CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM SSC-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

>> Methane Capture, Combustion and Possible Electricity Generation from AWMS in Mexico
Version 06
04/12/2012

A.2. Description of the small-scale programme of activities (PoA):

>>
Financiera Rural[1], is a decentralized organism of the Federal Public Administration, subdivision at the Ministry of Finance, with legal personality and its own patrimony, began operations in 2003 with a clear mission: contribute to the development of agricultural, livestock, forestry, fishery and all other economic activities in rural Mexico through a self-sustainable financial model.

To this end, Financiera Rural combines the use of two fundamental tools: loans and the provision of training, advisory and technical assistance services, which enable future clients to be prepared for accessing credit and making a better use of it.

According to the latest available Livestock Census realized in 2007 by the National Institute of Statistics, Geography and Informatics (INEGI)[2] there are in Mexico 9 million[3] head of swine and 23.3 million[4] head of cattle. Since there are no national laws that regulate the treatment of livestock wastes, and the business as usual in Mexico is to dispose them in anaerobic lagoons, GHG emissions from livestock activities are considerable.

Financiera Rural decided to create in 2010 a voluntary sustainability program for swine and cattle farms, in order to generate benefits by implementing new animal waste management systems technologies (AWMS), developing Clean Development Mechanism (CDM) projects and reducing GHG emissions.

The purpose of the programme of activities (PoA) is to promote sustainable development of livestock management system by improvements on their wastewater treatment systems. Through this Program, Financiera Rural will offer financial help to those producers that are not able to implement a proper waste management control system. However, producers that do not require financial help from Financiera Rural or receive financial help from another entity are also eligible to participate in this PoA as long as they comply with the eligibility criteria specified in section A.4.2.2. of the PoA-DD.
The resources obtained from carbon credit trading will be used to finance the Program.

It is confirmed that the proposed PoA is a voluntary action taken by Financiera Rural (which is the coordinating/managing entity).

This PoA would cover the entire Mexican territory with swine farms and cattle farms that comply with the eligibility criteria. Preliminary, it is estimated a participation of 30 CPAs with a potential emission reductions of 100,000 tCO2e per year.

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[1] See: http://www.financierarural.gob.mx/Paginas/Financieraruralini.aspx
[2] See: http://www.inegi.org.mx/est/contenidos/proyectos/agro/default.aspx
[3] See:"INEGI Censo Agropecuario Porcino 2007.pdf"
[4] See:"INEGI Censo Agropecuario Bovino 2007.pdf"

The proposed waste management system will reduce methane emissions generated in the anaerobic decomposition of swine and cattle manure in anaerobic lagoons. For all CPAs that would be included in the Program, the installed equipment will comply with technical standards established by Financiera Rural. The animal waste management system will consist of the construction of anaerobic digesters for capturing biogas which will be flared or used.

Financiera Rural has defined two possible scenarios for CPAs within the program based on the utilization of the biogas generated.

Scenario A: CPAs in which the captured biogas, composed mainly of CH_4 (60 to 70%[5]) and CO_2, will be sent to flares where the CH_4 is burnt.

Scenario B: CPAs in which the captured biogas will be sent to biogas generators in order to produce electricity to satisfy the energy demands of the installations where the AWMS is installed, reducing the consumption of electricity from grid. The remaining biogas will be sent to a flaring system.

The electricity generated will generally be consumed at the local installations where the animal manure is generated. However, if a surplus power is generated (understood as additional to the needs of the farm), farm owners are allowed to:

a. Supply electricity to another consumer facility via national grid through a contractual arrangement as wheeling.
b. Sell it to the National Grid.

In the case of incise a) and/or incise *b)* described above, the CERs from surplus of electricity sold to/via the National grid will not be claimed.

The project activities within the proposed PoA will not only result in emission reductions, but also in other benefits, such as:

a. Environmental benefits

The proposed CDM PoA, by installing anaerobic digesters, enclosed flare systems and electricity generators in the farms taking part in the Program, aims to reduce not only GHG emissions but also negative environmental impacts of livestock production. Properly handling of large quantities of animal waste is critical for protecting human health and the environmental quality. The advanced livestock waste management system to be employed diminishes the risks of underground water contamination, improves air quality and reduces emissions of volatile organic compounds (VOCs); decreases odours, diseases, among others, benefiting local people's health;

b. Economic benefits

Economic benefits are also achieved by creating job opportunities and increasing farmers' income. This project activity will increase local employment for skilled labor during production, installation, operation, and maintenance of the anaerobic digestion and electricity generation equipment and systems.

[5] See: "Methane from integrated biological systems.pdf"

The project will diversify the source of the energy supply through biogas production and biogas-based power generation. The effort will substitute electricity from the grid contributing to economic savings to the farm owner.

c. Technological benefits

The project activity will apply new, advanced, and environmentally friendly technologies in treating livestock wastes and associated utilization, which can be replicated on other livestock farms, which will dramatically reduce livestock-related GHG emissions.

A.3. Coordinating/managing entity and participants of SSC-POA:

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Party Involved	Private or Public Entity	Does the party involved want to be considered as a project participant (Yes/No)
Mexico	Financiera Rural (Public)	No

A.4. Technical description of the small-scale programme of activities:

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In order to reduce atmospheric pollution and to lessen the impact of greenhouse gas emissions from animal wastes, the project activity in the farms will be based on the implementation of a new manure management system at each SSC-CPA of this PoA. The new waste treatment technology consists of the installation of an anaerobic digestion system, for all CPAs in this PoA. The animal waste management systems (AWMS) in swine and cattle production would be based on the same initial concept.

These anaerobic digesters are designed to receive the daily volume of organic waste and to grow a steady state population of methanogenic bacteria for degradation of the organic matter.

Bacteria at the digester grow in anoxic conditions to mainly convert organic acids into biogas over time. Anaerobic digestion can be simplified and grouped into three steps:

Phase I – Hydrolysis – In this stage, bacteria release extra cellular enzymes that promote the compound's hydrolysis, generating small soluble molecules such as organic volatile acids. The products of this stage are the substrate for bacteria in the next step.

Phase II – Acidogenesis – The decomposed matter from the previous step is converted into organic acids. Other substances are formed: salts, carbon dioxide, water and ammonia.

Phase III – Methanogenesis – Methanogenic bacteria use hydrogen and carbon dioxide and transform it into methane, producing the biogas.

The volume of the digester is determined by the technology provider, after the analysis of hydraulic retention time (HRT) and volatile solid loading rate.

As stated above, Financiera Rural has defined two possible scenarios for CPAs within the program: Scenario A and Scenario B.

In both project activity scenarios, the lagoons from the pre-project situation could be used as secondary open lagoons where the effluent of the new digester lagoons will be directed to.

The effluent from the latter lagoon is disposed of through surface spread and is used to humidify arable land for farming purposes in the surrounding areas of the project sites.

The sludge deposited in the anaerobic digester will be drained using the sludge removal system included in the anaerobic digester installation. The sludge generated in the anaerobic digester and in the secondary lagoons will be removed periodically (according to technology providers); sludge will be used for soil applications in surrounding croplands[6]. Proper conditions and aerobic procedures for the sludge will be applied in order to avoid any methane emissions from these activities.

Financiera Rural is working in order to develop a list of technology minimum criteria for this Program, in order to standardize the project technology to implement and also to assure efficient and long lasting technology.

Each SSC-CPA participant will be able to choose the technology provider that best suits the project needs; however Financiera Rural suggests utilizing the technology providers listed as "reliable" in the FIRCO's Anaerobic Digester Roll[7], as long as they comply with the conditions established by Financiera Rural.

A.4.1. Location of the programme of activities:

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A.4.1.1. Host Party(ies):

>>Mexico

A.4.1.2. Physical/ Geographical boundary:

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All CPAs associated with the Methane Capture, Combustion and possible electricity generation from AWMS in Mexico PoA will be implemented within the geographical boundary of Mexico.

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[6] Sludges from anaerobic digestion are classified as sludges class C. According to NOM-004-SEMARNAT-2002 sludges within class C are good soil improvers. See: "IMTA Manure treatment.pdf" and "NOM-004-SEMARNAT-2002.pdf@

[7] Available at: http://proyectodeenergiarenovable.com/Empresas/Padron_Biodigestores/

Figure 1. PoA Project Activity Boundary

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

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A.4.2.1. Technology or measures to be employed by the SSC-CPA:

>> The proposed project activity for all CPAs in this PoA on AWMS in swine and cattle production would be based on the same initial concept. The process is to capture and flare/utilize biogas produced by fermentation of organic material in the anaerobic digesters. The project activity consists of substituting the business as usual of open-air lagoons with the installed anaerobic digester system, flaring system and in some cases electricity generation system.

On each CPA, an anaerobic digester lagoon with a cover will be constructed. Pre-project lagoons could be adapted to operate as anaerobic digesters. In both project activity scenarios (flaring system and in some cases electricity generation system), the lagoons from the pre-project situation could be used as secondary open lagoons where the effluent of the new digester lagoons will be directed to.

This anaerobic digester would be designed to receive the daily volume of organic waste, within the anaerobic digester, organic matter will be degraded by means of methanogenic bacteria. The anaerobic digester will be designed by the technology provider according the hydraulic retention time (HRT) and the organic matter loading rate (volatile solids) of each CPA.

The HRT represents the time the manure remains inside the digester, allowing the bacteria to decompose the organic matter. The volatile solids load rate represents the amount of organic matter required per unit volume in order to enhance proper degradation and efficient biogas generation rates.

In general, the basic digester design will include:

- Geo-membrane: waterproof, high-density polyethylene (HDPE) membrane to prevent leachate from infiltrating the underground aquifer;
- Floating cover: gas tight, high-density polyethylene (HDPE) membrane to avoid the release of biogas into the atmosphere;

- Sludge extraction pipes; and
- Biogas extraction pipes.

Since biogas generation will vary according to the characteristics of each CPA, Financiera Rural has defined two possible scenarios for CPAs within the program:

Scenario A: CPAs in which the captured biogas, composed mainly of CH_4 and CO_2, will be sent to flares where the CH_4 oxidizes to CO_2.

The biogas flaring system consists of an enclosed, high-efficient flare, where the CH_4 oxidizes to CO_2, thus reducing GHG emissions. The flare is built of stainless steel, a highly thermo-resistant material. Ventilation devices regulate air flow to allow the complete combustion of methane. The average temperature considered for carbon crediting in the operation of the enclosed flare must be within a minimum of 500° Celsius and a maximum of 800° Celsius. The temperature is set as outlined by the manufacturer for security.

Scenario B: CPAs in which the captured biogas will be sent to biogas generators in order to generate the electricity to satisfy the energy demands of the farm facilities, reducing the consumption of electricity from grid or from on site generators using fossil fuels. The remaining biogas will be sent to a flaring system.

Flaring system will have the same characteristics in both scenarios. The technology for generating electricity that will be implemented will consist of an internal combustion engine with a generator. The predicted gas flow rate and the operating plan will be used to size the electricity generation equipment.

The electricity generated will be consumed at the CPA farm facilities. However, if a surplus power is generated, farm owners are allowed to: a) utilize it in other facilities by means of electricity portage or b) sell it to the National Grid.

The proper procedures will be realized in order to obtain appropriate permits from the Federal Electricity Commission (CFE) and the Energy Regulatory Commission (CRE).

In both project activity scenarios, the lagoons from the pre-project situation could be used as secondary open lagoons where the effluent of the new digester lagoons will be directed to.

The effluent from the latter lagoon would be disposed of through surface spread and is used to humidify arable land for farming purposes in the surrounding areas of the project site, proper procedures will be carried on to avoid methane emissions.

The sludge deposited in the anaerobic digester will be drained using the sludge removal system included in the anaerobic digester installation.

The sludge generated in the anaerobic digester and lagoons will be removed periodically; and will be used for soil applications in surrounding croplands. Proper conditions and procedures for the sludge will be applied in order to avoid any methane emissions from these activities.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

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A SSC-CPA to be included in the proposed SSC-PoA shall comply with the following criteria:

1. *Each SSC-CPA must be located within the geographical boundary of Mexico.*

2. *Each SSC-CPA is able to participate voluntarily in the SSC-PoA whether or not requires financial help from Financiera Rural or receive financial help from another entity.*

3. *SSC-CPAs to be included shall consist of the implementation of anaerobic digestion as wastewater treatment, an enclosed flaring system and for CPAs corresponding to scenario B also an electricity generation system.*

4. *SSC-CPAs will have anaerobic lagoons as baseline scenario treatment.*

5. *SSC-CPAs corresponding to project activity scenario A will follow and shall comply with the requirements of AMS-III.D. "Methane recovery in animal manure management systems" (version 18). CPAs corresponding to project activity scenario B will follow and shall comply with the requirements of AMS-III.D. "Methane recovery in animal manure management systems" (version 18) and AMS-I.D. "Grid connected renewable electricity generation" (version 17).*
   Requirements of methodologies mentioned are further indicated in section E.2. of the CDM SSC-PoA-DD document.

6. *A de-bundling check shall be assessed, according to Annex 13 of EB 54, for SSC-CPA to be included in the PoA.*

7. *The coordinating entity will ensure that all CPAs under its PoA are neither registered as an individual CDM project activity nor included in another registered PoA, and that the CPA is subscribed to the PoA.*

8. *SSC-CPAs shall have a project starting date after the PoA-DD is submitted to Global Stakeholders Consultation.*

9. *The SSC-CPAs shall be in line with national and local regulations available at the time of inclusion into the SSC-PoA. If an Environmental Impact Assesement (EIA) is mandated for a CPA, such an EIA must be undertaken at the CPA level prior to the inclusion of the CPA in the PoA. In addition, it is indicated to the SSC-CPAs that stakeholder consultations has been done at PoA level, hence, there is no need to undertake a local stakeholder consultations.*

10. *The SSC-CPAs shall evidence that are not viable without CDM revenue, demonstrating through investment analysis as described in section E.5.2. of the PoA-DD.*

11. *The SSC-CPA will stay within the small scale threshold criteria of the Type I (i.e < 15 MW) and Type III (i.e < 60,000 CERs per year) components of the project activity and will remain within those thresholds throughout the crediting period of the CPA.*

12. *Each SSC-CPA will either not involve funding from Annex I parties, or if any funding from Annex I parties is involved, it will not result in a diversion of official development assistance.*

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

>> The following shall be demonstrated here:

(i) The proposed PoA is a voluntary coordinated action;

The PoA is a voluntary action, coordinated and implemented by the coordinating entity to supply, and finance anaerobic digesters to provide a better waste management system to livestock producers in Mexico and to reduce GHG emissions.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

The additionality is demonstrated using the CDM Methodological Tool: *Tool for the demonstration and assessment of additionality Version 06.1.0*, as described below.

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

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

The following are the possible alternative baselines:

i. The proposed project activity undertaken without being registered as a CDM project activity;
and

ii. Continuation of the current situation.

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

Currently the business-as-usual procedure for swine and cattle manure waste management systems in Mexico comprises non permeable open-air lagoons, where all methane produced in anaerobic processes is directly emitted into the atmosphere.

The proposed project replaces the business as usual procedure by capturing the biogas produced and utilizing it for energy or flaring it. The new technology allows methane recovery and destruction, mitigating GHG emissions.

Environmental legislation associated with livestock operations in Mexico is framed by the “General Law for Ecological Equilibrium and Environmental Protection” (LGEEPA according to its Spanish abbreviation[8]), enacted in 1988. This law establishes that wastewater discharges from the agriculture and livestock sector are subject to federal and local regulation (Article 120, paragraph III), and that wastewater discharges to sewage systems in populated areas, to water bodies, and those that are spilled on the soil or are infiltrated into the ground should comply with the necessary conditions to prevent water and land pollution.

[8] Available at: www.diputados.gob.mx/LeyesBiblio/ref/lgeepa.htm

To this end, the National Water Commission (CONAGUA according to its Spanish acronym), in coordination with state and municipal governments, is responsible for setting the conditions on wastewater discharges, for issuing permits and licenses for water use and discharge, and for drafting and enforcing the corresponding Mexican Official Standards. With regard to wastewater discharges applicable to livestock operations, SEMARNAT has set up two environmental standards: NOM-001-SEMARNAT-1996[9], which sets the maximum pollution limits for wastewater discharge into water bodies; and "NOM-002-SEMARNAT-1996[10], which establishes the maximum pollutant limits for wastewater discharges into urban and municipal sewage systems.

The following table summarizes the maximum limits for BOD (biochemical oxygen demand) and TN (total nitrogen) for wastewater discharge into water bodies.

Table 1. Maximum limits for BOD and TN established in NOM-001-SEMARNAT-1996

Par.	Rivers			Natural and artificial reservoirs		Coastal water			Soil
	Agricultural irrigation	Urban public use	Protection of aquatic life	Agricultural irrigation	Urban public use	Fishing, sailing, other uses	Recreation	Estuary	Natural wetland
	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)	D.A. (mg/L)
BOD	200	150	60	150	60	200	150	150	150
T.N.	60	60	25	60	25	NA	NA	NA	NA

Notes:
BOD = Biochemical Oxygen Demand
TN = Total Nitrogen
D.A. = Daily average. Value from the analysis of a sample
NA = Not applicable

Wastewater composition is variable because it depends on factors such as livestock diet, medication and the utilization of food supplements to accelerate or augment growth.

The following table summarizes the average concentration of BOD and TN in wastewater from livestock activities.

