CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Ecatepec – EcoMethane Landfill Gas to Energy Project
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A.2. Description of the project activity:

The Ecatepec – 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 taking place at the Santa Maria Chiconautla landfill in the Municipality of Ecatepec, Mexico, hereafter referred to as the "Host Country". The project will have an electricity component with an installed capacity between 2 and 5 MW.

The Santa Maria Chiconautla landfill was opened in 1990, and is receiving an average of 1,600 tonnes of municipal waste from the Municipality of Ecatepec, the most populated Municipality in the Host Country. The municipal government owns the landfill and operated it until 2005. In this year, the Municipality entered into an agreement with a private company for the operation and maintenance of the landfill. The landfill site is divided in two main areas. The first area contains most of the waste deposited on site to date, and was recently closed. Final closure and remediation works in this area are currently being carried out by the landfill operator. The second area is a new extension of the landfill where the municipal solid waste is currently being deposited. In both areas, there is no system in place to actively capture or flare the LFG generated at the landfill, so it is being vented to the atmosphere.

The objective of the Project is to collect and utilise the LFG generated at the Santa Maria Chiconautla landfill. 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 Ltd (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.

The Project will have several positive social and environmental impacts:

- First, properly collecting and destroying flammable LFG will reduce the risks associated with explosions in and around the landfill. This is particularly important as the LFG collection system will minimise the potential for LFG migration, which can infiltrate zones outside of the landfill's boundaries and pose dangers to the surrounding population and structures.
- Second, the destruction of the LFG will improve the local environment by reducing the amount of noxious air pollution arising from the landfill, resulting in a considerable reduction of nuisance caused by the odours and also health risks associated to these emissions, especially for the surrounding population located nearby the landfill.
- Third, the project will provide a model for managing LFG, a key element in improving landfill management practices throughout the Host Country.
- Fourth, the project will act as a clean technology demonstration project, encouraging less dependency on grid-supplied electricity, and will represent a technology transfer from the UK to the Host Country.
- Fifth, 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 fulfil its goals of promoting sustainable development. Specifically, the project:

- Increases employment opportunities in the area where the project is located;
- Diversifies the sources of electricity generation;
- 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 using landfill gas throughout the Country;
- Optimises the use of natural resources; and
- 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 (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Mexico (host)	Biogas Technology S.A. de C.V.	No
UK	Biogas Technology Ltd	No
UK	EcoSecurities Ltd	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

A.4.1.3. City/Town/Community etc:

Municipality of Ecatepec de Morelos

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

The Santa Maria Chiconautla landfill is located next to the road to the prison, at Ejido Santa Maria Chiconautla, in the Municipality of Ecatepec de Morelos. The site is located at the following coordinates: 19º38'33'' N and 98º58'26'' W. The picture below presents an aerial view of the landfill:

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 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.
- The gas collection pipe work consists of pipes connecting groups of gas wells to the manifolds. Manifolds connect into a main pipe and then into the main header pipe delivering 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.
- The gas collection pipe work allows for effective condensate management by employing dewatering points at strategic low points and returning the condensate back to landfill.
- The system operates at pressure slightly lower than atmospheric. A blower(s) draws the gas from the wells through the collection system and delivers it to the flare or gas fuelled internal combustion engine powering electricity generator. The system is optimised to address issues related to pressure losses.

- For efficient operation of the gas collection system, each landfill cell, where the gas is collected from, is covered by an impermeable material (high density polyethylene membrane or mineral material) to provide sufficient containment and prevent air ingress into 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 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. 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 mains 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 manual 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.
- Burners of proprietary Biogas design ensure full destruction of combustible constituents found in LFG at high temperature in accordance with the UK Environment Agency guidelines.
- The unit includes sophisticated instrumentation, as follows:
    - flow meter to measure accurately the flow of the gas through the system;
    - gas analyser (methane, carbon dioxide, oxygen) that measures the quality of the gas delivered to the flare, as well as gas flow rate and pressure (and other selected parameters);
    - sampling points for taking gas samples with portable instrumentation and for laboratory analysis;
    - ultraviolet camera fitted to the stack that monitors the presence of the flame;
    - 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
    - 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;
    - manual, automated or remote start and 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;
    - automatic notification of the alarms and shutdowns to the operator via telemetry;
    - automated temperature control;
    - local readout of the flare operating parameters and alarms; and
    - electrical isolation of the whole plant.

The Project Developer will provide all the training necessary to the site manager and operators for the adequate use of the equipment and instrumentation described above as well as for the monitoring procedures required by the project. This training will be provided by specialised technicians from the UK and according to established operation and maintenance manuals developed for this purpose.

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 of 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 pipe work. 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 of fully containerised Caterpillar (Cat 3516) 16 cylinder turbocharged 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 ensure no leaks of oil to ground, therefore environmentally friendly. As the gas production increases or decreases (gas production curve) then 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 landfill gas comes from the UK. Equipment will be imported and installed in Mexico, representing a transfer of technology.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

This project is based on two complementary activities, as follows:

- The collection 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 fossil fuels used for electricity generation.

The baseline scenario is the continued uncontrolled release of LFG to the atmosphere, which is what generally occurs at landfills throughout the Host Country.

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. In addition there is no economic incentive or support to develop the project. Therefore this kind of project is not part of the baseline scenario, it is concluded that the Project is additional.

The total emission reductions of the project over its crediting period of ten years are expected to be 2,093,526 tCO2e.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Table: estimated emissions reductions from the project.

Year	**Total Annual estimation of emission reductions in tonnes of CO_2e**
1	124,995
2	144,392
3	141,193
4	189,692
5	205,527
6	221,937
7	238,991
8	256,759
9	275,313
10	294,728
Total estimated reductions (tonnes of CO_2e)	2,093,526
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	209,353

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 methodology

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

For the landfill gas component, the latest version of ACM0001 “Consolidated baseline methodology for landfill gas project activities” will be used.

For the electricity generation component, the latest version of AMS- 1.D “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.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology ACM 0001 allows for the development of projects falling under 3 options:

a) Landfill projects where the captured gas is simply flared;

b) Landfill projects that use the gas to produce energy (e.g. electricity/thermal energy), but do not claim emission reductions from displacing or avoiding energy from other sources; and

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.

As previously described, 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., the captured landfill gas 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.2. Description of how the methodology is applied in the context of the project activity:

The methodology ACM0001 requires that 'Project proponents should provide an ex ante estimate of emissions 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 first order decay model is used to determine estimated emissions reductions ex ante. This ex ante estimate is for illustrative purposes, as emissions reductions will be monitored ex-post, according to the methodology.

The methodology 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 credits for these sources will be calculated using the Methodology for Small Scale Electricity Type 1.D., as the 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 Mexican Energy Ministry (SENER). The defaults used for the calculation of calorific values for fuel types and fuel oxidisation came from the IPCC GHG Gas Inventory Reference Manual (IPCC 1996).

The formulae used to calculate emissions reductions are detailed in section D.2.4.

The following table provides the key information and data used to determine the emission reductions in the project scenario:

Table: Data used to determine the emission reductions in the project scenario

Variable	Unit	Data Source
Total amount of LFG captured	m^3	Project developer
Amount of LFG flared	m^3	Project developer
Amount of LFG combusted in power plant	m^3	Project developer
Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)	%	Project developer
Methane fraction in the LFG	%	Project developer
Regulatory requirements relating to LFG projects	text	Host country legislation
Operating Margin Emissions Factor (EF_OM_y)	tCO_2/MWh	Calculated using data from the Host Country Energy Ministry
Build Margin Emissions Factor (EF_BM_y)	tCO_2/MWh	Calculated using data from the Host Country Energy Ministry
Electricity displaced by the Project ($EL_{EX,LFG}$)	MWh	Project developer and Grid electricity company
Electricity consumed by the Project (EL_{IMP})	MWh	Project developer and Grid electricity company

B.3. 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:

The determination of project scenario additionality is done using the CDM consolidated tool for demonstration of additionality, which follows the following 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:

Alternative 1: The landfill operator could continue the current business as usual practice of passive venting (i.e., not collecting and flaring) LFG from the waste management operations directly to the atmosphere. In this case, no power would be generated at the sites and the Host Country power system would remain unaffected.

