CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

SECTION A. General description of project activity

A.1 Title of the project activity:

Methane Recovery and Electricity Generation Project GCM 23
18/09/2006
Version 2

A.2. Description of the project activity:

The "Methane Recovery and Electricity Generation Project GCM 23" (hereafter, the "Project" or "GCM 23") is an anaerobic digestion (AD) swine wastewater treatment installation within the pig facility of Granjas Carroll Mexico (GCM). The project, hosted by GCM, Mexico and developed by EcoSecurities, is located in Jalacingo, Veracruz, Mexico.

There are three types of operations at the GCM farms: farrowing, nursing, and finishing. The farrowing unit (site 1) delivers pigs to the nursery unit (site 2). From the nursery unit, pigs are transferred to the finishing unit (site 3). Within each farm, there can be more than one building per site. At 13 of the farms, there are: one building for site 1 (building a), 2 buildings for site 2 (buildings a, b) and 2 buildings for site 3 (buildings a, b). The five remaining farms include 1 farrowing building (building a) and 6-8 finishing buildings (buildings a-h) each.

The Granjas Carroll wastewater operation consists of transporting wastewater, which consists of fresh water mixed with manure and urine that accumulates in pits under the barns, to three or two types of lagoon systems- 1) treatment, 2) recycling and 3) evaporation, or 1) treatment and 2) secondary lagoon for evaporation or recycling- once a week by way of gravity fed pipeline systems. The organic material degraded in the primary treatment lagoon is digested under anaerobic conditions, thereby producing significant amounts of methane.

GCM 23 will be implemented at a finishing swine operation consisting of two sites from farm 16: Sites 16-3a and 16-3c. Both 16-3a and 16-3c are finishing units within farm 16. The wastewater treatment system within this swine operation consists of two lagoons: a treatment lagoon and a secondary lagoon for recycling or evaporation.

The Project Activity consists of the construction of a new covered in-ground anaerobic reactor that will utilize the organic material currently treated in the wastewater ponds from the units listed above to produce biogas. The treatment lagoon will be converted to accommodate the digester, to which the secondary lagoon will also be connected to. As an enclosed unit, the anaerobic reactor system will reduce the amount of Chemical Oxygen Demand (COD) (representative of the amount of manure) in the wastewater prior to the wastewater reaching the open lagoon system.

The biogas produced in the anaerobic digester will be captured and run through a biogas driven generator to generate electricity for on-site usage, which is currently at 404,448 KWh per year. The installed capacity at GCM 23 will be in the range of 100 to 550 KW in order to meet this energy demand. Today, the operations covered under the Project rely on electricity from the Mexican grid. With the implementation of the project activity, electricity will henceforth be supplied by renewable biogas. Surplus biogas, where produced, will be flared rather than released to the atmosphere.

Development of the Project will reduce greenhouse gas emissions produced by the release of methane from the lagoons, and by carbon dioxide generated from the use of electricity from the Mexican grid. With annual projected volumes of 276 tons of methane and 215 tons of carbon dioxide, the Project is estimated to reduce emissions by 5,428 tCO_2 e per year (after project emissions are accounted for).

The Project is helping the Host Country fulfil its sustainable development goals in the following manner:

Socio-Economic Sustainability

- Improvement in air quality (e.g. – reduction of Volatile Organic Compounds [VOCs]) and worker safety;
- Elimination of odour in surrounding areas, which will improve living standards of neighbouring communities.
- By improving the waste management system at the farm, the project will support the continued production of pork, which should reach 107 million tons in 2010 (17% increase from current production) in order to meet the consumption needs of the growing global population.[1] Given that pork production is shifting to developing countries, and that Mexico is an important pork producer in the developing world, Mexico can have a significant effect by pursuing projects of this nature.

Economic Sustainability

- An increase in local employment of skilled labor for the manufacturing, installation, operation and maintenance of equipment;
- Additional employment opportunities in the agro-industrial sector, specifically from the use of recycled water from the waste management system on the farms for agricultural activities in surrounding land;
- Diversification of energy sources: Mexico is one of the biggest producers and consumers of oil. Using methane to generate clean electricity and/or heat on-site, will reduce dependence on a dirty and non-renewable commodity and will show that energy can be produced at a lower cost. More importantly, this model can be replicated throughout the country;
- Increase in energy self sufficiency, thereby reducing the import of fossil fuels from other countries;
- Introduction of a new and sustainable financial model that can be replicated for the funding of the renewable energy and waste management sector via the CDM.

Environmental Sustainability

- An overall decrease in the amount of Greenhouse Gases (GHGs) emitted into the atmosphere;
- Improvement in the quality of the water used in the waste management system and its potential use as water for irrigation by the farms' neighbours;
- Avoiding potential dumping of waste into clean sources of water.

[1] FAO.

Technological Sustainability

- This project will promote a model for the reduction of GHGs produced by animal farming in Mexico and promote a transfer of technology for methane production and capture through anaerobic digestion

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.		
Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
Mexico	Granjas Carroll Mexico	No
Switzerland	Cargill International S.A.	No
United Kingdom of Great Britain and Northern Ireland	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 involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM)*, at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

EcoSecurities Ltd. is the official contact for the CDM project activity. Further contact information for the project participants are provided in Annex 1 of this document.

A.4. Technical description of the project activity:

The new technology employed in the project activity consists of a 'covered, in-ground anaerobic digester/reactor' (CIGAR) that uses an oxygen free environment to promote the natural process of anaerobic digestion, through which organic contaminants are broken down and methane (CH_4) is produced.

