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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Rincón Verde LFGTE Project
Document Version Number 06
Document date: July 21, 2009

A.2. Description of the project activity:

The Rincón Verde Landfil Gas to Energy (LFGTE) Project (hereafter the "Project Activity"), reduces greenhouse gas emissions by avoiding the passive venting of methane from the Rincón Verde landfill. The methane is produced by the decomposition of solid waste in the Rincón Verde landfill that operated from 1975 to 2006, receiving up to 1,200 tonnes/day of Municipal Solid Waste (MSW). The estimated amount of waste disposed in the landfill during its operation is nearly 11 million tonnes. In 2006 a passive venting system was installed as part of the remediation works done at the landfill.
The Project Activity includes the retrofitting of the actual passive venting system with the installation of an active landfill gas (LFG) collection system. The LFG collection system consists of vertical gas wells, horizontal collectors and a blower allowing for optimal degassing efficiency. In conjunction with the active LFG collection system, 6 modular plants for electricity generation will be installed. The expected installed power capacity is 8.2 MWe with an estimated generation capacity of 54,486 MWh each year to fulfil the energy requirements of the Municipality of Naucalpan de Juárez.

In addition to the sustainable development benefits of the Project, the project participants will invest in an existing recreation park known as "Ojo de Agua", located in San Mateo Nopala. The investments include the design and installation of a solar water heating system for the pools. A share of the sales of the CERs from the project will be used for the retrofitting of "Ojo de Agua" recreational park.
As part of the project activity and the social project, 15 local residents will be employed in the construction phase, and 6 additional workers will be fully trained and employed for tasks related to operation, maintenance and surveillance.

A.3. Project participants:

Names of Party Involved	Private and/or public project participants	Does the Party involved wish to be considered as project participant
Mexico (Host)	Tú Transformas - Energías Renovables de México S.A. de C.V. (private entity) Tú Transformas - Energías Renovables, S.L. (private entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Mexico (the “Host Country”)

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

State of Mexico

A.4.1.3. City/Town/Community etc:

San Mateo Nopala

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

The Rincón Verde landfill site is located in the Municipality of Naucalpan, State of Mexico, in the following geographical coordinates: latitude from 19°29’39.31’’ to 19°29’40.76’’ North and longitude 99°17’43.81’’ to 99°17’42.95’’ West at a height of 2,428 meters above sea level as shown in the following image.

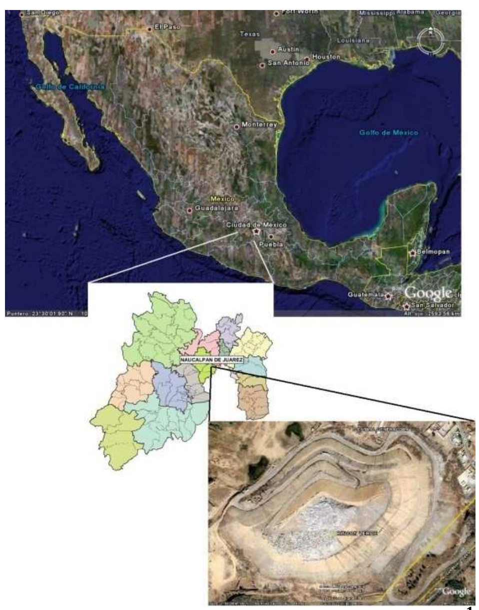

Image 1: Location of Rincón Verde landfill[1]

[1] Sources: Google Earth 2008, Gobierno del Estado de México http://www.edomex.gob.mx/portal/page/portal/edomex/nuestro-estado/regiones-y-municipios

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

Sectoral scope 13: Waste handling and disposal.

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

The Project Activity consists of the following elements:

[1] Active LFG collection system

The Project Activity includes retrofitting of the existing passive venting system into an active LFG collection system with vertical extraction wells, horizontal collectors and blowers that allow for an optimal degassing efficiency of up to 85%[2].

[2] Cogeneration plants

[2.1] Gas motor and synchronous generators

The Project will use Otto-cycle gas engines designed for biogas with a relatively low methane content ranging from 40-100%. The engines include a turbo compressor that uses exhaust gases and double circuit refrigeration of the mixture.[3] A synchronous generator is attached to each gas engine for electricity generation with voltage precision ranges within 1-2.5%.

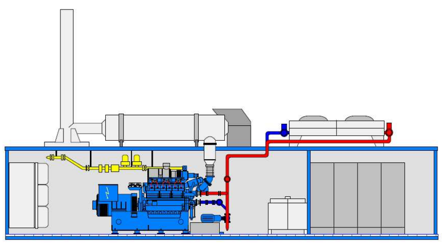

Figure 2: Container including motor and synchronous generator

[2.2] Blower-Torch

The container is divided into 3 sections (blower, high-temperature torch, and control room with gas analyzers) and has the following specifications:

- Oil lubricated blowers with capacity of 4 x 1,500 m^3/h at 3,500 rpm.
- High efficiency torch with flaring temperature of 1,200 °C and a retention time of over 0.3 seconds. The flare has a high methane destruction efficiency.
- Four 62 kW electric engines.
- Container with dimensions Length=12 m, Width=2.45 m, Height=2.6 m

[2] As a conservative approach, for the ex-ante estimation a 75% degassing efficiency was used.

[3] http://en.wikipedia.org/wiki/Turbocharger

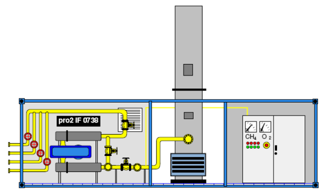

Image 3: Container including blower and flaring station

[2.3] TeleControl

TeleControl station for remote operation and diagnose including:

- On-site substation with telecommunications to remote locations
- Data converter and processor CP341 with TTY interface
- PRO_2 Master Station license for remote accessing.

This technology allows reduction in GHG emissions to the atmosphere by the collection and utilization of LFG and the prevention of passive venting.

[3] Grid Interconnection

[3.1] Power transformers

6 Power transformers (1 for each unit) will be installed on site for grid interconnection.

- Transformation capacity of 2000 kVA for each unit
- Voltage 480/23 kV

[3.2] Medium Voltage overhead line

The utility has a 23 kV grid within an acceptable distance (600 m) from the planned location. A medium voltage overhead line will be installed in order to transport the electricity generated from the Project Activity to the grid.

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

Years	Annual estimation of emission reductions in tonnes of CO_2e
2009[4]	333,656
2010	318,528
2011	304,172
2012	290,547
2013	276,957
2014	263,416
2015	250,560
2016	238,354
2017	226,763
2018	215,757
Total estimated reductions (tonnes of CO_2e)	**2,718,709**
Total number of crediting years	**10**
Annual average of the crediting period of estimated reductions (tonnes of CO_2e)	**271,871**

A.4.5. Public funding of the project activity:

The project will not receive any public funding from Parties included in Annex I of the UNFCCC

[4] Annual estimations for 2009 are presented for the whole year; actual emission reductions for 2009 will count from the starting date of the crediting period.

SECTION B. Application of a baseline and monitoring methodology

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

The following approved baseline and monitoring methodology has been applied to the project:
ACM0001 / Version 11 at EB47, "Consolidated baseline and monitoring methodology for landfill gas project activities"
Additionally the following tools were applied in the elaboration of the present CDM-PDD as indicated in the methodology:

- "Tool for the demonstration and assessment of additionality" Version 05.2 at EB 39
- "Tool to determine project emissions from flaring gases containing Methane" Version 1 at EB 28
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"; Version 01 at EB 39
- "Tool to calculate the emission factor for an electricity system"; Version 1.1 at EB 35
- "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" Version 04 at EB 41

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

The consolidated methodology ACM0001/ v.11 is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include situations such as:

a) The captured gas is flared; and/or
b) The captured gas is used to produce energy (e.g. electricity, thermal energy);
c) The captured gas is used to supply consumers through a natural gas distribution network.

The methodology ACM0001/ v.11 states that it is only applicable if:

a) The most plausible baseline scenario for the landfill gas is identified as either the atmospheric release of landfill gas or the landfill gas is partially captured and subsequently flared (LFG2); and
b) The most plausible baseline scenario for the energy component of the baseline scenario is one of the following scenarios described in the table below:

Table 1: Combinations of baseline options and scenarios applicable to methodology ACM0001/ v.11

SCENARIO	BASELINE			Description of situation
	Landfill gas	Electricity	Heat	
1	LFG2	P4 or P6	H4	The atmospheric release of landfill gas or landfill gas is partially captured and subsequently flared. The electricity is obtained from an existing/new fossil based captive power plant or from the grid and heat from an existing/new fossil fuel based boiler, air heater generating equipment

In the case of the Rincón Verde LFGTE Project, the baseline scenario is the total atmospheric release of the gas (Alternative LFG2), and the Project Activity includes electricity generation as stated in alternative P6 of the methodology. Thus methodology ACM0001/ v.11 is applicable to the Project Activity.

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

As set out in methodology ACM0001/ v.11, the project boundary is the site of the project activity where the gas will be captured and destroyed and/or used. If the electricity for project activity is sourced from the grid or electricity generated by the captured LFG would have been generated by power generation sources connected to the grid, the project boundary is required to include all the power generation sources connected to the grid to which the project activity is connected.

The following diagram illustrates the emission sources and gases both in the baseline scenario and the Project Activity.

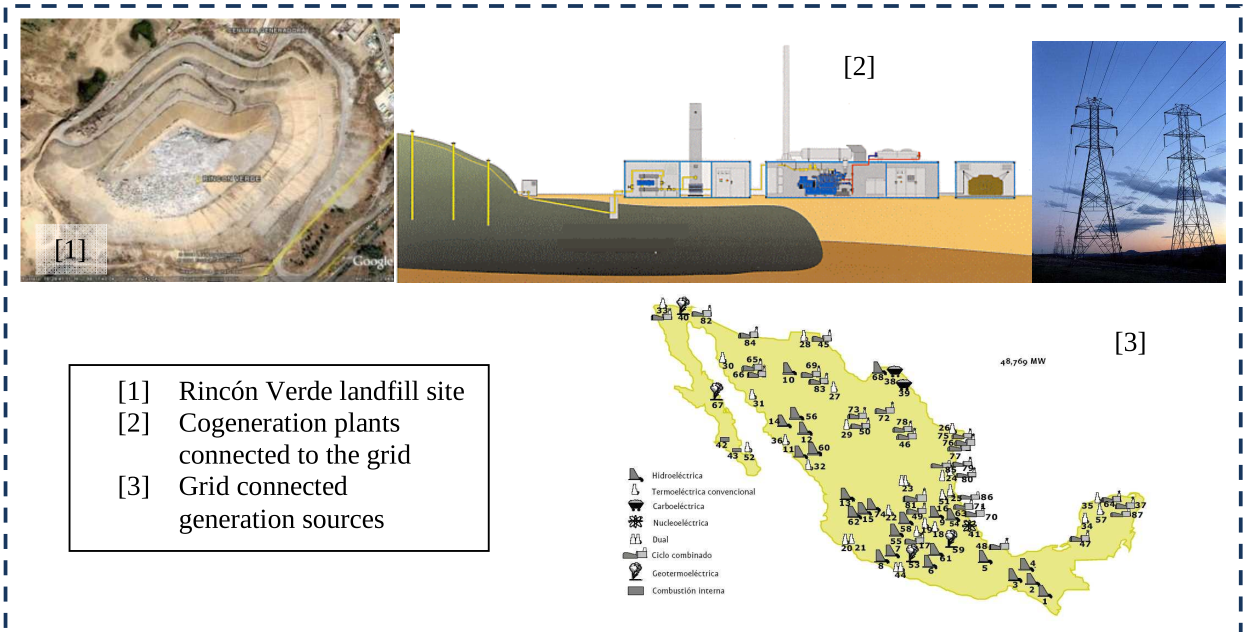

Diagram 1: Project boundary

The following emission sources are considered within the project boundary:

	Source	Greenhouse Gas	Included?	Justification
Baseline	Emissions from decomposition of waste at the landfill site	CH_4	Yes	This is the major source of emissions in the baseline.
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of this gas is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted.
Project Activity	Emissions from on-site electricity use	CO_2	Yes	Are an important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

Table 2: Emission sources considered within the project boundaries

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

Step B.4.1. **The baseline scenario has been identified according to the procedure for the selection of the most plausible baseline scenario as set out under the Methodology.** ***Identification of alternative scenarios***

According to methodology ACM0001/ v.11, step 1 of the "Tool for the demonstration and assessment of additionality" v. 05.2 should be used in order to identify alternative scenarios.

