produced by the project activity.

Ex-ante estimation of the amount of methane destroyed during the year, in tonnes of methane ($MD_{project,y}$)

Ex-ante baseline emissions are estimated as per **"***Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" version 05, where $BE_{CH4,SWDS,y}$ represents the methane emissions generated during the year *y* from the disposal of waste at the solid waste disposal site during the period from the start of the project activity to the end of the year y (tCO_2e).

As per the tool, $MD_{project,y}$ is evaluated by the following equation:

$$MD_{project,y} = BE_{CH4,SWDS,y}/GWP_{CH4}$$

Where:

$$BE_{CH4,SWDS,y} = \varphi.(1-f).GWP_{CH_4}(1-OX).\frac{16}{12}.F.DOC_f.MCF.\sum_{x=1}^{y}\sum_{j}W_{j,x}.DOC_j.e^{-k_j(y-x)}.(1-e^{-k_j})$$

Where:

$BE_{CH4,SWDS,y}$	=	Methane emissions generated from waste being disposed at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e).
φ	=	Model correction factor to account for model uncertainties (0.9).
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner (0).
GWP_{CH4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period (21).
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste) (0.1).
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5).
DOC_f	=	Fraction of degradable organic carbon (DOC) that can decompose (0.5)
MCF	=	Methane correction factor (1).
Wj,x	=	Amount of organic waste type *j* disposed in the SWDS in the year *x* (tons) (on average 687,408 tons per year between 1991-2004 and 750,000 tons per year between 2011-2013).
DOCj	=	Fraction of degradable organic carbon (by weight) in the waste type *j.*
kj	=	Decay rate for the waste type *j.*
j	=	Waste type category (index).
x	=	Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y).
y	=	Year for which methane emissions are calculated.

The efficiency of the degassing system (75%)[36] which will be installed in the project activity have both been taken into account while estimating the *ex ante* emission reductions.

Ex-post estimation of the amount of methane destroyed during the year, in tonnes of methane ($MD_{project,y}$)

$MD_{project,y}$ will be determined *ex-post* by metering the actual quantity of methane captured and destroyed once the project activity is operational. The methane destroyed by the project activity ($MD_{project,y}$) during a year is determined by monitoring the quantity of methane actually flared and gas used to generate electricity and the total quantity of methane captured.

$$MD_{project,y} = MD_{electricity,y} + MD_{flared,y} + MD_{thermal,y} + MD_{PL,y}$$

Where:

$MD_{electricity,y}$	=	Quantity of methane destroyed by generation of electricity (t CH4).
$MD_{flared,y}$	=	Quantity of methane destroyed by flaring (t CH4).
$MD_{thermal,y}$	=	Quantity of methane destroyed for generation of thermal energy (t CH4).
$MD_{PL,y}$	=	Quantity of methane sent to the pipeline for feeding to the natural gas distribution (tCH4).

There is no thermal energy produced under this project activity and no methane send to a pipeline and thus the previous equation can be simplified to:

$$MD_{project,y} = MD_{electricity,y} + MD_{flared,y}$$

Where:

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$$

Where:

$LFG_{electricity,y}$	=	Quantity of landfill gas fed into electricity generator.
$w_{CH4,y}$	=	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m³ CH4 / m³ LFG)
D_{CH4}	=	Methane density expressed in tons of methane per cubic meter of methane (t CH4/m3 CH4).

The quantity of methane destroyed by flaring (t CH4) is calculated using the following equation:

$$MD_{flared,y} = (LFG_{flare,y} \times w_{CH_4,y} \times D_{CH4,y}) - (PE_{flared,y} / GWP_{CH4})$$

Where:

$LFG_{flare,y}$	=	Quantity of landfill gas fed to the flare(s) during the year measured in cubic meters (m^3).
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in year y (t CO_2e) determined following the procedure described in the *"Tool to determine project emissions from flaring gases Containing Methane".* If methane is flared through more than one flare, the $PE_{flare,y}$ shall be determined for each flare using the tool.

Determination of $PE_{flare,y}$

The landfill uses open flare. According to the "*Tool to determine project emissions from flaring gases containing methane"* - EB 28 Annex 13, in case of open flares, the flare efficiency cannot be measured in a reliable manner (i.e. external air will be mixed and will dilute the remaining methane) and a default value of 50% is to be used provided that it can be demonstrated that the flare is operational (e.g. through a flame detection system reporting electronically on continuous basis)). If the flare is not operational the default value to be adopted for flare efficiency is 0%.

[36] Consistent with: US EPA, LFG Outreach program, 2009.

This tool involves the following seven steps:
STEP 1: Determination of the mass flow rate of the residual gas that is flared
STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas
STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis
STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis
STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis
STEP 6: Determination of the hourly flare efficiency
STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Project participants shall apply these steps to calculate project emissions from flaring ($PE_{flare,y}$) based on the measured hourly flare efficiency or based on the default values for the flare efficiency ($\eta_{flare,h}$). Note that steps 3 and 4 are only applicable in case of enclosed flares and continuous monitoring of the flare efficiency and thus do not apply to this case.

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

$$FM_{RG,h} = \rho_{RG,n,h} \times FV_{RG,h}$$

Where:

$FM_{RG,h}$	=	Mass flow rate of the residual gas in hour h, kg/h.
$\rho_{RG,n,h}$	=	Density of the residual gas at normal conditions in hour h, kg/m^3.
FVRG,h	=	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h, m^3/h.

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \times T_n}$$

Where:

P_n	=	Atmospheric pressure at normal conditions (101 325), Pa
R_u	=	Universal ideal gas constant (8 314), Pa.m^3/kmol.K
$MM_{RG,h}$	=	Molecular mass of the residual gas in hour h, kg/kmol
T_n	=	Temperature at normal conditions (273.15), K

$$MM_{RG,h} = \sum_i (fv_{i,h} \times MM_i)$$

Where:

$fv_{i,h}$	=	Volumetric fraction of component i in the residual gas in the hour h
MM_i	=	Molecular mass of residual gas component i, kg/kmol
i	=	limited to the two main components CH_4 and N_2.

Note that according to the recommendation of the methodological “Tool to determine project emissions from flaring gases containing methane” – EB 28 Annex 13, as a simplified approach, only the volumetric fraction of methane can be measured and the difference to 100% can be considered as being nitrogen (N_2). This option is selected for this project activity.

STEP 2. Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

Not applicable (refer to step 1), the simplified approach was slected, thus only the volumetric fraction of methane is to be measured and the difference to 100% is to be considered as being nitrogen (N_2).

STEP 3. Determination of the volumetric flow rate of the exhaust gas on a dry basis

Step 3 and Step 4 of the *Tool to determine project emissions from flaring gases containing methane* – EB 28 Annex 13 do not apply to open flare.

STEP 4. Determination of methane mass flow rate of the exhaust gas on a dry basis

Step 3 and Step 4 of the *Tool to determine project emissions from flaring gases containing methane* – EB 28 Annex 13 do not apply to open flare.

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

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n}$$

Where:

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

STEP 6 Determination of the hourly flare efficiency

In case of **open flares**, the flare efficiency in the hour h ($\eta_{flare,h}$) is

- 0% if the flame is not detected for more than 20 minutes during the hour h.
- 50%, if the flare is detected for more than 20 minutes during the hour h.

STEP 7. Calculation of annual project emissions from flaring

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$$

Where:

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in year y, tCO_2e
$\eta_{flare,h}$	=	Flare efficiency in hour h
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period, $tCO_2e/tCH4$

As the LFG volumes are declining, most the LFG captured will be used for electricity generation. Flaring will be then limited to shut downs and maintenance operations. For the purpose of the ex-ante estimation it is assumed that the electricity generation will be operational 100% of the time.

Determination of $CEF_{elec,BL,y}$ ($EF_{grid,\ CM,\ y}$)

The Tool to Calculate the Emission Factor for an Electricity System (version 02) is applied to calculate the combined margin emission factor. This section describes how the national emission factor has been determined as a combined margin (CM) based on the instructions for calculating the emission factors of the operating margin (OM) and build margin (BM).

According to the tool the grid emission factor is calculated as per the following seven steps:

STEP 1: Identify the relevant electricity systems.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3: Select a method to determine the operating margin (OM).
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Identify the group of power units to be included in the build margin (BM).

STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

Step 1 - Identify the relevant electricity systems

The proposed project activity will be connected to the national grid of *Mexico*. The national grid emission factor is calculated based on data developed by the Mexican Secretary of Energy (SENER).

The generated electricity is to be used either in the landfill or injected into the national grid. Thus the relevant electricity system for the project activity is the national grid.

Step 2 - Choose whether to include off-grid power plants in the project electricity system

The calculation of the operating margin and build margin emission factor will use the option I of the tool: *Only grid power plants are included in the calculation*.

Step 3 - Select a method to determine the operating margin (OM)

The Tool to Calculate the Emission Factor for an Electricity System provides the following four options to determine the operating margin:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

For the proposed project activity, option (a) (simple OM) has been chosen since the low-cost/must-run sources for Mexico (hydro, geothermal, nuclear and wind) constitute less than 50% of the total generated electricity of the grid for the most recent 5 years (with data available at the time of the PDD publication for global stakeholders). Data are presented in Appendix 3 of the PDD.

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

The simple OM emission factor has been calculated based on a 3-year vintage (2006-2008). The OM is calculated as the generation-weighted emissions per electricity unit of all generating units serving the system, excluding low cost and must-run power plants.

The OM is calculated as follows (Option B), using a 3-year average, since a) there are not adequate data for Option A; b) the low-cost/must-run data are provided by SENER; c) Off-grid power plants are not included (refer to Step 2).