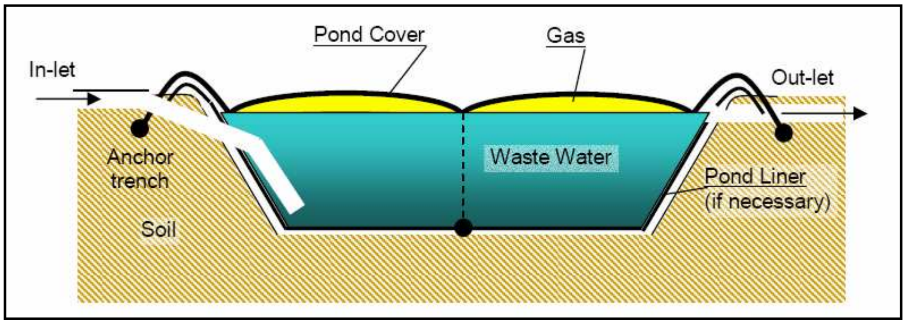

Figure 1: covered in-ground pond reactor

Structure of the Anaerobic Digester

The digester is an earthen lined lagoon design covered with a polymer membrane configured for the optimization of bacterial activity. It is the first stage of the wastewater treatment system for 100% of the wastewater, which is directed into the reactor via existing gravity-fed networks and stored for a period between 25 to 35 days. The reactor is lined with a high performance, high durability membrane-1.25mm UV-treated High Density Polyethylene (HDPE)- used to provide a durable 'gas seal' that prevents biogas (of which at least 65% by volume is methane) from escaping into the atmosphere and which provides for temporary storage of the biogas. The system is 'covered' by the HDPE 100% of the time. This overall process results in the reduction of at least 90% of BOD and 80% of COD, as well as the production and capture of methane - which is later used to generate electricity and/or flared. Furthermore, the long retention time-25-35 days- of wastewater in a ~25˚C-40˚C environment adds the benefit of killing most pathogenic material. The system also includes collector pipes to collect biogas after it is separated from the wastewater and blower systems for pumping the biogas to the combustion systems (generator and flare). The treated effluent is then discharged to the open lagoons- recycling and evaporation lagoons-, where it is aerated as per the design of the original lagoon system. The clean water is then recycled and sent back to the farms, or used for irrigation.

Description of the Generator, Flare, Meters and Other Systems

A biogas-based generator will be installed to produce electricity from the collected biogas. It will supply electricity to cover the farm's standard operations and energy consumption of the equipment associated with the anaerobic reactor. Surplus biogas will be flared using a high efficiency semi-enclosed or enclosed flare system. The flare and genset are both rated by their manufacturers at 98% combustion efficiency for biogas produced by the digester. (A conservative combustion efficiency of 90% will be applied ex-ante, but actual measurements of efficiency will be attempted ex-post.) For the purpose of monitoring the project's performance, electricity and flow meters will be installed. Biogas will be monitored through the use of a thermal gas flow meter.

Other equipment that will be included in the project activity include: biogas blowers, slow speed mixers, recycle/waste sludge disposal pumps, dewatering pumps and lighting. The electricity that will be required to run these instruments and other miscellaneous equipment will be in the range of 262,800 to 438,000 KWh per year. It is estimated that more electricity will be generated from the captured biogas than is required to meet the energy demand of the equipment mentioned above. If none or not enough electricity is generated during a year, the CO2 emissions associated with this electricity use will be estimated based on the calculated electricity consumption of the project equipment, accounted as project emissions and subtracted from total emission reductions.

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Mexico

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

Veracruz

A.4.1.3. City/Town/Community etc:

Jalacingo

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

The GPS coordinates for the Project are:

Site 16-3a: N19 37 03.6 W97 19 31.3
Site 16-3c: N19 36 55.4 W97 18 32.7

A.4.2. Type and category(ies) and technology of the small-scale project activity:

The categories for the project activity according to the UNFCCC's published "Appendix B - Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activities" are:

- Type III.D (reference AMS-III.D) / Version 09 – *"Methane recovery"* – for the methane recovery component.
- Type I.D (reference AMS-I D.) / Version 08 – *"Renewable Electricity Generation for the User"* – for the electricity generation component of the project activity.

The project conforms to project categories III.D and I.D since the project both reduces anthropogenic emissions by sources, directly emits less than 15 kilotonnes of carbon dioxide equivalent annually, and results in emission reductions lower than 25,000 tCO2e annually. A detailed discussion of the technology of the project activity can be found in Section A.4.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

In the absence of the project activity, *fugitive* emissions of methane from the pond system and *direct* emissions from the purchase of electricity from the Mexican grid continue unabated. The project will engineer a more sustainable waste treatment solution that reduces fugitive methane emissions, and makes available carbon neutral biogas for electricity generation. Under the business as usual scenario there would be continuing release of methane from the pond system and continuing carbon dioxide emissions from the electricity used on-site.

The current lagoon treatment system at the Project is the most common host country practice for associated wastewater treatment. This system is the most common practice due to the fact that it is the least expensive manure treatment which meets the requirements of local wastewater legislation. Moreover, the producers do not have the required access to capital in order to make large investments into biogas capture and renewable energy technologies. The current market situation and common practice in the industry, as well as the market, investment and technological barriers that drive a continuation of this prevailing business practice, will be discussed in greater detail in Section B.3.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emissions reductions shall be indicated using the following tabular format.

For type (iii) small-scale projects the estimation of project emissions is also required.

Years	**Annual estimation of emission reductions in tonnes of CO2e**
Year 1	5,428
Year 2	5,428
Year 3	5,428
Year 4	5,428
Year 5	5,428
Year 6	5,428
Year 7	5,428
Year 8	5,428
Year 9	5,428
Year 10	5,428
Total estimated reductions (tonnes of CO2e)	54,280
Total number of crediting years	10
Annual average over the crediting period of estimated reductions **(tonnes of CO2e)**	5,428

A.4.4. Public funding of the small-scale project activity::

The project has not received and is not seeking public funding.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

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Based on the information provided in Appendix C, this Project is not a debundled component of a larger project activity since the project participants have not registered nor operated another project in the region surrounding the project boundary within the previous 2 years, and because the project boundary is at least one kilometer apart from the project boundary of other proposed small-scale CDM project activities with similar characteristics.