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

Alternatives for disposal/treatment of the waste in the absence of the project activity:

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 odour concerns.

LFG3. The installation of an active collection system and high-efficiency torch for landfill gas flaring without being registered as a CDM project activity

Alternatives for Power generation:

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.

Alternative LFG 3 requires a significant capital investment, and no revenue will be generated. As elaborated below, there are no legally binding mechanisms or incentives encouraging the development of this particular project outside the CDM context. Therefore, Alternative LFG 3 is not a plausible baseline scenario.

On-site or off-site cogeneration or captive power plants using either fossil fuel or renewable energy (Alternatives P2, P3, P4 and P5), are not realistic and credible scenarios.
The project will not generate or utilize thermal energy, therefore alternatives P2 and P3 which contemplate cogeneration (simultaneous generation of electric and thermal energy) are not viable options.
On-site or off-site fossil fuelled captive power plants have higher costs for generating electricity (diesel generator 133.37€/MWh) than the purchasing from the national grid (98.04 €/MWh) therefore not a likely scenario (Alternative P4).

On-site or off-site renewable based captive power plants (Alternative P5) are not realistic options, given the high cost of their implementation. At the specific site, wind and water resources are not available; therefore the alternative would be photovoltaic energy generation. However the cost for installing a photovoltaic system would have higher costs (5,800€/kW for grid connected or 10,800 €/kW off-grid)[5] compared to 1,236€/kW for the project making the option not viable (Alternative P5).

Based on the previous arguments alternatives P2, P3, P4 and P5 can be discarded.

Additionally the Municipality Development Plan does not consider self supplying its electricity for public lighting with any of the previous alternatives (cogeneration or captive power plant)[6].
The business as usual scenario of purchasing the electric energy from the grid is therefore the most plausible (Alternative P6).

Alternatives for Heat generation
No heat generation is intended in the Project Activity since no potential consumers could be identified, and the LFG collected will be used mostly for power generation. Therefore no alternatives for heat generation were analyzed.

Outcome of Sub-step 1a. Realistic and credible alternative scenarios to the project Activity

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.

5 . http://www.iea-pvps.org/products/rep1_17.htm (pg.27)

6 http://www.naucalpan.gob.mx/pdf/PDM2006-2009.pdf

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

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

All the alternatives to the Project Activity identified in the previous section comply with the following related laws and regulations for solid waste and electricity generation:

Mexican laws and regulations regarding solid waste

Political Constitution of Mexico (Constitución Política de los Estados Unidos Mexicanos)

The Political Constitution of Mexico establishes concepts related to environmental protection, natural resources and public health in the following articles:

Article 4: Every person has the right to protect their health and that imbalances in the ecosystem should never affect the population or the individuals;
Article 25: Exploitation of resources should be done taking into account their preservation and the preservation of the environment;
Article 27: Establishes the need to preserve natural resources and to focus in populated areas in order to preserve and restore the equilibrium;
Article 73: Refers to law expediting environmental protection and restoring the ecological equilibrium.

General law for environment protection (Ley General del Equilibrio Ecológico y Protección al Ambiente)

Article 7 Fraction VI: Regulation in terms of collection systems, transportation, storage, treatment and final disposal of solid waste and industrial waste (not including hazardous wastes);
Article 8 Fraction VI: Corresponds to the Municipal authority the application of regulations related to prevention and control of the effects on the environment derived from the collection systems, transportation, storage, treatment and final disposal of solid waste and industrial waste (not including hazardous wastes);
Corresponds to the Municipal authority, according to local regulations and the federal dispositions, the correct collection systems, transportation, storage, treatment and final disposal of solid waste;
Article 136 SEMARNAT will publish regulations regarding the design, construction, operation of sites for final disposition of solid waste;
Article 138 SEMARNAT will promote coordination between state and municipal authorities for solid waste management and generation.

General law for prevention and management of solid waste (Ley General para la prevención y Gestión Integral de los Residuos)

Article 96 Defines actions related to federal and municipal authorities regarding the promotion of reductions of solid waste generation, and management programs in order to protect the environment and population;

Article 97 Refers to the federal regulations for the design, construction and operation of final disposition sites.

NOM-SEMARNAT-083-2003[7]

This technical standard specifies the parameters in order to select, design, construct, operate and monitor, closure and complementary activities of a *new* solid waste disposal site. Regarding existing facilities at the time of publication of the document, it states that a Regularization Program should be presented including the remediation works considered necessary in order to continue with the operation of the disposal site.

The laws and regulations set forth above provide only guidance on MSW management, and the collection flaring and use of the LFG. They do not specify a mandatory amount of LFG to be collected and utilized or flared. Therefore these laws and regulations do not define a mandatory baseline scenario in which LFG capture and destruction is required by law. In addition, the economic limitations of local authorities regarding MSW management hinder the ability to implement LFG capture systems. LFG capture and usage outside the CDM framework is therefore not the prevailing practice in the Host Country.

Mexican law and regulations regarding electricity generation

Political Constitution of Mexico (Constitución Política de los Estados Unidos Mexicanos)

Article 27 Corresponds to the Nation the generation, conduction, transformation, distribution and supply of electric energy for public service.

Electricity Public Service Law (Ley del Servicio Público de Energía Eléctrica)

Article 3 The following modalities are not considered public service:

I. Electricity generation for self-supply cogeneration and small-scale production.
II. Independent Power Producers (IPP) that sell the electricity to CFE
III. Electricity generation for export
IV. Electricity import for self-supply
V. Electricity generation for emergencies and interruptions in the public service

Outcome of Sub-step 1b. Considering that the identified alternatives to the Project activity are consistent with the applicable laws and regulations, none have been eliminated from further consideration and the next steps of the methodology were applied to the outcome of ***Sub-step 1a.***

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

Step B.4.2. Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable.

For the alternative P6 Power generation from existing or new grid connected power plants, the Ministry of Energy (SENER), the state-owned utility Federal Electricity Commission (CFE) and the National Energy Control Centre (CENACE) define the operation policy that includes the series of technologies (and fuels) used for electricity generation. In this context the baseline fuels are identified in the Electricity Sector Prospective published by SENER and are available in abundance since there are no supply constraints in the Host Country.

Step B.4.3. Investment and Barrier Analysis.

Investment Analysis

As specified in the methodology, Step 2 and or step 3 of the "Tool for demonstration and assessment of additionality" shall be used to assess which of the alternatives identified in previous Step B.4.1. As stated in the referred tool, the Investment Analysis (Step 2), is subdivided into the following several sub-steps:

Sub-step 2a. Determine appropriate analysis method

Since the simple cost analysis method (Option I) is not suitable for the project context, and considering that the alternative to the project activity is the supply of electricity from the grid, the benchmark analysis (Option III) was used in the present CDM-PDD.

Sub-step 2b. (Option III) Apply benchmark analysis

As stated in the "Tool for demonstration and assessment of additionality", and considering the Project Activity context the Project IRR was identified as a suitable indicator:

The benchmark, as stated in the tool, was identified as the yield to maturity of the 10 year government bond published by the Central Bank of Mexico (local risk free rate for an appropriate time frame for the project) increased by a suitable risk premium that reflects the additional return to equity in the local market as published by Bloomberg, an independent financial expert. The risk free rate for the Host Country on October 2008 was 8.5% and the country premium was 7.78% resulting in a total expected market return of 16.28%. This is low considering the risk associated with the Project Activity but for the financial analysis could be considered as a suitable benchmark.

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

Project IRR

For the financial comparison, the Project IRR, was chosen as the most representative indicator and the following assumptions were considered:

Table 3: Assumptions for financial indicators evaluation

Assumptions	
Investment '000 €	10,126 €
Exchange Rate [MXP/€][8]	17.38
Electricity Tariff [€/MWh]	98 €/MWh
Wheeling [€/MWh]	46 €/MWh
Distribution Losses [%]	30%
Taxes [%]	28%
Discount rate [%]	12%
Plant Factor [%]	80%
Escalation	5%
Fair Value (after 15 years)	0 €

Although the electric tariff for public services is relatively high[9], the wheeling[10] costs for low voltage, disperse charges in densely populated areas is also elevated since they depend on the electrical losses of the area (ranging 30-35%[11]) as stated in the calculation methodology defined by the Energy Regulatory Commission[12].

Considering that the best practice for financial evaluation takes into account the full lifetime of the project, a 15-year analysis was made in order to evaluate the indicators stated above with the following results. The Project IRR obtained was **7.28%** which is low considering the risk related to the Project Activity and would lead to a negative investment decision[13]. According to official sources the rate for risk-free investments (In an appropriate time frame for the project), 10 Year Government Bond that pays **8.5%[14]** and Bloomberg publications that suggest a rate of **7.78%**, the implementation is not justified without the CDM revenues.

On the other hand, considering the CDM revenues, the Project IRR would be **33.60%**, which is acceptable considering the risk involved in the Project Activity and would lead to a positive investment decision.

Sub-step 2d. Sensitivity Analysis

For the sensitivity analysis, the relevant parameters chosen were the Plant Availability (Plant Factor), electricity tariffs (including wheeling), the exchange rate MXP/€ and the Capital expenditure (CAPEX). The following table presents the positive and negative impacts in the Project IRR, NPV and B/C ratio:

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[8] Banco de Mexico, March 2008.

[9] http://www.cfe.gob.mx/aplicaciones/ccfe/tarifas/tarifas/Tarifas.asp

[10] http://en.wikipedia.org/wiki/Wheeling_%28electric_power_transmission%29

[11] http://www.sener.gob.mx/webSener/res/304/PDF-LFC/LFC%20-%20PERDIDAS%20DIST.pdf

[12] Comisión Reguladora de Energía CRE (Energy Regulation Commision) http://www.cre.gob.mx/documento/1330.pdf

[13] KHATIB, Hisham, Financial and Economic Evaluation of Projects in the electricity supply industry, IEE.

[14] (October 2008) http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarSeries

Table 4: Sensitivity Analysis

		Plant Load Factor		Electricity Tariffs		Exchange Rate		CAPEX		Distribution Losses	
	Base	**+10%**	**-10%**	**+10%**	**-10%**	**+10%**	**-10%**	**+10%**	**-10%**	**10%**	**-10%**
IRR	7.28%	10.46%	2.81%	13.59%	-1.16%	3.27%	10.83%	5.52%	9.35%	1.64%	11.26%
NPV [M€]	-2,079.2	-713.2	-3,785.5	759.8	-5,010.0	-3,617.3	-545.7	-3,091.8	-1,066.6	-4,159.2	-347.0
B/C ratio	0.9487	0.9834	0.9015	1.0183	0.8736	0.9063	0.9874	0.9256	0.9730	0.9024	0.9911

As shown in, even with positive impacts such as a 10% increment in the electricity tariff (almost 2 times last year´s annual increment and a very unlikely scenario), the IRR would be lower than the benchmark and considering the risk involved in the Project Activity and would lead to a no investment decision.