Alternative 2: The landfill operator would invest in a LFG collection system of high effectiveness, as well as a high efficiency flaring system and in LFG power generation equipment (the proposed project activity). The operation would reduce the generation of power for other grid-connected sources. Alternative 2 represents the proposed project activity.

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

The proposed project activity complies with all the applicable laws and regulations. Regulation NOM-083-SEMARNAT-2003 defines the specifications for environmental protection from the selection, design, construction and operation, monitoring and closure of final disposal sites for urban and special solid waste. This comprehensive regulation defines guidelines for the construction and operation of landfills, and also provides guidance regarding LFG, including recommendations for the collection, utilisation and/or flaring of the LFG. However, the regulation does not specify minimum requirements regarding the amount of gas to be collected and utilised or flared.

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 law 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 about one year ago. 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.

In short, 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 III 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., no collection and combustion of landfill gas), will be determined by comparing its IRR with the benchmark of interest rates available to a local investor. In April 2006, interest rates at local banks in Mexico were 7.6% and yields on government bonds were 7.31%. The benchmark rate of return on construction or projects with similar risks involved is commonly set at least at 15%.

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 carbon revenues) is negative[1], lower than the interest rates provided by local banks or government bonds in the Host Country.

Table: Financial results of the project (Alternative 2) with and without carbon finance. NPV uses 12% discount rate. The electricity price is assumed to be US$70/MWh, consistent with current prices, which are not expected to change substantially.

	With Carbon Revenues	**Without Carbon Revenues**
Net Present Value (US$)	2,233,571	-1,880,730
IRR	24.3%	-3.0%
Discount rate	12%	12%

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

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).

[1] Even under an optimistic scenario of reaching 5 MW of generation capacity, the project IRR would be only 4%

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 its alternative even in the case where these parameters change in favour of the project.

Table: Sensitivity analysis

Scenario	**% change**	**IRR (%)**	**NPV $US**
Original		-3.0%	-1,880,730
Increase in project revenue	10%	1.3%	-1,401,747
Reduction in project costs	10%	1.6%	-1,254,745

Note: NPV uses 12% discount rate.

In conclusion, the project IRR remains low even in the case where these parameters change in favour of the Project. Even though these numbers are closer to the risk free returns of government bonds, these are still too low for a risky enterprise such as the construction and operation of a landfill gas-to-energy project, and fairly lower than private equity investments such as 15%. Consequently, the Project cannot be considered as financially attractive.

Step 4. Common Practice Analysis

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

To date there has been very limited development of LFG projects in the Host Country. 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. As the table indicates, only two of the 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. Needless to say, the Prados de la Montaña landfill now sits amongst the most prized real estate in the entire country, flanked by headquarters of important Mexican and international corporations, top-level academic institutions, and highly valued residential properties and commercial centres. Despite the completion of this system years ago, it is not surprising that it took Global Environment Facility financing to build the second LFG capture system in Mexico – this one at the Simeprodeso landfill in Monterrey completed in 2003 and designed specifically as a demonstration project to promote the development of CDM projects. Since then, no LFG collection and flaring or utilisation systems have been developed in Mexico without considering carbon revenues.

Table: The Project control group

Landfill Name	Location	Waste Deposition Rate (tonnes/day)	Current Status
Prados de la Montaña	Mexico City	Closed	Passive system for venting and flaring LFG
Simeprodeso landfill (phase I)	Monterrey, Nuevo Leon	Closed	Landfill gas collection and utilisation project, funded with support from the GEF as demonstration project
Durango	Durango City, Durango	500	No system for collecting, venting or flaring LFG
Culiacan	Culiacan, Sinaloa	850	Passive system for venting of LFG only (no flaring)
Socavon San Jorge	Metepec, State of Mexico	500	Passive system for venting and flaring LFG
El Verde	Leon, Guanajuato	1,450	Passive system for venting and flaring LFG
Bordo Neza	State of Mexico	1,500	No system for collecting, venting or flaring LFG
Chiltepeque landfill	Puebla City, Puebla	1,595	No system for collecting, venting or flaring LFG
Bordo Poniente	Mexico City	11,999	No system for collecting, venting or flaring LFG
Santa Rita	San Luis Potosi	340	Passive system for venting of LFG only (no flaring)
Milpillas (Tetlama)	Temixco, Morelos	1,100	No system for collecting, venting or flaring LFG
Cancun	Cancun, Quintana Roo	700	Passive system for venting and flaring LFG

Thus, with the exception of the Prados de la Montaña and the first phase of the Simeprodeso landfills, none of the other landfills have proper LFG collection and flaring systems. In some cases, as in Ecatepec, the LFG is vented passively to atmosphere for safety purposes. Indeed, this is reflected in the Adjustment Factor (see section D.2.2.2). 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 Mexico.

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

As mentioned above in sub-step 4a, only two landfills in the Host Country have collection and flaring or utilisation schemes on them, and the conditions for the development of each of these systems was quite special. There are some plans to install efficient gas collection and flaring systems in other landfills, but all of these are in the context of the CDM.

Step 5. Impact of CDM registration

As shown in Step 2 above, the project is unlikely to move forward without the additional financial support of the CDM. If the developer were able to sell emission reduction credits from the project activity, the additional revenue generated by carbon sales would be sufficient to make the project go ahead (see Table in step 2c above).

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

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

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 I.D of small-scale CDM methodology, 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:

- CH_4 emissions from the un-recovered LFG liberated from the landfill sites. It is estimated that only 60% of LFG generated at the Santa Maria Chiconautla landfill will be captured, which means that the remaining 40%, 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.

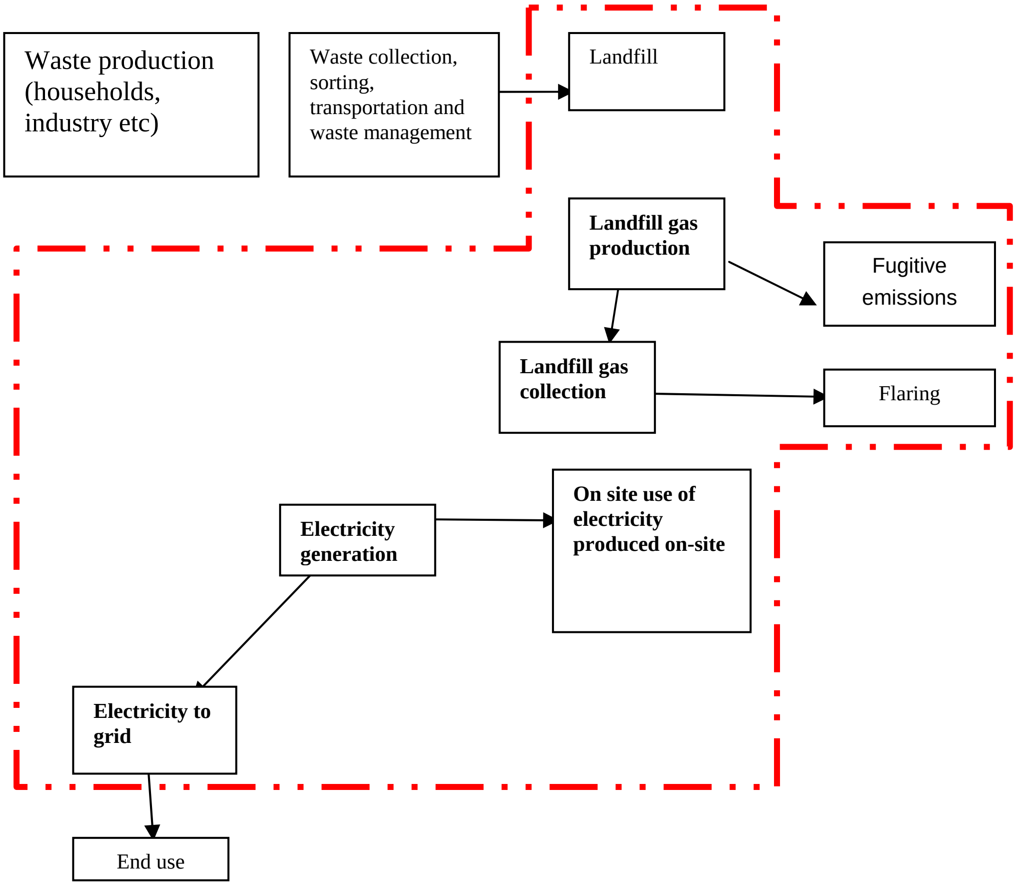

Figure: Flow chart of project boundaries (staggered line indicates boundaries)

