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

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Tultitlan – EcoMethane Landfill Gas to Energy Project
Document Version Number 1
Date completed 08/03/2007

A.2. Description of the project activity:

The Tultitlan – EcoMethane Landfill Gas to Energy Project (hereafter, the "Project") developed by Biogas Technology Ltd (hereafter referred to as the "Project Developer") is a landfill gas (LFG) collection and utilisation project in the city of Tultitlan, in the State of Mexico, Mexico, hereafter referred to as the "Host Country". The project will have an electricity component with maximum installed capacity reaching 1.3 MW.

In the meantime the Tultitlan site has become an engineered sanitary landfill, notwithstanding it opened and started its operation in 1987 as a common dump site. Since then approximately 2 million tonnes of solid municipal waste have been deposited at the site. Although the site currently receives up to 2,000 tonnes of municipal waste daily, its anticipated closure date is in 2007. The landfill includes a properly engineered leachate collection system, a lined leachate basin, and a simple passive vent system to partially collect the generated landfill gas.

The objective of the project is to replace the existing ineffective passive venting system by an active gas collection and flaring system. The purpose of LFG flaring is to dispose of the flammable constituents, particularly methane, safely and to control odour nuisance, health risks and adverse environmental impacts. Hence this will involve investing in a highly efficient gas collection system, flaring equipment and once the project secures a power purchase contract, a modular electricity generation plant. The generators will combust the methane in the LFG to produce electricity for export to the grid. Excess LFG, and all gas collected during periods when electricity is not produced, will be flared.

The Project is being developed through EcoMethane, an unincorporated joint venture dedicated to financing, constructing and operating projects that capture and make productive use of methane emissions. EcoMethane brings together investors, technology providers, engineers, and consultants to capitalise on the opportunities offered by the emerging market in greenhouse gas (GHG) emissions, particularly those related to activities that reduce emissions of methane to the atmosphere. EcoMethane works exclusively with Biogas Technology Ltd (Biogas) and the ENER*G Group PLC (ENER*G) for the financing, constructing and operation of LFG projects worldwide, and with EcoSecurities Group PLC (EcoSecurities) for the development of these projects under the Clean Development Mechanism of the Kyoto Protocol. For their part, Biogas and ENER*G (sister companies under the same ownership) have more than 20 years experience designing, installing and operating LFG collection and utilisation systems, and are respected leaders in the field. For example, Biogas has designed, installed and operated LFG collection systems on more than 100 landfills, and ENER*G has more than 90 MW of installed electrical generation capacity. For its part, EcoSecurities is a leading CDM/JI project development company. EcoSecurities is a world leader in origination and development of CDM projects and trading of carbon credits. Since it was founded in 1997, EcoSecurities has developed or advised on emissions reductions projects in over 20 countries in five continents and has currently over 200 projects in development around the world.

The Project will have several positive social and environmental impacts:

- First, the installed landfill gas collection and flaring system will prevent potentially explosive situations associated with the subsurface gas migration, as it represents an effective control system which minimises migration off-site.

- Second, many constituents of landfill gas are hazardous and pose a potentially significant risks to human health. The objective of LFG flaring is to dispose of the perilous constituents, particularly methane, safely and to control and reduce odour nuisance and health risks.

- Third, the project will minimise damage to or deterioration on the environment and reduce the emissions of methane globally.

- Fourth, provide a model for LFG management, a key element in improving landfill management practices throughout the Host Country.

- Fifth, the project will act as a clean technology demonstration project, encouraging less dependency on grid-supplied electricity.

- Finally, the project will provide for both short- and long-term employment opportunities for local people. Local contractors and labourers will be required for construction, and long-term staff will be used to operate and maintain the system.

The project is helping the Host Country to fulfil its goals of promoting sustainable development. Specifically, the project:

- guarantees sustainability in the environmental sector;
- will be incorporated in the Host Country's politics through a national programme;
- represents an investment in environmental funds
- promotes the integration of environmental infrastructure, such as appropriate waste management and storage, as well as rehabilitation of landfill sites;
- optimises the use of natural resources and avoids uncontrolled contaminations;
- promotes and diversifies sustainable energy systems;
- increases employment opportunities in the area where the project is located;
- uses clean and efficient technologies, and conserves natural resources;
- acts as a clean technology demonstration project, encouraging development of modern and more efficient generation of electricity energy using landfill gas throughout the Country;
- improves the overall management practices of the landfill.

A.3. Project participants:

Table: Project participants

Name of party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) Project participants (*)	Kindly indicate if the Party involved wishes to be considered as project

	(as applicable)	participant (Yes/No)
Mexico (host)	Biogas Technology S.A. de C.V.	No
United Kingdom of Great Britain and Northern Ireland	Biogas Technology Ltd.	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group PLC	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party (country) involved may or may not have provided its approval. At the time requesting registration, the approval by the Party(ies) involved is required.

Further contact information of project participants is provided in Annex 1.

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 (EDOMEX) / Region IV Cuautitlán Izcalli

A.4.1.3. City/Town/Community etc:

Municipality of Tultitlan

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

The project will be located in the south of the region "Sierra de Guadalupe" which can be accessed by an unpaved road, approximately 3km from a highway named "Avenida López Portillo" in the Municipality of Tultitlán. The geographical coordinates are 19°35' northern Latitude and 99°09' western Longitude. The figures below show a map of the location of the project:

Aerial view of the landfill of Tultitlan.

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

According to Annex A of the Kyoto Protocol, this project fits in Sectoral Category 13, Waste Handling and Disposal.

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

Landfill Gas Collection System

The Project Developer has over twenty years of practical experience in the design, installation and operation of LFG collection systems. The project activity involves the installation of state of the art LFG collection technology. This includes:

- Vertical gas wells drilled into the waste to extract the LFG. The gas wells cover the area of the landfill available for gas extraction and are spaced on a site-specific grid to maximise LFG collection.

- A gas collection pipe network which consists of pipes that connect groups of gas wells to the manifolds. The manifolds are connected into a main pipe and then into the main header pipe which delivers the gas to the extraction plant and the flare. The system is modular, so it is relatively easy to extend it on parts of the landfill available for gas extraction in the future.
- Dewatering points at strategic low points of the gas collecting work which allow effective condensate management by returning the condensate back to landfill.
- Blower(s) which draw the gas from the wells through the collection system and deliver it to the flare or gas fuelled internal combustion engine powering electricity generator. The system operates at pressure slightly lower than atmospheric and is optimised to address issues related to pressure losses.
- An impermeable cover material (high density polyethylene membrane or mineral material). For efficient operation of the gas collection system, each landfill cell, where the gas is collected from, must be covered with an appropriate capping material to provide sufficient containment and prevent air ingress into the landfill body.

Installation

The gas collection field installation is closely managed and monitored by experienced project managers from the Project Developer in accordance with proven quality control procedures. Experienced key workers are employed to ensure that the gas collection system is installed correctly, and a large portion of the plant and labour is sourced locally. In addition, a comprehensive installation record is maintained to ensure that any future expansion or repair works can be located quickly and efficiently.

Operation

Project Developer's trained personnel sets up the gas collection system for optimal long-term operation. Their engineers and technicians are involved in balancing the gas collection system on a regular basis in accordance with the monitoring plan.

Sophisticated portable gas monitoring equipment, fitted with an in-built data logging facility and data retrieval to a PC is used in the day-to-day operation of the system. Collected data are emailed to the UK for review on a daily basis. The Project Developer's senior management personnel provide technical support throughout the project to the local personnel employed on the ground.

Flare Technology

The Project Developer has designed, manufactured and installed skid / base mounted and mobile gas flares for burning LFG for over twenty years. Enclosed stacks provide conditions for high temperature combustion to effectively destruct methane with other combustible LFG components and meet low emission regulations in accordance with latest best practice guidelines (UK Environment Agency: Guidance on Landfill Gas Flaring, 2002 - version 2.1).

The project activity involves the installation of a modular enclosed gas flare consisting of pipe work, valves, blower, stack with proprietary burners, instrumentation and control panel. The main features of the gas flare system are presented below.

- The pipe work connects all the elements of the flare from the main header pipe to the burners via a demister with filter element, isolation and control valves, blower and instrumentation. All the pipe work has flanged or threaded connections and is fully galvanised. The demister element protects the fan from moisture and particulates that flow with the gas from the waste deposit. The pipe work has drainage valves for removal of condensate that may accumulate in it.
- Valves used are manually or automatically operated. They can isolate incoming gas or parts of the pipe work in accordance with operational requirements. They are also used to regulate the flow and pressure of the gas.
- The unit has a flame arrester for safety purposes. The flame arrester(s), which is of the deflagration type, is fitted on the main and pilot delivery lines. The arresters protect the blower and the field pipe work from flashback of the flame from the burners.
- The system includes a centrifugal electrically-powered blower, which is a pressure rising machine that generates suction in the gas collection system and positive pressure (above atmospheric) on the burners. The blower drives the gas from the gas wells into the burners.
- The flare stack is made of circular galvanised steel shroud with ceramic lining that maintains high combustion temperature inside. The dimensions of the stack are designed to guarantee safe and effective destruction of the LFG with minimal environmental impact (low emissions). At the bottom of the stack are a set of manual and automatic louvers that control air supply to the burners in order to maintain optimum combustion parameters. The stack is fitted with an igniter that starts the flame on the burners, with a thermocouple (to measure temperature) and a flame detector.
- At high temperature, burners of proprietary Biogas design ensure full destruction of combustible constituents found in LFG, in accordance with the UK Environment Agency guidelines.
- The unit includes sophisticated instrumentation, as follows:
  - pressure, vacuum and temperature gauges and transmitters fitted onto the pipe work that monitor the parameters of the LFG;
  - flow meter to measure accurately the flow of the gas through the system;
  - gas analyser (methane, carbon dioxide, oxygen) that measure the quality of the gas delivered to the flare, as well as gas flow rates and pressure (among other selected parameters);
  - sampling points for taking gas samples with portable instrumentation for laboratory analysis;
  - an ultraviolet camera fitted to the stack that monitors the presence of the flame;
  - a thermocouple that monitors accurately the temperature of the flame in the stack and feeds back the signal to the automated air louver in order to maintain the temperature within the stack at desired level; and
  - a data logging system that transmits the information via telemetry / satellite to the control centre managed by the Project Developer.

- The control panel houses all of the flare controls, motor starters, alarms and interlocks that ensure safe operation of the flare. The control panel enables:
  - powering the plant and its components;
  - a manual, automated or remote start and the shut down of the flare;

- automated shutdowns and isolation of the gas supply if the safety devices (e.g. flame detector) indicate unsafe operating conditions;
- an automatic notification of the alarms and shutdowns to the operator via telemetry;
- an automated temperature control;
- a local readout of the flare operating parameters and alarms; and
- an electrical isolation of the whole plant.

Electricity Generation Technology

As and when the project secures a power purchase agreement that will enable the generation of electricity, a modular reciprocating engine facility will be installed. The Project Developer would develop the electricity generation component of the project activity through its relationship with the ENER*G Group, whose subsidiary ENER*G Natural Power has extensive experience in the design, building, and operation of generators using LFG.

The electricity generation project component will involve the construction of a suitable sized compound (50m x 80m) which will comprise a level surface with concrete bases to support the engine units. The compound will have an electrical earthing blanket constructed below the surface to comply with electrical regulations. There will be an electrical sub-station constructed that will contain all suitable switching gear and metering equipment to facilitate a connection to the national grid network. There will be two small support buildings for offices and a workshop. A series of pipes and ducts will be laid to carry both electrical cabling and gas pipes. There will also be three fully bounded tanks for clean oil, dirty oil and coolant storage. The whole area will be securely fenced.