With a positive 20% variation in the Plant Factor, which would lead to an availability of 96%, the IRR would be 13.95% which is still lower than the benchmark.

With a 20% variation in the exchange rate, leading to a value of 13.90 MXP/€, the IRR would be 14.58% still lower than the benchmark. This scenario is unlikely to happen, since this exchange rate has not been available since October 2006 and since then the rate has been constantly climbing up to values over 19 MXP/€[15]

With 20% variation in the CAPEX, that would lead to a value of 8,101 M€, the IRR would be 11.85%, still lower than the benchmark. This scenario is unlikely to happen, since the costs used in the analysis are within the market value for this kind of projects.

From this analysis we can conclude that in every case the Project IRR is lower than the benchmark and in any case the Project Activity could not be considered as financially attractive, leading to the conclusion that the CDM revenues would be the only factor that would encourage the realization of the Project Activity.

Outcome of Investment Analysis: From the analysis of the Project IRR, it can be concluded that the Project Activity is not financially attractive without the CDM revenues and would lead to a no investment decision.

Although the “Tool for demonstration and assessment of additionality” suggests proceeding to the Common practice analysis, it was decided to present the Barrier Analysis in order to clarify certain concepts.

[15] Central Bank of Mexico (Banxico) http://www.banxico.com.mx/PortalesEspecializados/tiposCambio/

Barrier Analysis

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

[1] *Prevailing Practice:*

- In terms of electricity generation in the Host Country, the Energy Regulatory Commission (CRE) has granted 724 electricity generation permits, and only one is using LFG[16] as primary fuel[17]. In a further analysis we identified that from the 724 permits, 82 are similar in scale to the Project Activity (from 6-10 MW of installed capacity), and from this list we identified that 67 projects (82%) are fossil fuel based, 13 projects (16%) include imports, small-scale renewable and cogeneration and 2 projects (2%) include biogas (only 1 LFG) as primary fuel.
- The Host Country, is rich in oil and gas reserves, and the national policy indicates that fossil fuel based technologies will continue to be preponderant in the system as shown in table 5 [18]

Table 5: Capacity Additions 2006-2016

Technology	Capacity (MW)	%
Natural Gas Combined Cycle	12,184	45%
Hydroelectric	3,709	14%
Coal	3,478	13%
Geothermal	158	1%
Turbogas	379	1%
Internal Combustion	71	0%
Wind Power	589	2%
Distributed Generation (Fossil fuel based)	448	2%
Undefined (Mostly fossil alternatives)	6,021	22%
Total Additions 2006-2016	**27,037**	

Fossil Fuel based technologies	**22,581**	**84%**

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives

From the Investment analysis we can conclude that alternative LFG1 in combination with alternative P1 are not financially attractive alternatives since the identified indicators do not have the level expected for the risk associated to the Project Activity. Therefore alternatives LFG1 and P1 are eliminated from consideration.

[16] This permit was conceded to the Monterrey Project (GEF grant).
[17] CRE http://www.cre.gob.mx/articulo.aspx?id=171
[18] CFE, Subdirección de Programación, Programa de Obras e Inversiones del Sector Eléctrico POISE 2007-1016 pp 3-16

Alternative LFG 2 in combination with alternative P6 is not prevented by any of the identified barriers, and is considered to continue since it is a prevailing practice in the Host Country.

Outcome of Investment Analysis: Alternatives LFG 2 in combination with P6, the business as usual scenario (BAU) is expected to continue since it is a prevailing practice in the Host Country.

Step B.4.4. Identification of the Baseline Scenario.

Based on the Project IRR and Capital Cost analysis, it can be concluded that alternative LFG1 and LFG3 in conjunction with alternative P1 face prohibitive barriers that make them economically unattractive. As a result, alternative LFG2 (atmospheric release of the landfill gas) in conjunction with alternative P6 (existing grid connected power plants) are the most plausible baseline scenario for the Project Activity.

The actual conditions of the landfill include a passive collecting system and venting of the collected LFG. Electricity consumption of the Municipality of Naucalpan is supplied from the grid and is expected to continue like this in a *business as usual* scenario in the absence of the proposed Project Activity.

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

As stated in the methodology, the latest version of the "Tool for the demonstration and assessment of additionality" should be used for this section. The methodology also states that steps 1, 2 and 3 of the referred tool should be used to determine the most plausible baseline scenario as exposed in previous section B.4. Since steps 1,2 and 3 have been developed in the previous sections, only the outcomes of each step will be included in this sections.

In version 05.2 of the "Tool for the demonstration and assessment of additionality", the following steps should be followed:

Step B.5.1. Identification of alternatives to the project activity that can be the baseline scenario.

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

Outcome of *Sub-step 1a*. As detailed in previous ***Step B.4.1*** the realistic and credible alternative scenarios to the project Activity are:

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

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

Outcome of Sub-step 1b. Considering that the identified alternatives to the Project activity are consistent with all the applicable regulations, none of them have been eliminated for further consideration and the next steps of the methodology were applied to the outcome of ***Sub-step 1a***.

Step B.5.2. Investment analysis:

Outcome of Investment Analysis: From the analysis done in previous ***Step B.4.3*** it can be concluded that the project activity is not financially attractive without the CDM revenues and would lead to a no investment decision.

Step B.5.3. Barrier analysis:

Outcome of Barrier analysis: From the analysis done in previous ***Step B.4.3*** alternatives LFG 1 and P1 were eliminated from consideration, and alternatives LFG 2 and P6 (BAU scenario) is considered viable since the combination of these two alternatives is the prevailing practice in the Host Country.

Step B.5.4. Common practice analysis

Sub-step B.5.4.a. Analyze other activities similar to the proposed project activity

According to the Ministry of Social Development (SEDESOL) in the document "*Management of Municipal Solid Waste*"[19] the Host Country faces economical limitations for solid waste management in general, but specially for final disposition. As explained by SEDESOL this occurs because Municipal authorities use the limited resources for other areas considered as a priority over solid waste management. Over the past years final disposition in controlled sites has improved but as of today nearly 30% of the solid waste generated is disposed in uncontrolled open dumpsites as shown in Image 4

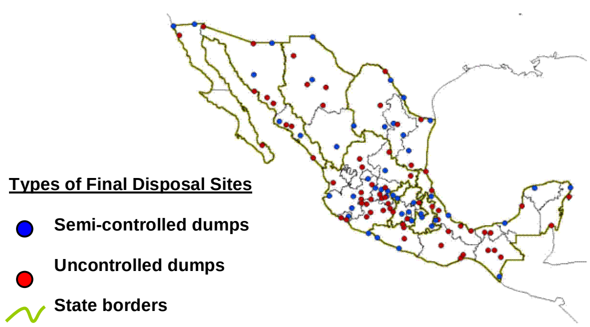

Image 4: Types of disposal sites[20]

SEDESOL summarizes the problems related to collection and final disposition of MSW faced by Municipal authorities as follows[21]

[19] Source: SEDESOL (Ministry of Social Development) El Manejo de los Residuos Sólidos Municipales

[20] http://sedesol2006.sedesol.gob.mx/subsecretarias/desarrollourbano/sancho/recoleccionydisposicion.htm

[21] idem

- Lack of long-term planning in short-term administrations
- Lack of infrastructure (mostly in final disposition)
- Obsolete collection equipment
- Practically no recycling or usage of waste with alternative technologies
- No incentives for investment in MSW management
- No public awareness regarding domestic solid waste within population or authorities
- Limited skills and resources of operators

According to a study performed by the Mexican Commission for Environmental Infrastructure (Comision Mexicana de Infraestructura Ambiental) on municipal landfills in Mexico[22], only 1 of the 112 identified landfills has an active LFG collection and utilization system. This landfill is in Monterrey, and is further described in the following paragraphs. Apart from this study, our research shows the capture and flaring project in Santa Fe, called *Prados de la Montaña*, also described in the following paragraphs.

As mentioned in the *"Success Stories"* section of the document, there is a biogas utilization project developed in Monterrey[23] that started operations in 2003. This project was developed with the support of the Global Environmental Facility (GEF) Trust Fund (outside the CDM context) with the objective of *"demonstrating the technology and laying the foundations for widespread introduction of methane capture and use, as a proven technique in the Mexican market"*.
On the other hand, *Prados de la Montaña* project in Santa Fe, México City, was developed by a private investor in conjunction with local authorities as part of the ZEDEC Santa Fe Project with the objective of cleaning the area from nuisance and hence encouraging strategic real estate investment. As of today, Santa Fe area is one of the most expensive areas for real estate investment in Mexico.
Referring to the Project Activity, its location is not related to any strategic ZEDEC project with local authorities, and no grants are expected from development programs, hence essential distinctions can be identified.
We can conclude that LFG collection and utilization is not widely observed in the Host Country and since the development of Phase I of the Monterrey Project, no other projects have been developed outside the CDM context.

Sub-step B.5.4.b. Discuss any similar options that are occurring

As mentioned in the previous section 4a, passive venting of methane is a common practice in the Host Country, and the projects that are in development are either registered or in the process of validation in the CDM context as shown in the following table[24].

Project Name	Status
Aguascalientes – EcoMethane Landfill Gas to Energy Project	Registered
Ecatepec – EcoMethane Landfill Gas to Energy Project	Registered
Hasars Landfill Gas Project	Registered
Tultitlan – EcoMethane Landfill Gas to Energy Project	Registered
Ciudad Juarez Landfill Gas to Energy Project	Registered

[22] "La Basura en el Limbo: Desempeño de Gobiernos Locales y Participación Privada en el Manejo de Residuos Urbanos", Mexican Commisión of Environmental Infrastructure, México, 2003.
[23] http://gefonline.org/projectDetailsSQL.cfm?projID=784
[24] http://cdm.unfccc.int

Proactiva Mérida Landfill Gas Capture and Flaring project	Registered
Durango – EcoMethane Landfill Gas to Energy Project	Registered
Milpillas Landfill Gas Recovery Project	Registered
Monterrey II LFG to Energy Project	Registered
Tecamac – EcoMethane Landfill Gas to Energy Project	Registered
Verde Valle Landfill Gas Project	Registered
Landfill Gas Management Project Puerto Vallarta Landfill site, Mexico	Registered
Landfill Gas Recovery and Flaring Project in the El Verde Landfill, León	Validation
Monterrey I LFG to Energy Project	Validation
Culiacan Northern Landfill Gas to Energy Project	Validation
León Landfill Gas to Energy Project	Validation
Hermosillo Sonora Landfill Gas Recovery Project	Validation
Proactiva Medio Ambiente Tlalnepantla Landfill Gas to Energy project	Validation
Coyula landfill gas project	Validation
Puebla Landfill Gas to Energy Project	Validation
Relleno Norte Landfill Gas Project	Validation
Querétaro landfill-gas-to-energy project	Validation

Table 6: Similar options occurring (CDM Projects)

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As identified in section B.2 methodology ACM0001/ v.11 applies to the proposed Project Activity and the following considerations will be followed to calculate emission reductions:

[1] Baseline emissions [BE_y]

According to the methodology, the baseline emissions are calculated as follows:

Equation 1. $$BE_y = \left(MD_{project,y} - MD_{BL,y}\right) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,BL,y} + ET_{LFG,y} * CEF_{ther,BL,y}$$

Where:

BE_y Baseline emissions in year y (tCO_2e)

$MD_{project,y}$ The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario

$MD_{BL,y}$ The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH_4)

GWP_{CH4} Global Warming Potential value for methane for the first commitment period is $21tCO_2e/tCH_4$

$EL_{LFG,y}$ Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours (MWh).

$CEF_{elecy,BL,y}$ CO_2 emissions intensity of the baseline source of electricity displaced, in tCO_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, during the year y in TJ.
$CEF_{ther,BL,y}$	CO_2 emissions intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation, in tCO_2e/TJ.