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must run resources and the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y}.NCV_{i,y}.EF_{CO2,i,y})}{EG_y}$$

Where

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year y (tCO2e/MWh)

$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year *y* (mass or volume unit)

$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	= CO2 emission factor of fossil fuel type i in year y (tCO2e/GJ)
EG_y	= Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i	= All fossil fuel types combusted in the project electricity system in year y
y	= The relevant year chosen as per the data vintage (i.e. 2006; 2007 and 2008)

According to the provisions in the monitoring tables of the *Tool to Calculate the Emission Factor for an Electricity System* – Version 02, $EG_{m,y}$ is determined once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (**ex ante option**).

The 3-year vintage OM was calculated using the data of all operational power fossil fuel fired plants supplying electricity to the grid for the years 2006, 2007 and 2008. The data of the plants used in the Operating Margin calculation were provided by SENER. They are presented in Appendix 3.

Step 5 - Identify the group of power units to be included in the build margin (BM)

According to the tool, the sample group of power units m used to calculate the build margin consists of either:

(a) Calculate the build margin emission factor based the set of five power units that have been built most recently; or

(b) Consider the set of power capacity additions in the electricity system that comprises 20% of the system generation (in MWh) and that have been built most recently.

From the above two options, the set of power units that comprises the larger annual generation is to be used.

The most recently built plants of the power grid have generated 51,070 GWh of electricity. This represents 21.8% of the overall electricity generated by all power plants in 2008. An overview of the data on the electricity generation and fuel consumptions of the power plants is presented in Appendix 3.

Accordingly, option b) that comprises the largest generated electricity has thus been used.

In terms of the BM EF, the project participants have chosen Option 1 of the tool consisting of for *the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.*

Step 6 - Calculate the build margin emission factor

The Build Margin emissions factor (BM) is calculated as the generation-weighted average emission factor of the most recently built plants, using the following formula:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} . EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where

- $EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2e/MWh)
- $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
- $EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO2e/MWh)
- m = Power units included in the build margin
- y = Most recent historical year for which power generation data is available

The build margin has been calculated using the electricity data of the most recent year for which the data are available, namely from 2004 to 2008. For the calculation of BM, please refer to Appendix 3.

Step 7 - Calculate the combined margin (CM) emissions factor

The final step in applying the tool is to calculate the combined margin emissions factor. This has been calculated as the weighted average of the emissions factor of the OM and the BM. The formula that has been used to calculate this weighted average emission factor is as follows:

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

Where

- $EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2e/MWh)
- $EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2e/MWh)
- w_{OM} = Weighting of operating margin emissions factor (%)
- w_{BM} = Weighting of build margin emissions factor (%)

As recommended by the tool for projects other than wind and solar projects, the default values of weighted factors w_{OM} = 0.5 & w_{BM} = 0.5 are used.

The official data for the fuels NCV and the latest default values recommended in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for the fuels emissions factors were used to derive the OM and the BM emission factors of the grid.

All the results of the EF calculation are presented in Appendix 3 and summarized as below:

Grid emission factors computation

Designation	**EF in tCO2e/MWh**
« Operating Margin » (OM)	
2006	0.6236
2007	0.5939
2008	0.6300
Average OM on 2006-2008	**0.6155**
« Build Margin » (BM)	**0.3132**
Combined Margin (weighted average OM and BM)	**0.4643**

This value of the Combined Margin emission factor determined ex-ante will be only used for the first crediting period.

Project Emissions

According to the methodology, project emissions are determined by the following:

$PEy = PE_{EC\,y} + PE_{FC\,j\,y}$

Where:
PEEC,y = Emissions from consumption of electricity in the project case.
PEFC,j,y = Project emissions from consumption of heat

This project activity does not involved heat consumption, thus $PE_{FC,j,y} = 0$.

Project emissions from electricity consumption ($PE_{EC,y}$) are calculated following the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption",* version 01.

Scenario A applies to this project activity (i.e., electricity from the grid). Furthermore, the option **A1** has been selected, i.e., the combined margin emission factor will be calculated, using the procedures of the Tool to calculate the emission factor for an electricity system ($EF_{EL,j,y} = EF_{grid,CM,y}$).

The generic approach has been selected for this project activity

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

Where:

$EC_{PJ,j,y}$ = Quantity of electricity consumed by the project activity during the year y (MWh/y)
$EF_{EL,j,y}$ = Emission factor for electricity generation for source j in year y (tCO2e/MWh)
$TDL_{j,y}$ = Average technical transmission and distribution losses for providing the electricity source j in year y
j = sources of electricity consumption in the project

Since electricity consumed is comes from the grid, the emission factor for the national grid ($EF_{EL,j,y}$, = $EF_{grid,CM,y}$ = CEFelec,BL,y) is used and calculated as per the Tool to calculate the emission factor for an electricity system – Version 02, please refer to Appendix 3 for the details.

Leakages
No leakages effects need to be accounted under this methodology.

Emission Reduction
Emission reductions will be calculated as follows:

$$\mathbf{ER_y = BE_y - PE_y}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr).
BE_y = Baseline emissions in year *y* (t CO_2e/yr).
PE_y = Project emissions in year *y* (t CO_2/yr).

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Data / Parameter	**Regulatory requirements relating to landfill gas**
Unit	Norms
Description	-
Source of data	Publicly available information

Value(s) applied	Will be reflected in the AF.
Choice of data or Measurement methods and procedures	The information will be recorded annually, to use it for changes to the adjustment factor (AF) or directly to $MD_{BL, y}$ at the renewal of the credit period.
Purpose of data	Calculation of baseline emissions.
Additional comment	To be recorded annually.

Data / Parameter	**GWP_{CH4}**
Unit	tCO2e/tCH4
Description	Global warming potential of CH4
Source of data	IPCC
Value(s) applied	25
Choice of data or Measurement methods and procedures	Shall be updated accordingly to any future COP/MOP decisions
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**D_{CH4}**
Unit	tCH_4/m^3CH_4
Description	Methane density
Source of data	IPCC
Value(s) applied	0.0007168
Choice of data or Measurement methods and procedures	At standard T and P (0 degrees C and 1,013 bar)
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**$BE_{CH4, SWDS,y}$**
Unit	tCO_2e
Description	Methane generation from the landfill in the absence of the project activity at year y
Source of data	Calculated as per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05

<table>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Year</th><th>$BE_{CH4,SWDS,y}$ (t CO2e)</th></tr>
<tr><td>01/06/2011-31/12/2011</td><td>140,074</td></tr>
<tr><td>01/01/2012-31/12/2012</td><td>262,046</td></tr>
<tr><td>01/01/2013-31/12/2013</td><td>283,712</td></tr>
<tr><td>01/01/2014-31/12/2014</td><td>266,483</td></tr>
<tr><td>01/01/2015-31/12/2015</td><td>250,405</td></tr>
<tr><td>01/01/2016-31/12/2016</td><td>235,395</td></tr>
<tr><td>01/01/2017-31/12/2017</td><td>221,378</td></tr>
<tr><td>01/01/2018-31/05/2018</td><td>86,166</td></tr>
<tr><td>Total</td><td>1,745,659</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>As per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Additional comment</td><td>Used for ex-ante estimation of the amount of methane that would have been destroyed/combusted during the year. The efficiency of the degassing system that will be installed is not considered.</td></tr>
</table>

Data / Parameter	φ
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	As per the “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05*
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**OX**
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	As per the “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05*

Value(s) applied	0.1
Choice of data or Measurement methods and procedures	According to the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05* for managed solid waste disposal sites.
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**F**
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	According to the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05.*
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	**f**
Unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data	According to the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site". – version 05*
Value(s) applied	0
Choice of data or Measurement methods and procedures	All the methane generated was directly vented to the atmosphere prior to the project activity.
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**DOC_f**
Unit	-
Description	Fraction of degradable organic carbon (DOC) that can decompose
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	According to the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05.*
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**MCF**
Unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1
Choice of data or Measurement methods and procedures	According to the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05* for managed solid waste disposal sites this value is to be applied to the Monterrey Landfill as it is an anaerobic managed solid waste disposal site.
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**DOC_j**
Unit	-
Description	Fraction of degradable organic carbon (by weight) in the waste type *j*.
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value(s) applied	The following values for the different waste types *j* are applied: Pulp, paper, Cardboard (other than Sludge): 40% Textiles: 24 % Food and Food Waste, beverages and tobacco (other than sludge): 15% Garden,Yard and Park Waste: 20% Wood & Wood Products: 43%
Choice of data or Measurement methods and procedures	In accordance with *"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05*
Purpose of data	Calculation of baseline emissions.
Additional comment	The values applied are for wet waste.

Data / Parameter	**kj**
Unit	-
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)

<table>
<tr><td>Value(s) applied</td><td>The following values for the different waste types j are applied:
<table>
<tr><th colspan="2">Waste type j</th><th>Tropical (MAT > 20ºC) dry (MAP < 1000 mm)</th></tr>
<tr><td rowspan="2">Slowly Degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.045</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.025</td></tr>
<tr><td>Moderately Degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.065</td></tr>
<tr><td>Rapidly Degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.085</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>In accordance with “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Additional comment</td><td>The values applied are for tropical (MAT> 20°C) and dry (MAP < 1000m) conditions. See Appendix 3 for reference and details</td></tr>
</table>

Data / Parameter	E_{DS}
Unit	%
Description	Efficiency of the degassing system which will be installed in the Project Activity
Source of data	Project Developer
Value(s) applied	75
Choice of data or Measurement methods and procedures	The collection efficiency value considers the physical conditions of this Landfill as well as the capping material (soil cover) used to cover the waste. The 75% is a reasonable conservative factor to differentiate between LFG estimated to be generated (from the pure application of the methodology) and LFG expected to be collected by the Project Developer.
Purpose of data	Calculation of baseline emissions.
Additional comment	This value is consistent with values provided in the US EPA, LFG Outreach program, 2009.