The packaged generation system consists of an outdoor acoustic containerised generating set comprising an engine/alternator set. The engine units comprise a fully containerised Caterpillar (Cat 3516) 16 cylinder turbo charged gas engine, with a separate control room and housing for its own transformer and switch. These units are designed to be fully mobile. The containers are fully sealed (no floor penetrations) to avoid spreading oil through leaks onto the ground, therefore they can be referred to as environmentally compliant. As the gas production increases or decreases (gas production curve) the containerised engine units can be easily added or taken away to match the gas production. These generators are designed and built by the ENER*G Group in Manchester and the design incorporates the following key features:

- Fully enclosed oil-bounded engine compartment and control room;
- Extended oil sumps to increase oil change intervals and reduce downtime;
- Sealed oil pumping lines to make oil changes faster and safer with no risk of spillage;
- A comprehensive, patented, engine management system designed and built in-house, which allows for remote operation and monitoring and has been proven in over 600 applications;
- Sound proofed engine compartments, typically reducing sound levels to 69 dB(A) at 10m;
- Engine emissions that achieve current pre December 31st 2005 engine emission limits as detailed in “Guidance for Monitoring Landfill Gas Engine Emissions” (UK standards);

- EA Technical Guidance, compliant exhaust stacks with monitoring points and optional access platform (retrofitted on site).

All engine units are fitted with remote monitoring technology which is Internet based and allows engines to be started and stopped remotely as well as monitor engine performance, output, and characteristics. Irrespective of this the generation facility will employ full time staff for operation, routine servicing and repairs.

The technology used in the project activity to collect, flare and utilise the LFG comes from the UK. Equipment will be imported and installed in Mexico, representing a transfer of technology.

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

Table: Estimated emission reductions from the project

Year	**Total Annual estimation of emission reductions in tonnes of CO_2e**
2007 (Aug – Dec)	21,924
2008	53,165
2009	56,143
2010	51,139
2011	46,916
2012	43,448
2013	39,816
2014	36,443
2015	33,308
2016	30,839
2017 (Jan – Jul)	16,406
Total estimated reductions (tonnes of CO_2e)	**429,547**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	42,955

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.

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:

For the LFG component, ACM0001 version 5, adopted at EB28, "Consolidated baseline methodology for landfill gas project activities" and "Consolidated monitoring methodology for landfill gas project activities" will be used.
ACM0001 refers to the following tools:

- "Tool for the demonstration and assessment of additionality" – version 03, adopted at EB29.
- "Tool to determine project emissions from flaring gases containing methane" – version adopted at EB28.

For the electricity generation component, AMS- I.D version 10, dated 23 December 2006, "Renewable electricity generation for a grid" based on Appendix B of the simplified modalities and procedures for small-scale CDM project activities will be used.
AMS-I.D refers to the following methodology:

- ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable source" – version 06, dated 19 May 2006.

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

The methodology ACM0001 allows for the development of projects falling under either of 3 options:

a) Landfill projects where the captured gas is simply flared; or
b) Landfill projects that use the gas to produce energy (e.g. electricity/thermal energy), but do not claim emission reductions for displacing or avoiding energy from other sources; or
c) Landfill projects where the captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources.

The Project is based on two complementary activities, as follows:

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

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

ACM0001 states that in the case of option c), the approved small-scale methodology for renewable electricity generation for a grid can be applied (Type I.D) if the amount of electricity generated is below the threshold for small scale projects (15MW). This category comprises renewable energy generation units that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit. This is therefore applicable to this project. Furthermore, the project activity is not financially viable without CER revenue. LFG revenues (gas, electricity and/or heat) alone are insufficient to recover project investments and operational costs.

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

According to ACM0001 baseline methodology, the project boundary is the site of the project activity where the gas will be captured and destroyed/used. According to AMS-I.D of small-scale CDM methodology, the project boundary should encompass the physical, geographical site of the renewable generation source.

The following project activities and emission sources are considered within the project boundaries:

Table: Sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	LFG venting and partial flaring	CO_2	No	It is not considered because it is part of the natural carbon cycle.
		CH_4	Yes	Included as main component of LFG.
		N_2O	No	Not applicable
Project Activity	Active LFG capture and flaring	CO_2	No	It is not considered because it is part of the natural carbon cycle.
		CH_4	Yes	Included as main component of LFG.
		N_2O	No	Not applicable
	LFG combustion for power generation	CO_2	No	It is not considered because it is part of the natural carbon cycle.
		CH_4	Yes	Included as main component of LFG.
		N_2O	No	Not applicable

- CH_4 emissions from the un-recovered LFG liberated from the landfill sites. It is estimated that only 50% of LFG generated at the EL Panul landfill will be captured, which means that the remaining 50% will be released as fugitive emissions.

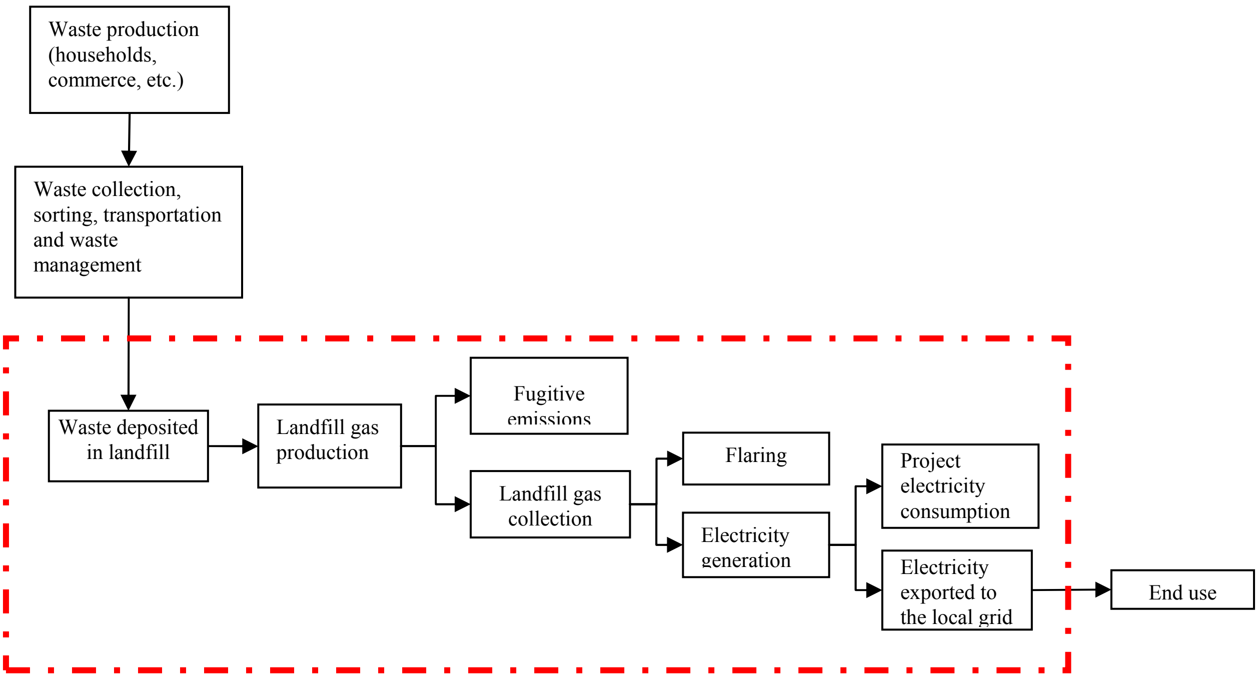
- CO_2 from the combustion of landfill gas in the flares and electricity generator. When combusted, methane is converted into CO_2. As the methane is organic in nature these emissions are not counted as project emissions. The CO_2 released during the combustion process was originally fixed via biomass so that the life cycle CO_2 emissions of LFG are zero. The CO_2 released is carbon neutral in the carbon cycle.

- Electricity required for the operation of the project activity should be accounted for in the project emissions and they need to be monitored. However, as the project activity involves electricity generation and uses electricity generated from LFG, only the net quantity of electricity fed into the grid should be used to account for emission reductions due to displacement of electricity in other power plants.

For the determination of baseline emissions of the electricity generation component of the project, the project boundary will account for the CO_2 emissions from electricity generation in fossil fuel power stations operating in the Project grid system, which will be displaced by the Project activity. The spatial extent of the project boundary is defined as the project site and the plants connected to the grid system to which the project will be connected.

A full flow diagram of the project boundaries is presented in the figure below. The flow diagram comprises all possible elements of the LFG collection systems and the equipment for electricity generation.

Figure: Flow chart of project boundaries (staggered line indicates boundaries)



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

For the baseline determination, the project boundary is the site of the project activity where the gas will be captured and utilised.

As mentioned before, the project activity is based on the two following complementary activities:

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

The baseline scenario in this particular case is the partial collection of the LFG, which occurs at most existing landfills in the Host Country, although some of the landfills in the Host Country still do not have any type of venting system, but release the LFG uncontrolled to the atmosphere, despite regulations calling for a controlled management of LFG.

There is no incentive to utilise the LFG to produce thermal energy, since the technology does still not exist in the Host country and there is no demand for thermal energy because the project is located in an isolated area.

Given that the results of the financial analysis conducted clearly show that implementation of this type of project is not the economically most attractive course of action, the project is considered to be additional (this is discussed in section B.5 below). In addition, there is no economic incentive or support to develop the project.

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 additionality):

The determination of project scenario additionality is done using the CDM consolidated Tool for the demonstration and assessment of additionality (version 31 adopted at EB29), which follows the subsequent steps:

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

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

The following alternatives have to be included according to the methodology:

- *The proposed project activity not undertaken as a CDM project activity;*

Alternative 1: The landfill operator would invest in an active LFG capturing system of high effectiveness, as well as a high efficiency flaring system and in LFG power recovery equipment. The operation would marginally reduce the generation of power from other grid-connected sources. Alternative 1 represents the proposed project activity.

- *Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs and on services (e.g. electricity, heat or cement) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;*

Alternative 2: The landfill operator would invest in an active LFG capturing system of high effectiveness, as well as in a boiler where the captured LFG will be burnt to supply thermal energy to nearby users.

- *If applicable, continuation of the current situation (no project activity or other alternatives undertaken).*

Alternative 3: The landfill operator could continue the current business as usual practice using a simple passive venting system (i.e. partially collect LFG using an inefficient venting system). In this case, no power or thermal energy would be generated at the site and the Host Country power system would remain unaffected.

Sub-step 1b. Enforcement of applicable laws and regulations:

Alternative 1, the proposed project activity, complies with all the applicable laws and regulations. NOM-083-SEMARNAT-2003 defines responsibilities regarding waste management as well as the specifications for environmental protection including the selection, design, construction and operation, monitoring and closure of final disposal sites for municipal solid waste. This comprehensive regulation calls for landfill gas control and management but does not clearly define specific requirements regarding amounts of LFG that need to be captured or technologies that shall be used.

For Alternative 2, there is no existing legal or regulatory requirement which addresses the thermal energy production from LFG at the moment, as the technology is not well known and not applicable for economic reasons. No similar projects using that technique can be found in the Host Country since no potential users could be identified to date.

Alternative 3, to simply continue the current situation, represents the business as usual practice for the project developer and most of the landfills in the Host Country. Existing regulations do provide recommendations, but do not detail specific requirements regarding the construction of gas collection systems or the technique which shall be applied to collect, control and monitor the LFG. The regulation notwithstanding, a common practice analysis shows that existing landfills in the Host Country do not adequately capture and utilise their LFG, as explained below in Step 4.