In the Project Activity, no thermal energy will be generated so Equation 1 can be simplified to determine Equation 2:

Equation 2. $$BE_y = \left(MD_{project,y} - MD_{BL,y}\right) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,BL,y}$$

[1.1] According to the methodology $MD_{project,\,y}$ is determined by:

Equation 3. $$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y}$$

Where:

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH_4)
$MD_{electricity,y}$	Quantity of methane destroyed by generation of electricity (tCH_4)
$MD_{thermal,y}$	Quantity of methane destroyed for the generation of thermal energy (tCH_4)
$MD_{PL,y}$	Quantity of methane sent to the pipeline for feeding to the natural gas distribution network (tCH_4)

Since no thermal energy will be produced and no methane will be sent to any natural gas distribution network, Equation 3 can be simplified to determine Equation 4:

Equation 4. $$MD_{project,y} = MD_{flared,y} + MD_{electricity,y}$$

As stated in the methodology, for the ex-ante estimation of $MD_{project,y}$ the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" should be used considering the following equations:

Equation 5. $$MD_{project,y} = BE_{CH4,SWDS,y} / GWP_{CH4}$$

Equation 6. $$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)$$

Where:

$BE_{CH4,SWDS,y}$	Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
φ	Model correction factor to account for model uncertainties
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4}	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction)
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor

$W_{j,x}$	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type *j*
k_j	Decay rate for the waste type *j*
j	Waste type category (index)
x	Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)
y	Year for which methane emissions are calculated

[1.1.1] $MD_{flared,y}$ will be determined as follows:

Equation 7. $$MD_{flared,y} = \{(LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})\}$$

Where:

$LFG_{flare,y}$	Quantity of landfill gas fed to the flare(s) during the year measured in cubic meters (m^3)
$w_{CH4,y}$	Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3 CH_4 / m^3 LFG),
D_{CH4}	Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)[25]
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (tCO_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.

[1.1.1.1] Calculation of $PE_{flare,y}$

Project Emissions from flaring gases are calculated according to "Tool to determine project emissions from flaring gases containing methane", which defines:

Equation 8. $$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH_4}}{1000}$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (tCO_2e)
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$	Flare efficiency in hour h. Since the Project Activity includes an ***enclosed flare and use of the default value***, the second option of Step 6 of the "Tool to determine project emissions from flaring gases containing methane" will be used to determine this parameter.
GWP_{CH4}	Global Warming Potential value for methane that for the first commitment period is $21tCO_2e/tCH_4$

[1.1.2] $MD_{electricity,y}$ will be determined as follows:

Equation 9. $$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$$

Where:

---

[25] At standard temperature and pressure (0°C and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4

$LFG_{electricity,y}$ Quantity of landfill gas fed into electricity generator measured in cubic meters (m^3)

[1.2] According to the methodology $MD_{BL,y}$ is determined by:

Equation 10. $MD_{BL} = MD_{project,y} * AF$

Where

AF Adjustment Factor.

No specific system for collection and destruction of methane is mandated by regulatory or contractual requirements neither it is specified in the contract or mandated by regulations any specific percentage of the "generated" amount of methane to be collected and destroyed. Because of this, the Adjustment Factor (AF) was set to zero.

[1.3] Determination of $CEF_{elec,BL,y}$:

The methodology states that in case the baseline is electricity generated by plants connected to the grid, the emission factor should be calculated according to the "Tool to calculate the emission factor for an electricity system" as follows:

[1.3.1] Identify the relevant electric power system

According to the "Tool to calculate the emission factor for an electricity system", in the absence of a published delineation by the DNA regarding the electricity system to be used, the national (or other largest) grid should be used. In the Project Activity the identified electricity system was the national grid, that has no transmission constraints and in 2007 the total electricity imports represented 0.11% and the total electricity exports represented 0.59% of the total electricity generation[26]

[1.3.2] Select an operating margin (OM) method

The simple OM method was selected, since the low cost/ must run resources constitute less than 50% of total grid generation.

Details are shown in Annex 3

[1.3.3] Calculate the operating margin emission factor according to the selected method

According to the "Tool to calculate the emission factor for an electricity system", the simple OM emission factor is calculated based on the available information which is data on the total net electricity generation of all power plants serving the system (including exports and considering imports with an emission factor of 0 (zero) tons CO_2 per MWh) and the fuel types and total fuel consumption of the project electricity system (option C) as follows:

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[26] Prospectiva del Sector Eléctrico 2008-2017 pg 111, Chart 22

Equation 11. $$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:

$EF_{grid,OMsimple,y}$ Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

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

$EF_{CO2,i,y}$ CO_2 emission factor of fossil fuel type *i* in year *y* (tCO2/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 power sources in the project electricity system in year *y*

y Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

[1.3.4] Identification of the cohort of power units to be included in the build margin (BM)

According to the "Tool to calculate the emission factor for an electricity system", a group of power units should be selected in order to calculate the build margin (BM). Considering the most recent information available, option b was selected, "The set of power capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently".

Option 1(ex-ante option) was selected for the estimation of the BM

Details are shown in Annex 3

[1.3.5] Calculate the build margin (BM) emission factor

The build margin emissions factor is calculated using the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

Equation 12. $$EF_{grid,BM,y} = \frac{\sum_i EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

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

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

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

m Power units included in the build margin

y Most recent historical year for which power generation data is available

According to the "Tool to calculate the emission factor for an electricity system" the CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in step 3(a) of the tool using

options B1, B2 or B3, using for y the most recent historical year for which power generation data is available and using for m the power units included in the build margin. Option B2 was selected based on the most recent information of electricity generation and fuel types available and the emission factor was calculated as follows:

Equation 13. $$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	Average CO_2 emission factor of fuel type i used in power unit m in year y (tCO_2/GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit m in year y (%)
y	most recent historical year for which power generation data is available

[1.3.6] Calculation of the combined (CM) margin emission factor

The combined margin is calculated as follows:

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

Where:

$EF_{grid,CM,y}$	Combined margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	weighting of operating margin emissions factor (%)
w_{BM}	weighting of build margin emissions factor (%)

Details are shown in Annex 3.

[2] Project emissions [PE_y]

According to the methodology, the project emissions are calculated as follows:

Equation 15. $$PE_y = PE_{EC,y} + PE_{FC,j,y}$$

Where:

$PE_{EC,y}$	Emissions from consumption of electricity in the project case. The project emissions from electricity consumption ($PE_{EC,y}$) will be calculated following the latest version of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". If in the baseline a part of LFG was captured then the electricity quantity used in calculation is electricity used in project activity net of that consumed in the baseline.
$PE_{FC,j,y}$	Emissions from consumption of heat in the project case. The project emissions from fossil fuel combustion ($PE_{FC,j,y}$) will be calculated following the latest version of "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion". For this purpose, the processes j in the tool corresponds to all fossil fuel combustion in the landfill, as well as any other on-site fuel combustion for the purposes of the project

activity. If in the baseline part of a LFG was captured then the heat quantity used in calculation is fossil fuel used in project activity net of that consumed in the baseline.

Since no consumption of heat is considered in the Project Activity, Equation 13 can be simplified to determine Equation 14

Equation 16. $PE_y = PE_{EC,y}$

[2.1] Determination of $PE_{EC,y}$ used in Equation 14:
From the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption":

Generic approach

In the generic approach, project, baseline and leakage emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

Equation 17.

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

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

$$LE_{EC,y} = \sum_l EC_{LE,l,y} \times EF_{EL,l,y} \times (1 + TDL_{l,y})$$

Where

$PE_{EC,y}$ Project emissions from electricity consumption in year *y* (tCO_2/yr)
$BE_{EC,y}$ Baseline emissions from electricity consumption in year *y* (tCO_2/yr)
$LE_{EC,y}$ Leakage emissions from electricity consumption in year *y* (tCO_2/yr)
$EC_{PJ,j,y}$ Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EC_{BL,k,y}$ Quantity of electricity that would be consumed by the baseline electricity consumption source *k* in year *y* (MWh/yr)
$EC_{LE,l,y}$ Net increase in electricity consumption of source *l* in year *y* as a result of leakage[2] (MWh/yr)
$EF_{EL,j,y}$ Emission factor for electricity generation for source *j* in year *y* (tCO_2/MWh)
$EF_{EL,k,y}$ Emission factor for electricity generation for source *k* in year *y* (tCO_2/MWh)
$EF_{EL,l,y}$ Emission factor for electricity generation for source *l* in year *y* (tCO_2/MWh)
$TDL_{j,y}$ Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
$TDL_{k,y}$ Average technical transmission and distribution losses for providing electricity to source *k* in year *y*
$TDL_{l,y}$ Average technical transmission and distribution losses for providing electricity to source *l* in year *y*
j Sources of electricity consumption in the project
k Sources of electricity consumption in the baseline
l Leakage sources of electricity consumption

Since no electricity is consumed in the baseline, and the scenario for the project is electricity consumption from the grid (Scenario A, Option A1), Equation 15 can be simplified to Equation 16.

Scenario A: **Electricity consumption from the grid**. The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exist, it is not operating or it can physically not provide electricity to the source of electricity consumption.

Option A1: Calculate the combined margin emissions factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j/k/l,y}$=$EF_{grid,CM,y}$)
Should the project use a fossil fuel generator as a back-up, then option B1 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" will be used to determine the corresponding emissions.

Equation 18. $$PE_{EC,y} = EC_{PJ,y} \times EF_{grid,CM,y} \times (1 + TDL_y)$$

Where:

$PE_{EC,y}$ Project emissions from electricity consumption in year *y* (tCO_2/yr)
$EC_{PJ,j,y}$ Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{grid,CM,y}$ Combined margin emission factor for the grid in year *y*
$TDL_{j,y}$ Average technical transmission and distribution losses for providing electricity to source *j* in year *y*

[3] Leakage

No leakage effects need to be accounted under this methodology.

[4] Emission Reduction

According to the methodology, the greenhouse gas emission reductions achieved by the Project Activity during a given year "y" (ER_y) is estimated as follows:

Equation 19. $$ER_y = BE_y - PE_y$$

Where:

ER_y Emission reductions in year y (tCO_2e/yr)
BE_y Baseline emissions in year y (tCO_2e/yr)
PE_y Project emissions in year y (tCO_2/yr)

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

Data / Parameter:	**$BE_{CH4,SWDS,y}$**
Data unit:	tCO_2e
Description:	Methane generation from the landfill in the absence of the project activity at year y
Source of data used:	Calculated as per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”
Any comment:	Used for ex ante estimation of the amount of methane that would have been destroyed/combusted during the year

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	IPCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value determined for the first commitment period.
Any comment:	Updated according to any future COP/MOP decisions.