SECTION B. Application of a baseline methodology

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

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- Project activity Type III.D. / Version 09 (reference AMS-III.D / Version 09) - *Methane recovery.*
- Project activity Type I.D. / Version 08 (reference AMS-I.D. / Version 08) – *Renewable electricity generation for the user*

B.2 Project category applicable to the small-scale project activity:

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The baseline calculation for the Project follows the procedures as outlined in Appendix B (version 09) of the simplified modalities and procedures for small-scale CDM project activities for categories:

- III.D, (AMS-III.D) / Version 09 - "*Methane recovery*" - for the methane recovery component of the project activity; and

- I.D. / Version 08, (AMS-I D.) – *"Renewable Electricity Generation for the User"* – for the electricity generation component of the project activity.

This selection is appropriate because the alternative to the project activity would be to continue with the business as usual scenario, which refers to the management of wastewater with anaerobic pond systems and the purchase of electricity from the grid.

- *Methane Recovery (AMS-III.D)*

For the methane recovery component of the project activity, the baseline has been calculated according to project activity type III.D, which states:

> *The emission baseline is the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the project activity.*
>
> *The baseline shall cover only the capture and flaring that would not have happened in the absence of the project activity.*
>
> *In the case of landfill gas, waste gas, waste water treatment and agro-industries: If the recovered methane is used for heat or electricity generation it can apply to the corresponding category of Type I project activities.*

- *Electricity Generation for the User (AMS I.D.)*

Baseline emissions from electricity generation will be calculated by multiplying the kWh purchased from the Mexican grid by the Carbon Emission Factor (CEF) for the grid, which is determined by using Option (a) of item 9 for Type I.D.:

(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.

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 small-scale CDM project activity:

The Project qualifies to use simplified methodologies since the project activity is under 15MW, will directly emit less than 15 kilotonnes of carbon dioxide equivalent annually, and result in less than 25,000 emission reductions annually.

MARKET SITUATION & NATIONAL POLICIES:

Mexico has approximately 5 million farms and over 18 million pigs. Hog production is one of the most important livestock industries in Mexico. According to the Mexican Ministry for Agriculture (Sagarpa), the hog industry is the third largest meat producer in Mexico, supplying 24% of the total meat produced in the country.[2] Pork represents a very important component of the Mexican diet. In addition, the swine sector has been growing every year, with pork production increasing from 1,037 million tons in 2003 to 1089 million tons in 2005. This accounts for a 5 percent increase. Due to continued strong domestic consumption of pork, hog production will likely continue to grow every year by 2 to 3 percent.

Pork production in Mexico will also be fuelled by international demand. In 1978, 60% of pork production was concentrated in developed countries. However, it is expected that by 2010 the bulk of the global pork industry will shift to the developing world. In 2010, it is also expected that pork production will have to be 17% higher than what it is today in order to meet the consumption needs of the growing global population. Therefore, as an important pork producer and rapidly growing economy amongst developing countries, Mexico could play a significant role in meeting this demand in 2010. Mexico has already experienced relatively high increases in its pork exports: In 2003, 28,300 tons of pork products were exported, which is 22.2% higher than the previous year.

The pork industry in Mexico faces a number of challenges and issues including lower prices due to the import of cheaper pork products from other countries, high costs of imported feed ingredients, a rapidly growing population that will lead to higher demands for pork, the lack of an efficient regulatory framework, and environmental concerns associated with the standard lagoon-based waste management system in place in Mexico. Such environmental concerns include the effect of these systems on the quality the soil, water and air, as well as odour and flies associated with this type of waste management. Although there are laws related to the preservation of the quality of the water and soil, which the GCM pig farms comply with, issues such as bad odour and the quality of the air remain unresolved. These are problems that can be fixed with the implementation of anaerobic digesters, but pig farmers in Mexico do not have the capital nor the regulatory incentives to move forward with these types of projects.

The main regulatory agencies that monitor the industry are the National Commission for Water (CNA), the Agriculture Ministry (Sagarpa), the Environment and Natural Resources Ministry (Semarnat), among others. The primary environmental law applicable to the project is "Norma Oficial Mexicana 001 (NOM-

[2] Sagarpa, 2001.

001)", established by the Semarnat which sets the maximum limits for the discharge of pollutants from waste waters in water sources and other national resources.[3]

ADDITIONALITY:

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities, evidence as to why the proposed project is additional is offered under the following categories of barriers: (a) investment barrier, (b) technological barrier, and (c) prevailing practice.

a) Investment Barrier

The following factors contribute to the investment barrier which these projects face:

- Current Practice - The current pond-based treatment method is considered standard operating practice in the Mexico and the region for wastewater treatment. Moreover, for the farmer the current pond system (business as usual scenario) is financially attractive, given that it works to required Mexican standards.

- Institutional Constraints - Mexico currently does not allow electricity generated onsite from biogas to be sold back to the grid. Without the CDM, this would reflect a crucial reduction in the benefits available to the farms for implementing anaerobic digesters.

- Economic Constraints – Like other livestock producers in developing countries, the Mexican hog industry faces economic challenges. Although a new anaerobic digester would reduce odour and offer an increase in water quality, which are issues faced by Mexican swine operators, these reasons alone are not compelling enough arguments for farms to upgrade to expensive anaerobic digestion systems.

- Perceived Risk – Without some kind of government guarantee or incentive, local banks are not interested in financing these projects primarily because of lack of knowledge and experience with the technology.

(b) Technological Barrier:

The predominant and known technology for the management of piggery wastewater in Mexico consists of a series of lagoons (oxidation ponds). Anaerobic digester systems are a new technology in this country, and where known, have often been mismanaged in the past due to inadequate operation and maintenance. This technology is still rather new to Mexico; the adoption of such is undergoing a growth in understanding regarding the proper mechanisms that must be in place in order for the correct function and long-term use of the anaerobic digesters.

(c) Prevailing Practice:

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[3] Rosario Perez Espejo. "Granjas Porcinas y Medio Ambiente." Semarnat.

SEMARNAT 1997.Norma Oficial Mexicana Nom-001-SEMARNAT que establece los límites máximos permisibles de contaminantes en las descargas de aguas residuales en aguas y bienes nacionales.

An open lagoon treatment system is the most common host country practice for associated wastewater treatment in swine operations. The implementation of anaerobic digester systems represents a higher risk alternative than the business-as-usual scenario.