The tool for the demonstration and assessment of additionality clearly states that only laws that are enforced need to be considered in the determination of the baseline scenario. NOM-083-SEMARNAT-2003 is clearly not enforced in Mexico, as outlined below:

- Norma 083 is a federal regulation that, given the sovereignty of local authorities in this area (landfills are within the responsibility of the municipalities), only becomes legally binding if it is adopted by the local authorities. So far, no local authorities have adopted NOM-083-SEMARNAT-2003.
- NOM-083-SEMARNAT-2003 has never been enforced since its adoption. Even the earlier norm, which NOM-083-SEMARNAT-2003 replaced, and which only required the active venting of LFG for safety reasons, was not enforced.
- Given the above, NOM-083-SEMARNAT-2003 has become more of a document outlining policy guidance rather than a regulation to be widely adopted.

As a result, NOM-083-SEMARNAT-2003 shall not be taken into account in the establishment of a baseline scenario for LFG projects in Mexico.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the tool for the demonstration and assessment of additionality, one of three options must be applied for this step: (1) simple cost analysis (where no benefits other than CDM income exist for the project), (2) investment comparison analysis (where comparable alternatives to the project exist) or (3) benchmark analysis.

Sub-step 2b: Option III - Apply benchmark analysis

According to the methodology for determination of additionality, if the alternatives to the CDM project activity do not include investments of comparable scale to the project, then Option (3) must be used. In this case, the most likely alternative to the project is to simply not install flaring and generation equipment at the site, and therefore does not involve investments of a similar scale to the project. Therefore benchmark analysis will be applied.

The likelihood of development of this project, as opposed to the continuation of current activities (i.e. partial collection and combustion of LFG) will be determined by comparing its IRR with the benchmark rates of return available to investors in the Host Country. These rates of return are taken from investment fund indices, provided by MSCI[1]. The rates of return on investment provided by this fund was 14.5% on average over the last 5 years (2001-2006), which represents a significant lower growth rate for emerging markets than typical for Latin America, and therefore can be considered as a moderate benchmark for the performance of investments in the landfill sector in the Host Country.

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

The Table below shows the financial analysis for the project activity. As shown, the project IRR (without CDM revenue) is -4.7%, lower than the benchmark IRR from the performance of the investment funds in the Host Country.

Table: Financial results of the project (Alternative 1) with and without carbon finance, considering a ten year period. NPV uses 12% discount rate. The electricity price is assumed to be US$58/MWh, consistent with current prices, which are not expected to change substantially.

	With CDM	**Without CDM**
Net Present Value (US$)	284,874	-944,091

[1] MSCI provides global equity indices, which, over the last 30+ years, have become the most widely used international equity benchmarks by institutional investors. MSCI constructs global equity benchmark indices that contribute to the investment process by serving as relevant and accurate performance benchmarks and effective research tools, and as the basis for various investment vehicles. http://www.msci.com/overview

IRR	15.7%	-1.6%
Discount rate	12%	

Summary of results of project analysis. Details made available to validators.

Input/Assumption	Value	Comments
Electricity price (UScts / kWh)	8.00	Conservative buy-off price in the private Sector in Mexico
Annual increase in electricity price (%/yr)	1.5%	Conservative assumption consistent with the Mexican Power Sector.
Annual Inflation Rate plus applied Risk Factor	6%	

Detailed information on the financial analysis carried out can be found in Annex 3.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Increase in project revenue (price of electricity sold to the grid);
- Reduction in project capital (CAPEX) and running costs (Operational and Maintenance costs).

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 10%, and assessing what the impact on the project IRR would be (see Table below). As it can be seen, the project IRR remains lower than the benchmark IRR even in the case where these parameters change in favour of the project.

Table: Sensitivity analysis

Scenario	% change	IRR (%)	NPV $US
Original		-1.6%	-944,091
Increase in project revenue	10%	4.2%	-575,498
Reduction in project costs	10%	4.7%	-490,461

Note: NPV uses 12% discount rate. Calculations consider a ten year period.

In conclusion, the project IRR remains low even in the case where these parameters change in favour of the Project. The IRR is still low, therefore not feasible for a risky enterprise such as the construction and operation of a landfill gas-to-energy project, and significantly lower than private equity investments with rates of return of 15.0%. Consequently, the Project cannot be considered as financially attractive without CDM revenue.

Step 4. Common Practice Analysis

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

To date there has been limited development of LFG projects in the Host Country. Only a few landfills in the Host Country have been designed to partially collect and flare the generated LFG. So far just two sites have LFG collection and flaring or utilisation systems. The Prados de la Montaña landfill in Santa Fe, Mexico City, collects and partially flares the LFG generated at the site because the area where its located was slated to become a prime real estate investment opportunity at the time, and the landfill was closed and "cleaned up" (i.e., to avoid nuisances and risks to nearby buildings) in order to encourage investment there. Despite the successful completion of this system years ago, it took Global Environment Facility financing to build the second LFG capture system in the Host Country. The Simeprodeso landfill in Monterrey was completed in 2003 and designed specifically as a demonstration project to promote the development of CDM projects.

The table below presents information regarding a representative sample of landfills throughout the Host Country. As the table indicates, landfills in Host Country either have: (1) no system for collecting, venting or flaring LFG; (2) a passive system for venting LFG only (no flaring); (3) a passive system for venting and flaring LFG; or (4) a system to actively collect and flare or utilise the LFG.
Since the publication of NOM-083-SEMARNAT-2003, no new proper LFG collection and flaring or utilisation systems have been developed in the Host Country without considering carbon revenues. All projects similar to the proposed project activity are developed under the CDM, and are therefore excluded from the common practice analysis.

Table: The Project control group

Landfill Name	Location	Waste Deposition Rate (tonnes/day)	Current Status
Bordo Poniente	Mexico City	12,000	No system for collecting, venting or flaring LFG
Chiltepeque landfill	Puebla City, Puebla	1,595	No system for collecting, venting or flaring LFG
Bordo Neza	Nezahualcoyotl, State of Mexico	1,500	No system for collecting, venting or flaring LFG
El Verde	Leon, Guanajuato	1,450	Passive system for venting and flaring LFG
Milpillas (Tetlama)	Temixco, Morelos	1,100	No system for collecting, venting or flaring LFG
Culiacan	Culiacan, Sinaloa	850	Passive system for venting of LFG only (no flaring)
Cancun landfill	Cancun, Quintana Roo	700	Passive system for venting and flaring LFG
Socavon San Jorge	Metepec, State of Mexico	500	Passive system for venting and flaring LFG

Thus, with the exception of the Prados de la Montaña, the first phase of the Simeprodeso landfills and a few landfills developing a CDM project, none of the other landfills have proper LFG collection and flaring systems. The reason for the lack of widespread LFG collection and combustion systems is that that there currently is no economic incentive for capturing and utilising the LFG. In summary, the passive venting method is still a common practice in landfills throughout the Host Country.

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

Not applicable as all similar projects throughout the Host Country are developed in the context of CDM activities.

B.6 Emission reductions:

B.6.1. Explanation of methodology choices:

The Project fulfils the conditions of option c) of Methodology ACM0001: "The captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources".

In this case a baseline methodology for electricity and/or thermal energy displaced shall be provided or an approved one used, including ACM0002 "Consolidated Methodology for Grid-Connected Power Generation from Renewable Sources" version 6, 19 May 2006. If capacity of electricity generated is less than 15MW, small-scale methodology AMS-I.D version 10 can be used. In the case of the project, the electricity generation will be less than 15 MW, therefore AMS-I.D has been chosen.

As mentioned before, the Project is based on two complementary activities, as follows:

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

The Project therefore fulfils the conditions of option c), and thus ACM0001 was considered the most appropriate methodology for the Project.

Project emissions:
The Methodology clearly states that possible CO_2 emissions, resulting from other fuels than the recovered methane, should be accounted for as project emissions. Hence, this has not to be taken into account for the proposed project activity as no other fuels are used within the project boundary.
When the project does not generate electricity, electricity for the operation of the project activity will be imported from the grid, and will be monitored as stated in Section B.7.1. The project emissions are calculated with the ($CEF_{electricity,y}$) listed in Section B.6.2.
When the project generates electricity, there is a net export of electricity to the grid and the project emissions from its electricity use are deducted from the emission reductions from its electricity generation (thus emission reductions only for the net electricity generated are claimed). In this case the project emissions are zero. The electricity imported for the operation of the project activity will be monitored as stated in the Section B.7.1.

Baseline emissions:
Although the project currently has a LFG collection system, no fossil fuel consumption exists for the baseline emissions because the site only contains a simple passive venting system where no pumping equipment is used.
The baseline emissions reductions due to the partial collection and uncontrolled combustion of the LFG will be taken into account by applying the AF.

Leakage emissions:
No leakage effects need to be accounted under this methodology.

Emission reductions:

According to the Methodology the greenhouse gas emission reductions achieved by the project activity during a given year "y" (ER_y) shall be estimated as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_y * CEF_{electricity,y} - ET_y * CEF_{thermal,y}$$

As the proposed project activity does not include a thermal component, the following simplified equation will be applied to estimate the emission reductions:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_y * CEF_{electricity,y}$$

As the project electricity consumption is already considered in the formula, in cases when the project is not generating electricity, the EL_y term would be negative and therefore the corresponding project emissions would be deducted from the project's overall emission reductions.

All equations and definitions of the parameters applied to obtain the emission reduction from the project activity are listed in Section B.6.3.

AMS-I.D states that the Operating Margin and the Build Margin for the grid to which the project is connected shall be calculated according to the procedures described in ACM0002.
Thus, ACM0002 version 6, 19 May 2006 was chosen to obtain the resultant grid Carbon Emission Factor. From the four different procedures to calculate the Operating Margin, option a) the Simple OM was chosen to be the most appropriate for the small scale electricity generation by the project activity.
Options b) and c), the Simple Adjusted OM and the Dispatch Data Analysis could not have been applied there was not enough detailed data publicly available at the time of completion of the PDD. Even if data for the Dispatch Data analysis was available, the costs of processing the data would not be considered affordable by the project developer due to the marginal size of the future grid displacement. Option a) the Average OM is not applicable in the Host Country since must-run generating sources make up less than 50% of grid generation[2].

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

Table: data and parameters that are available at validation

Data / Parameter:	**Carbon Emission Factor ($CEF_{electricity,y}$)**
Data unit:	tCO_2/MWh
Description:	CO_2 emissions intensity of the electricity displaced
Source of data to be used:	Official statistics from the Secretary of Energy; SENER (2003, 2004, 2005), Prospectiva del Sector Eléctrico 2004-2013, 2005-2014, 2006-2015
Value applied:	**0.510**
Justification of the choice of data or description of measurement methods and procedures actually	The $CEF_{electricity,y}$ is calculated according to the equations for small scale electricity projects, using AMS-I.D, based on fuel consumption and electricity generation data for plants connected to the grid, provided by CFE. Detailed information can be found in Annex 3.

[2] Source: SENER (2003, 2004, 2005), Prospectiva del Sector Eléctrico 2004-2013, 2005-2014, 2006-2015.

applied:	
Any comment:	

Data / Parameter:	**Regulatory requirements relating to landfill gas projects**
Data unit:	Test
Description:	Regulatory requirements relating to landfill gas projects
Source of data to be used:	National legislation and mandatory regulations
Value applied:	A value of 0% for the adjustment factor was chosen
Justification of the choice of data or description of measurement methods and procedures actually applied:	The information will be recorded annually, to use it for changes to the adjustment factor (AF) or directly to $MD_{reg,y}$ at renewal of the credit period.
Any comment:	Will be reflected in the AF. Further information can be found in section B.6.3.