Data / Parameter	W_x
Unit	tons
Description	Total amount of organic waste prevented from disposal in year *x* (tons)

Source of data	Project developer measure: 9,623,713 tons of waste from 1991 to 2004 (Historic volume of waste.doc). Project developer planning and estimate: from 2,250,000 tons (2011 to 2013) (ref: Simeprode Letter 2010/09/10).
Value(s) applied	11.873 million (total)
Choice of data or Measurement methods and procedures	From 1991 until 2004, the weight per year of waste disposed at the landfill is based on the weighted reports. From 2011 until 2013, the waste quantity disposed per year is based on the design capacity of the landfill expansion.
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	$p_{n,j,x}$
Unit	%
Description	Weight fraction of the waste type *j* in the sample *n* collected during the year *x*
Source of data	Sample measurements by project developer
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Based on specific waste composition study done by SIMEPRODESO (Waste characteristic.doc and Simeprode Letter 2010/09/10)
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Waste Composition		
Pulp, paper, Cardboard (other than Sludge)	% of Wet MSW	15.35%
Textiles	% of Wet MSW	6.53 %
Food and Food Waste, beverages and tobacco (other than sludge)	% of Wet MSW	38.42%
Garden,Yard and Park Waste	% of Wet MSW	4.09%
Wood & Wood Products	% of Wet MSW	2.10%

Data / Parameter	MM_{CH4}
Unit	kg/kmol
Description	Molecular mass of methane
Source of data	Constant
Value(s) applied	16.04
Choice of data or Measurement methods and procedures	As per “*Tool to determine project emissions from flaring gases containing methane EB28, Annex 13”*
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	MM_{N2}
Unit	kg/kmol
Description	Molecular mass of nitrogen
Source of data	Constant
Value(s) applied	28.02
Choice of data or Measurement methods and procedures	As per "*Tool to determine project emissions from flaring gases containing methane EB28, Annex* 13"
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	P_n
Unit	Pa
Description	Atmospheric pressure at normal conditions
Source of data	Constant
Value(s) applied	101,325
Choice of data or Measurement methods and procedures	As per "*Tool to determine project emissions from flaring gases containing methane EB28, Annex* 13"
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	R_u
Unit	Pa.m^3/kmol.K
Description	Universal ideal gas constant
Source of data	Constant
Value(s) applied	8,314.472
Choice of data or Measurement methods and procedures	As per "*Tool to determine project emissions from flaring gases containing methane EB28, Annex 13"*
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	T_n
Unit	K
Description	Temperature at normal conditions
Source of data	Constant
Value(s) applied	273.15
Choice of data or Measurement methods and procedures	As per "*Tool to determine project emissions from flaring gases containing methane EB28, Annex 13"*

Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**$EF_{grid,CM,y}$**
Unit	tCO_{2e}/MWh
Description	Combined margin emission factor
Source of data	Refer to Appendix 3
Value(s) applied	0.4643
Choice of data or Measurement methods and procedures	Calculated using the "*Tool to calculate the emission factor for an electricity system. Version* 02".
Purpose of data	Calculation of baseline emissions.
Additional comment	As it is mentioned in other sections of the PDD, this parameter is equivalent to CEFelec,BL,y and $EF_{EL,j,y}$

Data / Parameter	**$EF_{grid,BM,y}$**
Unit	tCO_2e/MWh
Description	Build margin emission factor
Source of data	Refer to Appendix 3
Value(s) applied	0.3132
Choice of data or Measurement methods and procedures	Calculated using the "*Tool to calculate the emission factor for an electricity system. Version* 02".
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	**$EF_{grid,OM,y}$**
Unit	tCO_2e/MWh
Description	Operating margin emission factor
Source of data	Refer to Appendix 3
Value(s) applied	0.6155
Choice of data or Measurement methods and procedures	Calculated using the "*Tool to calculate the emission factor for an electricity system. Version* 02".
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

B.6.3. Ex ante calculation of emission reductions

>>

Baseline Emissions

The ex ante estimate of baseline emissions is estimated following the formula below:

$$BE_y = MD_{project,y} \times GWP_{CH_4} + EL_{LFG,y} \cdot CEF_{elec,BL,y}$$

Calculation of $MD_{Project,y}$

a) Ex-ante estimation of the amount of methane generated by the disposal of waste at a solid waste disposal site during the year ($MD_{Project,y}$) are calculated by:

$MD_{project,y} = BE_{CH4,SWDS,y}/GWP_{CH4}$

Ex-ante estimation of the amount of methane destroyed during the first crediting period:

Year	$MD_{project,y}$ (t CH4)
01/06/2011-31/12/2011	5,003
01/01/2012-31/12/2012	9,359
01/01/2013-31/12/2013	10,133
01/01/2014-31/12/2014	9,517
01/01/2015-31/12/2015	8,943
01/01/2016-31/12/2016	8,407
01/01/2017-31/12/2017	7,906
01/01/2018-31/05/2018	3,077
Total	**62,345**

Ex-ante estimation of grid displacement:

	$EL_{LFG,y}$ (MWh)	Grid displacement (t CO2e)
01/06/2011-31/12/2011	26,907	12,493
01/01/2012-31/12/2012	50,337	23,371
01/01/2013-31/12/2013	54,499	25,304
01/01/2014-31/12/2014	51,189	23,767
01/01/2015-31/12/2015	48,101	22,333
01/01/2016-31/12/2016	45,217	20,994
01/01/2017-31/12/2017	42,525	19,744
01/01/2018-31/05/2018	16,552	7,685
Total[37]	**335,326**	**155,692**

Project Emissions

Project emissions are estimated as per the following formula:

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

[37] Values presented in the PDD are rounded at the unit digits; the sum of the quantities may not be equal to the total reported above. Refer to the Excel sheet provided with this PDD if necessary.

Since the electricity consumed comes from the grid, the emission factor for the national grid is used.

Where:

$TDL_{j,y}$ = 20%

$EC_{PJ,y}$ = 5.77MWh/year

$EF_{El,y}$ = 0.4643 tCO2e/MWh

$PE_{Ec,y}$ = 3.21 tCO2e/year

Emission Reductions

Ex-ante estimation of emission reductions:

Year	Estimation of baseline emissions (tCO2e)	Estimation of project activity emissions (tCO2e)	Estimation of overall emission reductions (tCO2e)
01/06/2011-31/12/2011	117,549	1.88	117,547
01/01/2012-31/12/2012	219,906	3.21	219,902
01/01/2013-31/12/2013	238,088	3.21	238,085
01/01/2014-31/12/2014	223,629	3.21	223,626
01/01/2015-31/12/2015	210,137	3.21	210,134
01/01/2016-31/12/2016	197,541	3.21	197,538
01/01/2017-31/12/2017	185,778	3.21	185,774
01/01/2018-31/05/2018	72,309	1.33	72,308
Total [38] (tonnes of CO2e)	**1,464,936**	**23**	**1,464,913**

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

Estimated ex-ante project emissions and emission reductions[39]:

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
01/06/2011-31/12/2011	117,549	1.88	0	117,547
01/01/2012-31/12/2012	219,906	3.21	0	219,902

[38] Values presented in the PDD are rounded at the unit digits; the sum of the quantities may not be equal to the total reported above. Refer to the Excel sheet provided with this PDD if necessary.
[39] Ibid.

01/01/2013-31/12/2013	238,088	3.21	0	238,085
01/01/2014-31/12/2014	223,629	3.21	0	223,626
01/01/2015-31/12/2015	210,137	3.21	0	210,134
01/01/2016-31/12/2016	197,541	3.21	0	197,538
01/01/2017-31/12/2017	185,778	3.21	0	185,774
01/01/2018-31/05/2018	72,309	1.33		72,308
Total	**1,464,936**	**23**	**0**	**1,464,913**
Total number of crediting years	7			
Annual average over the crediting period	**209,277**	**3**	**0**	**209,273**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter	$LFG_{total,y}$
Unit	Nm^3
Description	Total amount of landfill gas captured at normal temperature and pressure
Source of data	Measured on site (wet basis)
Value(s) applied	24,850,511 (Annual average over the first crediting period)
Measurement methods and procedures	Data will be measured with a thermal mass flow meter and monitored continuously (average value in a time interval not greater than an hour) by the Project Developer. Data to be aggregated monthly and yearly.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	The flow meter will be calibrated as per manufacturer specifications. It will be subject to a regular maintenance, testing and calibration regime in accordance with manufacturer specifications to ensure its accuracy, which is assumed to be above 95%.
Purpose of data	Calculation of project emissions.
Additional comment	Measurement is in normal cubic meter, therefore separate measurement of T and P is not required.

Data / Parameter	$LFG_{flared,y}$
Unit	Nm^3
Description	Amount of landfill gas flared at normal temperature and pressure
Source of data	Measured on site (wet basis)
Value(s) applied	Flaring is expected to be negligible over the first crediting period, as all gas will be sent to generators.

Measurement methods and procedures	Measured with a thermal mass flow meter continuously (average value in a time interval not greater than an hour), data to be aggregated monthly and yearly
Monitoring frequency	Every 5 minutes.
QA/QC procedures	The flow meter will be calibrated as per manufacturer recommendations. It will be subject to a regular maintenance, testing and calibration regime in accordance with manufacturer specifications to ensure its accuracy, which is assumed to be above 95%.
Purpose of data	Calculation of project emissions.
Additional comment	There will be only one flare; $LFG_{flare,y}$ is considered to be equivalent to the variable $FV_{RG,h}$ (volumetric flow rate of the residual gas) as described in the "*Tool to determine Project emissions from flaring gases containing methane*" EB 28 Annex 13 used to determine project emissions from flaring. Measurement is in normal cubic meter, therefore measure of T and P is not required.