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

Date of completion: 04 July 2006

Person/entity determining the baseline:

Bernardo Lazo
EcoSecurities Ltd - UK
First Floor
Park Central
40/41 Park End Street
Oxford OX1 1JD
United Kingdom
Phone: +44 (0) 1865 202 635
e-mail: bernardo@ecosecurities.com

Detailed baseline information is attached in Annex 3.

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:

01/09/2006

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:

30/09/2006

C.2.2.2. Length:

10 (ten) years

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

For the landfill gas component, the latest version of ACM0001 "Consolidated monitoring methodology for landfill gas project activities" will be used.

For the electricity generation component, the latest version of AMS- 1.D "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.

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

For the landfill gas component the chosen monitoring methodology is to be used in conjunction with baseline methodology ACM0001. The proposed project activity meets all the applicability requirements requested for this methodology.

ACM0001 recommends that for the electricity generation component, either the small-scale methodology 1.D or the Approved Consolidated Methodology ACM0002 should be used. This project will use AMS-1.D as it is below the threshold size for small-scale projects.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

This option is used for the electricity component (generation) of the project. Methane emissions from the landfill gas component of the project and baseline scenarios will be accounted for using option 2 (see section D.2.2 below).

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Since the project generates electricity, there is a net export of electricity to the grid. Energy use for the operation of pumps, flares and other auxiliary equipment is therefore accounted for by the net quantity of electricity displaced by the project during the year (EL_y), which is the sum of total electricity generated minus electricity used (i.e. the amount of electricity that is actually supplied to the grid). This calculation is made in section D.2.4 below.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Not applicable

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number ***(Please use numbers to ease cross-referencing to table D.3)***	**Data variable**	**Data unit**	**Measured (m), calculated (c), estimated (e),**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**For how long is archived data kept?**	**Comment**
1. $LFG_{total,y}$	Total amount of landfill gas captured	Kg	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by a mass flow meter. Data to be aggregated monthly and yearly. Since the mass of LFG is measured directly, there is no need to need to monitor the temperature and pressure to estimate the density of methane.
2. $LFG_{flared,y}$	Amount of landfill gas flared	Kg	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by a mass flow meter. Data to be aggregated monthly and yearly. Since the mass of LFG is measured directly, there is no need to need to monitor the temperature and pressure of LFG to estimate the density of methane.
3. $LFG_{electicity,y}$	Amount of landfill gas combusted in power plant	Kg	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by a mass flow meter. Data to be aggregated monthly and yearly. Since the mass of LFG is measured directly, there is no need to need to monitor the temperature and pressure to estimate the density of methane.

4. FE	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)	%	m/c	Quarterly, montly if unstable	n/a	electronic	During the crediting period and two years after	(1) Periodic measurement of methane content of flare exhaust gas. (2) Continuous measurement of operation time of flare (e.g. with temperature).
5. $W_{CH4,y}$	Methane fraction in the landfill gas	m^3 $CH_{4/}$ m^3 LFG	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by continuous gas quality analyser.
6. EL_{IMP}	Total amount of electricity imported to meet project requirements	MWh	m	Continuously	100%	electronic	During the crediting period and two years after	Required to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity. Measured with an electricity consumption meter only in periods when the project activity is not generating its own electricity. Otherwise, it will be monitored with ID 7. ($EG_{EX,LFG}$)
7. $EL_{EX,LFG}$	Total amount of electricity exported out of the project boundary	MWh	m	Hourly measured and monthly recording	100%	electronic	During the crediting period and two years after	Required to estimate the emission reductions from electricity generation from LFG. Double checked with receipts of sales.
8.	CO_2 emission intensity of the electricity and/or other energy carriers in ID 8.	tCO_2/MWh	c	Annual	100%	electronic	During the crediting period and two years after	The CEF is calculated ex-ante, according to the monitoring methodology AMS I. D
9.	Regulatory requirements relating to landfill gas projects	Text	n/a	Annual	100%	electronic	During the crediting period and two years after	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y}$

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 eq.):

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

For the methane destroyed in the project scenario, the equation is the following:

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

Where:

$MD_{project,y}$: amount of methane actually destroyed by the project activity during the year *"y"* (tCH_4);
$MD_{flared,y}$: quantity of methane destroyed by flaring during the year *"y"* (tCH_4);
$MD_{electricity,y}$: quantity of methane destroyed by generation of electricity during the year *"y"* (tCH_4);
$MD_{thermal,y}$: quantity of methane destroyed by generation of thermal energy (excluded, as no thermal energy will be used).

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

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

Where:

$MD_{flared,y}$: quantity of methane destroyed by flaring flared during the year *"y"* (tCH_4);
$LFG_{flaredy,y}$: quantity of landfill gas flared during the year *"y"* (m^3LFG);
$w_{CH4,y}$: the average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in $m^3\ CH_4 / m^3\ LFG$);
FE: the flare efficiency (the fraction of the methane destroyed).

The quantity of landfill gas flared by the project is estimated using a Project Developer's proprietary first order decay model based on the US EPA model, using Lo (methane generation potential) and k (methane generation rate constant) values appropriate for the Host Country and assuming that only 60% of the landfill gas generated in the landfill is collected by the gas collection system (average for landfills in developing countries). In any case, as this projection is merely for illustrational purposes only, the precision of these values are not as important as the actual emissions reductions will be monitored directly. The details of the assumptions of the model are provided in annex 3.

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:

$MD_{electricity,y}$: quantity of methane destroyed by generation of electricity during the year *"y"* (tCH_4);
$LFG_{electricityy,y}$: quantity of landfill gas fed into electricity generator during the year *"y"* (m^3 LFG);
$W_{CH4,y}$: the average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3 CH_4 / m^3 LFG);
D_{CH4}: the methane density expressed in tones of methane per cubic meter of methane (tCH_4/m^3CH_4).

The sum of the LFG quantities fed to the flare or to the power plant will be compared annually with the total LFG captured using the following formula:

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

Where:

$MD_{total,y}$: *the total quantity of methane captured; and*
$LFG_{total,y}$: *the total quantity of landfill gas captured.*

The lowest value must be adopted as $MD_{project,y}$.

For the methane destroyed in the baseline scenario, the equation is the following:

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

Where:

$MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year *"y"* in the in the absence of the project activity (tCH_4);
$MD_{project,y}$: amount of methane actually destroyed/combusted during the year *"y"* (tCH_4);
AF: Adjustment Factor (%).

The landfill operator is passively venting the collected LFG produced in the landfill, primarily for safety purposes, and there is no passive flaring of the LFG. Because there is no combustion of the LFG, all greenhouse gases generated at the site are being vented to atmosphere. For this reason the Adjustment Factor for the project was fixed at 0% for the baseline scenario.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

No leakage effects have to be accounted for under this methodology.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Not applicable.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 eq.)