B.6.3. Ex-ante calculation of emission reductions:

The methodology ACM0001 requires that 'Project proponents should provide an *ex-ante* estimate of emission reductions, by projecting the future GHG emissions of the landfill. In doing so, verifiable methods should be used'. In the case of this project, a proprietary model based on the US EPA's first order decay model is used to determine estimated emission reductions *ex-ante*. This *ex-ante* estimate is for illustrative purposes, as emission reductions will be monitored *ex-post*, according to the methodology.

ACM0001 will be applied using option c) of the Consolidated Methodology, where the gas captured is used for electricity generation and emission reductions are claimed for displacing or avoiding energy from other sources. The amount of ERs for these sources will be calculated using the Methodology for Small-scale Renewable Energy Projects Type I.D., as the electricity generation component of the project is smaller than 15 MW installed capacity. The data used for the calculation of combined margins is shown in Annex 3 of this document. The main source of data is the annual statistic 2006 from the CEF. The defaults used for the calculation of calorific values for fuel types and fuel oxidisation, come from the IPCC GHG Gas Inventory Reference Manual (IPCC 2006) or as clearly marked else wise.

Landfill gas component

The amount of methane destroyed by the project activity is calculated using the following equation, which is simplified in our case since there is no thermal component:

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

Where:

$MD_{project,y}$: tCH_4 Quantity of methane destroyed by the project activity during year *y*, in tonnes of methane;

$MD_{flared,y}$: tCH_4 Quantity of methane destroyed by flaring during year *y*, in tonnes of methane;

$MD_{electricity,y}$: tCH_4 Quantity of methane destroyed by generation of electricity during year *y*, in tonnes of methane.

Average		Per year (average)	10 years
$MD_{flared,y}$	tCH_4	435	4,353
$MD_{electricity,y}$	tCH_4	1,463	14,630
$MD_{project,y}$	**tCH_4**	**1,898**	**18,983**

The sum of the LFG quantities fed to the flare and/or the power plant will be compared annually with the total LFG captured using the formula below. The lowest value will be adopted as $MD_{project,y}$.

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

Where:

$MD_{total,y}$:	tCH_4	Total quantity of methane captured during year *y*, in tonnes of methane;
$LFG_{total,y}$:	Nm^3LFG	Total quantity of landfill gas captured during year *y*, in cubic meters of landfill gas;
$w_{CH4,y}$:	Nm^3CH_4 / Nm^3LFG	Average methane fraction of the landfill gas, as measured during year *y* and expressed as a fraction in cubic meter of methane per cubic meter of landfill gas;
D_{CH4}:	tCH_4 / Nm^3CH4	Methane density expressed in tonnes of methane per cubic meter of methane.

Average		Per year (average)	10 years
$w_{CH4,y}$	Nm^3CH_4 / Nm^3LFG	50%	
D_{CH4}	tCH_4 / Nm^3CH_4	0.0007168	
$MD_{total,y}$	**tCH_4**	**1,903**	**19,027**

As the tables above indicate, the $MD_{project,y}$ is slightly lower than the $MD_{total,y}$. Therefore $MD_{project,y}$ will be adopted for the project activity.

The quantity of methane destroyed by flaring is calculated using the following equation:

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

Where:

$MD_{flared,y}$:	tCH_4	Quantity of methane destroyed by flaring during year *y,* in tonnes of methane;
$LFG_{flared,y}$:	Nm^3LFG	Quantity of landfill gas fed to the flare during year *y,* measured in cubic meters of landfill gas;

$w_{CH4,y}$:	Nm^3CH_4 / Nm^3LFG	Average methane fraction of the landfill gas as measured[3] during a year *y* and expressed as a fraction in cubic meter of methane per cubic meter of landfill gas;
D_{CH4}:	tCH_4 / Nm^3CH_4	Methane density expressed in tonnes of methane per cubic meter of methane[4];
$PE_{flare,y}$:	tCO_2e	Project emissions from flaring of the residual gas stream in year *y* determined following the procedure described in the *"Tool to determine project emissions from flaring gases containing methane"*;
GWP_{CH4}:	tCO_2e / tCH_4	Global Warming Potential of methane valid for the first commitment period.

Average		Per year (average)	10 years
$LFG_{flared,y}$	Nm^3LFG	1,226,959	12,269,586
$w_{CH4,y}$	Nm^3CH_4 / Nm^3LFG	50%	
D_{CH4}	tCH_4 / Nm^3CH4	0.0007168	
$PE_{flare,y}$	tCO_2e	92	923
GWP_{CH4}	tCH_4 / tCO_2	21	
$MD_{flared,y}$	**tCH_4**	**435**	**4,353**

The quantity of LFG flared by the project is estimated using a proprietary model based on the US EPA First Order Decay Model[5], using L_o (methane generation potential) and k (methane generation rate constant) values appropriate for the Host Country and assuming that only 50% of the LFG generated is collected by the gas collection system. The collection efficiency value considers the physical conditions of this landfill as well as the capping material used to cover the waste. In any case, as this projection is merely for illustrational purposes only, the precision of these values are not as significant as the actual emission reductions will be monitored directly. The details of the assumptions of the model are provided in Annex 3.

Project emissions from flaring will be calculated and monitored according to the procedures described in the *"Tool to determine project emissions from flaring gases containing methane"*, using the option for continuous monitoring of the methane destruction efficiency of the flare.

For the *ex-ante* calculations of emission reductions, a 99% flare efficiency ($\eta_{flare,h}$) value will be assumed for the project (according to flare's manufacturer specifications and based on field tests using the same flare technology and design under similar operating conditions[6]). The actual emissions from the flare will be continuously monitored *ex-post*.

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[3] Methane fraction of the landfill gas to be measured on wet basis.

[4] At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4 / m^3CH_4.

[5] On this model, see US EPA manual "Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators" (December 1994).

[6]"Low Emissions Ground Flare Systems" by Biogas Technology Ltd.

According to the description in the *"Tool to determine project emissions from flaring gases containing methane"* the project emissions from flaring gases are calculated as follows:

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

Where:

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

Average			
$TM_{RG,h}$	kg / h	50	
$\eta_{flare,h}$	-	99%	
GWP_{CH4}	tCH_4 / tCO_2	21	
$PE_{flare,y}$	**tCO_2e / year**	**92**	**923**

The mass flow rate of methane in the residual gas is calculated as follows:

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

Where:

$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*;
$FV_{RG,h}$	Nm^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h;*
$fv_{CH4,RG,h}$	-	Volumetric fraction of methane in the residual gas on dry basis in hour *h*;
$\rho_{CH4,n}$	kg/Nm^3	Density of methane at normal conditions (0.7168).

		Average
$FV_{RG,h}$	Nm^3/h	140
$fv_{CH4,RG,h}$	-	50%
$\rho_{CH4,n}$	kg/Nm^3	0.7168
$TM_{RG,h}$	kg / h	50

The quantity of methane destroyed through combustion in the electricity generation engines is calculated using the following equation:

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

Where:

$MD_{electricity,y}$: tCH_4 Quantity of methane destroyed by generation of electricity during

		year *y,* in tonnes of methane;
$LFG_{electricity,y}$:	Nm^3LFG	Quantity of landfill gas fed into the electricity generator during year *y,* in tonnes of methane;
$w_{CH4,y}$:	Nm^3CH_4 / Nm^3LFG	Average methane fraction of the landfill gas as measured during year *y*, expressed as a fraction in cubic meter of methane per cubic meter of landfill gas;
D_{CH4}:	tCH_4 / Nm^3LFG	Methane density expressed in tonnes of methane per cubic meter of methane.

Average		Per year (average)	10 years
$LFG_{electricity,y}$	Nm^3LFG	4,082,000	40,820,000
$w_{CH4,y}$	Nm^3CH_4 / Nm^3LFG	50%	
D_{CH4}	tCH_4 / Nm^3CH4	0.0007168	
$MD_{electricity,y}$	**tCH_4**	**1,463**	**14,630**

The quantity of methane destroyed through the combustion in the electricity generation engines ($MD_{electricity,y}$) would be calculated using the same equation as above, except for not using the adjustment factor related to flare efficiency (FE).

For the amount of methane destroyed in the baseline scenario, we use the following equation:

$$MD_{reg,y} = MD_{project,y} * AF$$

Where:

$MD_{reg,y}$:	tCH_4	Quantity of methane that would have been destroyed / combusted during year *y* in the absence of the project activity;
$MD_{project,y}$:	tCH_4	Quantity of methane actually destroyed-combusted during year *y,* in tonnes of methane;
AF:	%	Adjustment factor in percentage.

Average		Per year (average)	10 years
$MD_{project,y}$	tCH_4	1,898	18,983
AF (%)	%	0%	
MD_{reg}	**tCH_4**	**0**	**0**

The adjustment factor AF was set at 0%. This value is justified based on the fact that the regulatory requirements do not indicate any specific amount of gas collection and destruction or utilisation and that in practice, no LFG is actually flared. Currently the landfill operator is only passively venting and the collected gas produced in the landfills, primarily for safety purposes.

Due to the exposed location of the landfill in the outskirts of the city of Durango, steady winds keep blowing over the lowlands, which do not allow flaring of the collected LFG with the actual passive gas

collection system. Therefore, the adoption of an adjustment factor of 0% is considered to be conservative for the baseline scenario.
$MD_{reg,y}$ therefore equals zero.

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Due to the exposed location of the landfill in the outskirts of the city of Durango, steady winds keep blowing over the lowlands, which do not allow flaring of the collected LFG with the actual passive gas collection system. Therefore, the adoption of an adjustment factor of 0% is considered to be conservative for the baseline scenario.
$MD_{reg,y}$ therefore equals zero.

Electricity component

The emission reductions from the electricity component are calculated using the grid emission factor calculated below and an estimation of the net quantity of electricity displaced by the project (ELy) based on the electricity calculation parameters provided in Annex 3.

The greenhouse gas emission reductions achieved by the project activity during a given year *y* (ER_y) are calculated using the simplified equation mentioned earlier in section B.6.1:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_y * CEF_{electricity,y}$$

Where:

ER_y:	tCO_2e	is emission reduction during a year *y*, in tonnes of CO_2 equivalents;
$MD_{project,y}$:	tCH_4	the amount of methane that would have been destroyed/combusted during a year *y*, in tonnes of methane;
$MD_{reg,y}$:	tCH_4	the amount of methane that would have been destroyed/combusted during a year *y* in the absence of the project, in, tonnes of methane;
GWP_{CH4}:	tCO_2e / tCH_4	Global Warming Potential of methane valid for the first commitment period;
EL_y:	MWh	net quantity of electricity exported during a year *y*, in megawatt hours ;
$CEF_{electricity,y}$:	tCO_2e/MWh	CO_2 emissions intensity of the electricity displaced during a year *y*, using AMS I.D.

Table: Greenhouse Gas Emission Reductions from the project activity:

Average		**Per year (average)**	**10 years**
$MD_{project,y}$	tCH_4	1,898	18,983
MD_{reg}	tCH_4	0	0
GWP_{CH4}	tCH_4 / tCO_2	21	
EL_y	MWh	6,017	60,172
CEF	tCO_2 / MWh	0.508	
ER_y	**tCO_2e**	**42,934**	**429,338**

Total electricity used *for* the project will be deducted from the amount of electricity produced *by* the project, thus emission reductions will only be claimed for the *net* electricity supplied to the grid. Net electricity generated by the project is therefore estimated using the following formula:

$$ELy = EL_{EX,LFG} - EL_{IMP}$$

Where:

$EL_{EX,LFG}$:	MWh	net quantity of electricity exported during a year *y*, produced using landfill gas, in megawatt hours;
EL_{IMP}:	MWh	net incremental electricity imported, defined as difference of project electricity imports less any imports of electricity in the baseline, to meet the project requirements.