Data / Parameter	$LFG_{electricity,y}$
Unit	Nm^3
Description	Amount of LFG sent to power plant at Normal temperature and pressure
Source of data	Measured on site (wet basis)
Value(s) applied	24,850,511 (Annual average over the first crediting period)
Measurement methods and procedures	Measured with thermal mass flow meters continuously (average value in a time interval not greater than an hour), data to be aggregated monthly and yearly
Monitoring frequency	The flow meters will be calibrated as per manufacturer recommendations. It will be subject to a regular maintenance, testing and calibration regime in accordance with manufacturer specifications to ensure its accuracy, which is assumed to be above 95%.
QA/QC procedures	Every 5 minutes.
Purpose of data	Calculation of project emissions.
Additional comment	Measurement is in normal cubic meter, therefore separate measurement of T and P is not required.

Data / Parameter	$PE_{flare,y}$
Unit	tCO_2e
Description	Project emissions from flaring of the residual gas stream in year *y*
Source of data	Project Developer
Value(s) applied	0 (flaring is expected to be negligible over the first crediting period, as all gas will be sent to generators).
Measurement methods and procedures	N/A
Monitoring frequency	Every 5 minutes.
QA/QC procedures	Calculated as per the "*Tool to determine Project emissions from flaring gases containing Methane*" EB 28 Annex 13
Purpose of data	Calculation of project emissions.
Additional comment	As per the "*Tool to determine Project emissions from flaring gases containing Methane"* EB 28 Annex 13

Data / Parameter	$w_{CH4,y}$
Unit	m³ CH_4/ m³ LFG
Description	Methane fraction in the landfill gas (wet basis)
Source of data	Project developer
Value(s) applied	50%
Measurement methods and procedures	Methane content will be measured continuously (average value in a time interval not greater than an hour) with a gas analyser by the Project Developer. Data will be aggregated monthly and yearly.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	The gas analyzer shall be subject to regular maintenance and calibration, based on the manufacturer’s specifications to ensure accuracy, which is assumed to be above 95%.
Purpose of data	Calculation of project emissions.
Additional comment	w_{CH4} is considered to be equivalent to the variable $fv_{CH4,h}$ (Volumetric fraction of the component CH_4 in the landfill gas in the hour h) as described in the “*Tool to determine Project emissions from flaring gases containing methane*” EB 28 Annex 13

Data / Parameter	Operation of the flare
Unit	N/A
Description	Operation of the flare system
Source of data	Project Developer
Value(s) applied	0 = The flare is not operational 1 = The flare is operational
Measurement methods and procedures	The flame detection system will report electronically on a continuous basis, to ensure that credits are not being claimed when the flare is not operational.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	The flame detector will be subject to maintenance in line with manufacturer’s specifications.
Purpose of data	Calculation of project emissions.
Additional comment	If the flame is not detected for more than 20 minutes during the hour h, the flare efficiency in the hour h ($\eta_{flare,h}$) will be 0%. If the flame is detected for more than 20 minutes during the hour *h*, the flare efficiency in the hour *h* ($\eta_{flare,h}$) will be 50%.

Data / Parameter	$fv_{CH4,h}$
Unit	-
Description	Volumetric fraction of component i in the residual gas in the hour h where i = CH_4
Source of data	Measurements by project participants using a continuous gas analyser
Value(s) applied	N/A

Measurement methods and procedures	Continuously. Values to be averaged hourly or at a shorter time interval. Measurement according to the *Tool to determine project emissions from flaring gases containing methane* EB 28 Annex 13. The same basis (i.e, wet) will be 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	Every 5 minutes.
QA/QC procedures	Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard certified gas.
Purpose of data	Calculation of project emissions.
Additional comment	As a simplified approach, project participants have chosen to measure the methane content of the residual gas and consider the remaining part as N_2. Data will be kept for 2 years after end of crediting period or last issuance of CERs for the project activity

Data / Parameter	$FV_{RG,h}$
Unit	m^3/h
Description	Volumetric flow rate of the residual gas at normal conditions in the hour h
Source of data	Project developer using flow meter
Value(s) applied	N/A
Measurement methods and procedures	Continuously, value to be averaged hourly. Same basis (wet) is to be considered for this measurement and the measurement of $\mathbf{fv_{CH4,h}}$.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	Flow meters are to be periodically calibrated according to the manufacturer's recommendation.
Purpose of data	Calculation of project emissions.
Additional comment	Data will be kept for 2 years after end of crediting period or last issuance of CERs for the project activity

Data / Parameter	Other flare operation parameters
Unit	N/A
Description	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer specifications including a flame detector.
Source of data	Project developer
Value(s) applied	-
Measurement methods and procedures	Continuously
Monitoring frequency	Every 5 minutes.
QA/QC procedures	N/A
Purpose of data	Calculation of project emissions.
Additional comment	Applicable to this case using default values for open flare.

Data / Parameter	EL_{LFG}

Unit	MWh
Description	Net amount of electricity generated using LFG.
Source of data	Project Developer
Value(s) applied	47,904(Annual average over the first crediting period)
Measurement methods and procedures	Electricity will be measured continuously using a bidirectional electricity meter property of BENLESA.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	Electricity meter will be subject to regular maintenance and testing in accordance with stipulation of the meter supplier to ensure accuracy. The electricity meter was calibrated initially by the manufactured and it is calibrated every two years in accordance with manufacturer recommendation. The electricity meter is in accordance with national regulation (*Laboratorio de Pruebas Equipos y Materiales "LAPEM"* / Laboratory to test Equipment and Materials, a company of CFE). There are three electricity meters installed in Benlesa, one of them is installed in Monterrey I, the second is installed in the Monterrey II, both electricity meters are property of Benlesa. The third electricity meter is installed in CFE's facility, and is property of CFE. The cross-check of the electricity generated is accomplished by comparing CFE meter information with the sum of net amount electricity meter from Monterrey I plus net amount electricity meter from Monterrey II.
Purpose of data	Calculation of project emissions.
Additional comment	Required to estimate the emission reductions from electricity generation from LFG.

Data / Parameter	Operation of the energy plants
Unit	hours
Description	Operation of the energy plants in a year y
Source of data	Project Developer
Value(s) applied	7,030
Measurement methods and procedures	Data will be recorded annually by the Project Developer to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	Equipment will be maintained in line with manufacturer's recommendations to assure high quality output.
Purpose of data	Calculation of project emissions.
Additional comment	

Data / Parameter	$PE_{EC,y}$
Unit	tCO_2e
Description	Project emissions from electricity consumption by the Project activity during the year y.
Source of data	Calculated as per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" – Version 01
Value(s) applied	3.21

Measurement methods and procedures	As per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" – Version 01
Monitoring frequency	Every 5 minutes.
QA/QC procedures	As per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" – Version 01
Purpose of data	Calculation of project emissions.
Additional comment	N/A

Data / Parameter	$EC_{PJ,j,y}$
Unit	MWh
Description	Onsite consumption of electricity provided by the grid attributable to the project activity during the year y
Source of data	Project Developer
Value(s) applied	5.77 MWh (ex-ante estimate from Project Developer based on meter readings from MTY I between April 2009-May 2010)
Measurement methods and procedures	Electricity will be measured continuously using an electricity meter. Data will be aggregated at least annually as stated in the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" – Version 01.
Monitoring frequency	Every 5 minutes.
QA/QC procedures	Electricity meter will be subject to regular maintenance and testing in accordance with stipulation of the meter supplier to ensure accuracy. Cross-check measurement results with invoices for purchased electricity if relevant.
Purpose of data	Calculation of project emissions.
Additional comment	Required to calculate project emissions

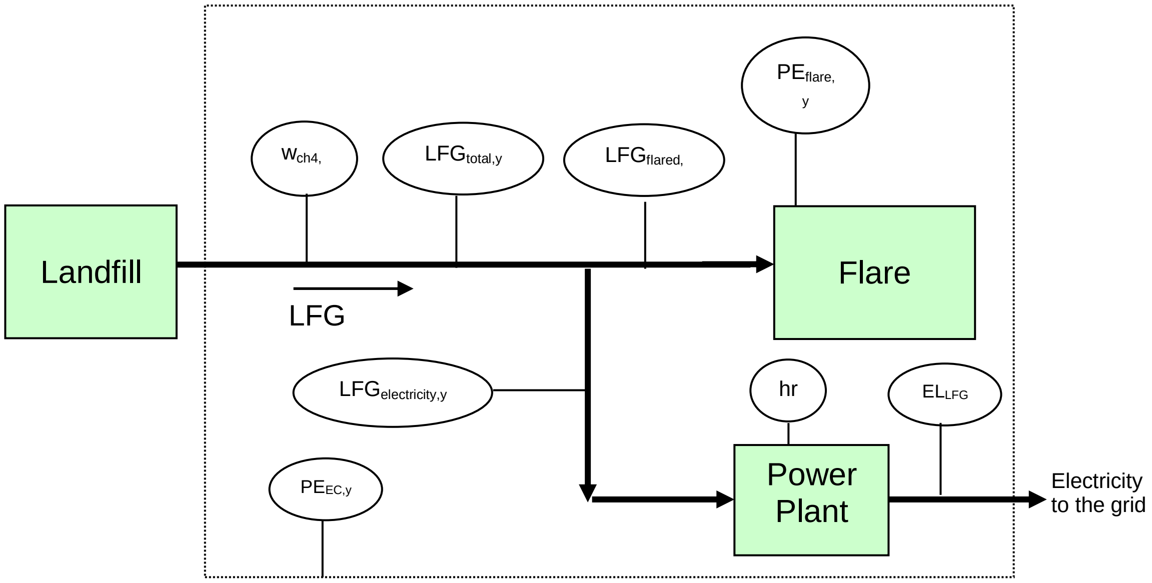
Data / Parameter	TDL_y
Unit	%
Description	Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.
Source of data	Most recent published literature available locally.
Value(s) applied	20% as per the default value according to the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"- Version 01*
Measurement methods and procedures	Reviewed annually as per the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"- Version 01*
Monitoring frequency	Every 5 minutes.
QA/QC procedures	N/A
Purpose of data	Calculation of project emissions.
Aditional comment	Required to calculate project emissions

B.7.2. Sampling plan

>>
Not applicable.