Data / Parameter:	**ϕ**
Data unit:	--
Description:	Model correction factor to account for model uncertainties
Source of data used:	“Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	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.
Any comment:	

Data / Parameter:	***f***
Data unit:	--
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Methodology ACM0001/ v.11 states that parameter "*f*" in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" shall be assigned a value 0
Any comment:	

Data / Parameter:	**OX**
Data unit:	--
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
Value applied:	0 (zero)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" states that a value of 0 (zero) should be applied to *other* types of solid waste disposal sites. Other in this context means not having a cover with oxidizing material.
Any comment:	

Data / Parameter:	**F**
Data unit:	--
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	The "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" states that a value of 0.5 should be used based on the IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Any comment:	

Data / Parameter:	**DOC_f**
Data unit:	--
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	The "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" states that a value of 0.5 should be used based on the IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Any comment:	

Data / Parameter:	**MCF**
Data unit:	--
Description:	Methane Correction Factor
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Rincón Verde qualifies as an **anaerobic managed solid waste disposal site** according to the definition in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".
Any comment:	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS

Data / Parameter:	**Composition of Solid Waste deposited in SWDS**
Data unit:	%
Description:	Amount of organic waste type j deposited in the SWDS in the year x.
Source of data used:	Municipality of Naucalpan de Juarez
Value applied:	

Waste type	**Composition [%]**
Wood and wood products	1.1%
Pulp, paper and cardboard (other than sludge)	25.5%
Food, food waste, beverages and tobacco (other than sludge)	33.3%
Textiles	4.5%
Garden, yard and park waste	0.8%
Glass, plastic, metal, other inert waste	34.8%

Justification of the choice of data or description of measurement methods and procedures actually applied :	Methodology ACM0001/ v.11 states that sampling to determine the different waste types is not necessary and that the waste composition can be obtained from previous studies. In this case data provided by the Municipality of Naucalpan has been used.
Any comment:	This value is applied to calculate the amount of Waste type *j* in year *x*

Data / Parameter:	**DOC_j**
Data unit:	--
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Source of data used:	"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	Values suggested in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" are based in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories Volume 5, Chapter 2, Tables 2.4 and 2.5.
Any comment:	Section 2.3.1 of Volume 5, Chapter 2 of the IPCC 2006 Guidelines states that it is *good practice* to use DOC values consistently with the way the waste composition data are derived.

Waste type	**DOC_j**
Wood and wood products	50%
Pulp, paper and cardboard (other than sludge)	44%
Food, food waste, beverages and tobacco (other than sludge)	38%
Textiles	30%
Garden, yard and park waste	49%
Glass, plastic, metal, other inert waste	0%

Data / Parameter:	**k_j**
Data unit:	--
Description:	Decay rate for the waste type *j*
Source of data used:	"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	see table below

Waste type	**k_j**
Wood and wood products	0.020

	Pulp, paper and cardboard (other than sludge) — 0.040 Food, food waste, beverages and tobacco (other than sludge) — 0.060 Textiles — 0.040 Garden, yard and park waste — 0.050
Justification of the choice of data or description of measurement methods and procedures actually applied :	Values suggested in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" are based in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories Volume 5, Chapter 3 Table 3.3.
Any comment:	MAT=15.20 °C MAP=877 mm according to Mexico´s National Water Commission statistics published in www.cna.gob.mx In absence of a specific value for PET, and as a conservative approach the Dry values of the decay rate "k" were chosen.

Data / Parameter:	$\mathbf{D_{CH4}}$
Data unit:	tCH_4/m^3 CH_4
Description:	Methane Density
Source of data used:	Methodology ACM0001/ v.011
Value applied:	0.0007168
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the Methodology ACM0001/ v.11
Any comment:	At standard temperature and pressure (0 degree Celsius and 1,013 bar)

Data / Parameter:	**Regulatory requirements relating to landfill gas projects**
Data unit:	--
Description:	Regulatory requirements relating to landfill gas projects
Source of data used:	National regulatory requirements relating to landfill gas projects
Value applied:	0%
Justification of the choice of data or description of measurement methods and procedures actually applied :	No specific system for collection and destruction of methane is mandated by regulatory or contractual requirements. Neither it is specified in the contract or mandated by regulations any specific percentage of the "generated" amount of methane to be collected and destroyed. Because of this, the Adjustment Factor (AF) is equal to zero.
Any comment:	

Data / Parameter:	**$CEF_{elec,BL,y}$**
Data unit:	tCO_2e/GWh
Description:	CO_2 emissions intensity of the baseline source of electricity displaced
Source of data used:	Calculated following the "Tool to calculate the emission factor for an electricity system"
Value applied:	489.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Methodology ACM0001/ v.11 states that in case the electricity generated by plants connected to the grid the emission factor should be calculated according to the "Tool to calculate the emission factor for an electricity system" As suggested in the cited tool data published by the Ministry of Energy in the annual Electricity Sector Prospective (www.sener.gob.mx) was used for calculation.
Any comment:	The "Tool to calculate the emission factor for an electricity system" is used to determine the emission factor of an electricity system ($EF_{grid,CM,y}$), and this value is equivalent to the CO_2 emissions intensity of the baseline source of electricity displaced ($CEF_{elec,BL,y}$) Details in Annex 3

Data / Parameter:	**$EF_{grid,CM,y}$**
Data unit:	tCO_2/GWh
Description:	Combined margin CO_2 emission factor in year *y*
Source of data used:	"Tool to calculate the emission factor for an electricity system"
Value applied:	489.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated using the "Tool to calculate the emission factor for an electricity system"
Any comment:	Details in Annex 3

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2 / TJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC Default values at the lower limit of the uncertainty at a 95% confidence level interval as provided in Table 1.4 of Chapter 1 Volume 2 (Energy) of the 2006 IPCC Guidelines on GHG Inventories.
Value applied:	see table below
Justification of the choice of data or description of	Data from invoices or national or regional average default values are not available

Value applied:

Fuel type *i*	**Emission Factor [tCO_2 / TJ]**
Fuel Oil	75.5
Natural Gas	54.3
Diesel	72.6
Coal	89.5

measurement methods and procedures actually applied :	
Any comment:	Used to determine the $EF_{grid,OM,y}$ as detailed in Annex 3

Data / Parameter:	$FC_{i,m}$
Data unit:	Gg
Description:	Amount of fossil fuel type *i* consumed by the project electricity system in case of $FC_{i,y}$) in year *y*
Source of data used:	Calculation based on the Mexican Ministry of Energy (www.sener.gob.mx) Electricity Sector Prospective and IPCC Guidelines
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Electricity Sector Prospective is an official publication of the Ministry of Energy
Any comment:	Details are shown in Annex 3.

Fuel Consumption [Gg]	Fuel Oil	Natural Gas	Diesel	Coal
2005	15,695	13,605	347	16,458
2006	12,933	16,259	389	16,166
2007	11,998	18,478	200	15,361

Data / Parameter:	NCV_i
Data unit:	TJ/Gg
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Details are shown in Annex 3.

	Fuel Oil	Natural Gas	Diesel	Coal
Fuel Consumption [TJ/Gg]	39.8	46.5	41.4	19.9

Data / Parameter:	**EG_y**
Data unit:	GWh
Description:	Net electricity generated and delivered to the grid the project electricity system in year *y*
Source of data used:	Mexican Ministry of Energy (www.sener.gob.mx) Electricity Sector Prospective
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Electricity Sector Prospective is an official publication of the Ministry of Energy
Any comment:	Details are shown in Annex 3.

Electricity Generation [GWh]	**Electricity System**
2005	173,338
2006	177,701
2007	187,714

Data / Parameter:	**$\eta_{m,y}$**
Data unit:	%
Description:	Average net energy conversion efficiency of power unit *m* in year y
Source of data used:	Mexican Ministry of Energy (www.sener.gob.mx) Electricity Sector Prospective
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Electricity Sector Prospective is an official publication of the Ministry of Energy
Any comment:	Details are shown in Annex 3.

Type	Abbreviation	Average Efficiency Values
Natural Gas (Simple Cycle)	TG	35.19%
Combined Cycle	CC	52.18%
Diesel (Internal Combustion)	CI	42.36%

Data / Parameter:	**P_n**
Data unit:	Pa
Description:	Atmospheric pressure at normal conditions
Source of data used:	“Tool to determine project emissions from flaring gases containing methane”
Value applied:	101,325
Justification of the	

choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to determine project emissions from flaring gases containing methane”
Any comment:	

Data / Parameter:	**T_n**
Data unit:	K
Description:	Temperature at normal conditions
Source of data used:	“Tool to determine project emissions from flaring gases containing methane”
Value applied:	273.15
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to determine project emissions from flaring gases containing methane”
Any comment:	

Data / Parameter:	**R_u**
Data unit:	Pa m^3/kmol K
Description:	Universal ideal gas constant
Source of data used:	“Tool to determine project emissions from flaring gases containing methane”
Value applied:	8,314.472
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to determine project emissions from flaring gases containing methane”
Any comment:	

Data / Parameter:	**MF_{O2}**
Data unit:	--
Description:	O_2 volumetric fraction of air
Source of data used:	“Tool to determine project emissions from flaring gases containing methane”
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to determine project emissions from flaring gases containing methane”
Any comment:	

Data / Parameter:	**MV_n**
Data unit:	--
Description:	Volume of one mole of any ideal gas at normal temperature and pressure
Source of data used:	"Tool to determine project emissions from flaring gases containing methane"
Value applied:	22.414
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to determine project emissions from flaring gases containing methane"
Any comment:	

Data / Parameter:	**MM_i**
Data unit:	kg/kmol
Description:	Molecular mass of component i
Source of data used:	"Tool to determine project emissions from flaring gases containing methane"
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to determine project emissions from flaring gases containing methane"
Any comment:	

Component	**MM_i**
CH_4	16.04
CO	28.01
CO_2	44.01
O_2	32
H_2	2.02
N_2	28.02

Data / Parameter:	**AM_i**
Data unit:	kg/kmol
Description:	Atomic mass of element i
Source of data used:	"Tool to determine project emissions from flaring gases containing methane"
Value applied:	see table below
Justification of the choice of data or	As per the "Tool to determine project emissions from flaring gases containing

Component	**AM_i**
C	12
H	1.01
O	16
N	14.01

description of measurement methods and procedures actually applied :	methane”
Any comment:	

Data / Parameter:	**$NA_{i,j}$**
Data unit:	**--**
Description:	Number of atoms of element j in component i depending on molecular structure
Source of data used:	“Tool to determine project emissions from flaring gases containing methane”
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to determine project emissions from flaring gases containing methane”
Any comment:	

Element / **Component**	**Carbon**	**Hydrogen**	**Oxygen**	**Nitrogen**
CH_4	1	4	0	0
CO	1	0	1	0
CO_2	1	0	2	0
O_2	0	0	2	0
H_2	0	2	0	0
N_2	0	0	0	2

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante estimation of emission reductions has been done according to the methodology ACM0001/ v.11 following Equation 2 for the Baseline Emissions [BE_y], Equation 15 for the Project Emissions [PE_y] and Equation 19 for the Emission Reductions [ER_y] as shown in the following steps:

[1] Baseline Emissions [BE_y]

[1.1] Determination of the amount of methane that would have been destroyed/combusted during the year [$MD_{project,y}$]

The ex-ante estimation of the amount of methane that would have been destroyed/combusted during the year, in tonnes of methane ($MD_{project,y}$) was done following the first order decay model of the latest version of the approved *“Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”* as detailed in Equation 5 and Equation 6 of the present document. Baseline information regarding parameters used in the calculations is included in Annex 3.

As suggested by the methodology, the efficiency of the degassing system installed in the Project Activity should be taken into account. According to the *Mexico Landfill Gas Model* developed by the US

Environmental Protection Agency in its Landfill Methane Outreach Program (LMOP) [27], and considering the actual situation of the Rincón Verde Landfill (please see pp. 2-6 of the User´s Manual[28]), the collection efficiency is estimated as 75%.

Considering this collection efficiency, it is expected that the amount of methane destroyed/combusted will be **118,646 tCH_4** in the whole crediting period.

[1.2] Determination of 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 [$MD_{BL,y}$]

Regarding the estimation of $MD_{BL,y}$, and taking into account the project context where there are no regulatory or contractual specifications of destruction or combustion of LFG, the Adjustment Factor (*AF*) was considered as 0 (zero). All regulatory requirements relating to landfill gas projects (including this parameter) will be updated at the renewal of every crediting period, as suggested in the methodology.

Considering the project context, it is expected that the amount of methane destroyed/combusted in the absence of the project due to regulatory and/or contractual requirement will be of **0 tCH_4** in the whole crediting period.