Table 2. Average concentration of BOD and TN in wastewater from livestock activities[11]

Parameter	mg/L
Biochemical Oxygen Demand (BOD)	5496
Total Nitrogen (TN)	880

[9] See "NOM-001-ECOL.pdf". Also available at:
http://www.semarnat.gob.mx/leyesynormas/normas/Pages/normasoficialesmexicanasvigentes.aspx
[10] See "NOM-002-ECOL.pdf". Also available at:
http://www.semarnat.gob.mx/leyesynormas/normas/Pages/normasoficialesmexicanasvigentes.aspx

[11] See: "Study for livestock wastewater treatment in Campeche.pdf"

To meet a BOD limit of, say, 200 mg/L starting with 5500 mg/L would require a reduction of over 96%. Similarly, reaching a TN limit of 60 mg/L starting with 880 mg/L would require a reduction of over 93%. Wastewater treatment with anaerobic lagoons cannot bring the output levels within the maximum limits established in NOM-001-SEMARNAT-1996. Neither can any enclosed anaerobic digestion technology, which can reduce BOD concentration 70%[12] and total nitrogen concentration by about 25%[13]. Considering average values from table 2, anaerobic digestion technology would reduce Biochemical Oxygen Demand from 5496 to 1649 mg/L (assuming 70% reduction) and total nitrogen concentration from 880 to 660 mg/L (assuming 25% reduction). Thus neither the current situation nor the project activity as unique treatment is sufficient to comply with federal regulations for wastewater discharge to sewage systems or to water bodies. Thus the project activity would not be undertaken to meet regulations, and additional treatment steps would be needed in any case.

An analysis of manure management regulations in Mexico identified no regulations that require livestock owners to invest in a control system comprising biogas capture and flaring or use. Thus, farmers are not required to implement the new technology with the anaerobic digester system, the flaring system and/or the electricity generation system to his farm.

Currently there is no relevant legislation at municipal or state level[14]. Federal legislation is the one applicable to livestock activities and wastewater treatment within the country[15].

According to Federal legislation, neither alternative identified in Sub-step 1a above is in compliance with current regulations on wastewater discharge, which is widely unmet at present. Meeting such regulations would require additional treatment steps in both baseline alternatives considered here.

Step 2: Investment Analysis

The Additionality Tool allows additionality to be demonstrated based on investment analysis, barrier analysis or both.

Investment Analysis has not been used for the assessment of additionality of the proposed PoA. Barrier Analysis will be used to demonstrate the additionality, as described below.

Step 3: Barrier Analysis

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

The project activity under the proposed PoA faces a number of barriers as described below.

a. *Investment barrier*

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[12] See: “Production of biogas by Anaerobic Digestion.pdf”

[13] See: “Development Document.....CAFO EPA.pdf”. Development Document for the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for the Concentrated Animal Feeding Operations, Table 8-10, Chapter 8.2 (US-EPA, 2001)

[14] Available at: http://www.semarnat.gob.mx/leyesynormas/normas/Pages/normasoficialesmexicanasvigentes.aspx and http://www.diputados.gob.mx/LeyesBiblio/gobiernos.htm

[15] See: Section 3.3from “Manual de buenas prácticas de producción en granjas porcícolas.pdf” and “Applicable legislation.pdf”

Since 2006, the Mexican economy has shown significant growth. However due the increase in prices of grains in 2008, and the "swine flu" epidemic (later designated H1N1), the sector has been economically affected with a drop of prices and profitability[16]. As a result, Mexican livestock producers have not showed a specific growth tendency during the last three years. In this context, it is not realistic to expect producers to invest in advanced animal waste management systems.

The Special Program on Climate Change 2009-2012[17] of the Mexican government makes reference to undertake improvements in livestock activities in order to reduce GHG emissions (especially methane) and to promote technologies such as anaerobic digestion. However, there are no specific targets, locations or timelines set for specific actions within the Special Program. As is known, no firm commitments on legally binding emissions limitations have emerged in COP15 and COP16. Moreover, the goals of the Special Program are conditioned on receiving financial assistance and technology transfer from Annex 1 parties.

Nevertheless, the implementation of anaerobic digestion technology for manure treatment in Mexico is supported by three government entities through financing services and subsidies given to the producers.

One such program is "Added Value Agribusiness Support Project with Shared-Risk Schemes" (PROVAR according to its Spanish acronym), which is a subsidy provided by the Shared Risk Trust (FIRCO, according to its Spanish acronym).

FIRCO financial support for digester construction is limited to (i) half of the total investment costs or (ii) one million Mexican pesos if the total costs exceed two million Mexican pesos. In order to qualify for the PROVAR subsidy for anaerobic digester construction, the producer must meet the following requirements[18]:

- The farm/dairy farm production systems are carried out intensively, with animal confinement and manure handling allows its use for biogas generation;
- Have a livestock inventory of at least 300 head of dairy cattle or 200 swine sows within its production unit;
- Have the necessary physical space within the production unit for the digester installation;
- Ensure conditions of biosafety after digester installation;
- Have an existing lagoon that allows establishing the baseline scenario according to the related CDM methodologies.
- The farm is a large-scale production operation or is part of a group of operational units that allow the integration of a CDM project in order to minimize investment costs for the project implementation and transaction costs for registration and supervision of CERs, as well as to facilitate monitoring procedures.

This means that the project needs to have conditions that make feasible the implementation of a CDM project to be granted the subsidy. Moreover it needs to present a significant amount of emission reductions which can be certified and sold in order to improve project economics when applying for the

[16] See: "Situacion actual y Prospectiva SAGARPA 2009.pdf"

[17] Available at: http://www.semarnat.gob.mx/temas/cambioclimatico/Paginas/pecc.aspx

[18] Available at: http://www.firco.gob.mx/proyectos/provar/Paginas/provar_2.aspx (31 Mar 2011)

subsidy. For these reasons, and in perspective, FIRCO provides a complement for a developer in its financial needs.

The Trust Funds for Rural Development (FIRA according to its Spanish abbreviation) offers financing up to 80%[19] of the total investment requirements for the implementation of anaerobic digestion technology. It is not a requirement for FIRA that the project has conditions to apply for CDM credits and also it acts as a second-tier bank, where it exist financial intermediates[20].

Financiera Rural also offers financing up to 80%[21] of the total investment requirements for implementing biogas recovery systems as a first-tier bank (having a direct credit line and contact with the developers). Note that Financiera Rural is in fact the coordinating entity for the proposed PoA. It expects to obtain CERs in order to finance anaerobic digesters to producers. By gathering small-scale projects under a programme of activities with a financial incentive it is easier to make them viable and is vital since the amount of projects would make difficult to manage them on a project-by-project basis.

Financiera Rural strategy consists in utilizing CER revenues to promote, operate and monitor the overall PoA and also to finance CPAs. However it is not feasible for Financiera Rural to support the implementation of all the projects within the PoA due to the size of the program magnitude[22] and the high costs[23] involved in the technology.

In the absence of CDM approval, this financial assistance would not be available. The high investment cost for the proposed project activity, compared to the open-air lagoons that represent no additional investment, makes the implementation unfeasible.

b. *Barriers due to prevailing practice:*

According to the Livestock Census from INEGI, there are 1,129,217 cattle production units[24] (farms) and 979,348 swine production units[25] (farms) with a total of 9.021 million head of swine and 23.3 million head of cattle in Mexico as of September 2007.

According to a study conducted in 2004[26], 80% of pig farms in Mexico used to collect pig manure through a sweeping and moving system, which made it easier to recover solid waste for feeding purposes. However, this practice was questionable because, if we take into account the nutritious value of manure and the time it takes to fatten a pig to reach the market weight, it may be concluded that it is inefficient.

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[19] See: "Financiamiento Biodigestores FIRA.pdf"

[20] See: http://www.fira.gob.mx/ProductosySolucionesXML/FondeoFira.jsp

[21] See: "Plan de trabajo para la implementación del MDL Programatico Financiera Rural.pdf"

[22] According to the Livestock Census, there are 1,129,217 cattle production units[22] (farms) and 979,348 swine production units[22] (farms) with a total of 9.021 million head of swine and 23.3 million head of cattle in Mexico as of September 2007.

[23] Covered lagoon system cost can be as low as $25,000 for 150 animals (swine) and as high as $1.3 million for 5,000 animals (dairy). See: "Anaerobic Digestion of Animal Wastes Factors to Consider.pdf"

[24] See: "Resumen Censo Agropecuario 2007.pdf"

[25] See: "Resumen Censo Agropecuario 2007.pdf"

[26] Study developed by MGM International

Furthermore, there is the well-known danger of pathogen microorganisms in manure, and in consequence the need for treating it prior to its use in animal feeding. Physical, chemical and biological treatments were used in order to turn manure into food ingredient, by improving its management and food properties.

Practices for cattle manure included the removal from sheds and the drying process (in open air) for its use as land fertilizer.

However, manure practices have evolved in recent years, with pig manure removal by scraping, and its use as animal feed being replaced by removal by water and treatment in an open anaerobic lagoon. This manure management process is now the common practice[27].

According to FIRCO, PROVAR supported the implementation of 45 anaerobic digesters in 2008[28], 102 anaerobic digesters in 2009[29], and 74 anaerobic digesters in 2010[30] **making a total of 221 anaerobic digesters implemented in Mexico with FIRCO support.**

Financiera Rural has granted loans for the implementation of 3 anaerobic digesters. And FIRA has granted loans for the implementation of 30 anaerobic digesters, as of 2010.

Thus, a total of 254 anaerobic digesters with biogas capture have been implemented in Mexico with government economic support. Of these 254 anaerobic digesters, 46 have requested CDM registration. In any case, the number of anaerobic digesters supported with government resources is an extremely small fraction of over 2 million cattle and swine production units.

More than 150 projects involving anaerobic digestion with biogas capture with flaring and/or use have applied for registration under the CDM. As of May 1, 2011, 4 projects have been withdrawn, 48 projects have finished validation (without requesting registration), 8 projects are at validation and 91 projects have been registered[31]. Statistical information about livestock wastewater treatment in Mexico is not available, therefore CDM information is utilized for the analysis of manure practices in Mexico.

Within the 150 projects applying for registration under the CDM are included more than 700 anaerobic digesters. The majority of these 150 projects were developed mainly by two international companies who were responsible for the implementation, O&M and monitoring of the anaerobic digesters, in exchange of carbon credits which would allow them to continue developing projects. As it turns out, one of these companies went bankrupt and abandoned most of its CDM projects. The other company also discovered that the credits were insufficient to cover all costs, and stopped developing new projects.

Moreover, of the 91 projects which have been registered, as of May 1, 2011 only 34 projects were fully implemented and currently are in operation. Only 16 projects have presented Monitoring Report but have not been able to request for issuance of CERs. And 41 projects might not have been fully implemented since no Monitoring Report was submitted in the following 24 months after the project registration.

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[27] See: "Manual de buenas prácticas de producción en granjas porcicolas.pdf"

[28] See: "PROVAR statistics.pdf"

[29] See: "FIRCO, beneficiaries 2009.pdf"

[30] See: "FIRCO beneficiaries 2010.xls"

[31] See: "CDMpipeline June 2011.xls". Or available at: http://cd4cdm.org/ Updated: June 1st 2011 (June 1st,2011)

This brief review of the project activity being developed by international companies through the CDM suggests that, despite initial optimism and large number of projects entering the CDM pipeline, few were actually implemented. This indicates that the barriers to project implementation were such that CDM revenues were insufficient to overcome the investment and other barriers. With the international players out of the picture, Financiera Rural is seeking to develop the same project concept under a programmatic approach with the hope of being able to introduce biodigestors at a significant number of animal farms, Financiera Rural as the Coordinating Managing Entity of the program would ensure that the technology implementation, operation and maintenance are carried out successfully.

The failure of many previous CDM projects indicates the strength of the barriers at play.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

There is only one alternative besides the project activity, the continuation of current practice. Since this alternative requires no investment it faces no barriers.

The continuation of current practices is therefore considered as the most probable baseline scenario for this SSC-PoA.

Step 4: Common practice analysis

The steps of the common practice analysis are the following:

Step 1: *Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.*

Step 2: *In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number* $N_{all.}$ *. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.*

For **Steps 1 and 2**, the scenarios presented in this PoA have as an output the animal manure treatment system from animals in the farms. At PoA level, it shall be considered for this exercise all the swine and cattle production units in Mexico (as discussed previously), and also because information of the quantity of animals per production unit is not publicly available.

As mentioned previously, considering the Livestock from INEGI, there are 1,129,217 cattle production units and 979,348 swine production units; making a total of 2,108,565 production units.

Since the public information provides data regarding the number of production units but do not provide details for every unit to distinguish between them, for conservativeness purposes in this calculation, it shall be considered all the production units (100%). Hence, $\mathbf{N_{all}}$ **=** 2,108,565

Step 3*: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number* N_{diff}

With the information provided by the Mexican Bioenergy Network ("Red Mexicana de Bioenergía", REMBIO)[32] , 8% of the swine farms have biodigesters as the animal manure treatment system[33]. Therefore, (100%-8%) 92% of these farms apply different technologies that the proposed programme of activities, or (979,348 * 0.92) 901,000 swine production units.

In addition, considering information provided to the Center for Scientific Research and Higher Education at Ensenada, Baja California (CICESE)[34], 7% of the cattle production units account with biodigesters as the animal manure treatment system[35]. Therefore, (100%-7%) 93% of these farms apply different technologies that the proposed programme of activities, or (1,129,217 * 0.93) 1,050,172 cattle production units

Hence, $\mathbf{N_{diff}}$ = (901,000 + 1,050,172) **= 1,951,172**

Step 4*: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.*

The calculation of the Factor F is the following:
$F = 1 – N_{diff}/N_{all}$

Where:
N_{diff} = 1,951,172
N_{all} = 2,108,565

Therefore, **F =** 1- (1,951,172 / 2,108,565) = **0.075**

The proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) *The factor F is greater than 0.2;* *and*
(b) *N_{all}-N_{diff} is greater than 3.*

For the PoA, the value calculated of the F factor is 0.075 (which is less than 0.2). Therefore, the project activity **is not a common practice.**

As a result of applying the *"Tool for demonstration and assessment of additionality*" *ver. 06.1.0* it is concluded that based on conservative approaches and assumptions the proposed PoA fulfils the additionality requirements, demonstrating that the CDM registration is required and fundamental for its implementation.

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[32] Information about REMBIO can be found at: < http://www.rembio.org.mx/2011/que-es-rembio.php>
[33] *Biogas (thematic areas) – Mexican situation ("Situación en México")*. REMBIO (2011). Refer to <http://www.rembio.org.mx/2011/Areas-Tematicas/biogas.php>
[34] Information about CICESE can be found at: < http://www.cicese.edu.mx/en/index.php>
[35] Vázquez, L (2010), *Status of wastewater treatment in dairy farms in Tijuana and their limiting factors for their technification.* CICESE. El Colegio de la Frontera Norte. Pp.28

C*onclusions*

For the reasons given above, it is concluded that the proposed SSC-PoA is additional.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

Financiera Rural will have overall operational and management responsibility for the implementation and monitoring of the proposed PoA; and is therefore acting as the PoA Managing Entity.

Financiera Rural will be responsible for the following operational and management activities related to each SSC-CPA under the PoA as listed below:

Inclusion of the CPAs

The procedures to follow for the inclusion of a CPA in this PoA are the following:

1. Financiera Rural will evaluate the project according to the eligibility criteria from section A.4.2.2., in order to confirm that it can be included in the PoA as a CPA.

2. The interested producer shall sign a covenant of agreement to participate in Financiera Rural's program. After this covenant is signed, Financiera Rural will continue with the arrangements for the inclusion.

3. If the producer is interested in receiving financial support from Financiera Rural, Financiera Rural will follow the internal procedures in order to analyze the amount of the credit and the approval of it.

4. Financiera Rural will discuss with the proponent the documentation and monitoring requirements of the PoA and begin collecting the basic project information necessary to finalize the CPA-DD.

5. After the necessary information and documentation requirements have been met, Financiera Rural reviews the project for including into the CPA based on the rules outlined in the PoA-DD, completes the CPA-DD and submits the information to the DOE for inclusion as per the rules and procedures of PoAs.

6. After the DOE confirms that the CPA is eligible for inclusion in the PoA, Financiera Rural tags the CPA and finalizes all the financing arrangements.

The operational and management activities related to each SSC-CPA under the PoA are listed below:

Technology

Currently there are several companies that offer services for the implementation of anaerobic digestion technology. These companies offer equipment of different brands, quality and characteristics.

Each SSC-CPA participant will be able to choose the technology provider that best suits the project needs; however Financiera Rural suggests utilizing the technology providers listed as "reliable" in the FIRCO's Anaerobic Digester Roll[36] , as long as they comply with the conditions established by Financiera Rural.

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The importance of the technical aspects makes necessary a strict follow-up and the clear establishment of all the specifications that need to be assessed to assure the correct design choice as well as the correct operation and maintenance of the technology installed.

Operation and Maintenance of the project technology

Financiera Rural in collaboration with the technology providers is developing a monitoring manual that establishes the proper procedures that shall be followed in order to operate and maintain the technology in a proper way fulfilling the data accuracy and control requirements.

The SSC-CPA participant will be responsible for the operation of the anaerobic digestion system. Special training, in the anaerobic digestion operation system will be provided to the SSC-CPA participants by the technology providers which will be complemented with the manual prepared by Financiera Rural.

SSC-CPA participants will be responsible for maintenance of the anaerobic digester and electricity generation systems, the SSC-CPA participant shall request calibration and maintenance services to the technology provider.

The technology suppliers will provide the maintenance and calibration services to the anaerobic digester and flaring system on request of the SSC-CPAs. They will also provide training to the project participant's personnel to ensure proper operation of the anaerobic digester, flaring and monitoring equipment.