B.7.3. Other elements of monitoring plan

>>
Simplified monitoring diagram (For complete details on required equipment for the measurement of each parameter, please see section B.7.1 above)



Measurements:

$w_{CH4,y}$ = fraction of CH_4 in LFG
$LFG_{Total,y}$ = Amount of landfill gas captured
$LFG_{Flared,y}$ = Amount of landfill gas flared
$LFG_{Electricity,y}$ = Amount of landfill gas used for electricity generation
EL_{LFG} = Net amount of electricity generated and delivered to the grid
$PE_{flare,y}$ = Project emission from flaring of the residual gas stream
$PE_{EC,y}$ = Project emissions from electricity consumption by the project activity
hr = Operation of the energy plants (hours)

According to ACM0001, the parameters below have to be monitored:

- Amount of landfill gas collected (in Nm³, using flow meter), where the total quantity ($LFG_{total,y}$) as well as the quantities fed to the flare ($LFG_{flare,y}$) and the quantity fed to the electricity generator ($LFG_{electricity,y}$) are measured continuously.
- The fraction of methane in the landfill gas ($w_{CH4,y}$) should be measured with a continuous analyzer. Methane fraction of the landfill gas to be measured on wet basis.
- The parameters used for determining the project emission from flaring of the residual stream in year y ($PE_{flare,y}$) should be monitored as per the "*Tool to determine project emissions from flaring gases containing Methane". EB 28, annex 13*.
- The operation of the flare will be monitored with a flame detector to ensure that credits are not being claimed when the flare is not operational.
- The volumetric fraction of the components i (CH_4) in the exhaust gas will be monitored for

the flare efficiency.

- Volumetric flow rate of the residual gas in dry basis at normal (NTP) conditions.
- Other flare operation parameters (as per the manufacturer).
- The net electricity produced and delivered to the grid (MWh) from the generators.
- The operation of the energy plants (hours).
- The quantity of electricity imported from the grid ($EC_{PJ,y}$) will be monitored to calculate the project emission ($PE_{EC,y}$).
- The average technical transmission and distribution losses in the grid in year y.
- Relevant regulations for LFG project activities shall be monitored and updated at renewal of each crediting period. Changes to regulations will be converted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{BL,y}$).

The Monitoring Plan will be implemented by the following parties:

The *project sponsor* BENLESA will oversee the development of the project and will periodically carry out internal audits to assure that project activities are in compliance with operational and monitoring requirements.

The *project operator* BENLESA will adopt the instructions given in the Monitoring Plan and implement all activities related to the implementation of the procedures given in the CDM Operational Manual. The main responsibilities of the operator are related to:

- *Data handling*: maintaining an adequate system for collecting, recording and storing data according to the protocols determined in the MP, checking data quality, collection and record keeping procedures regularly.
- *Reporting*: preparing periodic reports that include emission reductions generated, observations regarding MP procedures.
- *Training*: assuring personnel training regarding the performance of the project activities and the MP.
- *Quality control and quality assurance*: complying with quality control and quality assurance procedures to facilitate periodical audits and verification.

An Operational Manual produced by the *developer* of the project will include procedures for training, capacity building, proper handling and maintenance of equipment, emergency plans and work safety. The details of the Monitoring Plan are provided in Appendix 5.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
The baseline was completed on 5/12/2007 and updated 23/02/2011 by:
Zarina Azizova: zazizova@worldbank.org /Julie Godin: jgodin@worldbank.org / Manuel Luengo (mluengo@worldbank.org) (not Project participants).
World Bank Carbon Finance Unit
World Bank Carbon Finance Unit is a project participant and contact information is provided in Appendix 1.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
29/01/2009 (Evidence: Purchase order BNL-0758 for an additional Generator)

C.1.2. Expected operational lifetime of project activity

>>
12 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
7 year, renewable.

C.2.2. Start date of crediting period

>>
01/06/2011

C.2.3. Length of crediting period

>>
7 years and 0 month.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
Since the project is already in operation and does not require installation of any additional equipment on-site, there is no environmental impact assessment done for proposed CDM Project, The environmental impact assessment was done prior to construction of this site as a GEF project. No negative environmental impacts were identified.

D.2. Environmental impact assessment

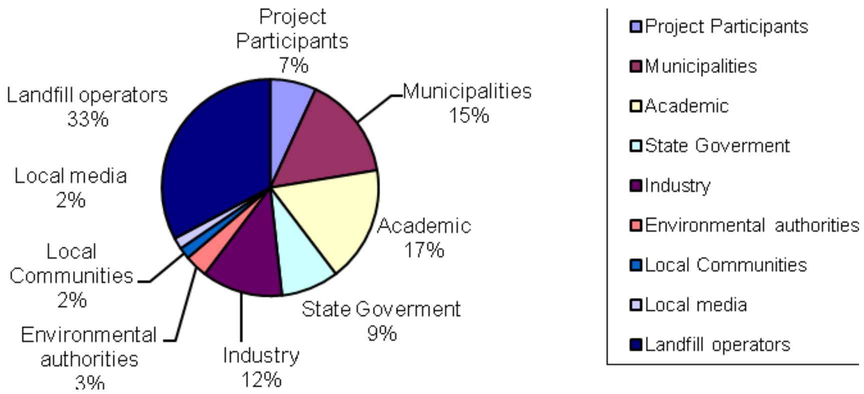
>>
N/A

SECTION E. Local stakeholder consultation

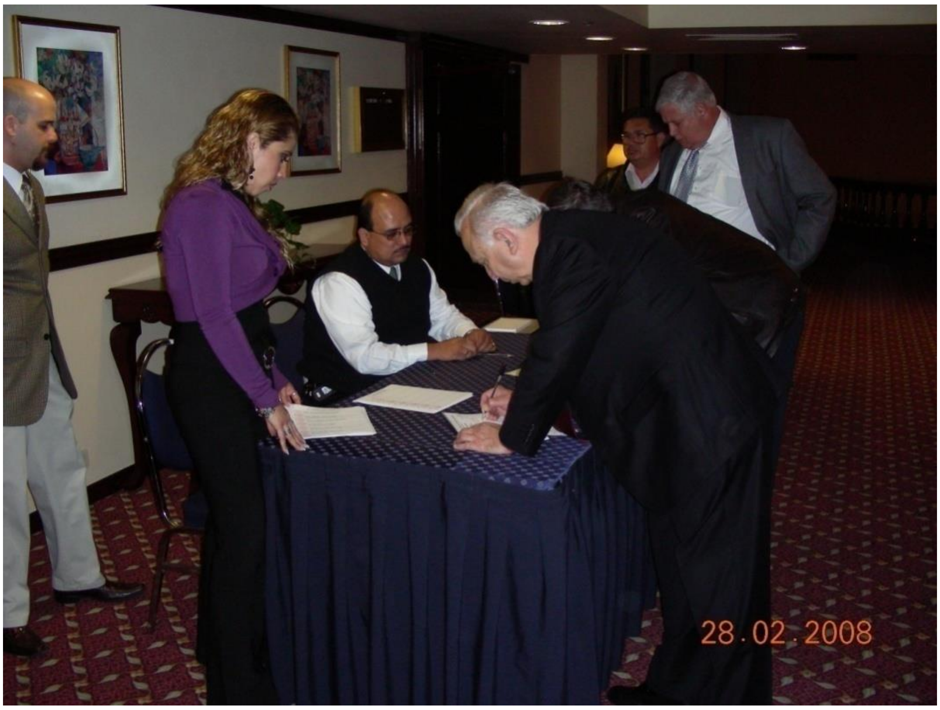
E.1. Solicitation of comments from local stakeholders

>>
Public consultation for the proposed project was held on February 28, 2008 at the "*Diplómaticos* / Diplomatics" room of the Sheraton Ambasador Hotel. The Sheraton Ambasador is a well known hotel located at Monterrey´s downtown. The event was properly announced on Friday 22, February 2008 in the main and most prestigious newspaper in the state of Nuevo Leon "*El Norte* / The North" (see the advertisement below).

This Stakeholders Consultation resulted in a very interesting and rewarding session for all the 62 people attending from local authorities, academia, local media, project participants, industry, local environmental authorities, local communities representatives and members of the community (see the graphic bellow) who were well informed about the: fossil fuels and related CO_2 emissions, climate change issues, electricity rates, biogas, biodiesel, microhidraulics, solar warmers, small windmills generators and the aims of the Kyoto Protocol (CDM). All participants were registered on appropriate formats kept in the project developer's files.



The below pictures show participants at the Stakeholders Consultation, where all the participants demonstrate their deep interest on all the presented topics, and a session aimed at addressing questions posed by the stakeholders.