The emission reductions of the project are calculated using the following equation:

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

Where:

ER_y: greenhouse gas emission reduction,in a given year *"y"* in tonnes of CO_2 equivalents (t CO_2e);
$MD_{project,y}$: amount of methane that would have been destroyed/combusted during the year *"y"*, in, tonnes of methane (tCH_4);
$MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year *"y"* in the absence of the project, in, tonnes of methane (tCH_4);
GWP_{CH4}: Global Warming Potential value for methane for the first commitment period is 21 t CO_2e / tCH_4;
EL_y: net quantity of electricity exported during the year *"y"*,in megawatt hours (MWh);
$CEF_{electricity,y}$: CO_2 emissions intensity of the electricity displaced, in tonnes of CO_2 equivalents per megawatt hours during year *"y"* (tCO_2e/MWh);
ET_y: incremental quantity of fossil fuel, defined as difference of fossil fuel used in the baseline and fossil fuel use during the project, for energy requirement on site under project activity during the year *"y"* (TJ);
$CEF_{thermal,y}$: CO_2 emissions intensity of the fuel used to generate thermal/mechanical energy(tCO_2e/TJ).

As the project will not include a thermal energy component, this factor will be excluded from the overall equation.

Total electricity used *for* the project will be deducted from the amount of electricity produced *by* the project, thus emissions 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:

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

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 grid will be calculated according to the equations for small scale electricity projects (Methodology for Small Scale Activities Type 1.D-Renewable Electricity Generation for a Grid), as shown below. The carbon emissions factor ($CEF_{electricity}$) is calculated according to option (a), the average of the "approximate operating margin" and the "build margin", where:

(i) The "approximate operating margin" is the weighted average emissions (in kg CO_2equ/KWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low cost biomass, nuclear and solar generation;
(ii) The "build margin" is the weighted average emissions (in kg CO_2equ/KWh) of recent capacity additions to the system, which capacity additions are defined as greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.

The carbon emissions factor of the grid (EF_y) is therefore calculated according to the equation below:

$$EF_y = (\omega_{OM} * EF\_OM_y) + (\omega_{BM} * EF\_BM_y)$$

where the weights ω_{OM} and ω_{BM} are by default 0.5.

The equation for the operating margin emission factor is:

$$EF\_OM_y\,(tCO_2\,/\,MWh) = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_j GEN_{j.y}}$$

Where:

$F_{i,j,y}$: is the amount of fuel i (in GJ) consumed by power source j in year y;
j: is the set of plants delivering electricity to the grid, not including low-cost or must-run plants and carbon financed plants;
$COEF_{i,j,y}$: is the carbon coefficient of fuel i (tCO_2/GJ);
$GEN_{j.y}$: is the electricity (MWh) delivered to the grid by source j.

The equation for the build margin emission factor is:

$$EF\_BM_y\,(tCO_2\,/\,MWh) = \frac{\sum_{i,m} F_{i,m,y} * COEF_{i,m}}{\sum_m GEN_{m.y}}$$

where $F_{i.m,y}$, $COEF_{i,m}$ *and* GEN_m are analogous to the *OM* calculation above.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.2.2.1 1. $LFG_{total,y}$	Low	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Table D.2.2.1 2. $LFG_{flared,y}$	Low	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Table D.2.2.1 3. $LFG_{electicity,y}$	Low	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Table D.2.2.1 4. FE	Medium	Regular maintenance will ensure optimal operation of flares. Flare efficiency should be checked quarterly, with monthly checks if the efficiency shows significant deviations from previous values.
Table D2.2.1 5. $W_{CH4,y}$	Low	The gas analyser should be subject to a regular maintenance and testing regime to ensure accuracy.
Table D.2.1.3 9.	Low	Default data (for emission factors) and grid statistics data will be used. All sources where data is obtained are cited and come from reputable sources.
Table D.2.1.1 11. EGy	Low	This data will be directly used for calculation of emission reductions. This data is very accurately measured, as it is measured both by the operator and by the grid company that will provide the electricity used by the project. To guarantee QC/QA, data from the operator will be double-checked by receipts of electricity purchases.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

Detailed in Annex 4

D.5 Name of person/entity determining the monitoring methodology:

Date of conclusion: 04 July 2006
Person/entity determining the monitoring methodology:

Bernardo Lazo
EcoSecurities Ltd - UK
First Floor
Park Central
40/41 Park End Street
Oxford OX1 1JD
United Kingdom
Phone: +44 (0) 1865 202 635
e-mail: bernardo@ecosecurities.com

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Since the project generates electricity, there is a net export of electricity to the grid and the project emissions from on-site electricity use are deducted from the emission reductions from the project's electricity generation. Thus the net project emissions are zero. In cases when there is no electricity generated, the project emissions will be accounted for and deducted from the total emission reductions of the project.

E.2. Estimated leakage:

No leakage needs to be accounted for by this methodology.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

The sum of E.1 and E.2 is equal to zero.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

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.

Landfill gas component

The amount of methane destroyed in the project scenario is calculated using the equation described in section D.2.2.2, which is simplified in our case since there is no thermal component:

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

As described in section D.2.2.2, the quantity of methane destroyed by flaring is calculated using the following equation:

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

where the landfill gas produced is calculated using the Project Developer's proprietary first order decay model based on the US EPA model.

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 reducing the amount of methane destroyed by using the adjustment factor related to flare efficiency (FE). Consequently, by assuming that all gas will be flared (as opposed to separating the amount to be flared from the amount used for electricity generation), this will lead to a more conservative analysis. This is the approach used in the estimation below.

The table below shows the emission reductions that would take place in the project scenario ($MD_{project}$), using the equations described above.

Table: Emission reductions in the project scenario for the landfill component (amount of methane destroyed).

	Per year (average)	**10 years**
LFG_{flare} (m^3 LFG)	26,626,553	266,265,532
CH_4 Concentration (%)	51%	51%
Density of CH_4 (t CH_4/m^3 CH_4)	0.0007168	0.0007168
Flare Efficiency (%)	99%	99%
$MD_{project} = MD_{flared}$ (tCH_4)	9,606	96,055
$MD_{project} = MD_{flared}$ (tCO_2e)	201,716	2,017,161

For the amount of methane destroyed in the baseline scenario, we use the other equation mentioned in section D.2.2.2:

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

where 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 utilization and that in practice, no registered amounts of LFG are actually flared. Only a passive venting system is currently used at the landfill site for safety purposes. Because no methane destruction is occurring in the baseline, the adoption of an adjustment factor of 0% is considered relevant for the baseline scenario.

The table below shows the emission reductions that would have taken place in the baseline scenario (MD_{reg}), using this equation.

Table: Emission reductions in the baseline scenario for the landfill component (amount of methane destroyed).

	Per year (average)	**10 years**
MDproject	9,606	96,055
AF (%)	0%	0%
MD_{reg} (tCH_4)	**0**	**0**
MD_{reg} (tCO_2e)	**0**	**0**

Electricity component

The emission reductions from the electricity component are calculated using the grid emission factor calculated in section D.2.4 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 table below shows the emission reductions from the displacement of grid electricity.

Table: Emission reductions in the project scenario for the electricity generation component

	Per year (average)	**10 years**
EL_{EXP} (MWh)	14,688	146,880
CEF (tCO_2/MWh)	0.531	0.531
Emission reductions from electricity generation (tCO_2e)	7,799	77,993

Table: Project emissions in the project scenario for the electricity consumption

	Per year (average)	**10 years (project period)**
EL_{IMP} (MWh)	307	3,066
CEF (tCO_2/MWh)	0.531	0.531
Project emissions from electricity consumption(tCO2e)	163	1,628

The following table summarises the total net emission reductions of the project by components.

Table: Summary of total net emission reductions from the project activity

	Per year (average)	**10 years**
Emission Reductions in Project Scenario – flaring (tCO_2e)	201,716	2,017,161
Emission Reductions in Baseline Scenario – flaring (tCO_2e)	0	0
Net Emission Reductions – flaring (tCO_2e)	201,716	2,017,161
Emission Reductions in Project Scenario - electricity generation (tCO_2e)	7,799	77,993
Project Emissions- electricity consumption (tCO_2e)	163	1,628
Net Emission Reductions – electricity (tCO_2e)	7,637	76,365
Total Net Emission Reductions by the Project Activity (tCO_2e)	**209,353**	**2,093,526**

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The emission reductions of the project are calculated using the following equation:

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

E.6. Table providing values obtained when applying formulae above:

The estimated results are expressed in the following table. The actual emission reductions generated by this project will be measured directly after the project is operational.