As mentioned earlier, a series of oxidation ponds is the prevailing practice in Mexico due to the fact that it is the least expensive manure treatment which meets the requirements of local, state and federal wastewater legislation. Moreover, the producers do not have the required access to capital in order to make large investments into biogas capture and renewable energy systems. The inclusion of revenues from carbon credits has therefore become an important part of the farmer's implementation and financing strategy.

Anaerobic digester systems exceed what is required under Mexican legislation for the treatment of swine manure. Furthermore, no current legislation exists which specifically requires the treatment of swine manure in order to decrease GHG emissions and none is expected in the foreseeable future. Such regulations would endanger a relatively stable and successful economic activity, which has been exposed to price downturns during the last year, and which needs to keep strengthening in order to satisfy the consumption needs of a growing Mexican population.

The current regulations associated with swine and other animal manure management systems in Mexico set parameters for water preservation, which are not sufficient to warrant the installation of costly anaerobic digestion systems. Farmers can comply with these rules without the need for investment in advanced technologies. As mentioned earlier, the primary environmental law applicable to the project is "Norma Oficial Mexicana 001 (NOM-001)", established by the Semarnat which sets the maximum limits for the discharge of pollutants from waste waters in water sources and other national resources.[4]

SUMMARY:

The current and expected practice in Mexico, which relies almost exclusively on lagoon-based wastewater treatment facilities for pig farms, as well as the combination of a lack of access to local financing for advanced animal waste-water treatment technologies, high perceived risks of the anaerobic digesters, and a regulatory environment that is not conducive to the installation of these systems at piggeries, clearly demonstrate that this project is additional and therefore not the baseline scenario. The barriers that exist in Mexico are confirmed by the observed trend in current piggery wastewater management practices in the host country.

The barrier analysis above shows that the most plausible baseline scenario for animal waste management in Mexico is the common practice of pond systems. The most significant barriers faced by the project activity include: familiarity with the technology and associated skill sets; perceived risk of the technology; economic constraints faced by pig farmers, an inefficient regulatory system which does not support the development of anaerobic digestion systems, and the relative lack of investment interest among the key local business constituency.

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

[4] Rosario Perez Espejo. "Granjas Porcinas y Medio Ambiente." Semarnat.

SEMARNAT 1997.Norma Oficial Mexicana Nom-001-SEMARNAT que establece los límites máximos permisibles de contaminantes en las descargas de aguas residuales en aguas y bienes nacionales.

The project boundary is defined as the notional margin around a project within which the project's impact (in terms of carbon emission reductions) will be assessed. As referred to in Appendix B for small-scale project activities:

- The project boundary for Type III.D (AMS-III.D) projects is the physical, geographical site of the methane recovery facility.

- The project boundary for Type I.D. (AMS-I.D.) is the physical, geographical site of the generating unit and the equipment that uses the electricity produced.

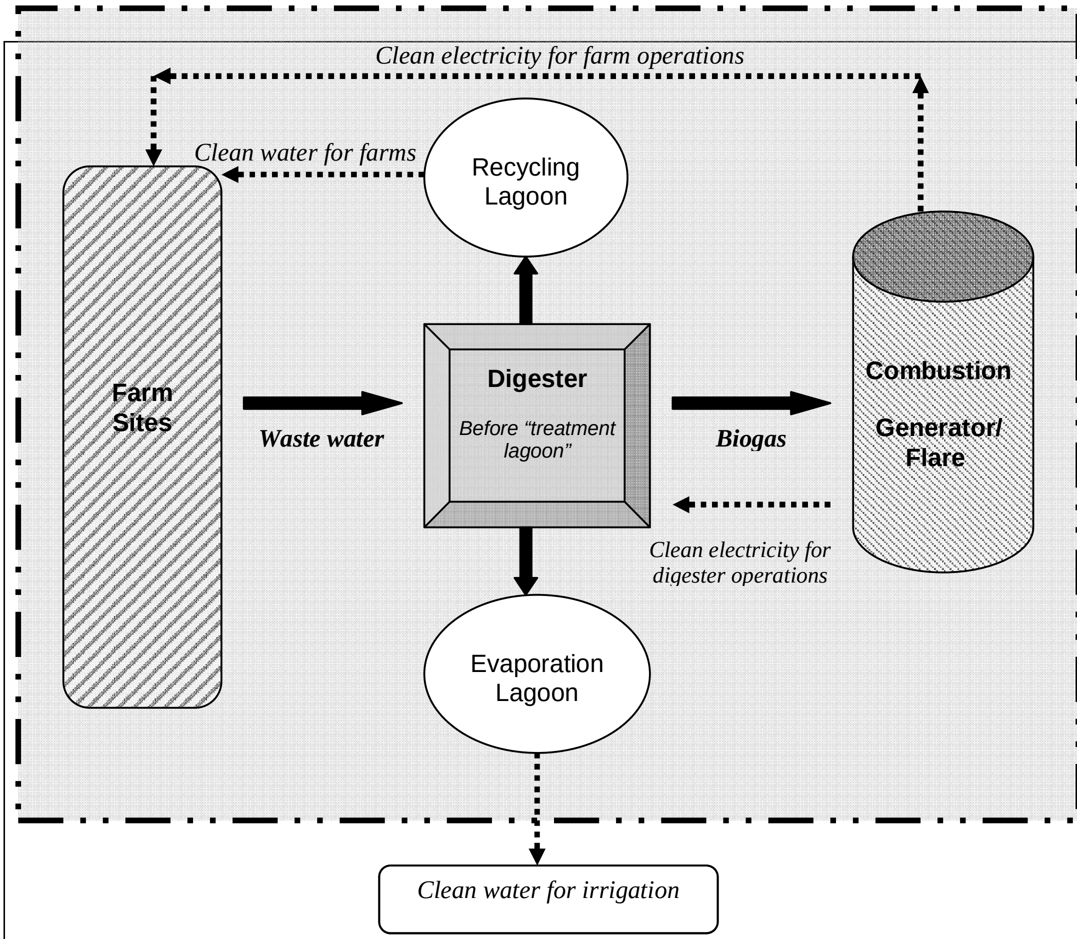
For the purposes of this analysis, different boundaries were applied in relation to the elements contributing to project and baseline emissions:

- Electricity and Fuel Oil Displacement/ Emissions: The boundaries are assumed to be the geographical site of the generating unit and the equipment that uses the electricity produced at the GCM 23 facility.