The event lasted 85 minutes and allowed all the participants understand in a very detailed manner every stage of the Monterrey I LFG to Energy Project. The explanation allowed the attendants understand all requirements and landfill conditions necessary for these projects and something that is very important: the formal and non formal steps one must go through with authorities, labour unions, National Electrical Utility (CFE), etc.

Some attendant people were surprised to know about electricity generation from waste and all other benefits for the community, the environment and everyone else. Everyone expressed interest and support for replication of such CDM projects in México.

E.2. Summary of comments received

>>
During the event and up to date no formal comments have been received from stakeholders. However, some stakeholders raised various questions regarding some project details and steps; all of them were properly answered and explained. Most of the questions were aimed to understand why Monterrey I and Monterrey II were the only projects in this region producing electric energy from biogas.

All members of the community and other participants who attended the public consultation meeting congratulated BENLESA for its courage and ability to overcome all issues in Mexico and making these projects happen. They expressed that “We need more facilities as BENLESA in Mexico”.

E.3. Report on consideration of comments received

>>
No negative comments were received.

SECTION F. Approval and authorization

>>
The letters of approval from Parties for the project activity have been made available at the time of submitting the PDD to the validating DOE for its registration.

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Bioenergía de Nuevo León, S.A de C.V
Street/P.O. Box	Ocampo #429 Pte Centro
Building	
City	Monterrey, N.L., México
State/Region	Nuevo Leon
Postcode	C.P. 64000
Country	Mexico
Telephone	+52 81 8344-2029
Fax	
E-mail	jsaldana@seisa.com.mx
Website	
Contact person	Ing. Jaime Saldana
Title	Director General
Salutation	Mr.
Last name	Saldana
Middle name	
First name	Jaime
Department	
Mobile	+52 81 1044-7240
Direct fax	+52 81 8344-2019
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	International Bank for Reconstruction and Development as Trustee of the Danish Carbon Fund
Street/P.O. Box	1818 H St
Building	
City	Washington, DC
State/Region	District of Columbia
Postcode	20433
Country	USA
Telephone	202-458-1873

Fax	202-522-7432
E-mail	IBRD-carbonfinance@worldbank.org
Website	www.carbonfinance.org
Contact person	Mr. Jose Andreu
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Salutation	Mr.
Last name	Jose
Middle name	
First name	Andreu
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	jandreu@worldbank.org

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Government of Denmark - The Danish Ministry of Climate and Energy/ The Danish Energy Agency
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Fax	+45 3311 4743
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Contact person	Ms. Birgitte OSTERTAG
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Middle name	
First name	Birgitte
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Direct fax	
Direct tel.	+45 3392 6779
Personal e-mail	tma@ens.dk

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	DONG Naturgas A/S
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City	GENTOFTE
State/Region	
Postcode	2820
Country	DENMARK
Telephone	+45 99 55 78 63
Fax	
E-mail	carbon@dongenergy.dk
Website	
Contact person	Harish Saini
Title	
Salutation	
Last name	Saini
Middle name	
First name	Harish
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	HARSA@dongenergy.dk

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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City	Aalborg
State/Region	
Postcode	DK-9000
Country	DENMARK
Telephone	+45 99 39 56 00
Fax	
E-mail	lhb@neasenergy.com
Website	
Contact person	Mr. Soren Agersbaek Jensen
Title	Chief Executive Officer
Salutation	Ms.

Last name	Agersbaek Jensen
Middle name	
First name	Soren
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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Fax	
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Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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Postcode	1263
Country	DENMARK
Telephone	+45 3363 3846
Fax	
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Website	
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Middle name	
First name	Kirstine
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Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Electrabel SA
Street/P.O. Box	Simon Bolivarlaan 34
Building	
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State/Region	
Postcode	1000
Country	Belgium
Telephone	
Fax	
E-mail	
Website	
Contact person	Ms. Katrin Fuhrmann
Title	
Salutation	Ms.
Last name	Fuhrmann
Middle name	
First name	Katrin
Department	
Mobile	
Direct fax	
Direct tel.	

Personal e-mail	Katrin.fuhrmann@gdfsuez.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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City	ROME
State/Region	
Postcode	00198
Country	ITALY
Telephone	
Fax	
E-mail	bos@ens.dk
Website	
Contact person	Mr. Alessandro SAPORI
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Salutation	Mr.
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Middle name	
First name	Alessandro
Department	
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Direct fax	
Direct tel.	+390683054975
Personal e-mail	alessandro.sapori@enel.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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City	Eskilstuna
State/Region	
Postcode	SE-631 04
Country	SWEDEN
Telephone	46-16-544 20 77
Fax	
E-mail	ulrika.raab@swedishenergyagency.se
Website	

Contact person	Ms.
Title	
Salutation	Ms.
Last name	Raab
Middle name	
First name	Ulrika
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Statkraft Markets GmbH
Street/P.O. Box	Statkraft Markets B.V. Gustav Mahlerplein 100
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State/Region	
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Country	The Netherlands
Telephone	
Fax	
E-mail	
Website	
Contact person	Mr. Eric Boonman
Title	
Salutation	Mr.
Last name	BOONMAN
Middle name	
First name	Eric
Department	
Mobile	
Direct fax	
Direct tel.	+31 (0)20 795 7830
Personal e-mail	eric.boonman@statkraft.com

Appendix 2. Affirmation regarding public funding

No public funding is involved in this project.

Appendix 3. Applicability of methodology and standardized baseline

BASELINE INFORMATION

Table 3.1 Site Characteristics

Population (million)	**1.3**
Location	**Salinas Victoria**
Average Temperature (℃)	**22**[40]
Rainfall (mm/year)	**413**[41]
Start up (year)	**1991**
Area (ha)	**26.4**

Table 3.2 Waste Composition

The composition of the waste at SIMEPRODESO is listed on the table on the following page.

Type of Waste	**Percent by weight (degradability)** SD=slowly degradable; MD=moderately degradable RD=rapidly degradable
Cardboard	2.4 (MD)
Coated cardboard	3.1 (MD)
Clothing	6.5 (SD)
Rubber	2.2 (SD)
Tin	2.3
Aluminum	0.85
China and ceramics	0.74
Wood	2.1 (MD)
Construction materials	2.9
Newspaper	3.1 (MD)
Toilet paper	3.6 (MD)
Office paper	3.1 (MD)
Plastic film	6.6 (SD)
Rigid plastic	3.4 (SD)
Polystyrene	1.1 (SD)
Food waste	38.4 (RD)
Garden waste	4.1 (RD)
Glass	4.3
Other	9.3
Rapidly degradable	42.5
Moderately+rapidly degradable	60.0
Total degradable	79.8
Moisture content*	46.6%

[40] Source: Weather underground, yearly average for Nuevo Leon 2009-2010.

[41] Ibid

Emission Factor for Electricity Generation in the Mexican Grid ($EF_{grid,CM}$)

The Tool to Calculate the Emission Factor for an Electricity System (version 02) is applied to calculate the combined margin emission factor. This section describes how the national emission factor has been determined based on the instructions for calculating the emission factors of the operating margin (OM) and build margin (BM).

According to the tool the grid emission factor is calculated as per the following seven steps:

STEP 1: Identify the relevant electricity systems.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3: Select a method to determine the operating margin (OM).
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Identify the group of power units to be included in the build margin (BM).
STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

Step 1 - Identify the relevant electricity systems

The proposed project activity will be connected to the national grid of *Mexico*. The national grid emission factor is calculated based on data developed by the Mexican Secretary of Energy (SENER).

The generated electricity is to be used either in the landfill or injected into the national grid. Thus the project electricity system is the national electricity grid.

Step 2 - Choose whether to include off-grid power plants in the project electricity system

The calculation of the operating margin and build margin emission factor will use the option I of the tool: *Only grid power plants are included in the calculation*.

Step 3 - Select a method to determine the operating margin (OM)

The Tool to Calculate the Emission Factor for an Electricity System provides the following four options to determine the operating margin:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

The methodology tool states that the Simple Operating Margin method can be used where low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The methodology tool further states that low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear, and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

Electricity generation in Mexico is dominated by thermal power plants. Thus, for this project activity, in the calculation of the operating margin emission factor, **option (a) the Simple Operating Margin method has been selected from the four options proposed in the**

methodology. The following table shows that the low-cost/must run resources in Mexico constitute less than 50% of the total grid generation in average of the five most recent years.

Table 3.3 Gross electricity generation in Mexico by type[42] (GWh)

Years	Hydro electric	Thermal	IPP's	Dual	Coal-fired	Nuclear	Geo thermal	Wind-driven	Total
2004	25,076	94,512	45,855	7,915	17,883	9,194	6,577	6	207,019
2005	27,611	93,226	45,559	14,275	18,380	10,805	7,299	5	217,160
2006	30,305	84,432	59,428	13,875	17,931	10,866	6,685	45	223,568
2007	27,042	83,354	70,982	13,375	18,101	10,421	7,404	248	230,927
2008	38,892	79,185	74,232	6,883	17,789	9,804	7,056	255	234,096

Table 3.4 Electricity generation (GWh) for OM emission factor calculation

Year	Low-cost/ must-run generation (GWh)	Total Generation	Low-cost/must-run generation (%)	%
2004	40,853	207,019	19.7%	<50%
2005	45,720	217,160	21.1%	<50%
2006	47,901	223,568	21.4%	<50%
2007	45,115	230,927	19.5%	<50%
2008	56,006	234,096	23.9%	<50%

Note: Low-cost/must-run sources for Mexico include hydro, geothermal, nuclear and wind.

For the Simple OM method, the emissions factor can be calculated using either *ex ante* option or *ex post* option. We choose *ex ante* option given the accessibility of data and simplification with respect to project monitoring and further emission reduction verification.