Table: Estimation of the emission reductions of the project

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)
1	124,995	0		124,995
2	144,392	0		144,392
3	141,193	0		141,193
4	189,692	0		189,692
5	205,527	0		205,527
6	221,937	0		221,937
7	238,991	0		238,991
8	256,759	0		256,759
9	275,313	0		275,313
10	294,728	0		294,728
Total (tCO_2e)	2,093,526	-	-	2,093,526

SECTION F. Environmental impacts

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

The project will collect and combust LFG, thereby improving overall landfill management and reducing adverse global and local environmental effects of uncontrolled releases of landfill gas. While 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:

- Although the majority of LFG emissions are quickly diluted in the atmosphere, in confined spaces there is a risk of explosion and/or fire, either within the landfill or outside its boundaries.

- Another potential threat of concentrated emissions of LFG is asphyxiation and/or toxic effects on humans.

- Landfill gas also contains over 150 trace components that can cause other local and global environmental effects such as odour nuisances, stratospheric ozone layer depletion, and ground-level ozone creation.

Flaring LFG and/or using it in electricity generators can also produce nitrogen oxide emissions that vary widely from one site to another, depending on the type of flare/generator and the extent to which steps have been taken to minimise such emissions. Combustion of LFG can also result in the release of organic compounds and trace amounts of toxic materials, including mercury and dioxins, although such releases are at levels significantly lower than with continued uncontrolled release of landfill gas. However, it is worth noting that the Developer's flares and electricity generation units 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.

The installation of the LFG collection and combustion systems is part of a broader effort by the landfill operator to continue improving its waste management practices. Overall, sustainable management of the landfill will result in accelerating waste stabilisation such that the full decomposition of the waste in the landfill will be largely complete within 30- 50 years.

For the LFG flaring component of the project activity, no Environmental Impact Assessment is required by the Federal Government of the host country. However, as part of the efforts of the landfill operator to meet all the legal requirements for the concession of the landfill, an Environmental Impact Assessment (EIA) and a preventive report that includes the LFG component of the project has been completed.

The EIA was focused on identifying potential negative impacts from the closure and remediation for the old section of the landfill. The preventive report focused on assessing the potential negative impacts related to the recent expansion of the landfill where the municipal solid waste is currently being deposited. The EIA assessed the impacts on the environment, local communities and economy, as well as developing mitigation measures, including activities to carry out for the closure of the old part of the landfill based on the minimum requirements stated in the NOM-083-SEMARNAT-2003. Some of those activities described in the EIA include compacting and capping of the landfill cells, leachate management and precipitation runoff and catchments systems, among others.

In both the EIA and the preventive report the LFG project activity was considered and the outcome of those reports was favourable. The project was found to have no significant negative impacts and many positive impacts as indicated above.

The EIA and the preventive report have been submitted for approval from the State Government in the host country. A copy of these reports will be provided to the Operational Entity validating the Project.

For the LFG utilisation component, only projects with an installed electricity generating capacity greater than 2 MW require an EIA from the Federal Government. In this case, the electricity generation estimated at the Santa Maria Chiconautla landfill is expected to range between 2 and 5 MW. However, the initial installed capacity will be 2 MW and could increase in the future according to the LFG generation curve potential of the project. If in any case the installed capacity exceeds 3 MW, an EIA will be conducted beforehand in order to comply with all the applicable regulations at a State and Federal level in the host country.

F.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 G. Stakeholders' comments

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

The stakeholder consultation took place on 22nd March 2006 at the Ecatepec Regional Cultural Center "Jose Maria Morelos y Pavon". 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 Ecapetec – EcoMethane Landfill Gas to Energy Project undertaken by the Project Developer.

The event was properly announced in the main local newspaper "Diario Amanecer" and in the national newspaper "Uno mas Uno" and it was well attended. Specifically, more than 100 people from local authorities, UK consulate, labour unions, industry, local media, and members of the community participated in the event which lasted approximately 70 minutes. Most of the participants represented local communities. All participants were registered with appropriate formats kept in the Project Developer's files.

The stakeholder consultation included an introduction from the Municipal President, a brief description of the project by the landfill operator 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.

G.2. Summary of the comments received:

To date no formal comments have been received from stakeholders. However, during the public consultation stakeholders raised various questions regarding the project, and the Project Developer and representatives of the Municipality provided comments, as follows:

1. Few Municipalities in the country have been addressing environmental issues as Ecatepec. In this case, what are the comparative technical advantages of this landfill compared to other landfills at a national and international level that allow to develop such a project?
    - First of all, the development of a LFG project requires that the site meets certain criteria regarding the landfill conditions and waste disposal management practices that allow the adequate collection and utilisation of the landfill gas. In the case of this landfill, it has sufficient amount of waste in place, and the waste is properly covered and confined, thereby making a project at the site feasible. In addition, the age of the waste and the topographic conditions are favourable for this project.

2. It is known that the Municipality of Aguascalientes is already implementing a landfill gas utilisation project. Are there any other municipalities working in the development of similar projects?
    - Many municipalities in the country have shown interest in developing emission reduction projects in landfills under the CDM. However, as of now, the only projects to date are a demonstration project developed by Simeprodeso in Nuevo Leon, that was financed with support from the World Bank and that is currently collecting the LFG and utilisng it for power generation but is not part of the CDM. In addition, the Municipality of Aguascalientes is already developing a LFG utilisation project under the CDM. The project in Ecatepec will

be the second one developed under the CDM in Mexico and will set an example for other municipalities in the country on how to develop succesfully a project to reduce GHG emissions and improve overall waste management practices.

3. You mentioned the utilisation of the landfill gas based on the organic waste, but what will happen with the inorganic waste, such as automobile and truck tires? How will that be finally disposed at the landfill?
    - The landfill operator responded: Efectively, the landfill gas project represents only part of a broader and integral solution under the concession to the landfill operator. As part of the conditions under this concession, it is required to reduce the amount of waste to be deposited into the landfill. For this purpose, the landfill operator will install and operate a waste treatment and recycling plant next to the landfill. This plant will bring new job opportunities as well as providing a modern solution for waste treatment and disposal, including the final disposal of tires.

4. Given that the carbon credits produced from emission reductions are sold in Europe at around 20-25 Euros, then the project revenues will be around 100 million Euros. From that how much will go to the municipality?
    - The price and the market of carbon credits has always created confusion. Firstly, the price of 20-25 Euros is related to those of the EU allowances, which are not the same as the carbon credits generated by CDM project activities. The CDM projects are subject to many risks which result in a discounted price for the CERs produced by the project, often much lower than the price for emission allowances. Furthermore, the carbon credits will be used to recover the investment in the infrastructure required to develop the project. Otherwise, the project would not be economically feasible to develop.

Members of the community expressed their satisfaction with the Clean Development Mechanism as a tool for reducing pollution at a local level.

Stakeholders, including community, industry, and local authorities congratulated the Municipality and the Project Developer for this project implementation and the public consultation, which helped to inform the community about its operations.