In addition, proper information such as the performance of the calibration as well as maintenance of the main equipments used in the operation of the anaerobic digester will be part of the monitoring plan. These data shall be available to the Coordinating Entity for internal auditions purposes at any moment. In the case data of calibration or no performance of such events were available from the CPAs, as a conservativeness purposes it shall be used in the calculations the maximum error range of the corresponding instrument in the ER calculations respectively. In case of lack of data, no emission reductions shall be claimed for the period where the data is not available

Monitoring

Monitoring is carried out by the farm operators. For this purpose, and given the importance of the monitoring stage, Financiera Rural in collaboration with the technology providers is developing a

[36] Available at: http://proyectodeenergiarenovable.com/Empresas/Padron_Biodigestores/

monitoring manual which will be delivered to the farm owners in order to give appropriate training to perform the monitoring procedures and also to standardize procedures such as data gathering.

Financiera Rural will be responsible for the implementation and accomplishment of the monitoring procedures in the CPAs. These can be accomplished by performing randomly internal audits to the CPAs.
Monitored data will be compiled by the operators in a database to summarize and store the data electronically. Finally, data will then be uploaded into the PoA electronic database managed by Financiera Rural. This will ensure that each CPA and its owner is identified and logged for monitoring and verification purposes. Annual monitoring reports and CER calculations will stem from this data.

With the access of Financiera Rural to the information compiled from the data stored electronically of the monitored parameters, the availability of daily registrations on the CPAs operation, maintenance, frequencies and execution of calibration of the instruments as well as the random internal audits to the CPAs, the CME will assure the CPA performance and proportionate recommendations or even courses of actions to the management system in each CPA to assure a proper functionality of the PoA.

SSC-CPA identification

Each SSC-CPA will have specific tagging. The unique references of each SSC-CPA under this PoA will prevent double counting:

a. Farm name.
b. Farm owner.
c. Type of livestock(s) at the farm.
d. Location: town/state , and physical address of the farm where the anaerobic digester will be installed.
e. GPS Coordinates.
f. Anaerobic digester's ID number.

Promotion of the PoA

The strategy to implement is divided into two phases:

1. Training at internal level
2. Training at external level

The first phase focuses in the training at internal level of Financiera Rural's personnel responsible of promoting the program within the livestock activities sector.

The following activities are considered for the implementation of this first phase:

a. Realization of a pamphlet with the basic information regarding the PoA.
b. Definition of a strategy in order to distribute the pamphlet in all Financiera Rural's offices within the host country.
c. Capacity building workshop focused on selling and promoting the PoA.

Once this first phase is overcome, as a second phase, the strategy will focus at external level, like producers and other involved stakeholders such as the Government, associations, chambers, banks, other intermediaries, etc.

The following activities are considered for the implementation of this second phase:

a. Define selling strategy;
b. Define marketing plan;
c. Organize launch of the PoA;
d. Identification of the media or activities to utilize to promote the program;
e. Development of printed material for clients willing to participate in the program;
f. Identify and develop strategies with key organizations such as local government, federal entities, and livestock associations, among others.

Several areas from Financiera Rural are involved in the development and the implementation of this PoA, however just one area will be responsible for the coordination of these areas and the PoA.

The following items will be addressed by Financiera Rural in the implementation of each CPA under the PoA:

i. A record keeping system for each CPA under the PoA:
General data and monitoring data from each CPA will be uploaded into the PoA electronic database managed by Financiera Rural; therefore a record of each CPA will be kept during the program.

ii. A system/procedure to avoid double-counting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA:
Producers that are interested in participate in this PoA shall demonstrate that the CPA has not been registered as a CDM project activity or as a CPA of another PoA. Double counting will be avoided by the specific tagging of SSC-CPA stated above.

iii. The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity:
A debundling check will be assessed for each CPA to be included in this PoA in accordance to Annex 13 of EB 54.

A.4.4.2. Monitoring plan:

This PoA considers a sampling method to be used for verification of the CPA. The Coordinating Managing Entity (Financiera Rural) will implement sampling rules according to EB 50 Report, Annex 30 "General Guidelines for Sampling and Surveys for Small-Scale CDM Projects".

Since this PoA would cover the entire Mexican territory, CPAs will be geographically dispersed, therefore and according to the General Guidelines, Financiera Rural will use a multi-stage sampling approach to address sampling for the verification of the CPAs included in the PoA.

All CPAs included in the PoA shall monitor the data and parameters included in section E.6.3. of this PoA-DD. Also, monitoring reports will be prepared separately for all CPAs included in the PoA, however only the sample will be verified by the DOE.

Monitored data and monitoring reports will be stored in the PoA's electronic database which will be managed by Financiera Rural in order to ensure that each CPA and its owner is identified and logged for monitoring and verification purposes. Annual monitoring reports and CERs calculations will stem from this data.

In multi-stage sampling, the units (referred to as primary sampling units) in the population are divided into smaller sub-units (referred to as secondary sampling units) and can be extended further to three or more stages. Data is only verified for only a sample of the sub-units.

In the PoA, population will be divided into 31 primary sampling units (PSU), each corresponding to a Mexican State where the individual elements, CPAs, are implemented. Each individual element of the population, CPA, can be assigned to one, and only one, PSU.

The following table summarizes the Primary Sampling Units defined for the PoA[37].

Table 3. Primary Sampling Units defined for the PoA

Primary Sampling Units	Mexican State
1	Aguascalientes
2	Baja California
3	Baja California Sur
4	Campeche
5	Chiapas
6	Chihuahua
7	Coahuila
8	Colima
9	Durango
10	Estado de Mexico
11	Guanajuato
12	Guerrero
13	Hidalgo
14	Jalisco
15	Michoacán
16	Morelos
17	Nayarit
18	Nuevo Leon
19	Oaxaca
20	Puebla
21	Queretaro

[37] Distrito Federal is not considered PSU since no livestock activities are developed within the territory.

Primary Sampling Units	Mexican State
22	Quintana Roo
23	San Luis Potosi
24	Sinaloa
25	Sonora
26	Tabasco
27	Tamaulipas
28	Tlaxcala
29	Veracruz
30	Yucatan
31	Zacatecas

The geographical location of the defined PSUs for the PoA is represented in Annex 4.

In this PoA, primary sampling units (Mexican States) are divided into two smaller sub-units. The defined scenarios for CPAs mentioned in section A.2. of the PoA-DD are considered the secondary sampling units (SSU) within this PoA.

Individual elements, CPAs, within the secondary sampling units are considered the tertiary sampling units (TSU). CPAs will be selected according to the procedure described below and will constitute a sample, which will be checked by the DOE.

The following diagram schematizes the sampling units defined for the PoA.

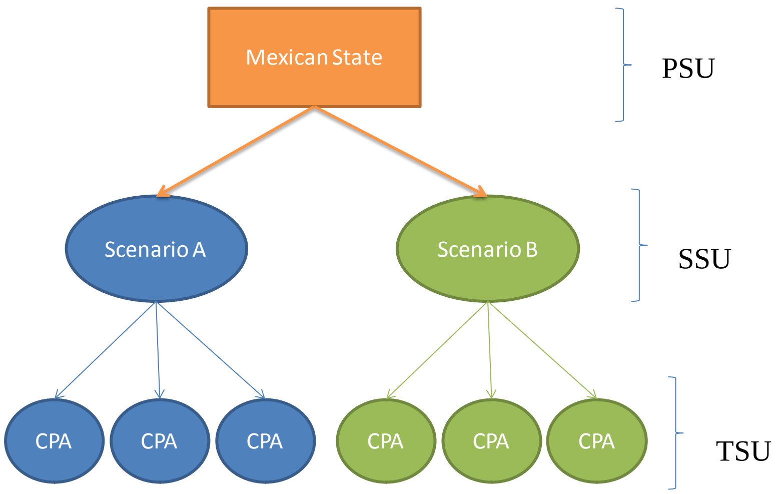

Figure 2. Diagram of SSU and TSU

In order to constitute the sample, the following steps must be followed:

1. Calculation of adequate sample size:
   1.1 Calculate a sample size, n^i, for an infinite population according to equation number one.
2. 1.2 Utilize the sample size value, n^i, to calculate the sample size for finite population, n^{ii}, according to equation number two. Selection of primary sampling units, according to table 3.
3. Selection of CPAs from Scenario A within the selected primary sampling unit, following scheme in figure 2.
4. Selection of CPAs from Scenario B within the selected primary sampling unit, following scheme in figure 2.
5. Constitution of the representative sample with the selected CPAs.

As a first step, Financiera Rural must calculate an adequate sample size which will be defined upon general statistic methods like the one described on the equations[38] below. As a first step, a sample size for infinite population must be estimated with the following equation:

Equation 1: Infinite Population (Very Large or Unknown Population)

$$n^i = \left(\frac{(T * CV)}{rp}\right)^2$$

Where:

n^i	=	Sample size for infinite population
T	=	Confidence interval (1.645 for 90%)
CV	=	Coefficient of variation (Usually between 0.5 and 1)
rp	=	Relative precision (0.1)

The General Guidelines for Sampling and Surveys for Small-Scale CDM Project Activities states the following: "Where there is no specific guidance in the applicable methodology, project proponents shall use 90/10 confidence/precision as the criteria for reliability of sampling efforts. This reliability specification shall be applied to determine the sampling requirements for each individual parameter value determined through a sampling effort". This implies to determine the sample size with 90% probability of falling in the range of ± 10% of the true population value (often denoted as 90/10 precision).

The sample size for infinite population is later adjusted according to the following equation in order to estimate the sample size of the finite population:

Equation 2: Finite Population (Small population)

$$n^{ii} = \frac{n^i}{\left(1 + \left(\frac{n^i}{N}\right)\right)}$$

Where:

[38] Available at: http://www.theenergyspot.com/2011/02/finding-sample-size/ (June 6th, 2011)

n^{ii} = Sample size for finite population

N = Population size

n^{i} = Sample size for infinite population

Once defined the sample size, Financiera Rural will select primary sampling units. CPAs from Scenario A and Scenario B, developed within the selected primary sampling units, will be randomly selected and will constitute the sample to be checked by the DOE.

The project database will record the start and end dates of each monitoring period, and record the emission reductions attributable to each monitoring period. Appropriate record keeping procedures will be implemented to ensure that each monitoring period data set can be transparently attributed to its corresponding CPA, preventing any occurrences of double counting.

Since 2006, the Mexican government has engaged in an extensive effort to combat transnational criminal organizations. Due to ongoing violence and persistent security concerns along Mexican roads, highways and cities, Financiera Rural, as the Coordinating and Managing Entity of the PoA, has decided to consider the possibility in which CPAs are located within cities or municipalities where drug-related violence is concentrated, making not feasible to conduct on-site inspections for verification process.

Since Financiera Rural has decided to implement a multi-stage sampling approach to address verification of the PoA, CPAs are randomly selected to constitute the sample to verify. Taking this in consideration, Financiera Rural considers that when a CPA is randomly selected and that on-site inspection is risky due critical unsafe conditions, Financiera Rural will make recommendations to the DOE in order to exclude the CPA from the verification sample; this recommendation will be properly justified.

Nonetheless, if the DOE decides not to exclude the CPA from the verification sample, the site visit must be realized, on the contrary, if the DOE, following recommendations from Financiera Rural, decides to exclude the CPA from the verification sample, another CPA will be selected randomly.
Records will be uploaded in the PoA database.

A.4.5. Public funding of the programme of activities (PoA):

>> Public funding from Party included in No Annex I of the UNFCCC was used in this PoA and related CPAs. The entity involved with the funds is the coordinating entity of the PoA, Financiera Rural.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

>>
30/08/2011
When the PoA-DD is submitted to Global Stakeholders Consultation.

B.2. Length of the programme of activities (PoA):

>>
28 years

SECTION C. Environmental Analysis

>>

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level ☒

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>> Environmental Analysis is done at SSC-CPA level, therefore no documentation is included.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

>>

Mexican environmental legislation does not require an environmental Impact Assessment for this type of activity in the case of existing facilities with starting date of operation before 1988.

For new facilities or expanding operations after this year, it is required a prior approval in environmental impact of the Environment and Natural Resources Ministry (SEMARNAT) as stated on the "Ley General del Equilibrio Ecológico y la Protección al Ambiente", Section V, Art. 28[39].

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☒
2. Local stakeholder consultation is done at SSC-CPA level ☐

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

The PoA involves the implementation of new technology for animal waste management, and it has been approved by the Government of Mexico[40], and does not entail significant negative environmental impacts. For this reason, it is reasonable to undertake a single environmental analysis at the level of the PoA rather than individual assessments for each SSC-CPA.

The Coordinating Managing Entity of this PoA submitted the invitations via e-mail on March 11th 2011. Personnel from Financiera Rural, producers, technology providers and personnel from Federal public entities such as FIRCO, SAGARPA, SEMARNAT, BANCOMEXT and CRE were invited. The press was also convened to the event.

[39] Available at: www.diputados.gob.mx/LeyesBiblio/pdf/148.pdf
[40] See: No objection Letter granted by SEMARNAT

The consultation was held in Fiesta Inn Hotel in Mexico City, on March 16th 2011. The list of participants and invitations are available in Annex 5.

In this presentation the PoA was described, presenting the main program aspects and the benefits for the producers and the environment. Furthermore, an introduction about global warming and climate change was given. In the presentation the importance of mitigating climate change were shown, and the details of the CDM process for PoAs was explained.

At the end of the presentation, all the comments and doubts from the stakeholders were answered and clarified.

At the end of the section of questions and answers, a questionnaire was delivered to the assistants who gave their opinion about the PoA initiative. Some of the comments received are summarized in section D.3.

A press release about the stakeholder's consultation was published on March 16th 2011 in Financiera Rural's web page[41]

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>

The Coordinating Managing Entity of this PoA submitted the invitations via e-mail[42] on 11/03/2011 Personnel from Financiera Rural, producers, technology providers and personnel from Federal public entities such as FIRCO, SAGARPA, SEMARNAT, BANCOMEXT and CRE were invited. The press was also convened to the event.

Figure 3. Image from the SHC and questionnaire provided to assistants

[41] See: "Press Release March 16th 2011 FR PoA.pdf"

[42] See: "Financiera Rural, SHC invitation.pdf"

D.3. Summary of the comments received:

>> The following is a brief summary of the comments received during the stakeholder comments:

Gimelina Ramírez, from Inter-american Development Bank (IDB):
"I think it's a well established project, ambitious and with a positive impact in the livestock activities and the atmosphere. It also presents enormous challenges like the importance of an integral monitoring system, which includes the active and responsible participation of the producer…….."

Gerardo Rojas, from the Mexican Porciculture Confederation:
"It is necessary that this program starts as soon as possible, since the way it is established it's an incentive for producers to make a responsible management of their wastes….."

Maria Teresa Crespo, FOMECAR executive from BANCOMEXT:
"Congratulations!!, this PoA is the opportunity to influence the development of the livestock sector"

Paola del Rio, senior sourcing manager from First Climate:
"Is innovative and could have a huge potential, however, it is important to define transaction costs which could be an entry barrier"

D.4. Report on how due account was taken of any comments received:

>> During the presentation, there were no negative comments regarding the project activity. Doubts were answered during the stakeholder's consultation.

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

>> Within this PoA two project activity scenarios for CPAs are contemplated.
Project activity scenario A comprises the CPAs in which all biogas generated is collected and conducted to a flaring system.
Project activity scenario B corresponds to the CPAs in which the captured biogas is utilized for electricity generation, with surplus sent to a flare.

The project activity of scenario A is developed using the approved methodology *AMS-III.D. "Methane recovery in animal manure management systems" (version 18).* Also, Methodologies *AMS-I.D. "Grid connected renewable electricity generation" (version 17)* and AMS-III.F. "*Avoidance of methane emissions through composting" (version 10)* are applied for the estimation of project emissions from electricity consumption[43] and the estimation of project emissions from incremental transportation[44] respectively.
The followings tools are also used in accordance with the methodologies:

[43] According to paragraph 15 of AMS-III.D.
[44] According to paragraph 12 of AMS-III.D.

- Tool *"Project emissions from flaring" (Version 02.0.0)* for emissions from flaring the biogas[45].
- *"Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 2.0.0)* to determine the mass flow of methane in the residual gaseous stream to be flared.
- *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01)* for project emissions resulting from electricity consumption.
- *"Tool to calculate the emission factor for an electricity system" (version 02.2.0)* for project emissions resulting from grid power consumption.
- *"Tool for the demonstration and assessment of additionally" (version 06.1.0)* for the assessment of additionality.

The project activity of scenario B is developed using the approved methodologies:

AMS-III.D."Methane recovery in animal manure management systems" (version 18).
AMS-I.D. "Grid connected renewable electricity generation" (version 17) for the estimation of baseline and project emissions from renewable energy generation.

Tools for CPAs from Scenario A and AMS-III.F. are also applied to Scenario B.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

>>

CPAs from Scenario A

Methodology AMS-III.D. was chosen since it covers project activities involving the replacement or modification of anaerobic animal manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane.

This methodology is only applicable under the following conditions:

a. *The livestock population in the farm is managed under confined conditions;*

Only farms with livestock populations managed under confined conditions are considered for the programme.

b. *Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise AMS-III.H. Methane recovery in wastewater treatment shall be applied;*

Only livestock farms where manure is not discharged into natural water resources (e.g. rivers or estuaries) are considered for the programme.

c. *The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C;*

Only farms with annual average temperature on the site higher than 5°C are considered for the programme.