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

The simple OM emission factor has been calculated based on a 3-year vintage (2006-2008) based on data availability a CDM stakeholder publication. The OM is calculated as the generation-weighted emissions per power plant of all power plants serving the system, excluding low cost and must-run power plants.

Option C for simple OM is used because total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system is available and is calculated as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y}.NCV_{i,y}.EF_{CO2,i,y}}{EG_y}$$

Where

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO2 emission factor in year *y* (tCO2e/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit).
NCVi,y	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

[42] Source: http://www.sener.gob.mx/webSener/res/476/Generation.pdf

$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2e/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plant / units in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation: 2006, 2007 & 2008

According to the provisions in the monitoring tables of the Tool to Calculate the Emission Factor for an Electricity System, $EG_{m,y}$ is determined once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (**ex ante option**).

The 3-year vintage OM was calculated using the data of all operational power fossil fuel fired plants providing electricity to the grid for the years 2006, 2007 and 2008. The data of the plants used in the Operating Margin calculation were provided by SENER.

Table 3.5 Fossil fuel consumption for power generation[43]

Fuel Type	% in 2006	TJ in 2006	% in 2007	TJ in 2007	% in 2008	TJ in 2008
Fuel oil	**32**	**514,738**	**28.9**	**477,531**	**22.7**	**388,093**
Natural Gas Liquids	**6**	**96,513**	**5.3**	**87,575**	**11.5**	**196,611**
Natural Gas	**41**	**659,508**	**46.7**	**771,650**	**47.1**	**805,250**
Diesel	**1**	**16,086**	**0.5**	**8,262**	**0.8**	**13,677**
Coal	**20**	**321,711**	**18.5**	**305,686**	**17.9**	**306,029**
Total	**100**	**1,608,555**	**100**	**1,650,703**	**100**	**1,709,660**

Table 3.6 Net Calorific Value[44] and CO_2 emission factor[45] for each fuel

Type of Fuel	CO2 emission factor (tonCO2/ TJ)	CO2 emission 2006 (tonCO2)	CO2 emission 2007 (tonCO2)	CO2 emission 2008 (tonCO2)
Residual fuel oil	75.5	38,862,689	36,053,560	29,301,008
Natural Gas liquids	58.3	5,626,725	5,105,612	11,462,415
Natural Gas	54.3	35,811,260	41,900,583	43,725,067
Diesel	72.6		599,805	992,971

43 Prospectiva del sector eléctrico 2007-2016, pp.116, Figure 40; Prospectiva del sector eléctrico 2008-2017 pp.148, Figure 39; Prospectiva del sector eléctrico 2009-2024, pp.144, Figure 47

44 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1 of Vol. 2 (Energy), Table 1.2, Pages 1.18 and 1.19

45 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1 of Vol. 2 (Energy), Table 1.4, Pages 1.23 and 1.24

		1,167,811		
Coal	87.3	28,085,370	26,686,359	26,716,344
Total	**/**	**109,553,855**	**110,345,919**	**112,197,805**

The Operating Margin of the project activity is calculated as:

Table 3.7 Operating Margin

OM_{2006}	0.6236
OM_{2007}	0.5939
OM_{2008}	0.6300
$OM_{2006\text{-}2008}$	**0.6155**

From the table above, the $EF_{grid,OMsimple,y}$ is 0. **6155** tCO2e/MWh.

Step 5 - Identify the group of power units to be included in the build margin (BM)

According to the tool, the sample group of power units m used to calculate the build margin consists of either:

(a) Calculate the build margin emission factor based the set of five power units that have been built most recently; or
(b) Consider the set of power capacity additions in the electricity system that comprises 20% of the system generation (in MWh) and that have been built most recently.

From the above two options, the set of power units that comprises the larger annual generation is to be used.

The most recent plants of the power grid have generated 51,070 GWh. This represents 21.8% of the overall electricity generated in 2008. An overview of the data on the electricity generation and fuel consumptions of the power plants is presented in table 3.8 and 3.9 below.

Accordingly, option b) that comprises the largest generated electricity has been used.

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

Step 6 - Calculate the build margin emission factor

The Build Margin emissions factor (BM) is calculated as the generation-weighted average emission factor of the most recently built plants, using the following formula:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} . EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where

- $EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2e/MWh)

- $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
- $EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2e/MWh)
- m = Power units included in the build margin
- y = Most recent historical year for which power generation data is available

The build margin has been calculated using the electricity data of the most recent year for which the data is available, namely from 2004 to 2008. The summation of the power generation of additions accounts for 21.8% of the total power generation in 2008 which is 234,096 GWh[46].

Table 3.8 New power plants installed

Years	Name	Capacity(MW)	Technology	Electricity generated (GWh)	Cumulative electricity (GWh)	Cumulative percentage (%)
2008	Humeros	5.00	GEO	321.00	321.00	0.1
	Ciudad del Carmen	16.00	TG		321.00	0.1
	Ciudad del Carmen	17.00	TG		321.00	0.1
2007	Ecatepec	32.00	TG		321.00	0.1
	Remedios	32.00	TG		321.00	0.1
	Victoria	32.00	TG		321.00	0.1
	Villa de las Flores	32.00	TG		321.00	0.1
	La Venta II	Not included – CDM project				
	Cuautitlán	32.00	TG		321.00	0.1
	Coyotepec	64.00	TG		321.00	0.1
	El Cajón (Leonardo Rodríguez Alcaine)	750.00	HID	1,829.00	2,150	0.9
	Baja California Sur I	79.00	CI	525.00	2,675	1.1
	Tamazunchale	1,135.00	CC	7,700.00	10,375	4.4
	Holbox	1.60	CI		10,375	4.4
	Vallejo	32.00	TG		10,375	4.4
	Santa Rosalía	4.80	CI		10,375	4.4
	Río Bravo (Emilio Portes Gil)*	511.00	CC	268.00	10,643	4.5
2006	Valladolid III	525.00	CC	3,646.00	14,289	6.1
	Tuxpan V	495.00	CC	3,792.00	18,081	7.7
	Altamira V	1,121.00	CC	8,096.00	26,177	11.2
	Los Cabos	27.20	TG		26,177	11.2
	Chihuahua II	619.00	CC	4,113.00	30,290	12.9
	Atenco	32.00	TG		30,290	12.9
2005	Holbox	0.80	CI		30,290	12.9
	La Laguna II	498.00	CC	3,566.00	33,856	14.5
	Río Bravo IV	500.00	CC	2,562.00	36,418	15.6
	Botello	9.00	HID		36,418	15.6
	Baja California Sur I	79.00	CI		36,418	15.6
	Yécora	0.70	CI		36,418	15.6
	Ixtaczoquitlán	1.60	HID		36,418	15.6
	Hermosillo*	93.30	CC		36,418	15.6
2004	Chicoasén (Manuel Moreno Torres)	2,400.00	HID	7,653.00	44,071	18.8
	Rio Bravo III PIE	495.00	CC	957.00	45,028	19.2
	San Lorenzo Potencia	266.00	TG		45,028	19.2

[46] Source: Electricity Sector Prospective 2009-2024.

Years	Name	Capacity(MW)	Technology	Electricity generated (GWh)	Cumulative electricity (GWh)	Cumulative percentage (%)
	Tuxpan (Pdte. Adolfo López Mateos)	2,263.00	TG	6,042.00	51,070	21.8
	El Sauz*	603.00	CC	2,349.00	53,419	22.8
	Guerrero Negro II	10.80	CI		53,419	22.8

Table 3.9 CO_2 emissions of new power plants installed

	Name	Fuel Type	Efficiency	CO2 emission factor (tCO2/TJ)	Fuel Consumption (TJ/GWh)	CO2 emissions (tCO2)	Accumulated CO2 Emissions (tCO2/year)
2008	Humeros	na				-	
	Ciudad del Carmen	GAS		54.3		-	
	Ciudad del Carmen	GAS		54.3		-	
2007	Ecatepec	GAS	39.42	54.3	9.13	-	-
	Remedios	GAS	39.42	54.3	9.13	-	-
	Victoria	GAS	39.42	54.3	9.13	-	-
	Villa de las Flores	GAS	39.42	54.3	9.13	-	-
	La Venta II	na		-		-	-
	Cuautitlán	GAS	39.42	54.3	9.13	-	-
	Coyotepec	GAS	39.42	54.3	9.13	-	-
	El Cajón (Leonardo Rodríguez Alcaine)	na		-		-	-
	Baja California Sur I	COM y GAS	45.07	54.3	7.99	227,705.09	227,705.79
	Tamazunchale	GAS	53.11	54.3	6.78	2,834,110.34	3,061,816.13
	Holbox	COM y GAS	45.07	54.3	7.99	-	3,061,816.13
	Vallejo	GAS	39.42	54.3	9.13	-	3,061,816.13
	Santa Rosalía	COM y GAS	45.07	54.3	7.99	-	3,061,816.13
	Río Bravo (Emilio Portes Gil)*	GAS	53.11	54.3	6.78	98,641.76	3,160,457.89
2006	Valladolid III	GAS	53.11	54.3	6.78	1,341,969.65	4,502,427.54
	Tuxpan V	GAS	53.11	54.3	6.78	1,395,707.32	5,898,134.86
	Altamira V	GAS	53.11	54.3	6.78	2,979,864.58	8,877,999.45
	Los Cabos	GAS	39.42	54.3	9.13	-	8,877,999.45
	Chihuahua II	GAS	53.11	54.3	6.78	1,513,856.60	10,391,856.05
	Atenco	GAS	39.42	54.3	9.13	-	10,391,856.05
2005	Holbox	COM y GAS	45.07	54.3	7.99	-	10,391,856.05
	La Laguna II	GAS	53.11		6.78	1,312,524.35	11,704,380.39

				54.3			
	Río Bravo IV	GAS	53.11	54.3	6.78	942,985.80	12,647,366.19
	Botello	na		-			12,647,366.19
	Baja California Sur I	COM y GAS	45.07	54.3	7.99		12,647,366.19
	Yécora	COM y GAS	45.07	54.3	7.99	-	12,647,366.19
	Ixtaczoquitlán	na		-			12,647,366.19
	Hermosillo*	GAS	53.11	54.3	6.78	-	12,647,366.19
2004	Chicoasén (Manuel Moreno Torres)	na		-			12,647,366.19
	Rio Bravo III PIE	GAS	53.11	54.3	6.78	352,239.43	12,999,605.62
	San Lorenzo Potencia	GAS	39.42	54.3	9.13	-	12,999,605.62
	Tuxpan (Pdte. Adolfo López Mateos)	GAS	39.42	54.3	9.13	2,996,169.86	15,995,775.48

Table 3.10: BM emission factor

Total CO2 emissions (tCO2e) $\sum_{i,m} EG_{m,y}.EF_{EL,m,y}$	15,995,775.48
Electricity generation for BM (GWh) $\sum_{m} EG_{m,y}$	51,070.00
BM emissions factor (tCO2e/MWh)	**0.3132**

Therefore, $EF_{grid,BM,y}$ is 0.3132 CO2/MWh.