- Wastewater Methane Emissions/ Mitigation: The boundaries are assumed to be physical, geographical site of the methane recovery facility at the GCM 23 facility.

The line diagram provided below shows the systems that are included within the project boundary.

Project Boundary



B.5. Details of the baseline and its development:

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As specified in Appendix B:

- The appropriate baseline for project category Type III.D. / Version 09 (AMS-III.D / Version 09) is found in paragraphs 5, 6, and 7.
- The appropriate baseline for project category Type I.D. / Version 08 (AMS-I.D. / Version 08) is found in paragraphs 9a.
- Date of completing the final draft of this baseline section *(DD/MM/YYYY)*: 06/08/2006

The baseline study was prepared by:

EcoSecurities Ltd. - Tel: +1-212-356-0160 (contact: Paloma Sarria, paloma@ecosecurities.com). EcoSecurities Ltd. is a project participant.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

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C.1.1. Starting date of the small-scale project activity:

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Starting date of the project activity *(DD/MM/YYYY)*: 01/05/2006

C.1.2. Expected operational lifetime of the small-scale project activity:

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Expected operational lifetime of the project activity: *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

25y-0m

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

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C.2.1. Renewable crediting period:

>>

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

>>

NA

C.2.1.2. Length of the first crediting period:

>>

NA

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

Starting date of the first crediting period *(DD/MM/YYYY)*: 01/02/2007

C.2.2.2. Length:

>>

10y-0m

SECTION D. Application of a monitoring methodology and plan:

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

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Monitoring the amount of methane used as fuel or combusted and metering the electricity as described in Appendix B of the simplified modalities and procedures for small-scale CDM project activities. The approved monitoring methodologies applied to this project are as follows:

AMS-III.D – (9) The amount of methane recovered and used as fuel or combusted shall be monitored; and, (10) The flare efficiency, defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process, shall be monitored, and (11) Flow meters, sampling devices and gas analysers shall be subject to regular maintenance, testing and calibration to ensure accuracy.

AMS-I.D.-(9) Monitoring shall consist of metering the electricity generated by all the renewable technology.

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

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The methodology was selected as suggested by the Simplified Monitoring Methodologies for small-scale CDM projects. Measuring the amount of methane recovered and metering the amount of electricity generated are the most appropriate methods of monitoring the project activity.

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

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The methodology was selected as suggested by the Simplified Monitoring Methodologies for small-scale CDM projects. Measuring the amount of methane is the most appropriate methods of monitoring the project activity.

D.3 Data to be monitored:

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(The table below specifies the minimum information to be provided for monitored data. Please complete the table for the monitoring methodology chosen for the proposed project activity from the simplified monitoring methodologies for the applicable small-scale CDM project activity category contained in appendix B of the simplified M&P for small-scale CDM project activities. Please note that for some project categories it may be necessary to monitor the implementation of the project activity and/or activity levels for the calculation of emission reductions achieved. Please add rows or columns to the table below, as needed)

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
D.3.1	*Electricity Generation of the Project*	*E*	*KWh*	*M*	*Continuous*	*100%*	*Electronic and paper*	*Crediting period plus 2 years*	*Electricity will be metered through the use of an electricity meter*
D.3.2	*Biogas recovered and used as fuel or flared*	*M*	*m3/ day*	*M*	*Continuous*	*100%*	*Electronic and paper*	*Crediting period plus 2 years*	*Biogas will be monitored through the use of a thermal gas flow meter.*
D.3.3	*Methane content of biogas*	*MC*	*%*	*M*	*Quarterly (monthly, if necessary)*	*Sample*	*Electronic and paper*	*Crediting period plus 2 years*	*The methane content (%) of the captured biogas will be analyzed quarterly using a portable gas analyzer. In the event that the methane content of the quarterly samples varies significantly, monthly samples will be taken.*
D.3.4	*Flare efficiency*	*Fef*	*%*	*M or default*	*Yearly (if attempted)*	*Sample*	*Electronic and paper*	*Crediting period plus 2 years*	*The flare efficiency is defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process. Flare efficiency is assumed to be 90% to estimate ex-ante CERs. Measurement of flare efficiency will be attempted ex-post.*
D.3.5	*Generator Efficiency*	*Gef*	*%*	*M or default*	*Yearly (if attempted)*	*Sample*	*Electronic and paper*	*Crediting period plus 2 years*	*The generator efficiency is defined as the fraction of time in which the gas is*

									combusted in the generator, multiplied by the efficiency of the generating process. For the purpose of the PDD CER estimates, an ex ante 90% efficiency is assumed. Direct measurements will be attempted, in which case the actual monitored % generator efficiency would be monitored and used to calculate CERs.
D.3.6	*Electricity consumption of the project equipment*	*Ep*	*KWh*	*C*	*Yearly*	*100%*	*Electronic and paper*	*Crediting period plus 2 years*	*If none or not enough electricity is generated during a year, the CO2 emissions associated with this electricity use will be estimated based on the calculated electricity consumption of the project equipment This electricity consumption associated with project equipment will be monitored by an electricity meter. The emissions from the monitored electricity usage will be subtracted from the gross electricity generation from biogas (if any), or from the total project emissions reductions (if no electricity is generated).*

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

>>

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.3.1	Low	Electricity meter will be subject to regular maintenance, calibration and testing regime to ensure accuracy.
D.3.2	Low	A thermal gas flow meter will be subject to regular maintenance, calibration and testing regime to ensure accuracy
D.3.3, D.3.4 and D 3.5	Low	The methane content of the combusted gas will be analysed with quarterly samples. In the event that the methane content of the quarterly samples varies significantly, monthly samples will be taken. A gas analyzer will be used to sample the biogas and measure the CH_4 fraction of biogas.
D.3.6	Low	The electricity meter for the project equipment energy consumption will also be subject to regular maintenance, calibration and testing regime to ensure accuracy.