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

As indicated in Section G.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 (as evidenced by the bullet point responses). 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

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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	**Data**
	Landfill data	
Year landfill started operation		1990
Waste in place at the beginning of project	Tonnes	4,390,000
Density of waste	tonne/m3	0.9
Area of site	Ha	20.0
Average daily waste rate	Tonnes/day	1,600
Date gas collection project starts		01-Sep-06
	Operational data	
Gas collection efficiency	%	60%
Flare efficiency	%	99%
	General data	
Lo	m3/tonne	160
k	1/yr	0.12
Methane content of landfill gas	%	51%
CH4 GWP	T CO2/T CH4	21
Density of Methane	Tonne/CH4/m3	0.0007168
	Baseline data	
Proportion of methane flared in Baseline (AF)		0%

Input data for the Electricity Generation component of the Project Activity

Input data	
PROJECT DATA	
Date project starts operating (year)	**2006**
Installed capacity (MW)	**2.04**
Estimated on-line availability of equipment (%)	**91%**
Operating period (h/yr)	**8,000**
BASELINE DATA	
Country	**Mexico**
CEF country (t CO2e/MWh)	**0.531**
Crediting period (years)	**10**
FINANCIAL PARAMETERS	
Electricity tariff (US cents/KWh)	**7.00**
Rate of increase of tariff (%/yr)	**1.5%**
Income tax	**32.0%**
Discount rate	**12.0%**
Depreciation	**10.0%**
Price of carbon (US$/tCO2)	**7.00**

Table: Proprietary first order decay model (based on the US EPA 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"

Table: Emission reductions from LFG electricity generation

Year		0	1	2	3	4	5	6	7	8	9	10
Methane Destruction												
m3 LFG/hour		0	1,886	2,048	1,999	2,730	2,969	3,216	3,473	3,741	4,020	4,313
m3 LFG/year		0	16,520,812	17,937,364	17,515,048	23,917,001	26,007,180	28,173,287	30,424,404	32,769,799	35,218,966	37,781,672
Concentration CH4 (m3CH4/m3LFG)	51%											
Density CH4 (tonne/m3)	0.0007168											
Flare Efficiency	99%											
Tons of CH4 destroyed/year		0	5,960	6,471	6,319	8,628	9,382	10,164	10,976	11,822	12,705	13,630
Tons of CO2e destroyed in project		0	125,158	135,889	132,690	181,189	197,024	213,434	230,488	248,256	266,810	286,224
Tons of CO2e destroyed in baseline (AF)	0%	0	0	0	0	0	0	0	0	0	0	0
Tons of CO2e destroyed (net)		0	125,158	135,889	132,690	181,189	197,024	213,434	230,488	248,256	266,810	286,224
Power Generation (Grid displacement)												
Installed capacity (MW)	2.04	0.00	0.00	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04
Number of operating hours per year/MW	8,000											
Electricity Generation (MWh/year)		0	0	16,320	16,320	16,320	16,320	16,320	16,320	16,320	16,320	16,320
Electricity Consumption by the project (MWh/year)	307	0	307	307	307	307	307	307	307	307	307	307
Net Electricity Exports: (MWh/year)		0	0	16,013	16,013	16,013	16,013	16,013	16,013	16,013	16,013	16,013
Baseline emissions												
CEF (tCO2/MWh)		0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531
Baseline emissions (tCO2/year)		-	-	8,503	8,503	8,503	8,503	8,503	8,503	8,503	8,503	8,503
Cummulative baseline emissions (tCO2)		-	-	8,503	17,006	25,509	34,012	42,516	51,019	59,522	68,025	76,528
Project emissions												
CEF (tCO2/MWh)		0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531
Net Project Emissions (tCO2/year)		-	163	-	-	-	-	-	-	-	-	-
Cummulative project emissions (tCO2)		-	163	163	163	163	163	163	163	163	163	163
Emission reductions												
Emission reductions due to flaring (tonnes CO2e/yr)		-	125,158	135,889	132,690	181,189	197,024	213,434	230,488	248,256	266,810	286,224
Emission reductions due to grid displacement (tonnes CO2e/yr)		-	0	8,503	8,503	8,503	8,503	8,503	8,503	8,503	8,503	8,503
Net Project Emissions		-	163	-	-	-	-	-	-	-	-	-
Net Emission Reductions (tCO2/yr)		**-**	**124,995**	**144,392**	**141,193**	**189,692**	**205,527**	**221,937**	**238,991**	**256,759**	**275,313**	**294,728**
Cummulative (tCO2)		-	124,995	269,387	410,580	600,272	805,799	1,027,736	1,266,726	1,523,485	1,798,798	2,093,526

CERs through 2012	**1,027,736**
CERs crediting period	**2,093,526**

Carbon Emission factors of the Mexican Electricity Grid

Operating Margin of the Mexican Electricity Grid	**2002**	**2003**	**2004**
Electricity Generation (GWh)	139,159	143,131	157,433
CO2 Emissions (tonnes)	95,328,117	97,705,797	95,802,514
Operating Margin	0.685	0.683	0.609

Build Margin of the Mexican Electricity Grid	**2004**
Electricity Generation (GWh)	42,212
CO2 Emissions (tonnes)	17,030,008
Operating Margin	0.403

Carbon Emission Factor	tCO2/MWh
Average Operating Margin 2002-2004	0.659
Average Build Margin 2004	0.403
Carbon Emission Factor	**0.531**

Carbon Emission Factors used to calculate the Build Margin

	Efficiency *	**CEF (T CO2/MWh)**
Combined cycle gas turbine power plants (CCGT)	50%	**0.402**
Open cycle gas turbine power plants (OCGT)	32%	**0.628**

Calculations

	Generation	Efficiency	Energy Consumption		Fuel Consumption	**CO2 emissions**
	GWh	%	GWh	TJ	tonnes	**T CO2/GWh**
CCGT	1.0	50%	2.00	7.20	137.67	**401.90**
OCGT	1.0	32%	3.13	11.25	215.11	**627.97**

Conversion Factors

Fuel		**Energy**	**CEF**	**CO2 emissions**	**Net calorific value**	**Carbon oxidation**
Unit		**TJ/GWh**	**tC/TJ**	**tCO2/tfuel**	**TJ/t fuel**	**%**
Natural gas (dry)		3.6	15.30	2.9194	0.0523	99.50

Source: 1996 IPCC Guidelines for national greenhouse gas inventories

Table: Data used to calculate the operating and build margin emissions factor for the electricity component of the project.