Average		**Per year (average)**	**10 years**
$EL_{EX,LFG}$	MWh	6,280	62,800
EL_{IMP}	MWh	263	2,628
EL_y	**MWh**	**6,017**	**60,172**

As the project electricity consumption is already considered in the formula above, in cases when the project is not generating electricity, the El_y term would be negative and therefore the corresponding project emissions would be deducted from the project's overall emission reductions.
The $CEF_{electricity,y,}$ for the relevant grid was calculated according to the requirements for small scale electricity projects in Methodology AMS-I.D version 10 from 22 December 2006.
Choosing option a) Combined Margin (CM) to obtain the grid emission factor, AMS-I.D. clearly states that calculations shall be carried out according to the procedures prescribed in ACM0002. Thus, all equations applied to calculate the grid emission factor are taken from ACM0002 version 6 from 19 May 2006. ACM0002 points out that power plant capacity additions registered as CDM project activities should be excluded from the calculations, they will not be taken into account in the following calculations.

The following tables show the emission reductions from the displacement of grid electricity.

The carbon emission factor ($CEF_{electricity}$) is calculated in 3 steps, as follows:

- STEP 1. Calculate the Operating Margin emission factor **($EF_{OM,y}$)**, based on option (a) Simple OM.
  (a) Simple OM. The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emission per electricity unit of all generation sources serving the system, not including low-operating cost and must-run power plants.

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

Where:

$F_{i,j,y}$	mass or volume unit	The amount of fuel *i* consumed by relevant power sources *j* in year(s) *y*;
$COEF_{i,j,y}$	tCO_2 / mass or volume unit of the fuel	The CO_2 emission coefficient of fuel *i*, taking into account the carbon content of the fuels used by relevant power sources *j* and the percent of oxidation of the fuel in year(s) *y*;
$GEN_{j,y}$	MWh	The electricity delivered to the grid by source *j*.

The CO_2 emission coefficient $COEF_{i,j,y}$ is obtained as

$$COEF_{i,j} = NCV_i \cdot EF_{CO2,i} \cdot OXID_i$$

Where:

NCV_i	TJ	Net calorific value per mass or volume unit of a fuel *i*;
$EF_{CO2,i}$	tCO_2 / TJ	CO_2 emission factor per unit of energy of the fuel *i* ();
$OXID_i$	%	Oxidation factor of the fuel.

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

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

Where:

$EF_{BM,y}$	tCO_2 / MWh	Build Margin Emission Factor in year *y*;
$F_{i,m,y}$	mass or volume unit	Amount of fuel *i* consumed by relevant power plants *m* in year(s) *y*;
$COEF_{i,m}$	tCO_2 / mass or volume unit of the fuel	CO_2 emission coefficient of fuel *i*,taking into account the carbon content of the fuels used by the relevant power plants *m* in year(s) *y*;
$GEN_{m,y}$	MWh	Electricity delivered to the grid by power plants *m* in year *y*.

$EF_{BM,y}$ will be determined *ex-ante*, basing on the most recent information on plants already built in the Host Country at the time of PDD submission.

- STEP 3. Calculate the baseline emission factor ***EF***$_y$ as the weighted average of the Operating Margin emission factor **EF**$_{OM,y}$ and the Build Margin emission factor ***EF***$_{BM,y}$ with the following equation:

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

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2 / MWh.

The tables below shows a summary of the OM and BM used for calculating the $CEF_{electricity,y,}$.

Table 1: Operating Margin of the Mexican Electricity Grid

Operating Margin of the Mexican Electricity Grid		**2003**	**2004**	**2005**
Electricity Generation	GWh	150,249	165,338	169,485
CO_2 Emissions	tonnes	103,428,586	101,770,405	101,185,307
Operating Margin	tCO_2 / MWh	0.688	0.616	0.597
Weighted Average Operating Margin	**tCO_2 / MWh**	**0.634**		

Table 2: Build Margin of the Mexican Electricity Grid

Build Margin of the Mexican Electricity Grid using the "*ex-ante* option"		**2005**
Electricity Generation	GWh	44,430
CO_2 Emissions	tonnes	17,135,744
Build Margin	**tCO_2 / MWh**	**0.386**

Table 3: Combined Margin of the Mexican Electricity Grid "SIC"

Carbon Emission Factor 2003 - 2005		
Average Operating Margin 2003-2005	tCO_2 / MWh	0.634
Average Build Margin 2005	tCO_2 / MWh	0.386
Carbon Emission Factor	**tCO_2 / MWh**	**0.510**

Detailed information of the used data and the calculations made are attached to Annex 3.

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

The Consolidated Methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the baseline scenario, as opposed to the amount of methane emitted in this scenario. We will use the convention established in the consolidated methodology and use this section to describe the amount of methane destroyed in the baseline and project scenario.

Year	**Estimation of project activity emission reductions (tonnes of CO_2e)**	**Estimation of baseline emission reductions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of emission reductions (tonnes of CO_2e)**
2007 (Aug-Dec)	21,924	0	not applicable	21,924
1	53,165	0	not applicable	53,165
2	56,143	0	not applicable	56,143
3	51,139	0	not applicable	51,139

4	46,916	0	not applicable	46,916
5	43,448	0	not applicable	43,448
6	39,816	0	not applicable	39,816
7	36,443	0	not applicable	36,443
8	33,308	0	not applicable	33,308
9	30,839	0	not applicable	30,839
10 (Jan-Jul)	16,406	0	not applicable	16,406
Total (tonnes of CO_2e)	**429,547**	**0**	**not applicable**	**429,547**

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:	Nm^3
Description:	Total amount of LFG captured
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	5,308,959 (average)
Description of measurement methods and procedures to be applied:	Data will be measured continuously with a flow meter by the project developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 3%. Data to be aggregated monthly and yearly.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	The flow meter will express gas flow in normalized cubic meters, therefore no separate monitoring of pressure (P) and temperature (T) of LFG is necessary to determine density.

Data / Parameter:	**$LFG_{flared,y}$ (also** $FV_{RG,h}$)
Data unit:	Nm^3
Description:	Amount of LFG fed to the flare
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,226,959 (average)

Description of measurement methods and procedures to be applied:	Data will be measured continuously with a flow meter by the project developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 3%. Data to be aggregated monthly and yearly.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	The flow meter will express gas flow in normalized cubic meters, therefore no separate monitoring of pressure (P) and temperature (T) of LFG is necessary to determine density. $\mathbf{LFG_{flared,y}}$ is considered to be equivalent to the variable $FV_{RG,h}$ (volumetric flow rate of the residual gas) as described in the "*Tool to determine project emissions from flaring gases containing methane*" to determine the project emissions from the flaring process.

Data / Parameter:	$\mathbf{LFG_{electricity,y}}$
Data unit:	Nm^3
Description:	Amount of LFG combusted in power plant
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4,082,000 (average)
Description of measurement methods and procedures to be applied:	Data will be measured continuously with a flow meter by the project developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 3%. Data to be aggregated monthly and yearly.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	The flow meter will express gas flow in normalized cubic meters, therefore no separate monitoring of pressure (P) and temperature (T) of LFG is necessary to determine density.

Data / Parameter:	$\mathbf{w_{CH4}}$ **(also** $\mathbf{fv_{CH4,,h}}$**)**
Data unit:	m^3 CH_4 / m^3 LFG
Description:	Methane fraction in the Landfill Gas
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50%
Description of measurement	Methane content will be measured continuously with a fixed gas analyser by the project developer. The gas analyser will be maintained and calibrated

methods and procedures to be applied:	regularly in line with the manufacturer's requirements in order to ensure that factory standards of accuracy are maintained.
QA/QC procedures to be applied:	The analysers should be subject to a regular maintenance and calibration according to manufacturer's recommendation to ensure accuracy. A zero check and a typical value check should be performed by comparison with a standard certified gas.
Any comment:	Used to determine the methane concentration in the landfill gas fed to the flare. In accordance with the *"Tool to determine project emissions from flaring gases containing methane"* only the methane content of the landfill gas is measured and the remaining part is considered as N_2. Further $\mathbf{w_{CH4}}$ is considered to be equivalent to the variable $fv_{CH4,h}$ (Volumetric fraction of the component CH_4 in the landfill gas in the hour *h*).

Data / Parameter:	$\mathbf{t_{O2,h}}$
Data unit:	
Description:	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour *h*
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Volumetric fraction of O_2 will be measured continuously with in situ analysers. The sample is taken with a high temperature probe and will be conducted through filtration and conditioning system to ensure optimized functioning of the analyzer. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height).
QA/QC procedures to be applied:	The analysers will be subject to a regular maintenance and calibration according to manufacturer's recommendation to ensure accuracy. That is, analysers must be calibrated according to the manufacturer's recommendations. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Any comment:	

Data / Parameter:	$\mathbf{fv_{CH4,FG,h}}$
Data unit:	mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour *h*
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of	Concentration of CH_4 in the exhaust gas will be measured continuously with in

measurement methods and procedures to be applied:	situ analyzers. The sample is taken with a high temperature probe and will be conducted through filtration and conditioning system to ensure dry basis and optimized functioning of the analyzer. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height).
QA/QC procedures to be applied:	The analysers will be subject to a regular maintenance and calibration according to manufacturer's recommendation to ensure accuracy. That is, analysers must be calibrated according to the manufacturer's recommendations. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Any comment:	Measurements will be undertaken in ppmv. This will be converted in accordance with the Tool.

Data / Parameter:	$\mathbf{T_{flare}}$
Data unit:	˚C
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measurement of the temperature in the exhaust gas with a type N thermocouple.
QA/QC procedures to be applied:	The thermocouple should be subject to a regular calibration according to manufacturer's recommendation to ensure accuracy.
Any comment:	Required to determine project emissions from methane flaring and indicate operating hours of the flare and its adequate operation.

Data / Parameter:	$\mathbf{EG_{EX,LFG}}$
Data unit:	MWh
Description:	Total amount of electricity exported out of the project boundary
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6,280 (average)
Description of measurement methods and procedures to be applied:	Required to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity. Electricity will be measured continuously using an electricity meter which will be maintained and calibrated regularly to assure high levels of accuracy. The records of any electricity imported in the baseline too should be recorded at the start of project.

QA/QC procedures to be applied:	Electricity meter will be maintained and calibrated regularly to assure high levels of accuracy.
Any comment:	Required to estimate the emission reductions from electricity generation from LFG, if credits are claimed.

Data / Parameter:	**EL_{IMP}**
Data unit:	MWh
Description:	Total amount of electricity imported to meet project requirements
Source of data to be used:	Grid operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	263
Description of measurement methods and procedures to be applied:	Required to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity. Electricity will be measured continuously using an electricity meter which will be maintained and calibrated regularly to assure high levels of accuracy. The records of any electricity imported in the baseline too should be recorded at the start of project.
QA/QC procedures to be applied:	Measurements are to be cross-checked with invoices.
Any comment:	Required to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity.

Data / Parameter:	**Operation of the power plant**
Data unit:	hours
Description:	Operation of the power plant
Source of data to be used:	Project developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8000 hours/year
Description of measurement methods and procedures to be applied:	Data will be recorded annually by the project developer to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
QA/QC procedures to be applied:	Equipment will be maintained in line with manufacturer's recommendations to assure high quality output.
Any comment:	

B.7.2. Description of the monitoring plan:

The monitoring plan details the actions necessary to record all the variables and factors required by the methodology ACM0001 (version 5 adopted at EB28) as detailed in section B.7.1 above. All data will be archived electronically, and backed up regularly. Moreover, it will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity (whichever occurs later).