[1.3] Determination of the net quantity of electricity produced using LFG, which in the absence of the project would have been produced by power plants connected to the grid [$EL_{LFG,y}$]

The Project Activity includes the installation of approximately 8.2 MW of power generation capacity (6 modules of 1.364 MW each). Technical details of the installation are included in Annex 3.

Considering this installed capacity, it is expected that the net quantity of electricity produced using LFG [$EL_{LFG,y}$] will be **500,600 MWh** in the whole crediting period.

[1.4] Determination of the CO_2 emissions intensity of the baseline source of electricity displaced [$CEF_{elec,BL,,y}$]

According to the methodology in case the baseline is electricity generated by plants connected to the grid, the emission factor should be calculated according to the "Tool to calculate the emission factor for an electricity system" as shown in the following steps:

Step 1. Identification of the relevant electric power system
We identified that the relevant electric power system should be the national grid, since the generation facility will be connected to it.

Step 2. Selection of Operating margin (OM) method
We selected option (a) Simple OM as the method for calculating the Operating Margin since the low-cost/must run resources constitute less than 50% of total grid generation (it constitutes near 20% as detailed in Annex 3 and used a 3 year generation weighted average (ex ante option) based on the most recent data available.

[27] http://www.epa.gov/outreach/lmop/international.htm#3
[28] http://www.epa.gov/outreach/lmop/int/UsersManualMexico_LFG_modelV1_5.pdf

Step 3. Calculation of the operating margin emission factor

The Simple OM emission factor was calculated based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the national grid (option C) since the specific data for option A or B is not available.

The CO_2 emission factor of the fossil fuels used were obtained from the IPCC Values Volume 2, Chapter 1: Energy Table 1.4

Using this option, the Simple operating margin CO_2 emission factor [$EF_{grid,OMsimple,y}$] is **617.8tCO_2/GWh** according to data published by the Mexican Ministry of Energy[29]. (see details in Annex 3)

Step 4. Identification of the cohort of power units to be included in the build margin

We decided to use the set of power capacity additions that have been built more recently and comprise 20% of the system generation since the "Tool to calculate the emission factor for an electricity system" recommends to use the set of power units that comprises the larger annual generation . In terms of the calculation of the build margin we decided to use the ex-ante option (Option 1) based on the most recent information available.

Step 5. Calculation of the build margin emission factor

The Build Margin emission Factor was calculated based on the generation-weighted average emission factor of all the power units during the most recent year for which power generation data is available. In this case, based on the data published by the Mexican Ministry of Energy and the IPCC values for energy industries, the Build margin CO_2 emission factor [$EF_{grid,BM,y}$] is **361.84 tCO_2/GWh** (see details in Annex 3)

Step 6. Calculation of the combined margin

The Combined Margin emission factor was determined using a weighting of operating margin emission factor of 0.50 and a weighting of build margin emission factor of 0.50 as suggested in the "Tool to calculate the emission factor for an electricity system". Using this weights the Combined Margin emission factor [$EF_{grid,CM,y}$] is **489.8 tCO_2/GWh**

Considering the previous calculation, the CO_2 emissions intensity of the baseline source of electricity displaced [$CEF_{elec,BL,,y}$] is **489.8 tCO_2/GWh** for the whole crediting period.

Outcome of Step [1]: The estimated Baseline Emissions [BE_y] are 2,736,753tCO_2 for the crediting period.

[2] Project Emissions [PE_y]

The Project emissions related to the electricity consumption of the Project Activity are calculated according to the methodology the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

Scenario A, Option A1 of the "Tool to calculate baseline, project and leakage emissions from electricity consumption" have been selected since the electricity consumed by the Project Activity will be purchased from the grid. The project is expected to consume **32 GWh** in the whole crediting period and the grid

[29] http://www.sener.gob.mx/

emission factor used is **489.8 tCO_2/GWh** as detailed in the previous section. Referring to the transmission and distribution losses (TDL) the value applied for the calculation was 16.82% (see Annex 3 for details).

Outcome of Step [2]: The estimated Project Emissions [PE_y] are 18,044 tCO_2 for the whole crediting period.

[3] Emission Reductions [ER_y]

Outcome of Step [3]: The estimated emission reductions [ER_y] are 2,718,709tCO_2 for the whole crediting period.

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009[30]	1,804	335,460	-	333,656
2010	1,804	320,333	-	318,528
2011	1,804	305,976	-	304,172
2012	1,804	292,351	-	290,547
2013	1,804	278,761	-	276,957
2014	1,804	265,220	-	263,416
2015	1,804	252,364	-	250,560
2016	1,804	240,158	-	238,354
2017	1,804	228,568	-	226,763
2018	1,804	217,561	-	215,757
Total (tonnes of CO_2e)	**18,044**	**2,736,753**	**-**	**2,718,709**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$LFG_{total,y}$**
Data unit:	m^3
Description:	Total amount of landfill gas captured at Normal Temperature and Pressure
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating	This parameter was not used in the calculation of expected emission reductions

[30] Annual estimations for 2009 are presented for the whole year; actual emission reductions for 2009 will count from the starting date of the crediting period.

expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured by a flow meter. (average value in a time interval not greater than an hour shall be used in the calculations of emission reductions)
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field Measurement,

Data / Parameter:	**$LFG_{flare,y}$**
Data unit:	m^3
Description:	Amount of landfill gas flared at Normal Temperature and Pressure
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	Measured by a flow meter. (average value in a time interval not greater than an hour shall be used in the calculations of emission reductions)
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field Measurement,

Data / Parameter:	**$LFG_{electricity,y}$**
Data unit:	m^3
Description:	Amount of landfill gas combusted in power plant at Normal Temperature and Pressure
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement	Measured by a flow meter. Data to be aggregated monthly and yearly (average value in a time interval not greater than an hour shall be used in the calculations

methods and procedures to be applied:	of emission reductions)
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field measurement,

Data / Parameter:	**$PE_{flare,y}$**
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream in year *y*
Source of data:	Calculated data from onsite measurements as per the “Tool to determine project emissions from flaring gases containing Methane”
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	Parameters used in calculation are included in the Monitoring Plan
QA/QC procedures to be applied:	As defined in internal procedures
Any comment:	Calculated Data,

Data / Parameter:	**w_{CH4}**
Data unit:	m^3 CH_4 / m^3 LFG
Description:	Methane fraction in the landfill gas
Source of data:	Onsite measurements using a continuous gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	Methane fraction of the LFG to be measured on the same basis as the LFG flow. (average value in a time interval not greater than an hour shall be used in the calculations of emission reductions)
QA/QC procedures to	The equipment will be subject to maintenance and calibration according to

be applied:	manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field measurement. In case of the usage of the default flare efficiency value, the correct operation of the torch will be controlled and monitored between the values established by the manufacturer for this variable.

Data / Parameter:	**T**
Data unit:	°C
Description:	Temperature of the landfill gas
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	Measured to determine the density of methane D_{CH4}.
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field Measurement,

Data / Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the landfill gas
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	Measured to determine the density of methane DCH4.
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field measurement

Data / Parameter:	**EL_{LFG}**
Data unit:	MWh
Description:	Net amount of electricity generated using LFG.
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	see table below
Description of measurement methods and procedures to be applied:	Electricity meter
QA/QC procedures to be applied:	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Any comment:	Field measurement

Year	Expected electricity generation (MWh)
2009	54,486
2010	54,486
2011	54,486
2012	54,486
2013	53,144
2014	50,563
2015	48,112
2016	45,785
2017	43,575
2018	41,477

Data / Parameter:	**EC_{PJ}**
Data unit:	MWh
Description:	Onsite consumption of electricity provided by the grid attributable to the project activity
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	see table below

Year	Expected electricity consumption (MWh)
2009	3,154
2010	3,154
2011	3,154

	<table><tr><td>2012</td><td>3,154</td></tr><tr><td>2013</td><td>3,154</td></tr><tr><td>2014</td><td>3,154</td></tr><tr><td>2015</td><td>3,154</td></tr><tr><td>2016</td><td>3,154</td></tr><tr><td>2017</td><td>3,154</td></tr><tr><td>2018</td><td>3,154</td></tr></table>
Description of measurement methods and procedures to be applied:	Electricity meter
QA/QC procedures to be applied:	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. Cross check measurement results with invoices for purchased electricity
Any comment:	Field measurement

Data / Parameter:	Hours of operation of cogeneration plants
Data unit:	Hours
Description:	Hours of operation (OH) of cogeneration plants
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7,008 hours of operation
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	Field measurement,

Data / Parameter:	$PE_{EC,y}$
Data unit:	tCO_2
Description:	Project emissions from electricity consumption by the project activity during the year *y*
Source of data:	Calculated data from onsite measurements as per the “Tool to calculate baseline,

	project and/or leakage emissions from electricity consumption”.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Year: Project emissions from electricity consumption (MWh) 2009: 1,809 2010: 1,809 2011: 1,809 2012: 1,809 2013: 1,809 2014: 1,809 2015: 1,809 2016: 1,809 2017: 1,809 2018: 1,809
Description of measurement methods and procedures to be applied:	Parameters used in calculation are included in the Monitoring Plan.
QA/QC procedures to be applied:	As defined in the monitoring procedure
Any comment:	Calculated Data,

Data / Parameter:	$\mathbf{fv_{i,h}}$
Data unit:	-
Description:	Volumetric fraction of component *i* in the residual gas in the hour *h* where i = CH_4, CO, CO_2, O_2, H_2, N_2
Source of data:	Onsite measurements using a continuous gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	The same measurement basis (dry or wet) will be considered for the volumetric fraction of component i and the volumetric flow rate FV_{RG} when the gas temperature exceeds 60°C
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field measurements,

	In case a complete chromatography of the LFG is not available, the simplified approach of measuring only the methane content and considering the remaining part as N_2 will be used as recommended in the "Tool to determine project emissions from flaring gases containing methane".

Data / Parameter:	**$FV_{RG,h}$**
Data unit:	Nm^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*
Source of data:	Onsite measurements using a flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	The same measurement basis (dry or wet) will be considered for the volumetric fraction of component i and the volumetric flow rate FV_{RG} when the gas temperature exceeds 60°C
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Field Measurement. In case of the usage of the default flare efficiency value, the correct operation of the torch will be controlled and monitored between the values established by the manufacturer for this variable.

Data / Parameter:	**T_{flare}**
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Source of data:	Measurements by Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple.
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept Thermocouples will be calibrated every year and replaced if applicable

Any comment:	Field measurement. In case of the usage of the default flare efficiency value, the correct operation of the torch will be controlled and monitored between the values established by the manufacturer for this variable.

Data / Parameter:	$\mathbf{T_{flare<500°C}}$
Data unit:	minutes
Description:	Time of flare temperature below 500°C
Source of data:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used in the calculation of expected emission reductions
Description of measurement methods and procedures to be applied:	According to T_{flare} values
QA/QC procedures to be applied:	The equipment will be subject to maintenance and calibration according to manufacturer specifications. Calibration and maintenance records will be kept
Any comment:	Calculated Data,

Data / Parameter:	$\mathbf{TDL_y}$
Data unit:	%
Description:	Average technical transmission and distribution losses in the grid in year *y*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	16.63%
Description of measurement methods and procedures to be applied:	Data published by the Ministry of Energy in the Electricity Sector Prospective
QA/QC procedures to be applied:	
Any comment:	Calculated data,

B.7.2 Description of the monitoring plan:

The Monitoring Plan will be done as defined in the internal procedure. This document defines the Monitoring Platform to ensure the correct measurement, registration and calculation of data. The main activities are identified below and will be carried out in order to adequately control the monitoring parameters.

- Data monitoring
- Data management
- Reporting
- Equipment maintenance

The monitoring plan will be implemented over the project life with periodical reviews of the procedures in order to ensure proper process execution.