		Name of the Generation Unit	Scheme	Municipality	State	Date operations started	Installed Capacity (MW)			Gross Generation (GWh)					CO_2 Emissions (tonnes)			Carbon Emission Factor		
							2002	2003	2004	2002	2003	2004	Aggregated	%	2002	2003	2004	2002	2003	2004
	31	Guaymas II (Carlos Rodriguez Rivero		Guaymas	Sonora	10-Aug-62	484	484	484	187	195	41			193,041	203,411	41,547	1.034	1.043	1.007
	50	Poza Rica		Tihuatlán	Veracruz	4-Feb-63	117	117	117	654	568	441			539,072	484,412	397,125	0.824	0.853	0.900
	18	Valle de Mexico		Acolman	México	1-Apr-63	450	450	450	3,894	3,635	2,284			708,784	580,468	374,579	0.182	0.160	0.164
	27	Francisco Villa		Delicias	Chihuahua	22-Nov-64	399	399	399	1,920	1,773	1,677			1,182,656	1,151,104	1,072,084	0.616	0.649	0.639
	25	Monterrey		S.N. Garza	Nuevo Leon	15-Jul-65	465	465	465	2,538	1,784	287			1,342,594	793,783	55,188	0.529	0.445	0.192
	19	Jorge Luque [LyFC]		Tultitlán	México	N/A	362	362	362	N/A	N/A	N/A			N/A	N/A	N/A			
	21	Salamanca		Salamanca	Guanajuato	16-Jun-71	866	866	866	4,841	4,249	3,183	153,379	77.3%	3,266,400	2,344,996	1,436,931	0.675	0.552	0.451
	47	Dos Bocas		Medellín	Veracruz	14-Aug-74	452	452	452	2,429	3,013	3,086	150,196	75.7%	1,315,693	1,644,476	1,583,107	0.542	0.546	0.513
	49	Gómez Palacio		Gomez Palacio	Durango	5-Jan-76	200	200	200	1,045	721	757	147,110	74.2%	591,390	395,484	394,989	0.566	0.549	0.522
	23	Altamira		Altamira	Tamaulipas	19-May-76	800	800	800	4,656	3,528	3,955	146,353	73.8%	3,278,192	2,479,758	2,815,868	0.704	0.703	0.712
	34	Lerma (Campeche)		Campeche	Campeche	9-Sep-76	150	150	150	813	841	784	142,397	71.8%	707,889	725,875	688,216	0.871	0.863	0.877
	32	Mazatlán II (Jose Aceves Pozos)		Mazatlán	Sinaloa	13-Nov-76	616	616	616	3,284	3,677	3,280	141,613	71.4%	2,313,520	2,543,992	2,252,707	0.704	0.692	0.687
	35	Mérida II		Mérida	Yucatán	1-Apr-81	168	198	198	1,100	22	953	138,333	69.7%	0	25,683	49,630	0.000	1.171	0.052
	48	El Sauz		P. Escobedo	Querétaro	29-Jul-81	469	469	597	1,371	1,277	3,139	137,381	69.2%	254,647	390,888	781,775	0.186	0.306	0.249
	20	Manzanillo		Manzanillo	Colima	1-Sep-82	1,200	1,200	700	6,449	6,328	5,355	134,241	67.7%	4,270,855	4,128,721	3,431,651	0.662	0.652	0.641
	38	Río Escondido (Jose Lopez Portillo)		Rio Escondido	Coahuila	21-Sep-82	1,200	1,200	1,200	7,516	8,387	8,999	128,886	65.0%	11,174,878	12,346,091	12,952,607	1.487	1.472	1.439
	30	Puerto Libertad		Pitiquito	Sonora	1-Aug-85	632	632	632	3,350	3,127	3,081	119,887	60.4%	2,316,464	2,159,476	2,118,288	0.692	0.691	0.688
	22	Villa de Reyes		Villa de Reyes	SLP	1-Nov-86	700	700	700	2,926	4,239	3,579	116,806	58.9%	1,935,216	2,803,900	2,327,377	0.661	0.661	0.650
	56	Nachi-Cocom		Mérida	Yucatán	16-Apr-87	79	79	79	249	277	234	113,228	57.1%	233,631	260,395	209,716	0.937	0.941	0.898
	20	Manzanillo (Manuel Alvarez Moreno)		Manzanillo	Colima	24-Jul-89	700	700	1,200	5,034	4,113	4,069	112,994	57.0%	3,185,310	2,592,630	2,592,364	0.633	0.630	0.637
	29	Lerdo (Guadalupe Victoria)		Lerdo	Durango	18-Jun-91	320	320	320	1,980	2,037	2,335	108,925	54.9%	1,332,895	1,383,451	1,561,237	0.673	0.679	0.669
	17	Tula (Francisco Perez Rios)		Tula	Hidalgo	30-Jun-91	1,989	1,989	1,989	9,734	8,826	8,102	106,590	53.7%	6,368,679	5,639,108	4,066,439	0.654	0.639	0.502
	24	Tuxpan (Adolfo Lopez Mateos)		Tuxpan	Veracruz	30-Jun-91	2,100	2,100	2,100	15,031	13,241	14,327	98,488	49.6%	9,428,677	8,368,248	9,011,463	0.627	0.632	0.629
	39	Carbón II		Nava	Coahuila	2-Nov-93	1,400	1,400	1,400	8,636	8,294	8,884	84,160	42.4%	11,529,858	11,070,976	11,852,237	1.335	1.335	1.334
	43	Petacalco (Plutarco Elias Calles)		La Unión	Guerrero	18-Nov-93	2,100	2,100	2,100	13,879	13,859	7,915	75,276	37.9%	12,155,645	13,321,403	7,000,072	0.876	0.961	0.884
	37	Valladolid (Felipe Carrillo Puerto)		Valladolid	Yucatán	30-Jun-94	295	295	295	415	384	423	67,361	34.0%	336,991	313,067	348,029	0.812	0.816	0.823
	36	Topolobampo II (Juan de Dios Batiz)		Ahome	Sinaloa	12-Jun-95	360	360	360	1,997	2,030	1,951	66,938	33.7%	1,330,843	1,372,324	1,299,753	0.667	0.676	0.666
	44	Samalayuca II		Cd. Juárez	Chihuahua	12-May-98	522	522	522	3,902	3,486	3,170	64,987	32.8%	1,467,074	1,362,345	446,222	0.376	0.391	0.141
	28	Samalayuca		Cd. Juárez	Chihuahua	12-May-98	316	316	316	1,233	1,360	3,153	61,816	31.2%	852,530	868,865	855,336	0.692	0.639	0.271
	26	Río Bravo (Emilio Portes Gil)		Rio Bravo	Tamaulipas	1-Jul-99	520	520	520	1,031	695	741	58,663	29.6%	418,580	125,932	125,932	0.406	0.181	0.170
	63	Mérida III	IPP	Mérida	Yucatán	9-Jun-00	484	484	484	3,227	3,556	3,469	57,922	29.2%	1,154,518	1,316,802	1,256,799	0.358	0.370	0.362
	45	Huinalá I y II		Pesquería	Nuevo Leon	17-Sep-00	968	968	968	1,333	2,690	2,007	54,453	27.4%	837,121	1,689,056	1,260,194	0.628	0.628	0.628
	67	El Encino (Chihuahua II)		Chihuahua	Chihuahua	9-May-01	554	554	554	2,950	2,593	2,004	52,446	26.4%	1,185,486	1,042,120	805,602	0.402	0.402	0.402
	64	Hermosillo	IPP	Hermosillo	Sonora	1-Oct-01	238	238	250	507	542	238	50,442	25.4%	203,824	217,971	95,456	0.402	0.402	0.402
	70	Saltillo	IPP	Ramos Arizpe	Coahuila	19-Nov-01	248	248	248	1,796	1,306	1,298	50,204	25.3%	721,813	524,882	521,667	0.402	0.402	0.402
	68	Tuxpan II	IPP	Tuxpan	Veracruz	15-Dec-01	495	495	495	3,552	3,540	3,596	48,906	24.7%	1,427,550	1,422,727	1,445,234	0.402	0.402	0.402
	72	Río Bravo II	IPP	Valle Hermoso	Tamaulipas	18-Jan-02	495	495	495	3,127	3,300	3,098	45,310	22.8%	1,256,743	1,326,271	1,245,087	0.402	0.402	0.402
BM	74	Monterrey III	IPP	S.N. Garza	Nuevo Leon	27-Mar-02	449	449	449	2,453	3,098	2,892	42,212	21.3%	985,862	1,245,087	1,162,296	0.402	0.402	0.402
BM	75	Altamira II	IPP	Altamira	Tamaulipas	01-May-02	495	495	495	2,568	3,138	3,155	39,320	19.8%	1,032,080	1,261,163	1,267,996	0.402	0.402	0.402
BM	77	El Sauz (Bajio)	IPP	S. Luis de la Paz	Guanajuato	4-Jun-02	575	575	577	4,401	4,432	5,257	36,165	18.2%	1,768,764	1,781,223	2,112,790	0.402	0.402	0.402
BM	69	Tuxpan III y IV	IPP	Tuxpan	Veracruz	23-May-03		983	983	0	4,636	7,029	30,908	15.6%	0	1,863,210	2,824,958		0.402	0.402
BM	46	Campeche	IPP	Palizada	Campeche	28-May-03		252	252	0	1,093	1,772	23,879	12.0%	0	439,277	712,168		0.402	0.402
BM	79	Chihuahua III	IPP	Juárez	Chihuahua	9-Sep-03		259	259	0	432	1,456	22,107	11.1%	0	173,621	585,167		0.402	0.402
BM	80	Naco - Nogales	IPP	Agua Prieta	Sonora	4-Oct-03		258	258	0	572	1,717	20,651	10.4%	0	229,887	690,063		0.402	0.402
BM	76	Altamira III y IV	IPP	Altamira	Tamaulipas	24-Dec-03		1,036	1,036	0	501	6,541	18,934	9.5%	0	201,352	2,628,831		0.402	0.402
BM	25	Tuxpan (Adolfo Lopez Mateos)		Tuxpan	Veracruz	3-Jan-04			163	0	0	7,786	12,393	6.2%	0	0	3,129,197			0.402
BM	73	Río Bravo III	IPP	Valle Hermoso	Tamaulipas	1-Apr-04			495	0	0	2,440	4,607	2.3%	0	0	980,637			0.402
BM	18	Valle de Mexico		Acolman	México	1-Jun-04	549	549	549	1,150	1,736	1,490	2,167	1.1%	722,353	1,089,885	935,906	0.628	0.628	0.628
BM	2	Chicoasén (Manuel Moreno Torres 2a Etapa)		Chicoasén	Chiapas	22-Dec-04			900	0	0	677	677	0.3%	0	0	0			0.000
		Otras					2,043	2,043	4,494											
						Total National Interconnected system (excluding hydro, wind, nuclear and geothermal)	**28,024**	**30,842**	**34,993**	**139,159**	**143,131**	**157,433**			**95,328,117**	**97,705,797**	**95,802,514**			
						Build Margin			**6,416**			**42,212**					**17,030,008**			