A monitoring team will make regular site audits to ensure that monitoring and operational procedures are being observed in accordance with the monitoring plan and monitoring protocol. Uncertainties will be mitigated through regular maintenance and calibration, as well as ongoing data auditing and cross checking.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

>>

Shift Operator → Shift Manager → Farm General Manager → GCM Environment Division

Project Participants will monitor biogas production and electricity generation as part of the standard operating procedures for the project activity. GCM will delegate technical staff from the Environment Division to oversee all activities related to Operation, Maintenance and Monitoring (OM&M) at the site of the Project Activity. With the advice of the technology provider, qualified technician(s) will be designated by GCM for data recording and collection, the operation of the equipment, and for ongoing maintenance and calibration of the instruments (in some cases this will mean subcontracting external entities for calibration). Training for the equipment operation, maintenance and calibration will be given by the technology provider in the form of actual training and manuals. EcoSecurities will provide training on the monitoring requirements, data entry templates, and will cross-check data to ensure accuracy.

All data will be recorded daily by designated technicians and maintained in both paper and electronic forms by farm management. Internal audits of data will be conducted on a weekly basis by GCM to ensure consistency and accuracy. Further, each month electronic copies will be sent to EcoSecurities who will input all data into a monitoring workbook to calculate emission reductions and monitor project performance.

D.6. Name of person/entity determining the monitoring methodology:

>>
The monitoring methodology was prepared by:

EcoSecurities Ltd. – Tel: +1-212-356-0164 (contact: Paloma Sarria, paloma@ecosecurities.com). EcoSecurities Ltd. is a project participant.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

>>

E.1.1 Selected formulae as provided in appendix B:

>>
For AMS-III.D. / Version 09:
Annual methane capture from biogas multiplied by the global warming potential (GWP) of methane (21 tCO_2 / tonne methane).

For AMS- I.D. / Version 08:
Annual electricity generation (Megawatts per hour) multiplied by the Emissions Coefficient (tCO_2e per Megawatt hour) of the Mexican grid

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

>>
For AMS-III.D / Version 09 and AMS- I.D., Version 08:
Total GHG emissions due to the project activity will be 10% of total methane captured:

$$FM_{project} = FM_{baseline} * 0.10$$

Where:

$FM_{project}$: Project fugitive methane emissions (t CO_2e / year)
$FM_{baseline:}$ Baseline fugitive methane emissions (t CO_2e / year)

Therefore;

$FM_{project}$ = 5792 (tonnes CO_2e/year) * 0.10 = **579 tCO_2e/year.**

These project emissions are comprised of incomplete combustion of methane in the flare and/or generator systems.

Other project emissions might include emissions associated with the electricity usage of other equipment at the Project Activity site, i.e. biogas blowers, slow speed mixers, recycle/waste sludge disposal pumps, dewatering pumps and lighting.

At GCM 23 the power that will be required to run these instruments and other miscellaneous equipment will be in the range of 262,800 to 438,000 KWh per year. If electricity is generated, this estimated electricity consumption of the project equipment will be subtracted from electricity generation and only the net electricity will be used to calculate CO2 emissions from displacing grid electricity.

With an annual estimated production of 603,358 m^3 of biogas, the clean power generation potential at GCM 23 will be of 1,013,642 KWh per year. As it is shown below, there will be enough clean electricity to cover the energy usage of miscellaneous equipment and that associated with farm operations, which is 404,448 KWh per year.

Power Generation Potential > Farm Energy Usage + Equipment Energy Usage

With equipment energy consumption of 262,800 KWh/yr:

1,013,642 KWh/yr > 404,448 KWh/ yr + 262,800 KWh/yr

1,013,642 KWh/yr > 667,248 KWh/yr

With equipment energy consumption of 438,000 KWh/yr:

1,013,642 KWh/yr > 404,448 KWh/ yr + 438,000 KWh/yr

1,013,642 KWh/yr > 842,448 KWh/yr

If none or not enough electricity is generated in the period for which emission reductions are verified, the CO2 emissions associated with the electricity use will be estimated based on the calculated electricity consumption of the project equipment and accounted as project emissions. For GCM 23, these project emissions would be in the range of 140 to 230 tCO2e per year.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>>
For AMS-III.D / Version 09:

No leakage calculation is required.

For AMS-I.D. / Version 08:

Leakage is to be considered if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity.

This is not required for this Project because the energy generating equipment that will be installed is new, therefore not being transferred from an existing activity. In addition, the new equipment will not replace any existing generators that would be transferred to another activity because the operations covered by the project activity currently rely on the Mexican grid.

Therefore, leakage is zero: **0 tCO2e/year.**

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

>>

Project emissions + Leakage = Project Activity Emissions

Therefore;

579 (tCO2e/year) + 0 (tCO2e/year) **= 579 tCO2e/year**

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

Methane Capture Component (AMS-III.D.):

Baseline fugitive methane emissions are:

$$FM_{baseline} = MC_{BIO} * GWP_{CH4}$$

Where:

$FM_{baseline}$: Baseline fugitive methane emissions (t CO_2e / year)
MC_{BIO}: Total annual methane produced by anaerobic digestion (tonne / year)
GWP_{CH4}: Global warming potential of methane (tCO_2 / tonne methane)

Electricity Generation Component (AMS-I.D.):

Baseline electricity generation emissions are given by:

$$E_{baseline} = EG * CEF_{electricity}$$

Where:

$E_{baseline}$: Baseline electricity generation emissions (t CO_2e / year)
EG: Annual electricity generation from the grid (MWh/year), which is equal to:
Electricity Generation of the Project - Electricity Consumption of the Project Equipment
$CEF_{electricity}$: Carbon Emissions Factor for the Mexican grid (t CO_2e / MWh).

The $CEF_{electricity}$ of the grid is calculated according to Option (a) of AMS-I.D., 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 ($CEF_{electricity}$) is calculated according to the equation below:

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

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.