Tú Transformas will perform QA/QC measures and ensure proper archiving of the data for the specified period.

Further details of the monitoring plan are shown in annex 4

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

The baseline study was completed on May 19, 2008 by:
Tú Transformas - Energías Renovables de México SA de CV
Cordillera de los Andes 240
Lomas de Chapultepec, Mexico City C.P. 11000

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

October 15, 2008[31]

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

15 years

[31] The starting date is mandated by the formalization of the letter of intent for the acquisition of the engineering services “EPC” which includes the generation equipment.

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

C.2.1. Renewable crediting period

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

10 November 2009 or the date of registration, whichever is later.

C.2.2.2. Length:

10 (ten) years

SECTION D. Environmental impacts

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

The main purpose of the Project Activity is to reduce the environmental impacts caused by LFG. As required by the Host Country, an Environmental Impact Assessment (MIA[32]) is required for every activity related electricity generation. In accordance to the procedure[33] defined by the Ministry of Environment and Natural Resources (SEMARNAT) the following is required:

I. **Brief description of the Project, the Project Developer and participants in the study: In this** section, a brief introduction to the Project is needed, including among others, location, operational lifetime and details of the Project Developer and the responsible of developing the environmental impact study.

II. **Detailed description of the Project:** In this section a detailed description of the Project is needed including the nature of the project activity, the selection of site, specific location, investment and size of the project, actual usage of land and water in site and service requirements. Additionally a detailed schedule is needed that includes the following phases: preparation, construction, operation and maintenance and abandonment.

[32] Manifestación de Impacto Ambiental
[33] Guía para la presentación de la Manifestación de Impacto Ambiental del Sector Eléctrico Modalidad: Particular

III. **Legal documentation:** All environmental laws that are applicable should be followed, including land usage and regularization.

IV. **Environmental inventory:** The study requires an environmental diagnose detailing aspects including climate conditions, geology and geomorphology, soil, superficial and subterranean hydrology and biotical aspects such as flora and fauna. It also includes socioeconomic aspects such as demographic and socio-cultural indicators.

V. **Identification, description and evaluation of environmental impacts:** This section includes impact indicators, methodology of evaluation and justification of the chosen methodology. It also includes a list of indicators of environmental impact.

VI. **Preventive and mitigation measures:** Description of the program for mitigation or correction of environmental impacts including residual impacts

VII. **Description of methodological and technical references:** This section includes maps, photos, videos and other references that allow verification.

The study was approved by SEMARNAT in, 2008. The MIA will be available for the DOE during validation.

In summary, the Project Activity will collect and utilize landfill gas for electricity generation which is currently released to the atmosphere, thereby reducing harmful global and local environmental effects that pose serious health and safety problems to the local environment, affecting the neighbouring population and causing damages to crops, plants and to the local fauna.

The Project Activity has the following positive environmental impacts:

- Improvement of the local environment: LFG collection improves the air quality of the surrounding community by reducing landfill odours.
- Positive impact on global climate, by avoiding the release of LFG into the atmosphere
- Beneficial impact by reducing explosion hazards from gas accumulation in structures on or near the landfill
- LFG combustion and flaring will diminish health hazards as well as odour nuisances.
- Electricity generation will reduce the use of fossil fuel based generation plants used by the state-owned utilities.

In a social context, the proposed project has a contribution to local development due to the employment of local workers. In construction phase, 15 local residents will be employed and 6 additional workers will be fully trained and employed for tasks related to operation, maintenance and surveillance.

It is expected that the project activity provides economical benefits to the community. A percentage of the revenues obtained through the sale of Certified Emission Reductions ("CERs"), will be dedicated to productive social projects and infrastructure improvements such as "Ojo de Agua" Project in order to contribute with the development of the communities affected by the activity of the dumpsite.

Despite the numerous positive effects of the Project Activity, the following adverse impacts may be cause for concern and shall, therefore, be considered:

- CO_2 emission from consumption of electricity from the grid. The emissions will be measured during operation according to the monitoring plan and will be controlled by applying the appropriate maintenance programs.
- Noise and vibration caused by LFG collection and combustion LFG equipments. The associated impact is considered as moderate because the facilities will be located sufficiently apart from the neighbouring village and will comply with the national legislation.

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

The Project Activity results in mainly positive environmental impacts. Of the possible adverse impacts, these are minimized by the use of efficient technology, operative and maintenance procedures according to the QA/QC program.

According to Mexican regulations, an Environmental Impact Assessment is required for the implementation of electricity generation which will be available for the DOE at validation.

The Project Activity meets all regulatory requirements at municipal, state and federal level in the Host Country

SECTION E. Stakeholders' comments

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

Two assemblies were held at the Ejido of San Mateo Nopala, where the landfill is located and the main stakeholders live, on November 3rd, 2007 and January 26th, 2008.

Additionally, another formal consultation took place on March 28th, 2008 at the conference room "Sor Juana" which is located in Parque Naucalli, Naucalpan, State of Mexico. During the gathering, the proposed project was presented to the stakeholders, who expressed their views and comments on the activity.

Local stakeholders were invited through a letter published in the national newspaper "Excelsior" and announcements posted at local universities and the Town Council building. In addition, personal invitations were made to local environmental authorities.

A group of neighbours, local authorities, NGOs, and others attended to the meeting as shown in the following list:

Name	Institution
Mario Emilio Rojas	Neighbour
Ma. Luisa Becerril Díaz	Neighbour
Agustín Mendoza Olivares	Neighbour
Tania I. Fernández Martínez	Neighbour

Luis Ricardo Camacho Cárdenas	Student
Rodrigo Camacho Cárdenas	Student
Patricia Macedo Mendoza	Student
Rosario Joffre	Neighbour
Maricarmen Gaytán C.	head hunter (PC)
Ricardo Conzuelo	Municipality
Carlos Guevara	Municipality
Manuel Gómez Morin	OAPAS Naucalpan
Dora Pescador	Neighbour
Miguel Angel Ortiz	Neighbour
Reynaldo Camacho Rodriguez	Neighbour
Flora Cárdenas Chávez	Neighbour
Roman Cedillo Campos	Neighbour
Olivia Ortiz Pérez	Neighbour
José Luis Cedillo C.	Neighbour
Socorro Ibarra	Municipality
Ana María A. Trejo Gonzalez	Neighbour
Juan José Samano	Volmex - Satélite
Guadalupe González R.	Neighbour
Luz Ma. Vargas	Neighbour

Table 7: List of attendees to the public consultation

Through the gathering, a presentation was performed explaining the following topics:

- The greenhouse effect and climate change
- The Kyoto protocol and the flexibility mechanisms
- The environmental impacts caused by a waste disposal site
- The proposed project activity
- The environmental and social benefits of the project

After the presentation, questions were raised by stakeholders and answered by the project proponent.

E.2. Summary of the comments received:

Throughout the session, the neighbours, authorities and all participants expressed their support to the project and the associated benefits for the community. The stakeholders commented about the social and environmental contribution of the proposed project to the region and the importance of the development of CDM projects in the country and around the world in order to contribute with the mitigation of environmental problems.

Also, each participant answered a questionnaire in order to state their opinion. The questions were:

What do you think about the "Rincon Verde Gas to Energy Project"
Do you believe "Rincon Verde Gas to Energy Project" will contribute to the environmental protection, social and economic development of the region?
Please provide additional comments about the project

All comments received were positive and supportive to the project.

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

In all the meetings, no negative comments were received and no adjustment is needed in the project.

During the assemblies at the Ejido of San Mateo Nopala, everyone welcomed the project activity and the questions raised were about the financial profits to be received by the Municipality and Ejido (community). The majority of the questions were related to the social project "Ojo de Agua" which will be implemented in the area in order to contribute with the regional sustainable development.

In the last consultation, some questions were received related to the location of the project, the duration and the technology that will be used to generate electricity.

All the questions were answered by the project proponent in order to clarify the doubts.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Tú Transformas - Energías Renovables S.L.
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Represented by:	
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Organization:	Tú Transformas - Energías Renovables de México SA de CV
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URL:	www.tutransformas.com
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Middle Name:	
First Name:	Juan José
Department:	

Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	jjmartinez@tutransformas.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding

Annex 3

BASELINE INFORMATION

A3.1 Site Parameters for Rincón Verde LFGTE Project

Site Parameters	
Name	Rincón Verde
Location	Naucalpan de Juárez, Estado de México
Coordinates	19°29'39.31'' to 19°29'40.76'' N 99°17'43.81'' to 99°17'42.95'' W
Altitude	2,428 m over sea level
Area	17 hectares
Climatic conditions	MAP 876.7 mm, MAT 15.2 °C

A3.2 Landfill characteristics

Landfill characteristics	
Opening Date	1975
Closing Date	2006
Estimated amount of waste in site	11 MMt of MSW
Methane correction factor	1
Oxidation Factor	0
Adjustment Factor	0%

A3.3 Solid waste characterization

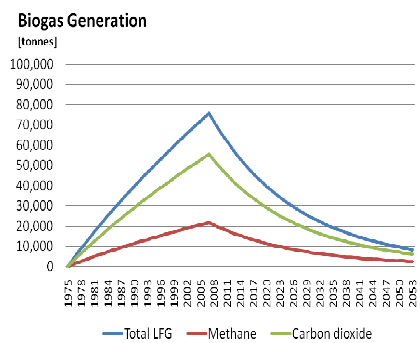
Solid Waste Characterization			
Waste type j	**Composition**	**DOC_j**	**Decay Rate k**
Wood and wood products	1.05%	0.50	0.02
Pulp, paper and cardboard	25.54%	0.44	0.04
Food, food waste, beverages and tobacco	33.27%	0.38	0.06
Textiles	4.51%	0.30	0.04
Garden, yard and park waste	0.80%	0.49	0.05
Glass, plastic, metal, other inert waste	34.82%	0.00	0.00

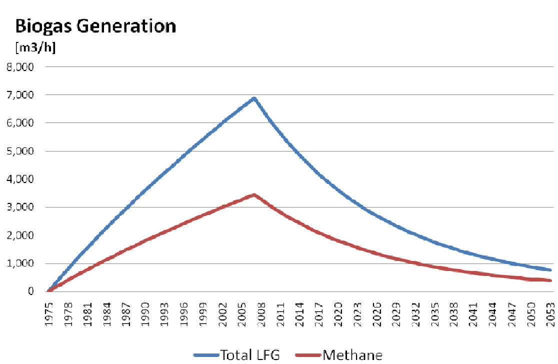
A3.4 Project Characteristics

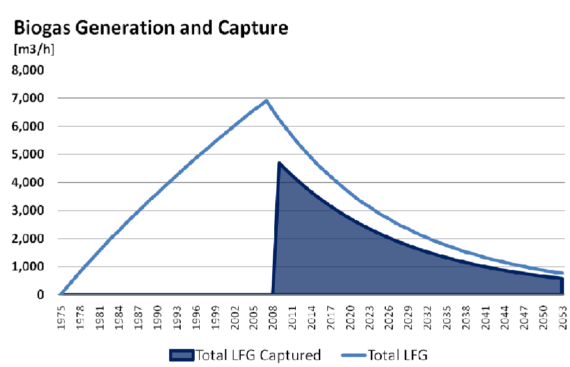
Project Characteristics		
Parameter	Unit	Value
Degassing efficiency	%	75%
Installed Capacity	MW	8.184
Per Unit consumption	Nm^3/h	655
Availability	%	80%
Altitude correction factor	%	95%
Operation hours	hours	7,008