[45] It should be noted that AMS-III.D version 18 refers to this Tool as "*Tool to determine project emissions from flaring gases containing methane*"

d. *In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and in case of anaerobic lagoons in the baseline, their depths are at least 1 m;*
   Only livestock farms with anaerobic lagoons operating as waste treatment in the baseline are considered for the programme. The HRT of manure in the lagoons is greater than one month and the lagoons have a minimum depth of 1 m.

e. *No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario.*
   Only farms that do not destruct, combust or utilize the methane produced in the lagoons are considered for the programme.

f. *The residual waste from the animal manure management system shall be handled aerobically; otherwise the related emissions shall be taken into account as per relevant procedures of AMS-III.AO. Methane recovery through controlled anaerobic digestion. In case of soil application, proper conditions and procedures (not resulting in methane emissions) must be ensured;*
   The mineralized sludges will be handled aerobically, and the final application will be made in the proper conditions in order to avoid methane emissions.

g. *Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared;*
   The project activity will replace the current open anaerobic lagoons with new closed anaerobic digesters that will capture the generated biogas in order to burn it through an enclosed flare; in case the production of biogas is considerable, it will be utilized for electricity generation; therefore all methane will be used or flared.

h. *The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester.*
   Only livestock farms in which the storage time of the manure after removal from the barns does not exceed 45 days are considered for the programme.

Emissions from this electricity consumption are calculated according to *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"* considering that this refers to electrical equipments installed due to the implementation of the proposed project activity (which it will occur either in Scenario A or Scenario B defined in the PoA).

According to AMS-III.D., project emissions from incremental transportation distances are determined as per the procedures described in AMS-III.F. "*Avoidance of methane emissions through composting",* therefore, the methodology is applied to the project activity.

The applicability conditions provided in the related Tool "*Project emissions from flaring gases*" are also fulfilled:

This tool is applicable to the flaring of flammable greenhouse gases where:

- *Methane is the component with the highest concentration in the flammable residual gas; and*

Biogas generated from anaerobic treatment typically consists mainly of methane (at least around 60% of CH_4). It can also contain smaller fractions of nitrogen (N_2), hydrogen (H_2), hydrogen sulphide (H_2S) and Oxygen (O_2).

- *The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).*

The residual gas stream to be flared will be obtained from the treatment of manure through closed anaerobic digesters; hence, it comes from a biogenic source.

From the applicability conditions of the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream"* are fulfilled as follows:

- *This tool provides procedures to determine the following parameter: $F_{i,t}$ - Mass flow of greenhouse gas i (CO_2, CH_4, N_2O, SF_6 or a PFC) in the gaseous stream in time interval 't' (kg/h). The mass flow of a particular greenhouse gas is calculated based on measurements of: (a) the total volume flow or mass flow of the gas stream, (b) the volumetric fraction of the gas in the gas stream and (c) the gas composition and water content. The flow and volumetric fraction may be measured on a dry basis or wet basis. The tool covers the possible measurement combinations, providing six different calculation options to determine the mass flow of a particular greenhouse gas (Options A to F shown next)*

The tool will be applied for the proposed project activity. This tool is referred in the related Tool "*Project emissions from flaring gases*" to determine the amount of methane in the biogas from the anaerobic digester treatment system used in the project activity that shall be flared.

- *(...) Typical applications of this tool are methodologies where the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions.*

In this case, the tool is applied in order to calculate project emissions from flaring gases, hence, its applicability is suitable and appropriate.

According to AMS-I.D., the Emission Factor can be calculated in a transparent and conservative manner according to the procedures prescribed in the *"Tool to calculate the Emission Factor for an electricity system".*

Since the tool in its version 02.2.0 states that: *"this tool is also referred to (….) for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary",* and the project activity will consume electricity from the grid, it is concluded that this tool is applicable to the project activity.

Methodologies and tools are applicable since all the requirements are fulfilled.

CPAs from Scenario B

For CPAs corresponding to Scenario B, emission reductions from methane recovery in animal manure management systems are determined following methodology AMS-III.D., the activity fulfills all the methodology requirements, therefore can be applied to the project activity. According to AMS-III.D. , project emissions from incremental transportation distances are determined as per the procedures described in AMS-III.F. "*Avoidance of methane emissions through composting",* therefore, the methodology is applied to the project activity.

This category of CPAs will claim emission reductions from the electricity generation through biogas, these emissions are calculated following methodology AMS-I.D.

This methodology is only applicable under the following conditions:

a. *This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant (s).*
The CPAs project activity falls in category (a) since a new power plant will be installed at sites where there was no renewable energy power plant operating before the implementation of the PoA.

b. Hydro power plants with reservoirs that satisfy at *least one of the following conditions are eligible to apply this methodology.*
Not relevant

c. *If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.*
There are no renewable and non renewable components in the CPAs units.

d. *Combined heat and power (co-generation) systems are not eligible under this category.*
CPAs will only generate electricity; therefore it is no applicable to the project activity.

e. *In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.*
Not relevant

f. *In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.*
Not relevant

The applicability conditions provided in the related Tool "*Project emissions from flaring gases*" are also fulfilled:

This tool is applicable to the flaring of flammable greenhouse gases where:

- *Methane is the component with the highest concentration in the flammable residual gas; and*

Biogas generated from anaerobic treatment typically consists mainly of methane (at least around 60% of CH_4). It can also contain smaller fractions of nitrogen (N_2), hydrogen (H_2), hydrogen sulphide (H_2S) and Oxygen (O_2).

- *The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).*

The residual gas stream to be flared will be obtained from the treatment of manure through closed anaerobic digesters; hence, it comes from a biogenic source.

According to AMS-I.D., the Emission Factor can be calculated in a transparent and conservative manner according to the procedures prescribed in the *"Tool to calculate the Emission Factor for an electricity system"*.

Since the tool in its version 02.2.0 states that: *"this tool is also referred to (….) for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary",* and the project activity will consume electricity from the grid, it is concluded that this tool is applicable to the project activity.

Methodologies and tools are applicable since all the requirements are fulfilled.

E.3. Description of the sources and gases included in the SSC-CPA boundary

>> The sources and gases included in the project boundary are summarized in the table below.

Table 4. Baseline and project emissions for CPAs from Scenario A

	Source	Gas	Included?	Justification/Explanation
Baseline	Direct emissions from uncovered anaerobic lagoon	CO_2	No	Excluded for simplification. This is conservative
		CH_4	Yes	Anaerobic lagoon corresponds to the major source of emissions in the baseline
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from electricity/thermal energy consumption	CO_2	No	Excluded for simplification. This is conservative.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activity	Emissions from physical leakage	CO_2	No	This is a negligible emission source. Excluded for simplification.
		CH_4	Yes	The anaerobic digester is the major source of methane emissions. Minor CH_4 emissions from secondary anaerobic lagoon are accounted.
		N_2O	No	This is a negligible emission source. Excluded for simplification
	Emissions from flaring biogas	CO_2	Yes	Emissions from the flaring or combustion of biogas

	Source	Gas	Included?	Justification/Explanation
		CH_4	No	This is a negligible emission source. Excluded for simplification
		N_2O	No	This is a negligible emission source. Excluded for simplification
	Emissions from on-site electricity consumption	CO_2	Yes/No	To be included when the project operation involves emissions from electricity consumption of installed equipments because of the implementation of the proposed project activity..
		CH_4	No	This is a negligible emission source. Excluded for simplification
		N_2O	No	This is a negligible emission source. Excluded for simplification
	Emissions from incremental transportation distances	CO_2	Yes/No	Project emissions from incremental transportation distances are determined as per the procedures described in AMS-III.F. "Avoidance of methane emissions through composting ".
		CH_4	No	This is a negligible emission source. Excluded for simplification
		N_2O	No	This is a negligible emission source. Excluded for simplification
	Emissions from the storage of manure before being fed into the anaerobic digester	CO_2	No	This is a negligible emission source. Excluded for simplification
		CH_4	Yes/No	Project emissions from storage are determined as per the procedures described in AMS-III.D.
		N_2O	No	This is a negligible emission source. Excluded for simplification

Table 5. Baseline and project emissions for CPAs from Scenario B

For CPAs from Scenario B, baseline and project emissions are the same as per CPAs from Scenario A, plus the following emissions:

	Source	Gas	Included?	Justification/Explanation
Baseline	Emissions from electricity generation in the Project Activity	CO_2	Yes	According to AMS-I.D. , the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants.
		CH_4	No	This is a negligible emission source. Excluded for simplification
		N_2O	No	This is a negligible emission source. Excluded for simplification
Project Activity	Emissions from electricity	CO_2	No	According to AMS-I.D. , for most renewable energy project activities, $PE_y = 0$

	Source	Gas	Included?	Justification/Explanation
	generation in the Project Activity	CH_4	No	This is a negligible emission source. Excluded for simplification
		N_2O	No	This is a negligible emission source. Excluded for simplification

The project boundaries are defined in the following figures.

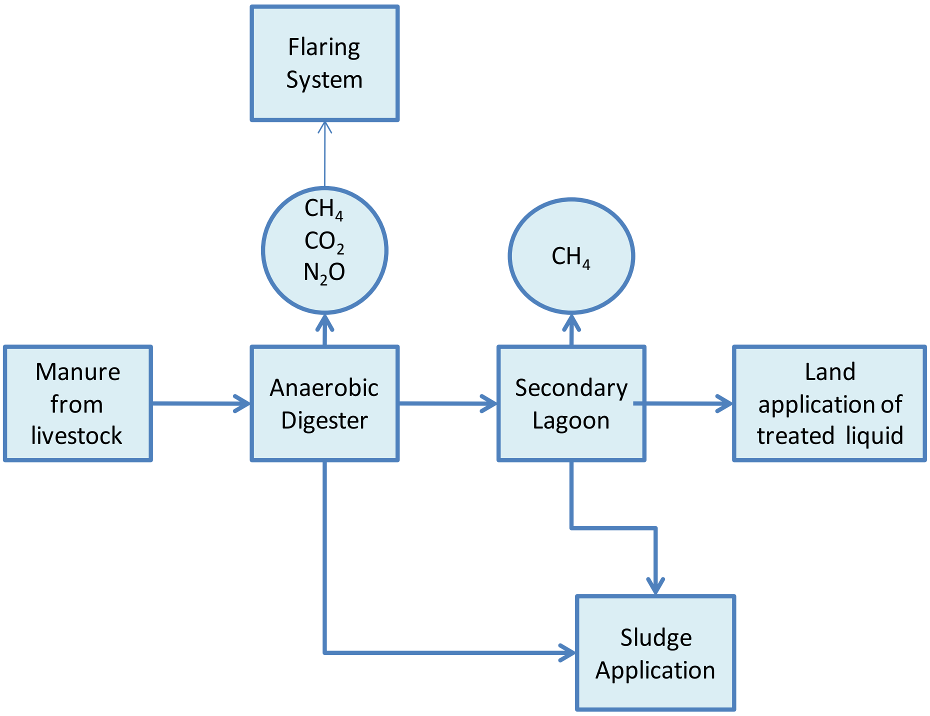

Figure 4. Project boundary for scenario A

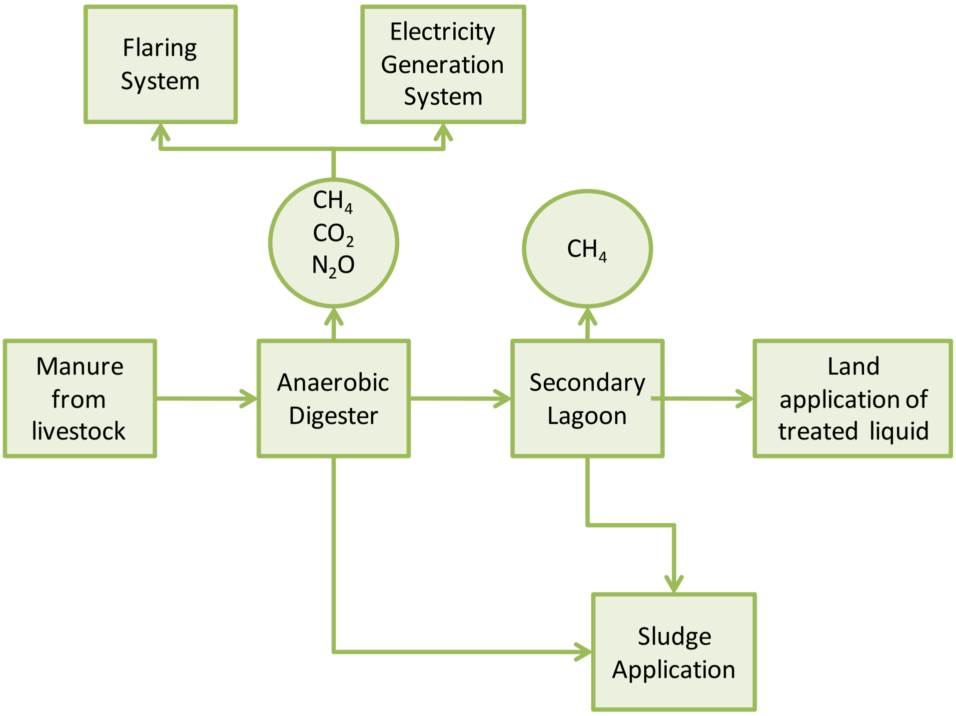

Figure 5. Project boundary for scenario B

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

>>Currently in the host country there is no legislation that regulates the treatment of wastes related to livestock activities. Since no regulation exists, the common practice in the host country is to manage the manure by different systems in which the methane gas produced by the organic decomposition is emitted to the atmosphere.

The manure management system identified as the baseline scenario for this PoA is the anaerobic lagoon. The baseline scenario for this project activity is defined as the volume of methane gas that would be emitted, from the anaerobic lagoons, into the atmosphere during the crediting period in the absence of the project activity.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

>>

Additionality shall be demonstrated through investment analysis, according to eligibility criteria number 9 described in section A.4.2.2. of the PoA-DD, in order to evidence that implementation is not feasible without the CDM revenues.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

>>
Each CPA, that is funded and implemented by Financiera Rural is additional as per the additionality demonstration for the entire PoA (section E.5.1.). The PoA faces financial barriers as well as barriers due to prevailing practice and has no intention to implement the CPA without the additional carbon revenue.
However, the additionality of each CPA shall be demonstrated through the application of an investment comparison analysis. Investment analysis shall be realized using a relevant financial indicator such as IRR or NPV and considering that no debt is used for the project; therefore it will follow a project IRR/NPV calculation. Net Present Value shall be calculated when project IRR could not be estimated.

Criteria and data for the assessment of additionality are discussed in the CPA-DD section B.3.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

>>
Emissions Reduction for CPAs from Scenario A
According to the methodology AMS-III.D. (version 18), the formulae to calculate the baseline emissions, leakage emissions and project emissions are described below:

<u>Baseline emissions</u>

Baseline emissions (BE_y) are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (*VS*) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_o);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (*SVS*) content.

For the project activity option (a) is chosen, therefore he baseline emissions are calculated as follows:

$$BE_Y = GWP_{CH_4} \times D_{CH_4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j}$$

Where:

$BE_{;y}$ = Baseline emissions in year *y*. y = 2010.(tCO_2e/y)

GWP_{CH_4} = Global Warming Potential (GWP) of CH_4 (21 tCO_2e/tCH_4)

D_{CH_4} = CH_4 density (0.00067 t/m^3 at room temperature (20°C) and 1 atm pressure)

LT = Index for all types of livestock

j = Index for animal waste management system

MCF_j = Annual methane conversion factor (MCF) for the baseline animal waste management system *j*. No country-specific data is available; therefore the value was selected from the 2006 IPCC Guidelines.

$B_{O,LT}$ = Maximum methane producing potential of the volatile solids generated for animal type *LT* (m^3 CH_4/kg dm).

$N_{LT,y}$ = Annual average number of animals of type *LT* in year *y*

$VS_{LT,y}$ = Volatile solids for livestock type *LT* entering the animal manure management system in year *y* (on a dry matter weight basis, kg dm/animal year).

$MS\%_{Bl,j}$ = Fraction of manure handled in baseline animal manure management system *j*

UF_b = Model correction factor to account for model uncertainties (0.94)

Since no country-specific data is available for the parameter $B_{O,LT}$ and $VS_{default}$, the values were selected from the 2006 IPCC Guidelines. The chosen values correspond to Latin American values or North American values, according to each CPA livestock characteristics.

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) \times VS_{default} \times nd_y$$

Where:

W_{site} = Average animal weight of a defined livestock population at the project site (kg)

$W_{default}$ = Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)

$VS_{default}$ = Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)

nd_y = Number of days in year *y* where the treatment plant was operational.

The annual average number of animals of type *LT* in year *y* ($N_{LT,y}$) is determined as follows:

$$N_{LT,y} = N_{da,y} \times \left(\frac{N_{p,y}}{365} \right)$$

Where:

$N_{da,y}$ = Number of days animal is alive in the farm in the year *y* (numbers). This data is available Average animal weight of a defined livestock population in the Project Proponent farm inventories.

$N_{p,y}$ = Number of animals produced annually of type *LT* for the year *y* (numbers). This data is available in the Project Proponent farm inventories.

Project emissions

The project activity emissions consist of:

a) Physical leakage of biogas in the manure management system which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use ($PE_{PL,y}$);
b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);
c) CO_2 emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);
d) CO_2 emissions from incremental transportation distances ($PE_{transp,y}$);
e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y}$$

PE_y = Project emissions in year y (tCO_2e)

$PE_{PL,y}$ = Emissions due to physical leakage of biogas in year y (tCO_2e)

$PE_{flare,y}$ = Emissions from flaring or combustion of the biogas stream in the year y (tCO_2e)

$PE_{power,y}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y (tCO_2e)

$PE_{transp,y}$ = Emissions from incremental transportation in the year y (tCO_2e), as per relevant paragraph in AMS-III.F.