Therefore, total baseline emissions ($TB_{emissions}$) are:

$TB_{emissions} = FM_{baseline} + E_{baseline}$

For AMS-III.D:

Baseline emissions of the methane component of the project activity are:
275.82 (tonne / year) * 21 (tCO_2 / tonne) = **5,792 tonnes CO_2e/year**

For AMS-I.D:

Baseline emissions of the electricity component of the project activity are:
404 (MWh/yr) * 0.531 (t CO2e / MWh) = **215 tonnes CO_2e/year**

Therefore;

$TB_{emissions}$ = 5,792 tonnes CO_2e/year + 215 tonnes CO_2e/year = **6,007 tonnes CO_2e/year**

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>
Baseline emissions – Project Emissions = Emission Reductions

Therefore;

6,007 – 579 = 5,428 tonnes CO_2e/year

E.2 Table providing values obtained when applying formulae above:

>>

	Description	Value	Unit	Source
Methane Emissions from Manure Management	Methane content of 1m3 of biogas	0.64	m3	measured
	Moles of gas in 1m3 at RTP (1mole=22.4 liters/mole)	44.64	mole / m3	http://www.1728.com/stp.htm
	Methane in 1m3 biogas	28.57	mole / m3	Calculated
	Methane in 1m3 biogas	457.14	g / m3	Calculated (1mole=16g)
	Daily biogas offtake	1,653.04	m3 / day	Estimated utilizing Waste Solutions Ltd. model
	Annual biogas offtake	603,359.60	m3 / year	Estimated utilizing Waste Solutions Ltd. Model
	Annual CH4 capture	275,821,531.43	g / year	Calculated
	Annual CH4 capture	275.82	tonne /year	Calculated
	GWP CH4	21.00	N/A	Approved Global Warming Potential for CH4
	Annual CO2e emissions reductions from CH4	**5,792.25**	**tonne CO2e / year**	**$FM_{baseline} = MC_{BIO} * GWP_{CH4}$**

For AMS-I.D. $E_{baseline}\ (t\ CO_2/yr) = <E>_{baseline} * PG$

Annual Electricity Generation (MWh / year)	**x**	**Emissions Coefficient (t CO2e / MWh)**	**=**	**Annual CO2e emissions reductions from Electricity Generation (tonne CO2e / year)**
404.45	**x**	**0.531**	**=**	**214.76295**

TOTAL EMISSIONS REDUCTIONS: AMS-III.D. + AMS I.D.

AMS-III.D (tonne CO2e / year)	+	**AMS-I.D (tonne CO2e / year)**	=	**TOTAL EMISSIONS REDUCTIONS (tonne CO2e / year)**
5,792.25	+	**214.76295**	=	**6,007.02**

Carbon Emission factor 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**

Source: Prospectiva del Sector Electrico, SENER (Secretaria de Energia) and CFE (Comision Federal de Electricidad), Mexico

Carbon Emission Factors used to calculate the Build Margin

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

Calculations

	Generation	Efficiency	Energy Consumption		Fuel Consumption	**CO2 emissions**
	GWh	%	GWh	TJ	tonnes	**T CO2**
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

1996 IPCC Guidelines for national greenhouse gas inventories

SECTION F.: Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

The host country does not require an analysis of the environmental impacts of the components of the project activity.

For the specific component of electricity generation, only projects with an installed capacity greater than 3 MW require an EIA. In this case, the electricity generation estimated at GCM 23 will be less than 3 MW. If in any case the installed capacity exceeds 3 MW, an EIA will be carried over beforehand in order to comply with all the applicable regulations at a State and Federal level in the host country. A copy of the preventive report will be provided to the Operational Entity validating the Project.

It should be also noted, that the project activity generates considerable environmental benefits. The CIGAR system decreases GHG emissions through two significant avenues. Prior to the project activity, the farm relied on the local grid for electricity generation. With the implementation of the project activity, biogas collected from the degradation of swine-farm waste is used for electricity generation, thus eliminating the demand for electricity from the grid. In addition to directly reducing the emission of GHGs by eliminating a source of fossil fuel combustion, the project activity captures methane (CH_4) from an industrial source, preventing its release into the atmosphere. Methane is an extremely potent GHG whose greenhouse warming equivalent is 21 times that of carbon dioxide (CO_2).

In addition to reducing GHG emissions, this closed system of energy production produces considerable improvements for waste management at the farm. Wastewater discharge from piggeries can be hazardous to aquatic ecosystems. The extent to which wastewater discharge threatens aquatic ecosystems depends on the amount of organic material and solid material contained within the wastewater as measured by biochemical oxygen demand (BOD), chemical oxygen demand (COD, suspended solids, and color indicators. The CIGAR system, owing to its anaerobic digestions properties, reduces COD by approximately 80%, destroys approximately 90% of harmful BOD, diminishes suspended solids, and improves the colour quality of the wastewater.

SECTION G. Stakeholders' comments:

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

>>

The stakeholder consultation for the Project was held on July 12, 2006 at the Crowne Plaza Hotel in the city of Xalapa, Veracruz, Mexico. Representatives from local and federal authorities, labor unions, academia, local media, and members of the community were invited and participated in the event. The following is a list of a number of invitees to the event:

- *State delegates of the Ministry of Environment and Natural Resources (SEMARNAT, which also acts as the Mexican DNA at a federal level)*
- *State coordinators for the environment*
- *Federal representatives of the Ministry of Environment and Natural Resources (SEMARNAT, which also acts as the Mexican DNA at a federal level)*
- *State delegates of the Ministry for Rural Development*
- *State and federal delegates of the Ministry of Agriculture and Rural Development (SAGARPA)*
- *State delegates of PROFEPA (Mexico's Environmental Agency)*
- *State Delegates of Secretariat for Social Development*
- *Regional representatives of CNA*
- *Municipal Presidency of Xalacingo, Veracruz*
- *Municipal Presidency of Altotonga, Veracruz*
- *Municipal Presidency of Villa Aldama, Veracruz*
- *Municipal Presidency of Perote, Veracruz*
- *Senate and Congress representatives for the State of Veracruz*
- *Municipal gents for communities in Veracruz*
- *Community representatives in State of Veracruz*
- *GCM employees*

The event, which lasted approximately 3 hours and included the participation of more than 40 representatives from local authorities and communities, allowed stakeholders to understand the basic concepts related to global warming and its consequences, the international solution proposed by the Clean Development Mechanism (CDM) of the Kyoto Protocol, as well as the most important features of the project. The agenda included a presentation by GCM on the technicalities of the project and how the project activity would help improve the waste management system at the project site; a presentation by EcoSecurities on climate change, the CDM, and CDM methane capture and electricity generation projects in the anaerobic digestion sector; a final presentation by the service provider G. O. Sistemas on the technology that will be implemented by the project activity; and a session aimed at addressing questions, concerns and comments posed by the stakeholders.