Weighted Average OM 2002	2003	2004	**Average OM**
0.685	**0.683**	**0.609**	**0.659**

Build Margin	**0.403**
Efy	**0.531**

Total generation in 2004	**198,393**	**GWh**
Total generation of plants considered in the BM	**42,212**	**GWh**
% of total generation considered for BM	**21%**	

BM Plants considered for Build Margin Calculation

CEF Values calculated in worksheet "CEF for Build Margin"

Annex 4

MONITORING PLAN

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the EcoMethane – Ecatepec Landfill Gas to Energy Project. The main components covered within the monitoring plan (MP) are:

1. Parameters to be monitored, and how the data will be collected
2. The equipment to be used in order to carry out monitoring
3. Operational procedures and quality assurance responsibilities

The requirements of this MP are in line with the kind of information routinely collected by companies managing landfill gas collection and destruction systems, so internalising the procedures should be simple and straightforward. If necessary, the MP can be updated and adjusted to meet operational requirements, provided that a Designated Operational Entity approves such modifications during the process of verification.

Monitoring for EcoMethane – Ecatepec Landfill Gas to Energy Project will begin with the start of operation in September 2006. The Monitoring Plan details the actions necessary to record all the variables and factors required by the methodology ACM0001, as detailed in section D of the PDD. All data will be archived electronically, and data will be kept for the full crediting period, plus two years.

Table 4a Data to be collected or used to monitor emissions reductions from the project activity.

ID Number	Data Variable	Data Unit	Measured (m), calculated (c) or estimated (e)	Monitoring Frequency and Method	Proportion of data to be Monitored	Responsible Parties/ Individuals For Monitoring	Monitoring Equipment	Comments
1. $LFG_{total,y}$	Total amount of landfill gas captured	Kg	m	Continuously	100%	Project Developer	LFG Thermal Flow Meter	A thermal mass LFG flow meter will be used, and this unit will measure directly kilograms of total LFG collected – instead of a volumetric figure, so the calculation of temperature and pressure to determine the correct density will no longer be necessary. The unit will measure the flow of LFG continuously and reports will be presented daily, and aggregated monthly and yearly.
2. $LFG_{flared,y}$	Amount of landfill gas flared	Kg	m	Continuously	100%	Project Developer	LFG Thermal Flow Meter	A thermal mass LFG flow meter will be used, and this unit will measure directly kilograms of LFG being delivered to the flare – instead of a volumetric figure, so the calculation of temperature and pressure to determine the correct density will no longer be necessary. The unit will measure the flow of LFG continuously and reports will be presented daily, and aggregated monthly and yearly.
3. $LFG_{electicity,y}$	Amount of landfill gas combusted in power plant	Kg	m	Continuously	100%	Project Developer	LFG Thermal Flow Meter	A thermal mass LFG flow meter will be used, and this unit will measure directly kilograms of LFG being delivered to the power plant – instead of a volumetric figure, so the calculation of temperature and pressure to determine the correct density will no longer be necessary. The unit will measure the flow of LFG continuously and reports will be presented daily, and aggregated monthly and yearly.

4. FE	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)	%	m/c	Quarterly, monthly if unstable	n/a	Project Developer	Thermocouple	The efficiency of the flare will be determined in two ways. First, the temperature of the flare will be used to determine operating hours of the flare. This variable, which is critical for ensuring complete combustion of the methane, will be continuously monitored and measured by a digital temperature sensor (and transmitter) installed in the flare stack. The unit will measure the temperature within the flare stack continuously and reports will be presented daily, and aggregated monthly and yearly. In addition, samples of the exhaust gas will be taken quarterly to measure the methane, which will provide a measure of the flare's efficiency. The data can be monitored more frequently if there is an observed deviation from previous rating.
5. $W_{CH4,y}$	Methane fraction in the LFG	m^3 CH_4/ m^3 LFG	m	Continuously	100%	Project Developer	Fixed Gas Analyzer	The methane fraction in the LFG will be measured with a fixed gas analyser though its infrared sensor.
6. EL_{IMP}	Total amount of electricity imported to meet project requirements	MWh	m	Continuously	100%	electronic	During the crediting period and two years after	Measured with an electricity meter only in periods when the project activity is not generating its own electricity. Otherwise, it will be monitored with ID7. ($EG_{EX,LFG}$)
7. $EL_{EX,LFG}$	Total amount of electricity exported out of the project boundary	MWh	m	Hourly measured and monthly recording	100%	Project Developer	During the crediting period and two years after	Required to estimate the emission reductions from electricity generation from LFG. Double checked with receipts of sales. Double checked with receipts of sales.
8. CEF	CO_2 emission intensity of the electricity and/or other energy carriers in ID 8.	tCO_2/MWh	c	Annually	100%	electronic	During the crediting period and two years after	The CEF is calculated ex-ante, according to the monitoring methodology AMS I. D .
9.	Regulatory requirements relating to LFG projects	Test	N/a	Annually	100%	Project Developer	N/A	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y}$.

Table 4b Equipment used to monitor emissions reductions from the project activity

Equipment	Variables Monitored	Operational range	Calibration procedures	Parties responsible for operating equipment	Procedure in case of failure	Default value to use in case of failure	Comments
Thermal Mass Flow Meter	1. $LFG_{total,y}$ 2. $LFG_{flare,y}$ 3. $LFG_{electricityy}$		Equipment will be calibrated 18-24 months after initial installation by the equipment supplier on site	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the site events log book.	Daily average of the volume in the previous month minus 5%, per day of flow meter failure	
Thermocouple	4. FE		Equipment will be calibrated annually by the equipment supplier on site	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the site events log book. Repeat procedure within one month and if not possible contact other external company.	Daily average of the temperature in the previous month minus 5%, per day of device failure Repeat procedure within one month	
Fixed Gas Analyser	5. W_{CH4},y		Equipment will be calibrated annually by the equipment supplier on site	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the site events log book.	Average of the measured methane content in the previous month minus 5%, per day of gas analyser failure	

Electricity meter	6 and 7. Total amount of electricity generated by the project and electricity consumed for gas pumping (not derived from the gas)		Equipment will be checked monthly by the Lead Engineer	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the site events log book.	Daily average of the electricity generated in the previous month minus 5%, per day of electricity meter failure	

Table 4c Operational procedures and responsibilities for monitoring and quality assurance of emissions reductions from the project activity (E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed)

Task	Regional Manager	Site Engineer	Equipment Supplier	Project Developer	EcoSecurities
Collect Data	R	E			
Enter data into Spreadsheet	R	E		R	
Make monthly and annual reports	R	E		R	I
Archive data & reports	R	E		R	I
Calibration/Maintenance, rectify faults	I	R	E	I	I