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

Further information on the delegation of responsibilities can be found 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):

Date of completion: 08 March 2007

Person/entity determining the baseline:

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e-mail: ina.ballik@ecosecurities.com

Detailed baseline and monitoring information are attached to Annex 3 and 4.

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:

01/07/2007

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

More than 20 years

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:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

19/07/2007

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 project will actively collect and combust LFG, thereby improving overall landfill management and reducing adverse global and local environmental effects of uncontrolled releases of landfill gas. Whilst the main global environmental concern over gaseous emissions of methane, is the fact that it is a potent greenhouse gas, and thus contributes importantly to global warming, emissions of LFG can also have significant health and safety implications at the local level. For example:

- Risk of explosions and/or fires either within the landfill or outside its boundaries, although the majority of LFG emissions are quickly diluted in the atmosphere;
- Asphyxiation and/or toxic effects to humans from concentrated emissions of LFG;
- Local and global environmental effects such as odour nuisances, stratospheric ozone layer depletion, and ground-level ozone creation due to over 150 trace component contained in landfill gas.

Through both the installation of a well-designed LFG collection and a destruction/utilisation system and its proper operation, LFG will be captured and combusted in a controlled way, thereby removing safety risks from the surrounding community, reducing the risks of toxic effects on the local community and the local environment as well as reducing the emissions of a potent greenhouse gas.

It is worth noting that the Project Developer will install flares and electricity generation units which comply with stringent UK emission standards, thereby minimising the environmental impact from this particular source and suggesting that these emissions are significantly less harmful than the continued uncontrolled release of LFG. The Project will significantly reduce odour and greenhouse gas emissions.

In a previously conducted environmental impact study for a Latin-American landfill, where the same LFG collection and destruction/utilization system[7] was installed as a component of the closure and rehabilitation plan, it was clearly stated that the construction of the LFG collection system and the monitoring of the LFG constitutes a favourable environmental impact because its minimising the negative effects of the LFG and thereby the risks of the landfill. Further it declares, that this presents a global and permanent impact of high magnitude and importance. [8]

Thus, the project activity can be referred as environmentally ameliorative, and the installation of the LFG collection and combustion system is part of a broader effort by the landfill operator to continue to improve waste management practices.

Nevertheless, a Preventive Report is carried out by a local Consultant. It will be made available for the validators on request.

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:

Not applicable.

SECTION E. Stakeholders' comments:

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

The stakeholder consultation took place on the 17th of January 2007 in the Fiesta Inn Hotel Perinorte at km 32.5 of the highway "México-Querétaro", and was well attended. The event allowed stakeholders to understand the basic concepts related to climate change, its consequences and the aims of the Kyoto Protocol, as well as the most important features of the Tultitlan – EcoMethane Landfill Gas to Energy Project undertaken by the Project Developer.

The event was properly announced in a national newspaper "El Financiero". Specifically, people from local authorities, local media, academic institutions, representatives of the industry association AIEM and members of the community participated in the event which lasted approximately 3 hours. The local communities represented a big fraction of the participants. All participants were registered with appropriate formats kept in the Project Developer's files.

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[7] described in Section A.4.3.

[8] SIGEA (2006). Manifestación de Impacto Ambiental "Clausura y Ampliación del Relleno Sanitario de Ecatepec de Morelos, Estado de México". page 129, lines 13-15

The stakeholder consultation included a brief description of the project and its benefits by the project proponent as well as presentations by the Project Developer including the following topics: climate change; how this project is mitigating climate change through the Clean Development Mechanism of the Kyoto Protocol; the technical details of the project; and a session aimed at addressing questions posed by the stakeholders.

E.2. Summary of comments received:

To date no formal comments have been received from stakeholders. In general the community members manifested its appraisal for the project. However, during the public consultation stakeholders raised various questions regarding the project, and the Project Developer provided comments, as follows:

1. A member of the waste recollection cooperative requested the depth of the perforation for the gas wells as he was concerned about a sufficient gas yield.
    - The Project Developer answered the question briefly and explained the relationship between the variation of the depth of the gas wells and the according gas yield.

2. Another member of the waste recollection cooperative wondered if there would be a realistic chance for the project to generate electricity in future.
    - The Project Developer explained that the project activity consists of two phases, and that for the first phase only considers the flaring. During this time the gas flow will be analyzed and based on the data gathered a decision will be made.

3. A representative of the local industry mentioned that there is a possibility to generate electricity by recovering the methane, but that it requires a high investment. To date energy recovery from LFG is not considered as a renewable energy source according to Mexican legislation, which will represent operational barriers.

4. A member of the local community wondered why flaring LFG is less contaminant than releasing it to the atmosphere.
    - The Project Developer clarified that due to flaring the methane fraction of the LFG the Global Warming Potential will be minimised by the factor 21, since the methane will be converted into carbon dioxide.

5. The leader of the waste recollection cooperative wanted to know what the incentive for a foreign company is, and what benefit the Project Developer would obtain by implementing the project.
    - The Project Developer deferred to the presentation and stated that the incentive for a foreign company consists in commercializing the CERs which will be obtained from the proposed project activity, and that this comprises a core element of the CDM.

Members of the community expressed their satisfaction with the Clean Development Mechanism as a tool for reducing pollution at a local level and Stakeholders congratulated the Project Entity and the Project Developer for the implementation of this project and the public consultation, which helped to inform the community about its operations.

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

As indicated in Section E.2 above, there have been no formal comments submitted by any of the stakeholders regarding this project. Many of them had questions about specific parts of the project and/or the future management of the landfills, and those were addressed at the meeting. Overall, the stakeholder consultation was a positive event with stakeholders being informed about the project activities.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project developer:

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.

Annex 3

BASELINE INFORMATION

LANDFILL CALCULATION PARAMETERS		
Parameter	Units	**Tultitlán Landfill**
	Landfill data	
Year landfill started operation		1987
Waste in place at the beginning of project	tonnes	2,800,000
Density of waste	tonnes/m^3	0.8
Area of site	Ha	12
Average daily waste rate	tonnes/day	2,000
Date gas collection project starts		01-Jan-2007
	Operational data	
Gas collection efficiency	%	50%
Flare efficiency	%	99%
	General data	
Lo	m^3/tonne	152.38
k	1/yr	0.09
Methane content of landfill gas	%	50%
CH4 GWP	T CO_2/T CH4	21
Density of Methane	Tonne/CH4/m^3	0.0007168
	Baseline data	
Proportion of methane flared in Baseline (AF)	%	5%

Table: Proprietary decay model used to estimate emission reductions.

Proprietary first order decay model (based on US EPA model)

$$\sum_{i=1}^{n} 2\, k\, L_0\, M\, e^{-kt_i}$$

Lo = methane generation potential (m3/ton)
M = mass of waste deposited (tonnes) in year "i"
k = refuse decay rate (1/year)
ti = age of waste (years) in year "i"

CER CALCULATION

expected Methane fraction in LFG	Nm^3CH_4 / Nm^3LFG	50%
Density of methane at normal conditions	tonnes / m^3	0.0007168
Global Warming Potential of methane valid for the commitment period	tCO_2 / tCH_4	21
Tons of CO_2e destroyed in baseline	%	0%
ex-ante estimated Flare Efficiency	%	99%
LFG consumption per MWh generated	Nm^3LFG / MWh	650
Max. installed capacity	MW	1.30
Operating hours per year	h / yr	8,000
Electricity Consumption by the project	MWh / yr	263
ex-ante Carbon Emission Factor	tCO_2 / MWh	0.510

Year		*0*	1	2	3	4	5	6	7	8	9	10
		2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Methane Destruction												
LFG volume collected per hour	Nm^3LFG / h	*800*	817	773	710	652	599	550	506	464	427	392
LFG volume collected per year	Nm^3LFG / year	*2,921,786*	7,153,101	6,772,694	6,221,092	5,714,417	5,249,008	4,821,504	4,428,818	4,068,115	3,736,790	2,002,262
Total LFG volume to be combusted in power generation	Nm^3LFG / year	*0*	0	6,760,000	5,720,000	5,200,000	5,200,000	4,680,000	4,160,000	3,640,000	3,640,000	1,820,000
Total LFG volume to be flared	Nm^3LFG / year	*2,921,786*	7,153,101	12,694	501,092	514,417	49,008	141,504	268,818	428,115	96,790	182,262
Methane combusted in power generation	tCH_4 / yr	*0*	0	2,423	2,050	1,864	1,864	1,677	1,491	1,305	1,305	652
Methane flared	tCH_4 / yr	*1,047*	2,538	5	178	183	17	50	95	152	34	65
Project Emissions from flaring	tCH_4 / yr	*10*	538	1	38	39	4	11	20	32	7	*14*
Methane destroyed in project activity	tCH_4 / yr	*1,047*	2,538	2,427	2,228	2,046	1,881	1,728	1,586	1,456	1,339	717
Baseline Emission Reductions	tCH_4 / yr	*0*	0	0	0	0	0	0	0	0	0	0
Total Methane destroyed	tCH_4 / yr	*1,047*	2,538	2,427	2,228	2,046	1,881	1,728	1,586	1,456	1,339	717
Emission Reductions from Methane Destruction	tCO_2 / yr	*21,980*	53,299	50,973	46,785	42,970	39,502	36,278	33,313	30,586	28,117	15,056
Power Generation - Grid Electricity Displacement												
Installed capacity	MW	*0*	0.00	1.30	1.10	1.00	1.00	0.90	0.80	0.70	0.70	0.60
Gross Electricity Generation	MWh / yr	*0*	0	10,400	8,800	8,000	8,000	7,200	6,400	5,600	5,600	2,800
Electricity Consumption by the project	MWh / yr	*110*	263	263	263	263	263	263	263	263	263	153
Net Electricity Exports	MWh / yr	*-110*	-263	10,137	8,537	7,737	7,737	6,937	6,137	5,337	5,337	2,647
Emission reductions from grid electricity displacement	tCO_2e / yr	*-56*	-134	5,170	4,354	3,946	3,946	3,538	3,130	2,722	2,722	1,350
Emission reductions												
Total emission reductions from methane destruction	tCO_2e / yr	*21,980*	53,299	50,973	46,785	42,970	39,502	36,278	33,313	30,586	28,117	15,056
Emission reductions due to grid displacement	tCO_2 / yr	*-56*	-134	5170	4354	3946	3946	3538	3130	2722	2722	1350
Net Emission Reductions (tCO2/yr)	tCO_2 / yr	***21,924***	**53,165**	**56,143**	**51,139**	**46,916**	**43,448**	**39,816**	**36,443**	**33,308**	**30,839**	**16,406**