G.2. Summary of the comments received:

>>

During the consultation participants raised a number of questions and comments regarding the methane capture and electricity generation projects at GCM's pig farms in the State of Veracruz, which were addressed by the project developer, G.O. Sistemas and EcoSecurities.

- Representatives of the Technology Institute Ursula Galvan in Veracruz asked whether the flaring of biogas that will be implemented in the case that not all biogas is used to generate electricity can release injurious substances for the atmosphere.
    - In response a representative of G.O. Sistemas noted that the flaring systems that will be put in place are closed and made out of a porcelain interior.
- Members of Municipalities in the State of Veracruz congratulated GCM, G.O. Sistemas and EcoSecurities for their efforts in implementing methane capture and electricity generation projects at GCM's pig farms in the State of Veracruz which will help improve waste management systems at the farms, but noted that more needed to be done to fight the problems of bad odor and flies caused by manure management at the sites.
    - In response, the GCM representative stressed that the primary intention of moving forward with these projects is to help alleviate and solve these problems. He added, that it would be a matter of a few months until these issues were addressed completely, but that the idea is to install digesters in all of GCMs eighteen farms in order to eliminate these problems in all surrounding communities.
- Members of communities in the State of Veracruz suggested that this consultation about GCM's methane capture and electricity generation projects in Veracruz should be also implemented in the community centers and at primary and secondary schools of Veracruz in order to allow for a better diffusion of information. They asked how GCM planned to do this.
    - GCM representatives responded that information diffusion about their projects is one of their main goals and that one of the ways they plan to do this is by organizing community visits to the farms and additional stakeholder consultations.
- A member of a community in Perote suggested that GCM plant trees in the periphery of the farms in order to protect the environment and thus contribute to the improvements put forth by the methane capture and electricity generation projects at GCM's sites in Veracruz.
    - A representative of GCM noted that the planting of trees on the farms' surrounding areas had been considered before and in many cases implemented, but unfortunately with no success due to weather conditions. However, GCM noted that it actively promotes crop production on the land around the farms.
- Members of communities in the State of Veracruz were interested in learning how long it would take for all digester projects to be built in GCM's farms in the State of Veracruz.

  - GCM representatives noted that they're ready to move forward with the installation of digesters in most of the farms and envision that a number of these will move forward during the next 6-8 months. In particular, GCM mentioned that projects 8, 19 and 20 were ready to be built as soon as the projects entered validation.

- Stakeholders were interested in learning more about GCM's projects and other similar CDM waste improvement projects.

  - Representatives of GCM and EcoSecurities offered to share the presentations with the participants and noted that the projects would be published on the internet as soon as they are submitted for validation. EcoSecurities added that those who were interested could find more information about this type of projects on the UNFCCC CDM website and could contact EcoSecurities directly for more specific questions.

A number of participants were interested in learning about other similar CDM opportunities in Veracruz and in Mexico in general, and noted that GCM's projects could be used as a model to promote similar activities in the country. Overall, the participating stakeholders were satisfied with the outcome of the consultation and congratulated GCM, EcoSecurities and G.O. Sistemas for their efforts to implement these projects which they recognized would benefit the local and global environment, as well strengthen Mexico's sustainable development.

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

>>

All the questions and concerns raised about the projects were addressed during the stakeholder consultation, as can be seen in Section G.2.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not Applicable

Annex 3

DATA FOR CALCULATION OF THE GRID EMISSION FACTOR

		Name of the Generation Unit	Scheme	Municipality	State	Date operations started	Installed Capacity (MW)			Gross Generation (GWh)					CO2 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			3,266,400	2,344,996	1,436,931	0.675	0.552	0.451
	47	Dos Bocas		Medellin	Veracruz	14-Aug-74	452	452	452	2,429	3,013	3,086			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			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			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			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			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			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			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			4,270,855	4,128,721	3,431,651	0.662	0.652	0.641
	38	Rio Escondido (Jose Lopez Portillo)		Rio Escondido	Coahuila	21-Sep-82	1,200	1,200	1,200	7,516	8,387	8,999			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			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			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			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			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			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			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			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			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			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			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			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			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			852,530	868,865	855,336	0.692	0.639	0.271
	26	Rio Bravo (Emilio Portes Gil)		Rio Bravo	Tamaulipas	1-Jul-99	520	520	520	1,031	695	741			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			1,154,518	1,316,802	1,256,799	0.358	0.370	0.362
	45	Huinalá I y II		Pesqueria	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	Rio 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	Rio 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											

	Installed Capacity 2002	2003	2004	Gross Generation 2002	2003	2004	CO2 Emissions 2002	2003	2004	Weighted Average OM 2002	2003	2004	Average OM
Total National Interconnected system (excluding hydro, wind, nuclear and geothermal)	28,024	30,842	34,893	139,159	143,131	167,433	96,328,117	97,706,797	96,802,614	0.686	0.683	0.609	0.659
Build Margin			6,416			42,212			17,030,008			Build Margin	0.403
												Efy	0.631

BM Plants considered for Build Margin Calculation

CEF Values calculated in worksheet "CEF for Build Margin"

Source: Prospectiva del Sector Electrico, SENER (Secretaria de Energia) and CFE (Comision Federal de Electricidad), Mexico