$PE_{storage,y}$ Emissions from the storage of manure (tCO_2e)

a) Physical leakage of biogas emissions in the AWMS:

Project emissions due to physical leakage of biogas from the animal manure management system used to produce, collect and transport the biogas to the point of flaring or gainful use are estimated as 10% of the maximum methane producing potential of the manure fed into the management systems implemented by the project activity as follows:

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{Ch4} \times \sum_{i,LT} B_{o,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y}$$

Where:

$PE_{PL,y}$ = Emissions due to physical leakage of biogas in year y (tCO_2e)

GWP_{CH_4} = Global warming potential (*GWP*) of CH_4 (21 tCO_2e/tCH_4)

D_{CH_4} = CH_4 density (0.00067 t/m^3 at room temperature (20°C) and 1 atm pressure)

LT = All types of livestock

j = Animal waste management systems

$B_{O,LT}$ = Maximum methane producing potential of the volatile solids generated for animal type *LT* (m^3 CH_4/kg dm)

$N_{LT,y}$ = Annual average number of animals of type *LT* in year *y*

$VS_{LT,y}$ = Volatile solids for livestock type *LT* entering the animal manure management system in year *y* (on a dry matter weight basis, kg dm/animal year)

$MS\%_{Bl,j}$ = Fraction of manure handled in baseline animal manure management system *j*

a.1) Physical leakage of biogas emissions in the secondary treatment:

In case of sequential treatment stages, the reduction of the volatile solids during a treatment stage is estimated based on referenced data for different treatment types but with volatile solids adjusted for the reduction from the previous treatment stages by multiplying by (1 - RVS). Emissions from the next treatment stage are then calculated with the following equation:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) \times VS_{default} \times nd_y \times (1 - RVS)$$

Where:

W_{site} = Average animal weight of a defined livestock population at the project site (kg)

$W_{default}$ = Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)

$VS_{default}$ = Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)

nd_y = Number of days in year *y* where the treatment plant was operational.

RVS = The relative reduction of volatile solids from the previous stage. A value of 80% was chosen[46].

Once estimated the $VS_{LT,y}$, Project Emission ($PE_{PL,y}$) are then calculated following the approach outlined above.

b) Flaring emissions

Project emissions due to the biogas flaring will be monitored and calculated according to the Tool "*Project emissions from flaring"* Version 02.0.0
The tool differentiates between open and enclosed flares.

In the PoA it will be used enclosed flares, because they are more effective in destroying methane.

The tool involves the following steps:

STEP 1: Determination of the methane mass flow of the residual gas;
STEP 2: Determination of the flare efficiency;
STEP 3: Calculation of project emissions from flaring.

STEP 1. Determination of the methane mass flow of the residual gas

[46] See: "Development Documents…. CAFO EPA.pdf" Table 8-13. Anaerobic Unit Process Performance

The "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream"* shall be used to determine the parameter $F_{CH4,\ m}$.

In each CPA-DD, it shall be developed and specified which option of the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream"* shall be applied, by considering the characteristics of the biogas flowmeter(s) to be installed for the implementation of its project activity.

The density of the residual gas is determined based on the volumetric fraction of all components in the gas. As per the guidance of the tool, a simplified approach will be used and only the volumetric fraction of methane shall be taking into account, and the difference is considered to be Nitrogen (an inert gas).

$F_{CH4,m}$, which is measured as the mass flow during minute *m*, shall then be used to determine the mass of methane in kilograms fed to the flare in minute *m* ($F_{CH4,RG,m}$). $F_{CH4,m}$ shall be determined on a dry basis.

STEP 2: Determination of the flare efficiency

For enclosed flares that are defined as low height flares[47], the flare efficiency in the minute m ($\eta_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Options A or B. For example, the default value applied should be 80%, rather than 90%, and if for example the measured value was 99%, then the value to be used shall correspond to 89%.

Hence, for enclosed flares, the Tool proposes two options to determine the flare efficiency*:*

For enclosed flares, either of the following two options can be used to determine the flare efficiency:

(a) Option A: Apply a default value for flare efficiency.

The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

1. *The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m; and*
2. *The flame is detected in minute m ($Flame_m$).*

Otherwise $\eta_{flare,m}$ is 0%.

(b) Option B: Measure the flare efficiency.

The flare efficiency in the minute m is a measured value ($\eta_{flare,m} = \eta_{flare,calc,m}$) when the following two conditions are met to demonstrate that the flare is operating:

1. *The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m; and*
2. *The flame is detected in minute m ($Flame_m$).*

[47] Low height flare is an enclosed flare for which the flame enclosure has a height between 10 and two times the diameter of the enclosure.

Otherwise $\eta_{flare,m}$ *is 0%.*

In applying Option B, the project participants may choose to determine $\eta_{flare,calc,m}$ *using either Option B.1 or Option B.2. Under Option B.1 (Biannual measurement of the flare efficiency) the measurement is conducted by an accredited entity on a biannual basis and under Option B.2 the flare efficiency is measured in each minute.*

It shall be used **option A** for enclosed flares: default value for flare efficiency.

STEP 3. Calculation of project emissions from flaring

Following the option A which is the use of default value for flare efficiency, the project emissions from flaring are calculated as the sum of emissions for each minute *m* in year *y*, based on the methane mass flow rate in the residual gas ($F_{CH4,m} = F_{CH4,RG,m}$) and the flaring efficiency ($\eta_{flare,m}$), as follows:

$$PE_{flaring,y} = PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525,600} F_{CH4,RG,m} \times \left(1 - \eta_{flare,m}\right) \times 10^{-3}$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas in year *y* (tCO_2e)
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period
$F_{CH4,RG,m}$	Mass flow rate of methane in the residual gas in the minute *m* (kg)
$\eta_{flare,m}$	Flare efficiency in minute *m*

c) Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* (tCO_2e)

No emissions from the use of fossil fuel for the operation of the installed facilities will occur, since no extra equipment with fossil fuel consumption is to be used.

Emissions from this electricity consumption are calculated according to *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"* considering that this refers to electrical equipments installed due to the implementation of the proposed project activity (which it will occur either in Scenario A or Scenario B defined in section A.2 of this document), hence:

$$PE_{power,y} = \sum_{j} EC_{PJ,j,y} * EF_{CO2,grid,y} * \left(1 + TDL_{j,y}\right)$$

Where:

$PE_{power,y}$	Are the project emissions from electricity consumption by the operation of all installed equipment in the year *y* (tCO2 / yr)

$EC_{PJ,j,y}$	Quantity of net electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{CO2,grid,y}$	Is the emission factor of the national grid (tCO2/MWh).
$TDL_{j,y}$	Is the average technical transmission and distribution losses for providing electricity to source *j* in year *y* (%)

According to the methodology AMS-III.D. (version 18) paragraph (27), *"The annual fossil fuel or electricity used to operate the facility or power auxiliary equipment shall be monitored. Alternatively it shall be assumed that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum".*
When the second approach is to be chosen, the electricity consumption will be estimated as follows:

$$EC_{PJ,j,y} = CP_{i,j} * (1+10\%) * 8760$$

Where:

$EC_{PJ,j,y}$	Quantity of net electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$CP_{i,j}$	Rated capacity of electrical equipment *i* used for project activity in year y (MW)

And therefore, emissions from the use of electricity for the operation of the installed facilities using the second approach can be calculated as:

$$PE_{power,y} = \sum_j \left\{ CP_{i,j} * (1+10\%) * 8760 \right\} * EF_{CO2,grid,y} * \left(1+TDL_{j,y}\right)$$

According to AMS-I.D , the Emission Factor can be calculated in a transparent and conservative manner according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system".
The tool in its version 02.2.0 states that: *this tool is also referred (...) for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary".*

The combined margin calculated with this tool will be used for when project activity is consuming energy from the grid in order to meet project energy demand.

In order to calculate the combined margin CO_2 emission factor, the tool establishes the following six steps:

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

STEP 1. Identify the relevant electric power system.

The grid emission factor is calculated based on the last version of the "Electricity Sector Prospective" developed by the Mexican Secretary of Energy (SENER) [48].

The relevant power system is the one physically connected to the farms. This comprises the complete Mexican interconnected power grid, except Baja California and Baja California South, both geographical regions with an isolated system that is not connected to the national power grid.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).

Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. It was chosen not to include off-grid power plants.

STEP 3. Select an operating margin

Four different procedures are indicated for determining the operating margin emission factor ($EF_{grid,OM,y}$). These are denominated:

(a) Simple Operating Margin.
(b) Simple Adjusted Operating Margin.
(c) Dispatch Data Analysis Operating Margin.
(d) Average Operating Margin.

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

The project applies the Simple OM method, which is applicable since low-cost/must-run resources in Mexico constitute less than 50% of the total grid generation in average.

The tool states that the operating margin emission factor can be calculated using one of the following data vintages:

- *Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factors during the crediting period, or*
- *Ex-post option: Th year in which project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.*

In this PoA DD the ex-ante option is selected. As a consequence, the operating margin emission factor is calculated ex-ante and will remain fixed during the first crediting period.

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[48] Available at:

http://www.sener.gob.mx/portal/Default.aspx?id=1608&cx=016041137291724762691%3At7lsrffmdbw&cof=FORID%3A11&palabras=&q=prospectiva+sector+electrico+site%3Awww.energia.gob.mx&x=0&y=0#1058

STEP 4. Calculate the operating margin emission factor according to the selected method.

As shown in step 3, the operating margin calculation method chosen was Simple OM (method a).

For calculating the operating margin emission factor, the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system excluding the low-cost/must run generation units is considered.

Also, the tool gives two different options to calculate OM emission factor, as follows:

- Option A. Calculation based on average efficiency and electricity generation of each plant Option B. Calculation based on total fuel consumption and electricity generation of the system

Here we chose Option B, because only net electricity generation and fuel consumption of the electricity system data is available. The OM emission factor is given by the formula:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FE_{i,y}$	=	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / unit, in year *y* (MWh)
i	=	All fossil fuel types combusted in power plant / unit *m* in year *y*
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option) or the applicable year during monitoring (ex-post option), following the guidance on data vintage step 2

STEP 5. Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

- *Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the requested for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the*

second crediting period should be used. This option does not require monitoring the emissions factor during the crediting period.

- *Option 2: for the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emission factor shall be calculated ex-ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.*

In this PoA DD the ex-ante option is selected. As a consequence, the build margin emission factor is calculated ex-ante and will remain fixed during the first crediting period.

The sample group of power units ***m*** used to calculate the build margin is determined as per the following procedure, consistent with the data vintage selected above:

a. Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

b. Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

c. From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. Since none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, the SET_{sample} is used to calculate the build margin. Steps d, e and f are ignored.

The build margin emission factor is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants, calculated in a similar way as the operating margin.
The equation is given below:

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

Where:

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

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

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit m ($FE_{EL,m,y}$) is determined according to what the tool recommends, i.e., *"as per guidance in step 3 (a) for the simple OM".*

STEP 6. Calculate the combined margin (CM) emissions factor

The calculation of the combined margin (CM) emission factor is based on one of the following methods:

a. Weighted average CM; or
b. Simplified CM.

In this PoA DD option A is selected.

a. Weighted average CM

The tool provides the following formula:

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

The default values $w_{OM} = 0.5$ and $w_{BM} = 0.5$ are used.

d) Emissions due to incremental transport distances

Are calculated based on the incremental distances between:

(i) The collection points of biomass and/or manure and the compost treatment site as compared to the baseline solid waste disposal site or manure treatment site;
(ii) When applicable, the collection points of wastewater and treatment site as compared to baseline wastewater treatment site;
(iii) Treatment sites and the sites for soil application, landfilling and further treatment of the produced compost

$$PE_{transp,y} = \frac{Q_y}{CT_y} \times DAF_w \times EF_{CO_2} + \frac{Q_{treatment,y}}{CT_{treatment,y}} \times DAF_{treatment} \times EF_{CO_2}$$

Where:
$PE_{transp,y}$ = Emissions due to incremental transport distances in year *y* (tCO_2e)

Q_y = Quantity of raw waste/manure treated and/or wastewater co-treated in the year y (tonnes)

CT_y = Average truck capacity for transportation (tonnes/truck)

DAF_w = Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)

EF_{CO_2}	=	CO_2 emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used)
$Q_{treatment,y}$	=	Quantity of compost produced in year y (tonnes)
$CT_{treatment,y}$		Average truck capacity for compost transportation (tonnes/truck)
$DAF_{treatment}$		Average distance for compost transportation (km/truck)

e) Emissions from storage system

Project emissions on account of storage of manure before being fed into the anaerobic digester shall be considered if both condition (a) and condition (b) below are satisfied:

Condition (a): The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester; and

Condition (b): The dry matter content of the manure when removed from the animal barns is less than 20%.

The following method shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} * D_{CH_4} * \sum_{LT,l}\left[\frac{365}{AI_l}\sum_{d=1}^{AI}\left(N_{LT,y} * VS_{LT,d} * MS\%_l * \left(1-e^{-k(AI_l-d)}\right) * MCF_l * B_{0_{LT}}\right)\right]$$

Where:

$PE_{storage,y}$	=	Project emissions on account of manure storage in year y (tCO_2e)
AI_l	=	Annual average interval between manure collection and delivery for treatment at a given storage device l (days)
$VS_{LT,d}$	=	Amount of volatile solid production by type of animal LT in a day (kg VS/head/d)
$MS\%_l$	=	Fraction of volatile solids (%) handled by storage device l
k	=	Degradation rate constant (0.069)
MCF_l	=	Annual methane conversion factor for the project manure storage device l from Table 10.17, Chapter 10, Volume 4
d	=	Days for which cumulative methane emissions are calculated; d can vary from 1 to 45 and to be run from 1 up to AI_l

Leakage Emissions

As stated in applied methodology no leakage calculation is required.

Emission reductions (*ex-ante*):

The *ex-ante* annual emission reductions are calculated as below:

$ER_{y,ex\text{-}ante} = BE_y – PE_y$

Where:

$ER_{y,ex\text{-}ante}$	=	Emission reductions in year *y* (tCO_2e)
BE_y	=	Baseline emissions in year *y* (tCO_2e)
$PE_{,y}$	=	Project emissions in year *y* (tCO_2e)

Emission reductions (*ex-post*):

The emission reductions achieved in any year *y* of the project activity are the lowest value of the following:

$$ER_{y,ex\text{-}post} = min\ [(BE_{y,ex\text{-}post} - PE_{y,ex\text{-}post}), (MD_y - PE_{power,y,ex\text{-}post})]$$

Where:

$ER_{y,ex\text{-}post}$	= Emission reductions achieved by the project activity based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\text{-}post}$	= Baseline emissions calculated using equation 1 using *ex-post* monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$
$PE_{,y,ex\text{-}post}$	= Project emissions calculated using equation 4 using *ex-pos*t monitored values of $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$,AI_l, and if applicable $VS_{LT,y}$
D_{CH_4}	= CH_4 density (0.00067 t/m^3 at room temperature (20°C) and 1 atm pressure)
$PE_{power,y,ex\text{-}post}$	= Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year *y* (tCO_2e)

MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} \times w_{CH_4,y} \times D_{CH_4} \times FE \times GWP_{CH_4}$$

Where:

$BG_{burnt,y}$	= Biogas[49] flared or combusted in year y (m^3)
$w_{CH_4,y}$	= Methane content[50] in biogas in the year *y* (volume fraction)

Emissions Reduction for CPAs from Scenario B

The formulae to calculate the baseline emissions, leakage emissions and project emissions under the methodology AMS-III.D. follow the same procedures as for CPAs from Scenario A.

[49] Biogas and methane content measurements shall be at the same location(s) in the system and on the same basis (wet or dry).

[50] Biogas and methane content measurements shall be at the same location(s) in the system and on the same basis (wet or dry).

The methodology AMS-I.D. procedures describe how emission reductions from renewable electricity are to be determined.

Baseline emissions

According to the methodology *"The baseline scenario is the electricity delivered to the grid by the project activity that would have been otherwise generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid"."*

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

BE_y = Baseline Emissions in year *y* (t CO_2)

$EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO2,grid,y}$ = CO_2 emission factor of the grid in year y (t CO_2/MWh)

The purpose of the previous equation (electricity generation) is for baseline calculation, however, it is reminded that no CERs will be claimed from surplus of electricity sold to/via the National Grid (cases *a* and *b* detailed in section A.2) under the proposed PoA.

According to AMS-I.D. , the Emission Factor is calculated based on the "Tool to calculate the Emission Factor for an electricity system".

Project emissions

For most renewable energy project activities:

$PE_y = 0$

Leakage

The energy generating equipment is not transferred from another activity; therefore:

$LE_y = 0$

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$ER_{;y}$ = Emission reductions in year *y*. (tCO_2e/y)

$BE_{;y}$ = Baseline emissions in year *y*. (tCO_2e/y)

$PE_{;y}$ = Project emissions in year *y*. (tCO_2e/y)

$LE_{;y}$ = Leakage emissions in year *y*.(tCO_2e/y)

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

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Emission reductions are calculated *ex-ante* using data from the farm owner and default values from the methodology and the IPCC Guidelines 2006 respectively. Certain default values correspond to IPCC 2006 values, namely *VS* (default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population), *MS* (default value for methane conversion factors by manure management system component/methane source) and default values for body weight.

Emission Reductions for CPAs from Scenario A

According to the methodology AMS-III.D. (version 18), the formulae to calculate the baseline emissions, leakage emissions and project emissions are described below:

Baseline emissions

Baseline emissions (BEy) are calculated following option (a), therefore the following equation applies:

$$BE_Y = GWP_{CH_4} \times D_{CH_4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j}$$

Since no country-specific data is available for the parameter $B_{O,LT}$ and *VS*, the values are selected from the 2006 IPCC Guidelines. The chosen values correspond to Latin American values or North American values, according to each CPA livestock characteristics. Since annual methane conversion factor (MCF) for the baseline animal waste management system data is not available in the host country, values are sourced from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10A-4, table 10A-5, table 10A-7 and table 10A-8 according to livestock and average temperature.