Investment Analysis

			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CAPITAL COST	Flaring systems (Shipped and commissioned)	US$	$455,442	$9,789	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Gas collection system and civil works	US$	$420,353	$45,983	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Invstment gas collection & flaring	US$	**$875,795**	**$55,772**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Electrical Generating Equipment	US$	$0	$830,850	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Connection to Grid	US$	$0	$229,200	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Ongoing gas collection and maint	US$	$0	$57,300	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Civils	US$	$0	$133,700	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Invstment Energy Generation	US$	**$0**	**$1,251,050**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	TOTAL INVESTMENT	US$	**$875,795**	**$1,306,822**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
O&M COST	Operation and Project Support Gas Collection & Flaring	US$	$132,137	$175,075	$176,737	$176,066	$158,517	$142,498	$78,292	$0	$0	$0	$0
	Operation and Project Support Electricity Generation	US$	$0	$0	$298,753	$283,815	$269,624	$256,143	$243,336	$231,169	$219,611	$208,630	$198,199
	TOTAL O&M and PROJECT SUPPORT COST	US$	**$132,137**	**$175,075**	**$475,489**	**$459,881**	**$428,141**	**$398,641**	**$321,628**	**$231,169**	**$219,611**	**$208,630**	**$198,199**
	TOTAL PROJECT COST	**US$**	**$1,007,931**	**$1,481,897**	**$475,489**	**$459,881**	**$428,141**	**$398,641**	**$321,628**	**$231,169**	**$219,611**	**$208,630**	**$198,199**

Financial Analysis without CDM:

Tariff (US$/MWh)	US$ / MWh	80.0
Rate of increase of power tariff	%	1.5%
Depreciacion	%	10%
Income Tax	%	28%

CASH FLOW WITHOUT CDM		0	1	2	3	4	5	6	7	8	9	10
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Projected Emission Reductions (tCO_2)	tCO_2	21,924	53,165	56,143	51,139	46,916	43,448	39,816	36,443	33,308	30,839	16,406
REVENUE												
Electricity Generation												
Evolution of Power Tariff	US$ / MWh	$80.0	$81.2	$82.4	$83.7	$84.9	$86.2	$87.5	$88.8	$90.1	$91.5	$92.8
Annual Electricity Generation	MWh	-110	-263	10,137	8,537	7,737	7,737	6,937	6,137	5,337	5,337	2,647
Electricity Revenue	US$	**$0**	**$0**	**$835,488**	**$714,173**	**$656,959**	**$666,813**	**$606,835**	**$544,907**	**$480,985**	**$488,200**	**$245,728**
INVESTMENT & COSTS												
a) Capital Cost												
Flaring systems (Shipped and commissioned)	US$	$455,442	$9,789	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gas collection system and civil works	US$	$420,353	$45,983	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal: Investment gas collection & flaring	US$	**$875,795**	**$55,772**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Electrical Generating Equipment	US$	$0	$830,850	$0	$0	$0	$0	$0	$0	$0	$0	$0
Connection to Grid	US$	$0	$229,200	$0	$0	$0	$0	$0	$0	$0	$0	$0
Ongoing gas collection and maintenance	US$	$0	$57,300	$0	$0	$0	$0	$0	$0	$0	$0	$0
Civils	US$	$0	$133,700	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal: Investment Energy Generation	US$	**$0**	**$1,251,050**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL INVESTMENT	US$	**$875,795**	**$1,306,822**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
b) O&M Cost												
Operation and Project Support - Gas Collection & Flaring	US$	$132,137	$175,075	$176,737	$176,066	$158,517	$142,498	$78,292	$0	$0	$0	$0
Operation and Project Support - Electricity Generation	US$	$0	$0	$298,753	$283,815	$269,624	$256,143	$243,336	$231,169	$219,611	$208,630	$198,199
TOTAL O&M and PROJECT SUPPORT COST	US$	**$132,137**	**$175,075**	**$475,489**	**$459,881**	**$428,141**	**$398,641**	**$321,628**	**$231,169**	**$219,611**	**$208,630**	**$198,199**
TOTAL INVESTMENT & COST	US$	**$1,007,931**	**$1,481,897**	**$475,489**	**$459,881**	**$428,141**	**$398,641**	**$321,628**	**$231,169**	**$219,611**	**$208,630**	**$198,199**
Depreciacion	US$	$90,942	$218,262	$218,262	$218,262	$218,262	$218,262	$218,262	$218,262	$218,262	$218,262	$127,319
Gross profit before tax	US$	-223,079	-$393,336	$141,737	$36,031	$10,556	$49,910	$66,946	$95,476	$43,113	$61,308	-$79,790
Cummulative (for carryforward tax)	US$	-223,079	-$616,415	-$474,679	-$438,648	-$428,092	-$378,182	-$311,236	-$215,760	-$172,647	-$111,339	-$191,128
Income Tax	US$	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Profit	US$	-$223,079	-$393,336	$141,737	$36,031	$10,556	$49,910	$66,946	$95,476	$43,113	$61,308	-$79,790
Cashflow without CDM	US$	**-$1,007,932**	**-$1,481,897**	**$359,998**	**$254,292**	**$228,818**	**$268,172**	**$285,207**	**$313,738**	**$261,375**	**$279,570**	**$47,530**
Cummulativ	US$	-$1,007,932	-$2,489,828	-$2,129,830	-$1,875,538	-$1,646,720	-$1,378,548	-$1,093,341	-$779,603	-$518,228	-$238,658	-$191,128

	21 years without CDM	10 years without CDM
Net Present Value (US$)	-944,091	-944,091
IRR		-1.59%
Discount Rate		12.00%

Input data for the Electricity Generation component of the Project Activity

Input data	
PROJECT DATA	
Date project starts operating (year)	**2007**
Installed capacity (MW)	**1.30**
Estimated on-line availability of equipment (%)	**91%**
Operating period (h/yr)	**8,000**
BASELINE DATA	
Country	**Mexico**
CEF country (t CO2e/MWh)	**0.510**
Crediting period (years)	**10**
FINANCIAL PARAMETERS	
Electricity tariff (US cents/KWh)	**7.0**
Rate of increase of tariff (%/yr)	**1.5%**
Income tax	**28.0%**
Discount rate	**12.0%**
Depreciation	**10.0%**
Price of carbon (US$/tCO2)	**8.00**

Carbon Emission factors of the Mexican Electricity Grid

Operating Margin of the Mexican Electricity Grid		**2003**	**2004**	**2005**
Electricity Generation	GWh	150,249	165,338	169,485
CO_2 Emissions	tCO2	103,428,586	101,770,405	101,185,307
Operating Margin	tCO_2 / MWh	0.688	0.616	0.597
Average weighted OM	**tCO_2 / MWh**	**0.634**		

Build Margin of the Mexican Electricity Grid		**2005**
Electricity Generation	GWh	44,430
CO_2 Emissions	tCO2	17,135,744
Operating Margin	**tCO_2 / MWh**	**0.386**

Carbon Emission Factor	

Average Operating Margin 2003-2005	tCO_2 / MWh	0.634
Average Build Margin 2005	tCO_2 / MWh	0.386
Carbon Emission Factor	**tCO_2 / MWh**	**0.510**

Grid Emission Factor of the Mexican Electricity Grid 2003 – 2005

Principal Power Plants CFE (plants with a generation < 5 GWh / year are excluded)