A3.5 Ex-ante estimation of Biogas generation and capture

	$BE_{CH4,SWDS}$ [tCO_2e]	LFG [tonnes]	CH_4 [tonnes]
2009	308,773	68,376	19,605
2010	293,646	65,026	18,644
2011	279,289	61,847	17,733
2012	265,664	58,829	16,868
2013	252,731	55,965	16,046
2014	240,454	53,247	15,267
2015	228,799	50,666	14,527
2016	217,733	48,215	13,824
2017	207,225	45,888	13,157
2018	197,246	43,679	12,524

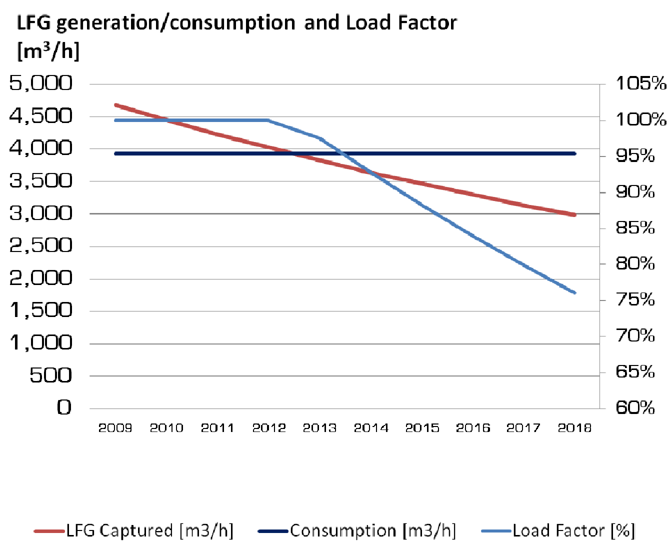






A3.6 Ex-ante electricity generation estimation

Year	LFG Captured [m3/h]	Consumption [m3/h]	Load Factor [%]	Generation [MWh]
2009	4,683	3,930	100%	54,486
2010	4,454	3,930	100%	54,486
2011	4,236	3,930	100%	54,486
2012	4,029	3,930	100%	54,486
2013	3,833	3,930	98%	53,144
2014	3,647	3,930	93%	50,563
2015	3,470	3,930	88%	48,112
2016	3,302	3,930	84%	45,785
2017	3,143	3,930	80%	43,575
2018	2,992	3,930	76%	41,477



A3.7 Emission Factor for the Mexican electricity system

Low-cost/must run resources[34]

Technology	Low-cost/ Must-run	2003	2004	2005	2006	2007
Residual fuel oil and/or gas	No	73,743	66,334	65,077	51,931	49,482

[34] Prospectiva del Sector Eléctrico 2007-2016 pg 85, Chart 22

Dual	No	13,859	7,915	14,275	13,875	13,375
Combined cycle	No	55,047	72,267	73,381	91,064	102,674
Gas turbine	No	6,933	2,772	1,358	1,523	2,666
Internal combustion	No	751	610	780	854	1,139
Hydroelectric	Yes	19,753	25,076	27,611	30,305	27,042
Coal	No	16,681	17,883	18,380	17,931	18,101
Nuclear	Yes	10,502	9,194	10,805	10,866	10,421
Geothermal	Yes	6,282	6,577	7,299	6,685	7,404
Wind	Yes	5	6	5	45	248
Imports	No	71	47	87	523	277
Total Generation GWh		203,556	208,634	218,971	225,079	232,552
Low-cost/must-run generation GWh		36,542	40,853	45,720	47,901	45,115
Low-cost/must-run generation %		17.95%	19.58%	20.88%	21.28%	19.40%

Average generation of the five most recent years: 19.82% which is lower than the 50% stated in the methodology so the Simple OM method is applicable.

A3.7.i. *Fuel Consumption in the Mexican electricity system*

Fuel Consumption [TJ]	Electric System	Fuel Oil	Natural Gas	Diesel	Coal
2005[35]	1,597,605	39.0%	39.6%	0.9%	20.5%
2006[36]	1,608,555	32.0%	47.0%	1.0%	20.0%
2007[37]	1,652,355	28.9%	52.0%	0.5%	18.5%

A3.7.ii. *Operating Margin (OM)*

Emission Factor (tCO_2/TJ)	Fuel Oil	Natural Gas	Diesel	Coal
EFCO2[38]	75.5	54.3	72.6	89.5

[35] Prospectiva del Sector Eléctrico SENER 2006-2015 pg 90 Graph 31

[36] Prospectiva del Sector Eléctrico SENER 2007-2016 pg 116 Graph 40

[37] Prospectiva del Sector Eléctrico SENER 2008-2016 pg 148 Graph 39

[38] Table 1.2 of Chapter 1 2006 IPCC Guidelines Volume 2

Emissions [tCO2]	Electric System Emissions [tCO_2]	Fuel Oil	Natural Gas	Diesel	Coal
2005	111,871,012	47,162,098	34,352,981	1,043,875	29,312,058
2006	109,875,566	38,862,689	41,051,932	1,167,811	28,793,135
2007	110,668,128	36,053,560	46,655,896	599,805	27,358,868

Emission Factor [tCO2/GWh]	Electric System
2005	645.392
2006	618.317
2007	589.557
OM Emission Factor	**617.756**

According to the "Tool to calculate the emission factor for an electricity system", the Operating Margin (OM) $EF_{grid,OM,simple}$ is **617.8 tCO_2/GWh**.

A3.7.iii. *Build Margin (BM)*

Power capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently. According to the Electricity Sector Prospective, the total electricity generated in 2006 was 225,079 GWh.

Addition year	Plant name	Technology	Installed Capacity [MW]	Electricity Generation 2007[39] [GWh]	Accumulated generation [GWh]	% of Total Production
2007[40]	El Cajon	HID	750.0	989	989	0.43%
	Baja California Sur I	CI	41.9	228.1	1,217.1	0.52%
	Tamazunchale	CC	1135.0	4,117	5,334.1	2.29%
	Rio Bravo	CC	211.1	177	5,510.9	2.37%
2006[41]	Valladolid III (PIE)	CC	525	3,573	9,083.9	3.91%
	Tuxpan V (PIE)	CC	495	3,921	13,004.9	5.59%
	Altamira V (PIE)	CC	1,121	8,391	21,395.9	9.20%
	Chihuahua II (El Encino)	CC	65	454	21,849.6	9.40%

[39] Prospectiva del Sector Eléctrico SENER 2008-2017 pg 205, Table 5.

[40] Prospectiva del Sector Eléctrico SENER 2008-2017 pg 101, Chart 19.

[41] Prospectiva del Sector Eléctrico SENER 2007-2016 pg 77, Chart 19.

2005[42]	La Laguna II PIE	CC	498	3,521	25,370.6	10.91%
	Rio Bravo IV PIE	CC	500	2,576	27,946.6	12.02%
	Baja California Sur I	CI	43	234	28,180.1	12.12%
	Hermosillo	CC	93	627	28,807.3	12.39%
2004[43]	Chicoasén	HID	900	1,267	30,074.1	12.93%
	Rio Bravo III PIE	CC	495	2,063	32,137.1	13.82%
	Tuxpan	TG	163	734	32,871.0	14.13%
	El Sauz	CC	128	1,081	33,952.4	14.60%
2003[44]	Altamira III y IV (PIE)	CC	1,036	6,052	40,004.4	17.20%
	Tuxpan III y IV (PIE)	CC	983	6,875	46,879.4	20.16%

According to the Ministry of Energy, the average efficiency of the fossil fuel based technologies are:

Type	Abbreviation	Average Efficiency Values[45]
Natural Gas (Simple Cycle)	TG	35.19%
Combined Cycle	CC	52.18%
Diesel (Internal Combustion)	CI	42.36%

The emissions of the capacity additions identified earlier are:

Plant name	**Technology**	**Electricity Generation 2007 [GWh]**	**Efficiency [%]**	**$EFEL_{,m,y}$ [tCO2/TJ]**	**$EFEL_{,m,y}$ [tCO2/GWh]**	**Emissions (tCO_2)**
El Cajon	HID	989.0	-	-	-	-
Baja California Sur I	CI	228.1	42.36%	72.6	617	140,725
Tamazunchale	CC	4117.0	52.18%	54.3	375	1,542,455
Rio Bravo	CC	176.8	52.18%	54.3	375	66,243
Valladolid III (PIE)	CC	3573.0	52.18%	54.3	375	1,338,642
Tuxpan V (PIE)	CC	3921.0	52.18%	54.3	375	1,469,022
Altamira V	CC	8391.0	52.18%	54.3	375	3,143,730

[42] Prospectiva del Sector Eléctrico SENER 2006-2015 pg 57, Chart 13.

[43] Prospectiva del Sector Eléctrico SENER 2005-2014 pg 51, Chart 14.

[44] Prospectiva del Sector Eléctrico SENER 2004-2013 pg 44, Chart 9.

[45] Prospectiva del Sector Eléctrico SENER 2008-2017 pg 168 Chart 49

(PIE)						
Chihuahua II(El Encino)	CC	453.7	52.18%	54.3	375	169,990
La Laguna II PIE	CC	3521.0	52.18%	54.3	375	1,319,160
Rio Bravo IV PIE	CC	2576.0	52.18%	54.3	375	965,111
Baja California Sur I	DI	233.5	42.36%	72.6	617	144,084
Hermosillo	CC	627.2	52.18%	54.3	375	234,986
Chicoasén	HID	1266.8	-	-	-	-
Rio Bravo III PIE	CC	2063.0	52.18%	54.3	375	772,913
Tuxpan	TG	733.9	35.19%	54.3	555	407,678
El Sauz	CC	1081.4	52.18%	54.3	375	405,154
Altamira III y IV (PIE)	CC	6052.0	52.18%	54.3	375	2,267,412
Tuxpan III y IV (PIE)	CC	6875.0	52.18%	54.3	375	2,575,753

The accumulated emissions from the previous table are 16,963,061 tCO_2 and the electricity generated by these power plants is 46,879.36 GWh. According to the "Tool to calculate the emission factor for an electricity system", the Build Margin (BM) $EF_{grid,BM}$ is **361.84 tCO_2/GWh**.

A3.7.iv. *Combined Margin (CM)*

According to the "Tool to calculate the emission factor for an electricity system", the Combined Margin (CM) must be evaluated as follows:

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

$EFgrid_{,OM,y}$	617.76
wOM	0.50
$EFgrid_{,BM,y}$	361.84
wBM	0.50
$EFgrid_{,CM,y}$	**489.8**

A3.8 Project Emissions

Project emissions were calculated as specified in the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" with the following parameters:

Project Characteristics		
Parameter	Unit	Value
Auxiliary equipment requirements (per unit)	kW	75
Total equipment requirements	kW	450
Availability	%	80%
Operation hours	hours	7,008
Total consumption	MWh/year	3,154
Total System Generation	GWh	235,471
Total System Losses (including T&D)	GWh	39,600
Transmission and Distribution Losses	%	16.82%

Annex 4

MONITORING INFORMATION

Image 5: Multi-level Monitoring System

Image 6: Flow Diagram of Monitoring System[46]

The Monitoring plan develops procedures for the systematic control of the CDM Project Activity by the measuring, managing and recording the performance-related indicators relevant to the activity, which are included in Section B.7.1.

The Monitoring Plan includes:

1. **Data monitoring**, monitoring parameters will be measured as specified in section B.7.1. Data collected from monitoring equipment will be transmitted to a local computer.

2. **Data management**, data stored in the local computer will be transmitted to a central database, where this data will be stored and can be reviewed. In order to identify possible errors or omissions, main data will be checked in the database prior to being used in calculations. With the validated data the CER quantity calculations will be carried out.

3. **Reporting**, Spreadsheets will be used and will serve as a registry of monitoring parameter data and CER quantity calculation.

4. **Equipment calibration**, calibration and maintenance procedures will be developed in order to comply with the technology provider's recommendations and in order to assure high levels of accuracy.

[46] Based on technology provider diagram