Table 6. Market and breeding swine default values[51]

	Market Swine			**Breeding Swine**		
Region	$\mathbf{W_{default}}$ (kg)	$\mathbf{B_{0,LT}}$ ($m^3CH_4kg\_dm$)	$\mathbf{VS_{default}}$ (kg-dm/animal/yr)	$\mathbf{W_{default}}$ (kg)	$\mathbf{B_{0,LT}}$ ($m^3CH_4kg\_dm$)	$\mathbf{VS_{default}}$ (kg-dm/animal/yr)
Latin America	28	0.29	0.3	28	0.29	0.3
North America	46	0.48	0.27	198	0.48	0.5

Table 7. Dairy and other cattle default values[52]

[51] Sourced from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-7, and Table 10A-8, pages 80 and 81.

	Dairy Cattle			Other Cattle		
Region	**$W_{default}$** (kg)	**$B_{0,LT}$** ($m^3CH_4kg\_dm$)	**$VS_{default}$** (kg-dm/animal/yr)	**$W_{default}$** (kg)	**$B_{0,LT}$** ($m^3CH_4kg\_dm$)	**$VS_{default}$** (kg-dm/animal/yr)
Latin America	400	0.13	2.9	305	0.1	2.5
North America	604	0.24	5.4	389	0.19	2.4

With the use of the default IPCC values for *VS,* it shall be adjusted considering each site-specific average animal weight, with the following equation:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) \times VS_{default} \times nd_y$$

The annual average number of animals of type *LT* in year *y* ($N_{LT,y}$) is determined as follows:

$$N_{LT,y} = N_{da,y} \times \left(\frac{N_{p,y}}{365}\right)$$

<u>Project emissions</u>

The project activity emissions consist of:

f) Physical leakage of biogas emissions in the AWMS:

As for baseline emissions option (a) was selected, emissions are calculated as follows:

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{Ch4} \times \sum_{i,LT} B_{o,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y}$$

a.1) Physical leakage of biogas emissions in the secondary treatment:

Since there are sequential treatment stages, emissions from the next treatment stage are then calculated with the following equation:

Table 8. Values applied for the determination of physical leakage of biogas in the secondary treatment

Variable	Value	Units	Description

[52] Sourced from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4, and Table 10A-5, pages 77 and 78.

RVS	80	**%**	Relative reduction of volatile solids from the previous stage. Sourced from the table in annex 1from the applied methodology.

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) \times VS_{default} \times nd_y \times (1 - RVS)$$

Once estimated the $VS_{LT,y}$, Project Emission ($PE_{PL,y}$) are then calculated following the approach outlined above.

g) Flaring emissions

Project emissions from flaring biogas where calculated following the guidelines of the methodological "Project emissions from flaring" .

The project activity will include the use of enclosed flares where the biogas will be combusted. According to the tool, there are two approaches to determine the flare efficiency for enclosed flares:

Option (a): Apply a default value for flare efficiency. Continuous monitoring of compliance with manufacturer's specification of flare ($SPEC_{flare}$) shall be performed. If in a specific minute any of the parameters are out of the limit of manufacturer's specifications, a 0% default value for the flare efficiency should be used for the calculations for this specific minute.

Option (b): Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

For the project activity, option "a" was chosen, i.e. to apply a default value of the flare efficiency. If in a specific minute any of the parameters are out of the limit of manufacturer's specifications, a 0% default value for the flare efficiency should be used for the calculations for this specific minute.

STEP 1: Determination of the methane mass flow rate of the residual gas
The "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream"* shall be used to determine the parameter $F_{CH4,\ m}$.

In each CPA-DD, it shall be developed and specified which option of the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream"* shall be applied, by considering the characteristics of the biogas flowmeter(s) to be installed for the implementation of its project activity.

The density of the residual gas is determined based on the volumetric fraction of all components in the gas. As per the guidance of the tool, a simplified approach will be used and only the volumetric fraction of methane shall be taking into account, and the difference is considered to be Nitrogen (an inert gas).

$F_{CH4,m}$, which is measured as the mass flow during minute *m*, shall then be used to determine the mass of methane in kilograms fed to the flare in minute *m* ($F_{CH4,RG,m}$). $F_{CH4,m}$ shall be determined on a dry basis.

The components present in the residual gas (biogas) produced at anaerobic digesters are mainly CH_4 and CO_2.[53] It can be assumed that a typical biogas composition consists of 60 to 70% of CH_4[54]. However, for *ex-ante* estimation and according to the tool´s simplified approach[55], it was assumed that the residual gas composition consists of 60% CH_4 in volume and 40% N_2.

The flow rate of the biogas on dry basis at normal conditions depends on the number of animals, and the type of livestock and manure system.

The total volumetric flow rate of the biogas on dry basis at normal conditions (FV_{biogas}) can be estimated for *ex-ante* purposes only as follows[56]:

$$FV_{biogas} = \frac{\sum_{j,LT} MCF_j \times B_{o,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{BL,y}}{w_{CH4} \times nd_y \times 24}$$

Where:

FV_{biogas} = Volumetric flow rate of the biogas on dry basis at normal conditions (m^3/hr)

MCF_j for anaerobic digestion was estimated assumed to be 100% as a conservative approach, since according to IPCC Guidelines this value varies between 0 and 100%.

Table 9. Values applied for the determination of the mass flow rate of the residual gas

Variable	Value	Units	Description
MCF	100%	%	Annual methane conversion factor (*MCF*) for the baseline animal waste management system[57]
minutes	525,600	mins/yr	Number of minutes per year

As mentioned in the tool: "*As a simplified approach, project participants may only measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N_2)".*

Table 10. Values applied for the determination of the mass flow rate of the residual gas that is flared

[53] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 Chapter 10: Emissions from Livestock and Manure Management (2006) 49 Table 10.18: Definitions of manure management systems.

[54] U.S. EPA. Managing Manure with Biogas Recovery Systems: Improved Performance at Competitive Cost, AgStar Program. (2006).

[55] *"The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool)".* Tool "Project emissions from flaring gases" Version 02.0.0 (page 3).

[56] Following equation was proposed by the Project developer

[57] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 Chapter 10: Emissions from Livestock and Manure Management (2006) 46 Table 10.17. Assumed 100% as a conservative approach

Variable	Value	Variable	Value
Volumetric fraction of methane	0.60	Volumetric fraction of nitrogen	0.40
Molecular mass of methane	16.04	Molecular mass of nitrogen	28.02

STEP 2- Determination of flare efficiency.

The flare efficiency depends on the efficiency of combustion in the flare and the time that the flare is operating. In the case of this CPA, it shall be used an enclosed flare. For determining the efficiency of combustion of enclosed flares it has been selected Option A which is a default value for the flare efficiency.
For enclosed flares that are defined as low height flares, the flare efficiency in the minute *m* ($\eta_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Option A (i.e. the default value applied **should be 80%,** rather than 90% for the flare efficiency).
The time that the flare is operating is determined by monitoring the flame using a flame detector and, for the case of enclosed flares, in addition the monitoring requirements provided by the manufacturer's specifications for operating conditions shall be met.

For the *ex-ante* estimation of project emissions, the value of 90% efficiency is used for each farm included in the project activity. However, for the *ex-post* calculations, the selected parameters will be monitored during the development of the project activity to determine the flare efficiency.

STEP 3: Calculation of project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions for each minute *m* in year *y*, based on the methane mass flow in the residual gas ($F_{CH4,RG,m}$) and the flare efficiency ($\eta_{flare,m}$), as follows:

$$PE_{flaring,y} = PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525,600} F_{CH4,RG,m} \times \left(1-\eta_{flare,m}\right) \times 10^{-3}$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas in year *y* (tCO_2e)
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period
$F_{CH4,RG,m}$	Mass flow rate of methane in the residual gas in the minute *m* (kg)
$\eta_{flare,m}$	Flare efficiency in minute *m*

h) Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* (tCO_2e)

No emissions from the use of fossil fuel for the operation of the installed facilities will occur, since no extra equipment with fossil fuel consumption will be used. According to the methodology applied, project emissions from electricity consumption are determined as per the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"* as:

$$PE_{power,y} = \sum_j EC_{PJ,j,y} * EF_{CO2,grid,y} * \left(1 + TDL_{j,y}\right)$$

Where:

$PE_{power,y}$	Are the project emissions from electricity consumption by the operation of all installed equipment in the year *y* (tCO2 / yr)
$EC_{CO2,grid,y}$	Quantity of net electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{CO2,grid,y}$	Is the emission factor of the national grid (tCO2/MWh).
$TDL_{j,y}$	Is the average technical transmission and distribution losses for providing electricity to source *j* in year *y* (%)

According to the methodology AMS-III.D. (version 18) paragraph (27), *"The annual fossil fuel or electricity used to operate the facility or power auxiliary equipment shall be monitored. Alternatively it shall be assumed that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum".*
In the cases that the second approach is chosen, the electricity consumption will be estimated as follows:

$$EG_{BL,y} = CP_{i,j} * (1 + 10\%) * 8760$$

Where:

$EG_{BL,y}$	Quantity of net electricity consumed in the project activity from the grid in year y (MWh)
$CP_{i,j}$	Rated capacity of electrical equipment *i* used for project activity in year y (MW)

And therefore, emissions from the use of electricity for the operation of the installed facilities using the second approach can be calculated as:

$$PE_{power,y} = \sum_j \left\{CP_{i,j} * (1 + 10\%) * 8760\right\} * EF_{CO2,grid,y} * \left(1 + TDL_{j,y}\right)$$

According to AMS-I.D. the Emission Factor can be calculated in a transparent and conservative manner according to the procedures prescribed in the *"Tool to calculate the Emission Factor for an electricity system".* See development of the tool at the end of this section.

f) Emissions due to incremental transport distances

Are calculated based on the incremental distances between:

(i) The collection points of biomass and/or manure and the compost treatment site as compared to the baseline solid waste disposal site or manure treatment site;
(ii) When applicable, the collection points of wastewater and treatment site as compared to baseline wastewater treatment site;

(iii) Treatment sites and the sites for soil application, landfilling and further treatment of the produced compost

$$PE_{transp,y} = \frac{Q_y}{CT_y} \times DAF_w \times EF_{CO_2} + \frac{Q_{treatment,y}}{CT_{treatment,y}} \times DAF_{treatment} \times EF_{CO_2}$$

i) Emissions from storage system

Project emissions on account of storage of manure before being fed into the anaerobic digester shall be considered if both condition (a) and condition (b) below are satisfied:

Condition (a): The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester; and

Condition (b): The dry matter content of the manure when removed from the animal barns is less than 20%.

The following method shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} * D_{CH_4} * \sum_{LT,l} \left[\frac{365}{AI_l} \sum_{d=1}^{AI} \left(N_{LT,y} * VS_{LT,d} * MS\%_l * \left(1 - e^{-k(AI_l - d)}\right) * MCF_l * B_{0_{LT}} \right) \right]$$

__Leakage Emissions__

As stated in applied methodology no leakage calculation is required.

__Emission reductions (ex-ante):__

The *ex-ante* annual emission reductions are calculated as below:

$ER_{y,ex\text{-}ante} = BE_y - PE_y$

__Emission reductions (*ex-post*):__

The emission reductions achieved in any year *y* of the project activity are the lowest value of the following:

$ER_{y,ex\text{-}post} = \min [(BE_{y,ex\text{-}post} - PE_{y,ex\text{-}post}), (MD_y - PE_{power,y,ex\text{-}post})]$

MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} \times w_{CH_4} \times D_{CH_4} \times FE \times GWP_{CH_4}$$

Emissions Reduction for CPAs from Scenario B

The formulae to calculate the baseline emissions, leakage emissions and project emissions under the methodology AMS-III.D. follow the same procedures as for CPAs from Scenario A.

The methodology AMS-I.D. procedures describe how emission reductions from renewable electricity are to be determined.

Baseline emissions

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

The purpose of the previous equation (electricity generation) is for baseline calculation, however, it is reminded that no CERs will be claimed from surplus of electricity sold to/via the National Grid (cases *a* and *b* in section A.2) under the proposed PoA.

According to AMS-I.D. , the Emission Factor shall be calculated based on the "Tool to calculate the Emission Factor for an electricity system".

Project emissions

For most renewable energy project activities:

$$PE_y = 0$$

Leakage

The energy generating equipment is not transferred from another activity; therefore:

$$LE_y = 0$$

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

"Tool to calculate the Emission Factor for an electricity system".

In order to calculate the emission factor so-called "combined margin", the tool establishes the following six steps:
The tool in its version 02.2.0 states that: *this tool is also referred (...) for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary".*

The combined margin calculated with this tool will be used for when project activity is consuming energy from the grid in order to meet project energy demand.

In order to calculate the emission factor so-called "combined margin", the tool establishes the following six steps:

STEP 1. Identify the relevant electric power system.

The grid emission factor is calculated based on the last version of the "Electricity Sector Prospective" published by the Mexican Secretary of Energy (SENER) [58].
The relevant power system is the one where the farms are located, and comprises all of Mexico, except Baja California and Baja California Sur, each of which has an isolated system, not connected to the rest of Mexico, or to each other.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).

Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. It was chosen not to include off-grid power plants.

STEP 3. Select an operating margin

Four different procedures are indicated for determining the operating margin emission factor ($EF_{grid,OM,y}$). These are denominated:

(a) Simple Operating Margin.
(b) Simple Adjusted Operating Margin.
(c) Dispatch Data Analysis Operating Margin.
(d) Average Operating Margin.

In the proposed project activity, the method applied is the Simple Operating Margin method (option a of the Tool), since low-cost/must-run resources of Mexico constitute less than 50% of the total grid generation in average of the five most recent years, as shown below.

Electricity generation in Mexico is dominated by thermal power plants. The following two tables show that the low-cost/must run resources in Mexico constitute much less than 50% of the total grid generation in average of the five most recent years.

Table 11. Power generation in Mexico*[59]*

Type	Low cost or must run	2005	2006	2007	2008	2009
Conventional thermoelectric	no	65,077	51,931	49,482	43,325	43,112
Dual	no	14,275	13,875	13,375	6,883	12,299

[58] Available at:

http://www.sener.gob.mx/portal/Default.aspx?id=1608&cx=016041137291724762691%3At7lsrffmdbw&cof=FORID%3A11&palabras=&q=prospectiva+sector+electrico+site%3Awww.energia.gob.mx&x=0&y=0#1058

[59]Source: Electricity Sector Prospective 2010-2025, page 117, table 20

Combined cycle	no	73,381	91,064	102,674	107,830	113,900
Gas turbine	no	1,358	1,523	2,666	2,802	3,735
Internal combustion	no	780	854	1,139	1,234	1,241
Hydroelectric	yes	27,611	30,305	27,042	38,892	26,445
Coal	no	18,380	17,931	18,101	17,789	16,886
Nuclear	yes	10,805	10,866	10,421	9,804	10,501
Geothermal	yes	7,299	6,685	7,404	7,056	6,740
Wind	yes	5	45	248	255	249

Table 12. Low cost/must run generating percentage in the total electricity generation in Mexico

	2005	2006	2007	2008	2009
Total generation (GWh)	218,971	225,079	232,552	235,870	235,108
Low cost/must run generation (GWh)	45,720	47,901	45,115	56,007	43,935
Low cost/must run generation	20.88%	21.28%	19.40%	23.74%	18.69%
Average low cost/must run generation	20.80%				

As shown above, the average low-cost/must run generation in the last five years is below 50%.

The tool states that the operating margin emission factor can be calculated using one of the following data vintages:

- *Ex ante option:*
- *Ex-post option:*

In this CPA DD, the ex-ante option is selected. As a consequence, the operating margin emission factor is calculated ex-ante and will remain fixed during the first crediting period. This requires the calculation to be based on the three most recent years of data available.

STEP 4. Calculate the operating margin emission factor according to the selected method.

As shown in STEP 3, the operating margin calculation method chosen was Simple OM (method a).

For calculating the operating margin emission factor, the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system excluding the low-cost/must run generation units is considered.
Also, the tool gives two different options to calculate OM emission factor, as follows:

- Option A. Calculation based on average efficiency and electricity generation of each plant
- Option B. Calculation based on total fuel consumption and electricity generation of the system

Here we chose Option B, because only net electricity generation and fuel consumption of the electricity system data is available. The OM emission factor is given by the formula:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y}$$

For determining the operating margin emission factor, it is necessary to determine the electricity imports. The Mexican electricity imports and exports with other electric systems are the following:

Table 13. Electricity exportation and importation[60] (GWh)

Year	**2005**	**2006**	**2007**	**2008**	**2009**
Total Exports	1,291	1,299	1,451	1,452	1,249
Total Imports	87	523	277	351	346
Net exchange	**1,204**	**776**	**1,174**	**1,102**	**904**

Electricity exports are not subtracted from electricity generation data used for calculating the grid emission factor.

There are no imports from other systems inside Mexico. For imports from connected electricity system located in another country, the emission factor is 0 tCO_2/MWh.

Thus, the total generation of electricity considered in calculation of the operating margin emission factor results to be:

Table 14. Electricity generation for OM emission factor calculation (GWh)

Year	**2005**	**2006**	**2007**	**2008**	**2009**
Total generation	218,971	225,079	232,552	235,870	235,108
Low cost/must run generation	45,720	47,901	45,115	56,007	43,935
Imports	87	523	277	351	346
Electricity generation for OM (Σ_j GEN_j)	173,388	177,701	187,714	179,512	190,827

The consumption of fossil fuels for the years 2006-09 is shown in the table below, according the balance of the Electricity Sector Prospective.