	Name of the Generation Unit	Scheme	Municipality	State	Date operations started	Number of Units	Installed Capacity (MW) 2003	2004	2005	Gross Generation (GWh) 2003	2004	2005	Aggregated	%	CO2 Emissions (tonnes) 2003	2004	2005	Carbon Emission Factor 2003	2004	2005
	Guaymas II (Carlos Rodriguez Rivero		Guaymas	Sonora	10-Aug-62	4	484	484	484	195	41	1,358	175,028	79.6%	203,411	41,547	1,109,516	1.043	1.007	0.817
	Poza Rica		Tihuatlán	Veracruz	4-Feb-63	3	117	117	117	568	441	591	173,670	79.0%	484,412	397,125	572,136	0.853	0.900	0.968
	Valle de Mexico		Acolman	México	1-Apr-63	4	450	228	1,087	3,635	2,284	1,523	173,079	78.7%	580,468	374,579	820,308	0.160	0.164	0.539
	Francisco Villa		Delicias	Chihuahua	22-Nov-64	5	399	399	300	1,773	1,677	1,479	171,556	78.0%	1,151,104	1,072,084	1,146,763	0.649	0.639	0.775
	Salamanca		Salamanca	Guanajuato	16-Jun-71	4	866	866	866	4,249	3,183	2,546	170,077	77.3%	2,344,996	1,436,931	1,791,394	0.552	0.451	0.704
	Dos Bocas		Medellín	Veracruz	14-Aug-74	6	452	452	452	3,013	3,086	2,665	167,531	76.2%	1,644,476	1,583,107	1,434,225	0.546	0.513	0.538
	Gómez Palacio		Gomez Palacio	Durango	5-Jan-76	3	200	200	200	721	757	146	164,866	74.9%	395,484	394,989	100,125	0.549	0.522	0.685
	Altamira		Altamira	Tamaulipas	19-May-76	4	800	800	800	3,528	3,955	3,776	164,720	74.9%	2,479,758	2,815,868	2,960,707	0.703	0.712	0.784
	Lerma (Campeche)		Campeche	Campeche	9-Sep-76	4	150	150	150	841	784	729	160,944	73.2%	725,875	688,216	710,634	0.863	0.877	0.975
	Mazatlán II (Jose Aceves Pozos)		Mazatlán	Sinaloa	13-Nov-76	3	616	616	616	3,677	3,280	3,694	160,215	72.8%	2,543,992	2,252,707	2,780,056	0.692	0.687	0.753
	Mérida II		Mérida	Yucatán	1-Apr-81	3	198	198	198	22	953	1,017	156,521	71.2%	25,683	49,630	641,803	1.171	0.052	0.631
	El Sauz		P. Escobedo	Querétaro	29-Jul-81	7	469	597	601	1,277	3,139	3,193	155,504	70.7%	390,888	781,775	1,181,613	0.306	0.249	0.370
	Manuel Alvarez Moreno (Manzanillo I)		Manzanillo	Colima	1-Sep-82	2	1,200	1,200	1,200	6,328	5,355	5,846	152,311	69.2%	4,128,721	3,431,651	4,341,680	0.652	0.641	0.743
	Río Escondido (José López Portillo)		Rio Escondido	Coahuila	21-Sep-82	4	1,200	1,200	1,200	8,387	8,999	9,357	146,465	66.6%	12,346,091	12,952,607	7,462,254	1.472	1.439	0.798
	Puerto Libertad		Pitiquito	Sonora	1-Aug-85	4	632	632	632	3,127	3,081	3,518	137,108	62.3%	2,159,476	2,118,288	2,665,924	0.691	0.688	0.758
	Villa de Reyes		Villa de Reyes	SLP	1-Nov-86	2	700	700	700	4,239	3,579	3,243	133,590	60.7%	2,803,900	2,327,377	2,408,276	0.661	0.650	0.743
	Nachi-Cocóm		Mérida	Yucatán	16-Apr-87	3	79	79	49	277	234	264	130,347	59.3%	260,395	209,716	285,376	0.941	0.898	1.081
	Mérida I		Mérida	Yucatán	8-Jun-87		168	168	168	1,077	1,077	1,017	130,083	59.1%	936,414	797,884	893,779	0.870	0.741	0.879
	Manzanillo II		Manzanillo	Colima	24-Jul-89	4	700	700	700	4,113	4,069	4,331	129,066	58.7%	2,592,630	2,592,364	3,098,982	0.630	0.637	0.716
	Lerdo (Guadalupe Victoria)		Lerdo	Durango	18-Jun-91	2	320	320	320	2,037	2,335	2,305	124,735	56.7%	1,383,451	1,561,237	1,740,660	0.679	0.669	0.755
	Tula (Francisco Pérez Ríos)		Tula	Hidalgo	30-Jun-91	11	489	489	489	3,168	2,989	2,961	122,430	55.7%	1,412,183	1,227,051	1,282,867	0.446	0.411	0.433
	Tula (Francisco Pérez Ríos)		Tula	Hidalgo	30-Jun-91		1,500	1,500	1,500	8,826	8,102	8,742	119,469	54.3%	6,519,456	5,581,767	6,234,850	0.739	0.689	0.713
	Tuxpan (Adolfo López Mateos)		Tuxpan	Veracruz	30-Jun-91	6	2,100	2,100	2,100	13,241	14,327	11,682	110,727	50.3%	9,410,454	10,133,952	8,904,402	0.711	0.707	0.762
	Carbón II		Nava	Coahuila	2-Nov-93	4	1,400	1,400	1,400	8,294	8,884	9,023	99,044	45.0%	11,070,976	11,852,237	6,694,931	1.335	1.334	0.742
	Petacalco (Plutarco Elias Calles)		La Unión	Guerrero	18-Nov-93	6	2,100	2,100	2,100	13,859	7,915	14,275	90,021	40.9%	13,321,403	7,000,072	7,846,840	0.961	0.884	0.550
	Valladolid (Felipe Carrillo Puerto)		Valladolid	Yucatán	30-Jun-94	5	75	75	75	384	423	467	75,746	34.4%	313,067	765,003	437,848	0.816	1.809	0.938
	Valladolid (Felipe Carrillo Puerto)		Valladolid	Yucatán	30-Jun-94		220	220	220	1,323	1,101	1,047	75,279	34.2%	768,302	234,033	589,010	0.581	0.213	0.563
	Topolobampo II (Juan de Dios Batiz)		Ahome	Sinaloa	12-Jun-95	3	360	360	360	2,030	1,951	2,094	74,232	33.7%	1,372,324	1,299,753	1,562,000	0.676	0.666	0.746
	Guaymas I		Guaymas	Sonora	16-Aug-95		70	70	70	195	41	15	72,138	32.8%	228,738	46,692	16,825	1.173	1.131	1.128
	Cancún		Cancún	Quintana Roo	14-Jun-97		102	102	102	136	39	87	72,123	32.8%	157,833	47,363	101,494	1.162	1.218	1.162
	Chávez		Mezquite de Chávez	Guanajuato	24-Nov-97		28	28	28	37	36	10	72,036	32.7%	33,405	14,710	9,221	0.905	0.412	0.906
	Samalayuca (B. Juárez)		Cd. Juárez	Chihuahua	12-May-98	2	316	316	316	1,360	3,153	1,560	72,026	32.7%	868,865	855,336	1,225,464	0.639	0.271	0.786
	Samalayuca II		Cd. Juárez	Chihuahua	12-May-98	6	522	522	522	3,486	3,170	4,394	70,466	32.0%	1,362,345	446,222	1,670,586	0.391	0.141	0.380
	Río Bravo (Emilio Portes Gil)		Rio Bravo	Tamaulipas	1-Jul-99	4	520	520	520	695	741	1,513	66,072	30.0%	125,932	125,932	950,316	0.181	0.170	0.628
	Huinalá I y II		Pesquería	Nuevo Leon	17-Sep-00	8	968	828	828	4,846	3,339	3,761	64,559	29.3%	2,116,894	1,132,307	1,527,100	0.437	0.339	0.406
	Mérida III	IPP	Mérida	Yucatán	13-Oct-00	1	484	484	484	3,556	3,469	3,371	60,799	27.6%	1,316,802	1,256,799	1,361,505	0.370	0.362	0.404
	El Encino (Chihuahua II)		Chihuahua	Chihuahua	9-May-01	4	423	423	423	2,593	2,004	3,053	57,428	26.1%	1,040,672	826,136	1,158,630	0.401	0.412	0.379
	Valle de Mexico	LFC			18-May-01		88	88	88	54	822	3,218	54,374	24.7%	37,931	126,807	1,480,899	0.000	0.154	0.460
	Jorge Luque [LyFC]		Tultitlán	México	25-Jun-01	8	369	369	362	750	750	581	51,156	23.3%	526,852	473,230	366,654	0.703	0.631	0.631
	Hermosillo	IPP	Hermosillo	Sonora	1-Oct-01	1	238	250	250	542	238	1,316	50,575	23.0%	219,048	95,928	531,516	0.404	0.404	0.404
	Saltillo	IPP	Ramos Arizpe	Coahuila	18-Nov-01	1	248	248	248	1,306	1,298	1,432	49,259	22.4%	527,477	524,246	578,367	0.404	0.404	0.404
	Tuxpan II	IPP	Tuxpan	Veracruz	15-Dec-01	1	495	495	495	3,540	3,596	3,397	47,827	21.7%	1,429,762	1,452,380	1,372,006	0.404	0.404	0.404
BM	Río Bravo II	IPP	Valle Hermoso	Tamaulipas	18-Jan-02	1	495	495	495	3,300	3,098	2,279	44,430	20.2%	1,332,829	1,251,244	920,460	0.404	0.404	0.404
BM	El Sauz (Bajio)	IPP	S. Luis de la Paz	Guanajuato	9-Mar-02	1	575	577	565	4,432	5,257	4,698	42,151	19.2%	1,790,030	2,123,238	1,897,464	0.404	0.404	0.404
BM	Monterrey III	IPP	S.N. Garza	Nuevo Leon	27-Mar-02	1	449	449	449	3,098	2,892	3,147	37,453	17.0%	1,251,244	1,168,043	1,271,035	0.404	0.404	0.404
BM	Altamira II	IPP	Altamira	Tamaulipas	01-May-02	1	495	495	495	3,138	3,155	3,083	34,306	15.6%	1,267,400	1,274,266	1,245,186	0.404	0.404	0.404
BM	Ciudad del Carmen		Ciudad del Carmen	Campeche	28-Oct-02		14	14	14	6	5	5	31,223	14.2%	7,738	7,306	6,728	1.358	1.338	1.340
BM	Tuxpan III y IV	IPP	Tuxpan	Veracruz	23-May-03	1	983	983	983	4,636	7,029	5,464	31,218	14.2%	1,872,423	2,838,927	2,206,842	0.404	0.404	0.404
BM	Campeche	IPP	Palizada	Campeche	28-May-03	1	252	252	252	1,093	1,772	1,782	25,754	11.7%	441,449	715,689	719,728	0.404	0.404	0.404
BM	Chihuahua III	IPP	Juárez	Chihuahua	9-Sep-03	1	259	259	259	432	1,456	1,100	23,972	10.9%	174,479	588,060	444,276	0.404	0.404	0.404
BM	Naco - Nogales	IPP	Agua Prieta	Sonora	4-Oct-03	1	258	258	258	572	1,717	1,819	22,872	10.4%	231,024	693,475	734,672	0.404	0.404	0.404
BM	Altamira III y IV	IPP	Altamira	Tamaulipas	24-Dec-03	1	1,036	1,036	1,036	501	6,541	5,932	21,053	9.6%	202,348	2,641,829	2,395,862	0.404	0.404	0.404
BM	Tuxpan (Adolfo Lopez Mateos)		Tuxpan	Veracruz	3-Jan-04	1	0	163	163	0	7,786	907	15,121	6.9%	0	3,144,670	641,369	0.000	0.404	0.404
BM	Río Bravo III	IPP	Valle Hermoso	Tamaulipas	1-Apr-04	1	0	495	495	0	2,440	1,717	14,214	6.5%	0	985,486	693,475	0.000	0.404	0.404
BM	Valle de Mexico		Acolman	México	1-Jun-04	3	549	549	1087	1,736	1,490	4,760	12,497	5.7%	1,095,274	940,534	3,003,915	0.631	0.631	0.631
BM	Chicoasén (Manuel Moreno Torres 2a Etapa)		Chicoasén	Chiapas	22-Dec-04	8	0	900	2,400	0	677	5,543	7,737	3.5%	0	0	0	0.000	0.000	0.000
BM	La Laguna II	IPP	Gómez Palacio	Durango	15-Mar-05	1	0	0	39	0	0	144	2,194	1.0%	0	0	107,157	0.000	0.000	0.743
BM	Hermosillo		Hermosillo	Sonora	1-Apr-05	2	0	0	225	0	0	165	2,050	0.9%	0	0	86,247	0.000	0.000	0.523
BM	Río Bravo IV	IPP	Valle Hermoso	Tamaulipas	1-Apr-05	1	0	0	500	0	0	1,885	1,885	0.9%	0	0	761,328	0.000	0.000	0.404
	Otras					500	2,043	4,494	1,885.0											

	Number of Units	Installed Capacity 2003	2004	2005	Gross Generation 2003	2004	2005	CO2 Emissions 2003	2004	2005	Carbon Emission Factor 2003	2004	2005	Average OM
Total National Interconnected system (excluding hydro, wind, nuclear and geothermal)	660	29,823	34,512	33,020	150,249	165,338	169,485	103,428,586	101,770,405	101,185,307	0.688	0.616	0.597	0.634
Build Margin				9,715			44,430			17,135,744				Build Margin 0.386

Total generation in 2005	219,971	GWh
Total generation of plants considered in the BM	44,430	GWh
% of total generation considered for BM	20%	

Efy 0.510

Hydro

BM

Applied Conversion Factors and Assumptions taken for the grid emission calculation

Carbon Emission Factors used to calculate the Build Margin

	Efficiency *	CEF (tCO_2/MWh)
Combined cycle gas turbine powerplants (CCGT)	50%	**0.404**
Open cycle gas turbine powerplants (OCGT)	32%	**0.631**

Calculations

	Generation	Efficiency	Energy Consumption		Fuel Consumption	CO_2 emissions
	GWh	%	GWh	TJ	tonnes	**T CO2**
CCGT	1.0	50%	2.00	7.20	149.99	**403.89**
OCGT	1.0	32%	3.13	11.25	234.36	**631.07**

Conversion Factors

Fuel	Energy	CEF	CO_2 emissions	Net calorific value	Carbon oxidation
Unit	**TJ/GWh**	**tC/TJ**	**tCO2/tfuel**	**TJ/t fuel**	**%**
Natural gas (dry)	3.6	15.30	2.6928	0.0480	100.00

2006 IPCC Guidelines for national greenhouse gas inventories

The Board recommended, however, that the project participants, in absence of power plant specific fuel data, use the following values for fuel the efficiency level in Brazil, as a conservative proxy for plant efficiencies, to calculate the build margin emission factor for grid electricity:
(i) Combined cycle gas turbine power plants - 50%,
(ii) Open cycle gas turbine power plants - 32%,
(iii) Sub-critical coal power plants - 33%, and
(iv) Oil based power plant sub-critical oil boiler - 33%.

This approach was also considered to calculate the build margin emission factor for the Mexican Grid.

Annex 4

MONITORING INFORMATION

Table: Operational procedures and responsibilities for monitoring and quality assurance of emission reductions from the project activity (E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed, N = not involved)

Process	Site Operators	Site/Regional Manager	Carbon Credits Data Provider	Equipment Supplier	Carbon Credits Data Controller	Carbon Credits Process Manager	EcoSecurities
Field Balancing	E	R	N	N	I	I	N
Secondary Daily Data Gathering	E	R	N	N	R	I	N
Internal calibration/maintenance	E	R	N	I	I	I	N
External calibration/maintenance	I	R	N	E	R	I	I
Calibration/ Maintenance; faults reporting	E	I	I	I	E	R	I
Enter secondary data into data gathering sheet	E	R	N	N	R	I	N
Ensuring upload primary data to data base	N	N	E	N	R	R	N
Download primary data from data provider	N	I	I	N	E	I	I
Data analysis	N	I	N	N	E	R	I
CER calculation	N	N	N	N	E	R	I
Archive primary and secondary data and reports	N	N	E	N	E	R	I
Produce monthly & annual reports	N	N	I	N	E	R	R
Ensure quality management of data and operations under ISO9000	I	I	I	N	I	E	R