Step 7 - Calculate the combined margin (CM) emissions factor

The final step in applying the tool is to calculate the combined margin emissions factor. This has been calculated as the weighted average of the emissions factor of the OM and the BM. The formula that has been used to calculate this weighted average emission factor is as follows:

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

Where

- $EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2e/MWh)
- $EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2e/MWh)
- w_{OM} = Weighting of operating margin emissions factor (%)
- w_{BM} = Weighting of build margin emissions factor (%)

As recommended by the tool for projects other than wind and solar projects, the default values of weighted factors w_{OM} = 0.5 and w_{BM} = 0.5 are used. Thus,

$$EF_{grid,CM} = EF_{grid,OM} \times w_{OM} + EF_{grid,BM} \times w_{BM} = 0.6155 \times 0.5 + 0.3132 \times 0.5 = 0.4643$$

The results of the EF calculation are summarized below:

Table 3.11 Grid CO_2 emission factor (CM)

Designation	EF in tCO_2e/MWh
« Operating Margin » (OM)	
2006	0.6236
2007	0.5939
2008	0.6300
Average OM 2006-2008	0.6155
« Build Margin » (BM)	0.3132
Combined Margin (weighted average OM and BM)	**0.4643**

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

Years	Annual estimation of emission[47] reductions (tons of CO_2e)
01/06/2011-31/12/2011	117,547
01/01/2012-31/12/2012	219,902
01/01/2013-31/12/2013	238,085
01/01/2014-31/12/2014	223,626
01/01/2015-31/12/2015	210,134
01/01/2016-31/12/2016	197,538
01/01/2017-31/12/2017	185,774
01/01/2018-31/05/2018	72,308
Total estimated reductions (tonnes of CO2e)	**1,464,913**
Total crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	**209,273**

[47] Values reported in the PDD are rounded at the unit digits; the sum of the annual emission reductions may not be equal to the total reported above. Refer to the Excel sheet presented with this PDD if necessary.

Appendix 5. Further background information on monitoring plan

Purpose of the Monitoring Plan

In the context of the Clean Development Mechanism (CDM) of the Kyoto Protocol, monitoring describes the systematic surveillance of a project's performance by measuring and recording performance-related indicators relevant to the project or activity. Verification is the periodic auditing of monitoring results, the assessment of achieved emission reductions (ER) and of the project's continued conformance with all relevant project criteria.

This document contains the Monitoring Plan (MP) for the Mexico Monterrey I LFG to Energy Project. It describes the requirements for the collection, processing and auditing of data from the project for the purpose of calculating and verifying the ERs the project has produced.

Calculation of Emission Reductions and Monitoring

The total amount of landfill gas captured will be determined daily by on-site measurements from flow meters and gas analysers. In addition flow meters will measure the amount landfill gas combusted in the power plant. All details on parameters monitored (B.7.1), available at validation (B.6.2) and formulas to calculate emission reductions (B.6.1) are presented in this PDD.

Monitoring Plan Management

Project management responsibility. Information on the Monitoring Manager, the project team, and internal inspection of the LFG capture and flare program are addressed below.

- Monitoring Manager. A competent manager will be assigned responsibility for the monitoring plan and supervision on the collected data. The manager will report monthly about project performance and data. Additionally, the manager will report immediately to senior company management if non-conformance in the performance is detected such as flow meters not working. The Monitoring Manager will be the main contact person for the verifiers, Mexican DNA and any other designated entity, during the crediting period.

- Project Team. The LFG project team will gather, at least monthly, to discuss the performance of the LFG capture and flaring project. Members of the project team will include the Monitoring Manager and the General Manager of the LFG collection system and the power plant. Meetings of the project team can be part of regular meetings, but meeting minutes will be recorded as required. In case of non-conformance, each members of the team will be called in for a project team meeting.

- Internal inspection. The monitoring plan including all defined procedures, reports, data, and personnel will be inspected internally to ensure the monitoring activities are in-compliance. Especially in the beginning of the crediting period, these internal inspections should take place, to guarantee the monitoring procedures.

Training. A training program will be developed for all employees involved in the landfill gas capture and flaring project. The program will define the type and frequency of training. The site’s General Manager will ensure that only trained and skilled staff will work in the project. The training program’s content will depend on the trainees’ background and the function to which each will be assigned. Depending on each staff member’s assignment, they will receive comprehensive information on the general and technical aspects of the gas capture and flaring project.

The technology suppliers will be requested to provide instructions and training to the project staff on the instalment, operation, maintenance and calibration of monitoring equipment. Over time, as staff members change, new employees will be trained by existing staff on these topics.

Data management - Quality control and quality assurance procedures. The project will establish a quality management system that will ensure the quality and accuracy of the measured data, including corrective measures in case of non-conformity. The quality management system will include:

- Gas field monitoring records
  - Daily readings of all field meters will be filled out on paper worksheets or electronically and filed consecutively. All data collected will also be entered on electronic worksheets and stored on a computer system immediately and on discs periodically.
  - Periodic controls of the LFG field monitoring records will be carried out to check any deviations from the estimated ERs following the guidelines for the LFG flare operation and monitoring for correction or future references.
  - Periodic reports to evaluate performance and assist with performance management will be elaborated.

- Monitoring data evaluation
  - Following the main criteria such as use and strict adherence to standard methods, use of non-standard methods only after approved validation, use of standard reporting forms including process measures as well as emission data, etc. to guarantee the data reliable and accurate.
  - A procedure will be developed to define the responsibility of how critical data parameters and possible adjustments or uncertainties will be evaluated and performed.

- Equipment calibration and maintenance.
  - Flow meters, gas analyzers, other critical CDM project equipment will be subject to regular maintenance and testing according to the technical specifications from the manufactures to ensure accuracy and good performance.
  - Calibration of equipment will be conducted periodically according to manufacturer's technical specifications.

- Corrective actions
  - Actions to correct deviations from the Monitoring Plan and the guidelines for LFG capture and flare operation and monitoring will be implemented as these deviations are observed either by the operator or during internal audits.
  - Corrective actions also will be set down in case of equipment or systems malfunction or breakdown.

- Site audits
  - The company's management team for this project will make regular site audits to ensure that monitoring and operational procedures are being observed in accordance with the monitoring plan and the guideline for LFG capture and flare operation and monitoring activities.

- Documents storage
  - List of monitoring equipment (flow meters, gas analyzers, thermometers, etc.), including their numbers, names, manufacturers, specifications, use requirements, etc.
  - Calibration lists and reports, including equipment or parts calibrated, date, method and procedures of calibration, their precision after these procedures, personnel, devices needed, etc.
  - Maintenance lists and reports, including equipment or parts maintained, date, method and procedures of maintenance, their performance after these procedures, personnel, devices needed, etc.

  - Operational manual of the proposed project
  - Meeting minutes of CDM project team meeting
  - Non-conformance reports
  - Worksheets, monthly and yearly
  - Training plan
  - Internal audit/inspection reports, including personnel, time, findings, corrective actions, follow-up inspections
  - Annual monitoring review

- Emergency preparedness for unintended emissions
  - In case of equipment malfunction or breakdown, the timely corrective actions will be carried out to minimize the unintended consequences.
  - Project staff will be trained to appropriately cope with the emergent situations. They will be able to effectively judge an abnormal situation and make a prompt response such as fixing malfunctioned equipment, recording and reporting to the management team in a timely manner.
  - The plant operator will inspect the gas capture and flare system, at least once per week, including all methane-containing parts of the plant (on the surface). All findings will be documented. In case a leakage is found, the leakage will be repaired according to the manufacturer’s recommendations.

Verification. Verification is the focal point of a CDM project and all relevant documents will be in place, archived and accumulated in a Monitoring Report or on-site review by the DOE (verifier), who is verifying the project. The project management team will work closely with the verifier and answer all questions raised by the DOE for the emission reduction verification.

Appendix 6. Summary of post registration changes

On version 9of the PDD, a post registration change has been introduced in section A.3 to reflect the installation of a Hofstetter Siloxane Removal System on 02/06/2014, and therefore update the project design. Also the investment analysis used to demonstrate additionality in Section B.5 has been updated including the cost of the Hofstetter Siloxane Removal System.

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Document information

Version	*Date*	*Description*
06.0	9 March 2015	Revisions 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; • Editorial improvement.
05.0	25 June 2014	Revisions 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;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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