Table 15. Fossil fuel consumption for power generation.[61]

	2007		**2008**	**2009**
	%	**TJ/day**	**m^3/day (natural gas) or tonne/year**	**m^3/day (natural gas) or tonne/year**
Diesel	0.50%	23	700	1,100
Coal (national)	18.50%	837	9,100,000	8,500,000
Coal (imported)			1,700,000	5,200,000

[60] Source: Electricity Sector Prospective 2010-2025, page 101, table 16

[61] Source: Electricity Sector Prospective 2006-2015, Page 90, Graphic 31Electricity Sector Prospective 2006-2015, Page 90, Graphic 31. Electricity Sector Prospective 2005-2014, Page 82, Graphic 30. Electricity Sector Prospective 2007-2016, Page 117, Graphic 40, Electricity Sector Prospective 2008 -2017 page 146 graphic 39, Electric Sector Prospective 2010-2025, Page 164, Table 41

	2007		2008	2009
	%	TJ/day	m^3/day (natural gas) or tonne/year	m^3/day (natural gas) or tonne/year
Natural gas	52.10%	2,359	71,900,000	76,600,000
Residual fuel oil	28.90%	1,308	29,000	26,500

2006 IPCC Guidelines for National Greenhouse Gas Inventories provide values of carbon emissions from fuel combustion in terms of tonnes of C per TJ. Considering a factor of (44/12) to convert from C to CO_2 and the fraction of carbon oxidized ratio, also taken from IPCC, the CO_2 emissions corresponding to fuel consumption in Mexico's power sector can be estimated.

The CO_2 emission coefficient of each fuel is shown in the table below:

Table 16. CO_2 emission coefficient of each fuel

Fuel	CO_2 emission factor[62] (tCO_2/TJ)
Residual fuel oil	77.40
Natural gas	56.10
Diesel	74.10
Coal	94.60

Total CO_2 emissions from fuel combustion by the power plants, excluding low-operating cost and must-run power plants, are shown in the following table:

Table 17. Total CO_2 emissions

Year	CO_2 emissions (tCO_2/year)
2009	115,865,082
2008	107,773,337
2007	110,757,851
2006	109,875,566

Thus, the operating margin emission factor results to be:

Table 18. Operating margin emission factor

	2007	2008	2009
Total CO_2 emissions (tCO_2)	110,757,851	107,773,337	115,865,082
Total generation (GWh)	232,552	235,870	235,108
Self consumption (GWh)	11,252	10,763	10,833
Net total generation (GWh)	221,300	225,107	224,275
Net total generation excluding low cost/must	178,368	171,656	182,364

[62] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, Table 1.4, Pages 1.23 and 1.24.

	2007	2008	2009
run (GWh)			
Imports (GWh)	277	351	346
Electricity generation for OM (GWh)	178,091	171,305	182,018

From the above table, the figure for the operating margin emission factor is obtained as 0.6293 tCO_2/MWh.

STEP 5. Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

- *Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the requested for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emissions factor during the crediting period.*
- *Option 2: for the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emission factor shall be calculated ex-ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.*

In this case, the most recent data available would correspond to one or two years prior to the year in which project generation occurs, thus the Option 1 is selected among the two options proposed by the methodology. As a consequence, the build margin emission factor is calculated *ex-ante* and it is considered fixed along the first crediting period.

The sample group of power units ***m*** used to calculate the build margin is determined as per the following procedure, consistent with the data vintage selected above:

a. Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

Table 19. Identified five power units[63]

SET$_{5\ UNITS}$							
Units	**Plant**	**Unit**	**Capacity (MW)**	**Technology**	**Power generation (MWh)**	**Self consumption**	**Net power generation (MWh)**
1	San Lorenzo Potencia	5	116.1	CC	235,000	2.20%	229,830
2	Humeros	8	5	GEO	40,125	0.00%	40,125
3	Rio Bravo (Emilio Portes Gil)	1	33.0	CC	17,307	2.78%	16,826
4		2	33.0	CC	17,307	2.78%	16,826
5		4	145.1	CC	76,099	2.78%	73,984
						AEG$_{Set-5-units}$	**377,591**

b. Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET-\geq 20\%}$, in MWh);

As shown in the table below, the larger annual generation corresponds to the most recently built power plants capacity additions that comprise 20% of the system generation. The 20% of the system generation during 2009 would be 0.20 × 235,108,000 MWh = 47,022,000 MWh. The following table comprises all the plantsinstalled in Mexico from 2003 to 2009.

[63] See: Mexican_Grid_EF_June_2011.xls

CC = Combined cycle; GT = Gas turbine; IC= Internal combustion; HYD = Hydroelectric; GEO = Geothermal

Table 20. New power plants installed[64]

Year	Plant	Unit	Capacity (MW)	Technology	Power generation (MWh)	Self consumption	Net power generation (MWh)	Cumulative power generation (MWh)
2009	Iztapalapa	1	32	GT	-	-	0	0
	Coapa	1	32	GT	-	-	0	0
	Santa Cruz	1	32	GT	-	-	0	0
	Magdalena	1	32	GT	-	-	0	0
	San Lorenzo Potencia	5	116.1	CC	235,000	2.20%	229,830	229,830
2008	Ciudad del Carmen	2	16	GT	-	1.00%	0	0
		3	17	GT	-	1.00%	0	0
	Humeros	8	5	GEO	40,125	0.00%	40,125	40,125
2007	Rio Bravo (Emilio Portes Gil)	1	33.0	CC	17,307	2.78%	16,826	56,951
		2	33.0	CC	17,307	2.78%	16,826	73,777
		4	145.1	CC	76,099	2.78%	73,984	147,761
	Santa Rosalia	9	1.6	IC	-	6.77%	0	147,761
		10	1.6	IC	-	6.77%	0	147,761
		11	1.6	IC	-	6.77%	0	147,761
	Vallejo (LFC)	1	32.0	GT	-	1.00%	0	147,761
	Holbox	8	0.8	IC	-	6.77%	0	147,761
		9	0.8	IC	-	6.77%	0	147,761
	Tamazunchale (PIE)	1	1,135.0	CC	7,700,000	2.78%	7,485,940	7,633,701
	El Cajon (Leonardo Rodriguez Alcaine)	1 and 2	750.0	HYD	1,829,000	0.00%	1,829,000	9,462,701
	Coyotepec (LFC)	2	32.0	GT	-	1.00%	0	9,462,701

[64] See: Mexican_Grid_EF_June_2011.xls

CC = Combined cycle; GT = Gas turbine; IC= Internal combustion; HYD = Hydroelectric; GEO = Geothermal

Year	Plant	Unit	Capacity (MW)	Technology	Power generation (MWh)	Self consumption	Net power generation (MWh)	Cumulative power generation (MWh)
	Coyotepec (LFC)	1	32.0	GT	-	1.00%	0	9,462,701
	Cuautitlan (LFC)	1	32.0	GT	-	1.00%	0	9,462,701
	La Venta II (registered CDM project)	98 units	83.3	W	-	-	0	9,462,701
	Villa de las flores (LFC)	1	32.0	GT	-	1.00%	0	9,462,701
	Victoria (LFC)	1	32.0	GT	-	1.00%	0	9,462,701
	Remedios (LFC)	1	32.0	GT	-	1.00%	0	9,462,701
	Ecatepec (LFC)	1	32.0	GT	-	1.00%	0	9,462,701
2006	Chihuahua II (El Encino)	5	65.3	CC	433,892	2.78%	421,829	9,884,530
	Altamira V (PIE)	1	1,121.0	CC	8,096,000	2.78%	7,870,931	17,755,462
	Tuxpan V (PIE)	1	495.0	CC	3,792,000	2.78%	3,686,582	21,442,044
	Valladolid III (PIE)	1	525.0	CC	3,646,000	2.78%	3,544,641	24,986,685
	Atenco (LFC)	1	32.0	GT	-	1.00%	0	24,986,685
2005	Ixtaczoquitlan	1	1.6	HYD	-	0.00%	0	24,986,685
	Botello	2	9.0	HYD	-	0.00%	0	24,986,685
	Hermosillo	2	93.3	CC	729,959	2.78%	709,667	25,696,352
	Rio Bravo IV (PIE)	1	500.0	CC	2,562,000	2.78%	2,490,776	28,187,128
	La Laguna II (PIE)	1	498.0	CC	3,566,000	2.78%	3,466,865	31,653,993
	Yecora	4	0.7	IC	-	6.77%	0	31,653,993
	Holbox	7	0.8	IC	-	6.77%	0	31,653,993
2004	Chicoasen (Manuel Moreno Torres)	6, 7 and 8	900.0	HYD	2,869,875	0.00%	2,869,875	34,523,868
	El Sauz	7	128.0	CC	498,627	2.78%	484,765	35,008,633
	Rio Bravo III (PIE)	1	495.0	CC	957,000	2.78%	930,395	35,939,029
	Tuxpan (Pdte. Adolfo Lopez Mateos)	7	163.0	GT	435,195	1.00%	430,843	36,369,872
	San Lorenzo Potencia	3 and 4	266.0	GT	-	1.00%	0	36,369,872
	Guerrero Negro II	3 units	10.8	IC	-	6.77%	0	36,369,872

Year	Plant	Unit	Capacity (MW)	Technology	Power generation (MWh)	Self consumption	Net power generation (MWh)	Cumulative power generation (MWh)
2003	Los Azufres	13	26.80	GEO	208,490	0.00%	208,490	36,578,362
	Los Azufres	3 units	79.80	GEO	620,803	0.00%	620,803	37,199,165
	Transalta Campeche (PIE)	1	252.40	CC	1,834,000	2.78%	1,783,015	38,982,180
	Naco Nogales (PIE)	1	258.00	CC	2,163,000	2.78%	2,102,869	41,085,049
	Transalta Chihuahua III (PIE)	1	259.00	CC	1,702,000	2.78%	1,654,684	42,739,733
	Tuxpan III and IV (PIE)	1	983.00	CC	7,207,000	2.78%	7,006,645	49,746,378
	Altamira III and IV (PIE)	1	1,036.00	CC	6,173,000	2.78%	6,001,391	55,747,769

Tuxpan III and IV and Altamira III and IV are excluded since the cumulative power generation exceeds the value of 47,022,000 MWh. The annual electricity generation $AEG_{SET\text{-}\geq 20\%}$, is 49,976,208 MWh.

c. From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

$SET_{\geq 20\%}$ is selected as SET_{sample}. Since none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, the SET_{sample} is used to calculate the build margin. Steps d, e and f are ignored.

The build margin emission factor is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants, calculated in a similar way as the operating margin. The equation is given below:

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

The CO_2 emission factor of each power unit m ($FE_{EL,m,y}$) is determined according to what the tool recommends, i.e., *“as per guidance in step 3 (a) for the simple OM”*.

Finally, in order to calculate total CO_2 emissions from fuel combustion by the sample group of power plants, the CO_2 emission coefficients determined previously in Table 16 are used.

Fuel consumption of the sample group and the corresponding CO_2 emissions are calculated as shown below.

Table 21. CO_2 emissions of the sample group of power plants[65]

Year	Plant	Efficiency ($MWh_{electric}$ / MWh_{fuel})	Fuel consumption (TJ)	CO_2 emission factor (tCO_2/TJ)	CO_2 emissions (tCO_2)	Cumulative CO_2 emissions (tCO_2)
2009	Iztapalapa	-	-	-	0	0
	Coapa	-	-	-	0	0
	Santa Cruz	-	-	-	0	0
	Magdalena	-	-	-	0	0
	San Lorenzo Potencia	52.86%	1,600	54.30	86,905	86,905
2008	Ciudad del Carmen	40.67%	0	54.30	0	0
		40.67%	0	54.30	0	0
	Humeros	-	-	-	0	0
2007	Rio Bravo (Emilio Portes Gil)	52.86%	118	54.30	6,400	6,400
		52.86%	118	54.30	6,400	12,801
		52.86%	518	54.30	28,142	40,943
	Santa Rosalia	45.07%	0	72.60	0	40,943
		45.07%	0	72.60	0	40,943
		45.07%	0	72.60	0	40,943
	Vallejo (LFC)	40.67%	0	54.30	0	40,943
	Holbox	45.07%	0	72.60	0	40,943
		45.07%	0	72.60	0	40,943
	Tamazunchale (PIE)	52.86%	52,440	54.30	2,847,514	2,888,457
	El Cajon (Leonardo Rodriguez Alcaine)	-	-	-	0	2,888,457

[65] See: Mexican_Grid_EF_June_2011.xls

Year	Plant	Efficiency ($MWh_{electric}$ / MWh_{fuel})	Fuel consumption (TJ)	CO_2 emission factor (tCO_2/TJ)	CO_2 emissions (tCO_2)	Cumulative CO_2 emissions (tCO_2)
	Coyotepec (LFC)	40.67%	0	54.30	0	2,888,457
	Coyotepec (LFC)	40.67%	0	54.30	0	2,888,457
	Cuautitlan (LFC)	40.67%	0	54.30	0	2,888,457
	La Venta II (registered CDM project)	-	-	-	0	2,888,457
	Villa de las flores (LFC)	40.67%	0	54.30	0	2,888,457
	Victoria (LFC)	40.67%	0	54.30	0	2,888,457
	Remedios (LFC)	40.67%	0	54.30	0	2,888,457
	Ecatepec (LFC)	40.67%	0	54.30	0	2,888,457
2006	Chihuahua II (El Encino)	52.86%	2,955	54.30	160,456	3,048,913
	Altamira V (PIE)	52.86%	55,137	54.30	2,993,958	6,042,871
	Tuxpan V (PIE)	52.86%	25,825	54.30	1,402,308	7,445,179
	Valladolid III (PIE)	52.86%	24,831	54.30	1,348,316	8,793,496
	Atenco (LFC)	40.67%	0	54.30	0	8,793,496
2005	Ixtaczoquitlan	-	-	-	0	8,793,496
	Botello	-	-	-	0	8,793,496
	Hermosillo	52.86%	4,971	54.30	269,944	9,063,440
	Rio Bravo IV (PIE)	52.86%	17,448	54.30	947,446	10,010,885
	La Laguna II (PIE)	52.86%	24,286	54.30	1,318,732	11,329,617
	Yecora	45.07%	0	72.60	0	11,329,617
	Holbox	45.07%	0	72.60	0	11,329,617
2004	Chicoasen (Manuel Moreno Torres)	-	-	-	0	11,329,617
	El Sauz	52.86%	3,396	54.30	184,396	11,514,013
	Rio Bravo III (PIE)	51.08%	6,745	54.30	366,238	11,880,251
	Tuxpan (Pdte. Adolfo Lopez Mateos)	40.67%	3,852	54.30	209,176	12,089,427
	San Lorenzo Potencia	40.67%	0	54.30	0	12,089,427

Year	Plant	Efficiency ($MWh_{electric}$ / MWh_{fuel})	Fuel consumption (TJ)	CO_2 emission factor (tCO_2/TJ)	CO_2 emissions (tCO_2)	Cumulative CO_2 emissions (tCO_2)
	Guerrero Negro II	45.07%	0	72.60	0	12,089,427
2003	Los Azufres	-	-	-	0	12,089,427
	Los Azufres	-	-	-	0	12,089,427
	Transalta Campeche (PIE)	52.86%	12,490	54.30	678,226	12,767,653
	Naco Nogales (PIE)	52.86%	14,731	54.30	799,893	13,567,546
	Transalta Chihuahua III (PIE)	52.86%	11,591	54.30	629,412	14,196,957
	Tuxpan III and IV (PIE)	52.86%	49,083	54.30	2,665,199	16,862,157
	Altamira III and IV (PIE)	52.86%	42,041	54.30	2,282,819	19,144,976

Altamira III and IV are excluded since the cumulative power generation exceeds the value of 47,022,000 MWh.

Furthermore, the CO_2 emissions were calculated following exactly the same procedure as has been done in estimating operating margin emission factor, as follows:

Table 22. Build margin emission factor

Total CO_2 emissions (tCO_2) $\Sigma EG_{m,y} \times EF_{EL,m,y}$	16,862,157
Electricity generation for BM (MWh) $\Sigma EG_{m,y}$	49,746,378
BM emission factor (tCO_2/MWh)	**0.3390**

Thus, an estimate for the build margin emission factor would be 0.3390 tCO_2/MWh.

STEP 6. Calculate the combined margin emissions factor

In order to calculate the Combined Margin emission factor, the tool provides the following methods:

a. Weighted average CM; or

b. Simplified CM.

In this PoA DD option A is selected, therefore the following equation is utilized.

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

According to the nature of the proposed project, the combined margin is calculated as follows:

$$EF_{grid,CM,y} = 0.6293 \times 0.5 + 0.3390 \times 0.5 = 0.4841 tCO_2 / MWh$$

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data/Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of methane
Source of data used:	2006 IPCC Guidelines for National GHG Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC value for the Global Warming Potential of methane. The same value is given in the applied methodology
Any comment:	-

Data/Parameter:	**D_{CH4}**
Data unit:	t/m^3
Description:	Methane density at room temperature (20°C) and 1 atm pressure
Source of data used:	Methodology AMS-III.D. (version 18)
Value applied:	0.00067
Justification of the choice of data or description of measurement methods and procedures actually applied:	As given in the applied methodology
Any comment:	-

Data/Parameter:	**MCF_j**
Data unit:	%
Description:	Annual methane conversion factor for the baseline animal waste management system
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81
Value applied:	The values will vary according to the local weather of each one of the project sites.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Baseline Methane Conversion Factors are determined according to the average annual temperature for project site.

Any comment:	-

Data/Parameter:	$\mathbf{B_{0,LT}}$
Data unit:	m^3CH_4/kg dm
Description:	Maximum methane producing potential of the volatile solids generated for animal type LT
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81
Value applied:	View Table 5
Justification of the choice of data or description of measurement methods and procedures actually applied:	Baseline maximum methane producing potential of the volatile solids generated for animal type *LT* will be determined according to the type of animals involved on each one of the project sites.
Any comment:	The use of the feed can be validated through the nutritional formula from each farm.

Data/Parameter:	$\mathbf{VS_{default}}$
Data unit:	Kg dm/ hd/ day
Description:	Volatile solid for livestock type *LT* in year *y*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81
Value applied:	View Table 5
Justification of the choice of data or description of measurement methods and procedures actually applied:	Baseline default volatile solids generated for animal type *LT* will be determined according to the type of animals involved on each one of the project sites.
Any comment:	The use of the feed can be validated through the nutritional formula from each farm.

Data/Parameter:	$\mathbf{MS\%_{Bl,j}}$
Data unit:	%
Description:	Fraction of manure handled in baseline animal manure management system *j*
Source of data used:	Project proponent
Value applied:	(Percentage defined according to the operations on manure disposition on each CPA farm)
Justification of the choice of data or description of measurement methods and procedures actually applied:	In the baseline situation, all or most of the daily volume of manure is conducted to the lagoon(s). If not all the daily volume of manure is conducted to the lagoon(s), the CPA participant shall account and calculate the proper volume of manure through visual inspections or with registered data (when available). With this data, it will be calculated and determined the respective percentage of fraction of manure handled in baseline animal manure management system *j*.
Any comment:	-

Data/Parameter:	$\mathbf{W_{default}}$
Data unit:	kg
Description:	Default average animal weight of a defined population
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81
Value applied:	View Table 5
Justification of the choice of data or description of measurement methods and procedures actually applied:	Baseline Default average animal weight of a defined population will be determined according to the type of animals involved on each one of the project sites.
Any comment:	-

Data/Parameter:	$\mathbf{W_{site}}$
Data unit:	kg
Description:	Average animal weight of a defined livestock population at the project site
Source of data used:	Livestock inventory system from Farm owner
Value applied:	(According to the characteristics of the project sites.)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Baseline Average animal weight of a defined livestock population will be determined according to the characteristics presented on each one of the project sites.
Any comment:	-

Data/Parameter:	$\mathbf{nd_y}$
Data unit:	Days
Description:	Number of days that the animal manure management system capturing methane was operational
Source of data used:	Reports from farm
Value applied:	365
Justification of the choice of data or description of measurement methods and procedures actually applied:	The farms operate every day, in case any farm has no operation it will be properly documented and taken into account for the $BE_{ex\text{-}post}$ calculation. Data will be transferred to a spreadsheet on a monthly basis.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{N_{da,y}}$
Data unit:	Days
Description:	Number of days animal is alive in the farm in the year y (numbers)
Source of data used:	Livestock inventory system from Farm owner

Value applied:	The value is estimated according to the inventories
Justification of the choice of data or description of measurement methods and procedures actually applied:	To be collected for each animal type *LT* population in the farm. Animal stock and inlet program of animals (Net inlet considering mortality) are recorded. Archive electronically during project plus 5 years.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$N_{p,y}$
Data unit:	Number
Description:	Number of animals produced annually of type LT for the year y
Source of data used:	Livestock inventory system from Farm owner
Value applied:	The value is estimated according to the inventories
Justification of the choice of data or description of measurement methods and procedures actually applied:	To be collected for each animal type *LT* population in the farm. Animal stock and inlet program of animals (Net inlet considering mortality) are recorded.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2/MWh
Description:	Operating margin CO_2 emission factor for the project electricity system in year y
Source of data used:	Estimated as per procedures of the “Tool to calculate the emission factor for an electricity system.” For details of calculation, see “Mexican_Grid_EF_June_2011.xls”
Value applied:	0.6293
Justification of the choice of data or description of measurement methods and procedures actually applied:	-
Any comment:	Value fixed for the entire crediting period

Data/Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor for the project electricity system in year y
Source of data used:	Estimated as per procedures of the “Tool to calculate the emission factor for an electricity system.” For details of calculation, see “Mexican_Grid_EF_June_2011.xls”
Value applied:	0.3390
Justification of the	-

choice of data or description of measurement methods and procedures actually applied:	
Any comment:	Value fixed for the entire crediting period

Data/Parameter:	$\mathbf{EF_{grid,CM,y}}$ **(or** $EF_{CO2,grid,y}$**)**
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for the project electricity system in year y
Source of data used:	Estimated as per procedures of the "Tool to calculate the emission factor for an electricity system." For details of calculation, see "Mexican_Grid_EF_June_2011.xls"
Value applied:	0.4841
Justification of the choice of data or description of measurement methods and procedures actually applied:	-
Any comment:	Value fixed for the entire crediting period

Data/Parameter:	$\mathbf{CP_{i,j}}$
Data unit:	MW
Description:	Rated capacity of electrical equipment *i* used for project activity in year *y*
Source of data used:	Equipment at site according to technology provider specifications
Value applied:	To be defined according to each technology provider specifications
Justification of the choice of data or description of measurement methods and procedures actually applied:	The values to be considered are the ones stated by the technology provider.
Any comment:	To be defined according to each technology provider specifications. The purpose of this parameter is to determine the rated capacity of the electrical equipments installed because of the implementation of the project activity and that will consume electricity when it is selected to assume that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum, as per the AMS-III.D version 18, paragraph 27.

Data/Parameter:	$\mathbf{TDL_{j,y}}$
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data used:	Tool to calculate baseline, project and/or leakage emissions from electricity

	consumption
Value applied:	20
Justification of the choice of data or description of measurement methods and procedures actually applied:	Using the default value from "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".
Any comment:	-

Data/Parameter:	***SPEC**$_{flare}$*
Data unit:	Temperature - °C Flow rate - kg/h or m^3/h
Description:	Manufacturer's flare specifications for temperature and flow rate.
Source of data used:	Flare manufacturer.
Value applied:	(To be specified from each CPA participant)
Justification of the choice of data or description of measurement methods and procedures actually applied:	The flare specifications are set by the manufacturer for the correct operation of the flare for these parameters: (a) Minimum and maximum inlet flow rate, if necessary converted to flow rate at reference conditions or heat flux; and (b) Minimum and maximum operating temperature.
Any comment:	This parameter is applicable in case of enclosed flares. Note, however, that the maintenance schedule is not required when Option A (default flare efficiency value) is selected to determine flare efficiency of an enclosed flare

Data/Parameter:	**FV_{biogas}**
Data unit:	m^3/ hr
Description:	Volumetric flow rate of the biogas on dry basis at normal conditions
Source of data used:	Calculated value
Value applied:	(To be specified from each CPA participant)
Justification of the choice of data or description of measurement methods and procedures actually applied:	-
Any comment:	Parameter only to estimate the *ex-ante* volume of biogas in the baseline scenario.

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

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data and parameters to be monitored by CPAs from Scenario A

Data/Parameter:	**$BG_{burnt,y}$**
Data unit:	m^3 biogas/year
Description:	Biogas volume in year y
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Quantity of biogas flared will be determined according to the characteristics presented on each one of the project sites (CPAs), and value will be measured to determine the flare efficiency.
Description of measurement methods and procedures to be applied:	Biogas flow will be continuously measured. Biogas flow will also be measured to determine the flare efficiency default values. The system will be built and operated to ensure that there is no air inflow into the biogas pipeline.
QA/QC procedures to be applied:	Proper procedures including maintenance, calibration will be implemented in order to fulfill the data accuracy and control requirements. The frequency of the calibration and maintenance will be according to manufacturer's specifications.
Any comment:	The biogas flow will be monitored to perform continuous check of compliance with the manufacturer's specifications of the flare device (regarding gas flow). Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**Temperature of biogas**
Data unit:	°C
Description:	Temperature of biogas
Source of data to be used:	Temperature sensor
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Detection through a temperature sensor installed at the line of the biogas captured.
QA/QC procedures to be applied:	The proper procedures including maintenance will be implemented in order to fulfill the data accuracy and control requirements. The frequency of equipment maintenance and calibration will be done according with manufacturer's specifications.
Any comment:	Temperature of the biogas is required to determine the density of methane. If the biogas flow meter employed measures flow, pressure and temperature and displays/outputs normalised flow of biogas, there is no need for separate monitoring of pressure and temperature of the biogas.

Data/Parameter:	**Pressure of biogas**
Data unit:	Pa
Description:	Pressure of biogas
Source of data to be used:	Pressure sensor
Value of data applied for the purpose of calculating expected emission reductions in section B.5	101,325
Description of measurement methods and procedures to be applied:	Detection through a pressure sensor installed at the line of the biogas captured.
QA/QC procedures to be applied:	The proper procedures including maintenance will be implemented in order to fulfill the data accuracy and control requirements. The frequency of equipment maintenance and calibration will be done according with manufacturer's specifications.
Any comment:	Pressure of the biogas is required to determine the density of methane. If the biogas flow meter employed measures flow, pressure and temperature and displays/outputs normalised flow of biogas, there is no need for separate monitoring of pressure and temperature of the biogas.

Data/Parameter:	$\mathbf{w_{CH4,y}}$
Data unit:	%
Description:	Methane content in biogas in the year y
Source of data to be used:	Either from monitored data or standard value from the methodology.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	60%
Description of measurement methods and procedures to be applied:	A default value of 60% methane content is applied. However, if the project proponent decides to install a continuous analyzer, or another measurement device with periodical measurements at a 90/10 confidence/precision level, values obtained from these direct measurements will be applied.
QA/QC procedures to be applied:	N/A for the standard value. If measurements are done, the proper procedures including maintenance will be implemented in order to fulfill the data accuracy and control requirements. The frequency of equipment maintenance and calibration will be done according with manufacturer's specifications
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{T_{EG,m}}$
Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in minute *m*
Source of data to be	Monitored from project participant(s)

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measured data (above 500°C)
Description of measurement methods and procedures to be applied:	The continuously monitored data will be archived electronically during the project activity. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Where more than one temperature port is fitted to the flare, the flare manufacturer must provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperature
QA/QC procedures to be applied:	The proper procedures will be implemented in order to fulfill the data accuracy and control requirements. The equipment will be subject to regular maintenance, testing and calibration according to the manufacturer's recommendation, in order to ensure accuracy on the results. The frequency of equipment maintenance and calibration will be done yearly. Temperature measurement equipment should be replaced or calibrated in accordance with the manufacturer's specification.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met

Data/Parameter:	**$Flame_m$**
Data unit:	Flame on or Flame off
Description:	Flame detection of flare in the minute *m*
Source of data to be used:	Monitored from project participant(s)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Measure using a fixed installation optical flame detector: Ultra Violet detector or Infra Red, or both. The frecuency of monitoring should be once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off.
QA/QC procedures to be applied:	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations
Any comment:	-

Data/Parameter:	**FE**
Data unit:	%
Description:	Flare efficiency in the year *y*
Source of data to be	Default value according to the Tool *"Project emissions from flaring gases"*.

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For *ex-ante* estimation of emission reductions flare efficiency was assumed to be 90%.
Description of measurement methods and procedures to be applied:	N/A
QA/QC procedures to be applied:	Default value of flare efficiency used for enclosed flares; hence, continuous monitoring of biogas flow and temperature of flare will be done.
Any comment:	-

Data/Parameter:	**$MS\%_{i,y}$**
Data unit:	%
Description:	Fraction of manure handled in system *i* in year *y*
Source of data used:	CPA inventory.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(Fraction of manure handled in system *i* will be determined according to the characteristics on each one of the project sites.)
Description of measurement methods and procedures to be applied:	(When applicable, monitoring of manure not used in the biodigestor shall be described). Project Proponent considers realizing visual inspections in order to check that there are no leaks and also that the entire manure is conducted to the anaerobic digester. In case of leaks, these shall be fixed in less than 24 hours in order to avoid methane emissions. CPA participant will have records from this visual inspections in which will account the days the leaks remained unfixed, according to these records, CPA participant will consider reporting a realistic value. Data will be transferred to a spreadsheet on a monthly basis.
QA/QC procedures to be applied:	(When applicable, it shall be described the frequency calibration of the instrument and maintenance) The proper procedures will be implemented in order to fulfill the data accuracy and control requirements.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**$N_{LT,y}$**
Data unit:	Number
Description:	Annual average number of animals of type *LT* in year *y*
Source of data used:	CPA inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Calculated from data on the different CPA inventories. Calculation according to AMS-III.D. version 18.
Description of	The value will be estimated according the inventory of each CPA. Data will be

measurement methods and procedures to be applied:	transferred to a spreadsheet on a monthly basis.
QA/QC procedures to be applied:	The proper procedures including maintenance will be implemented in order to fulfill the data accuracy and control requirements
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{N_{da,y}}$
Data unit:	Days
Description:	Number of days animal is alive in the farm in the year *y*
Source of data to be used:	The value was estimated according to the inventories of each CPA.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be collected for each animal type *LT* population in the farm. Animal stock and inlet program of animals (Net inlet considering mortality) are recorded.
Description of measurement methods and procedures to be applied:	The value will be estimated according the inventory of each CPA. Data will be transferred to a spreadsheet on a monthly basis.
QA/QC procedures to be applied:	The proper procedures will be implemented in order to fulfill the data accuracy and control requirements.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{N_{p,y}}$
Data unit:	Number
Description:	Number of animals produced annually of type *LT* for the year *y*
Source of data to be used:	Farm inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The value shall be estimated according the inventory of each CPA.
Description of measurement methods and procedures to be applied:	The value will be estimated according the inventory of each CPA. Data will be transferred to a spreadsheet on a monthly basis.
QA/QC procedures to be applied:	The proper procedures will be implemented in order to fulfill the data accuracy and control requirements.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{W_{default}}$
Data unit:	kg
Description:	Default average animal weight of a defined population

Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4 page 77, table 10A-5 page 78, table 10A-7 page 80 and table 10A-8 page 81.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	View Table 5
Description of measurement methods and procedures to be applied:	This parameter will be obtained from the most recent IPCC Guidelines for National Greenhouse Gas Inventories. IPCC Guidelines will be annually revised in order to confirm this value.
QA/QC procedures to be applied:	N/A
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{VS_{default}}$
Data unit:	kg/animal/year
Description:	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population
Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 10 Table 10A-4 page 77, table 10A-5 page 78, table 10A-7 page 80 and table 10A-8 page 81.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	View Table 5
Description of measurement methods and procedures to be applied:	This parameter will be obtained from the most recent IPCC Guidelines for National Greenhouse Gas Inventories.
QA/QC procedures to be applied:	N/A
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$\mathbf{VS_{,LT,y}}$
Data unit:	kg dm/animal/year
Description:	Volatile solids on a dry matter weight basis for livestock LT entering the animal manure management system in year y
Source of data to be used:	Estimated according to equation 2 from the selected methodology AMS-III.D
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated according to equation 2 from the selected methodology AMS-III.D.

Description of measurement methods and procedures to be applied:	In case default IPCC values for VS are adjusted for a site-specific average animal weight, it shall be well explained and documented.
QA/QC procedures to be applied:	-
Any comment:	-

Data/Parameter:	**W_{site}**
Data unit:	Kg
Description:	Average animal weight of a defined livestock population at the project site
Source of data to be used:	CPA inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Average animal weight of a defined livestock population values will be defined according to the characteristics on each one of the project sites.
Description of measurement methods and procedures to be applied:	The weight of the animal type *LT* can be monitored by steps. Average values between the weight of swine when entering the farm and the weight of swine leaving the farm can be adopted. This data correspond to information contained in the farms' inventories. Data will be transferred to a spreadsheet on a monthly basis.
QA/QC procedures to be applied:	The proper procedures will be implemented in order to fulfill the data accuracy and control requirements
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**nd_y**
Data unit:	Days
Description:	Number of days that the animal manure management system capturing methane was operational
Source of data to be used:	Reports from each CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	365
Description of measurement methods and procedures to be applied:	In case any farm has no operation it will be properly documented and taken into account for the $BE_{ex\text{-}post}$ calculation. Data will be transferred to a spreadsheet on a monthly basis.
QA/QC procedures to be applied:	N/A
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**RVS**

Data unit:	%
Description:	Relative reduction of volatile solids from the previous stage
Source of data to be used:	Table 8-13. Anaerobic Unit Process Performance from *Development Document for the Proposed Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations* by EPA.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	80%
Description of measurement methods and procedures to be applied:	Emissions from the next treatment stage (secondary lagoon) are then calculated according to AMS-III.D. , but with volatile solids adjusted for the reduction from the previous treatment stages by multiplying by (1 - RVS). A value of 80%[66] was chosen.
QA/QC procedures to be applied:	N/A
Any comment:	-

Data/Parameter:	**FFR**
Data unit:	N/A
Description:	Formulated feed rations
Source of data to be used:	Internal database system
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	Formulated feed ration will be monitored from the internal database system and will be transferred electronically to a spreadsheet on a bi-monthly basis.
QA/QC procedures to be applied:	Feed intake level will be monitored for each CPA following the internal procedures.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**GS**
Data unit:	N/A
Description:	Genetic source
Source of data to be used:	CPA inventory
Value of data applied	Genetic source of the production operations livestock originate from an Annex I

[66] See: “Development Documents…. CAFO EPA.pdf” Table 8-13. Anaerobic Unit Process Performance

for the purpose of calculating expected emission reductions in section B.5	Party
Description of measurement methods and procedures to be applied:	Genetic source will be monitored each time gilt, boars and cattles are bought to the genetic supplier company. Invoices will be kept as evidence of genetic source supply. Data will be transferred to a spreadsheet.
QA/QC procedures to be applied:	Genetic source will be monitored for each CPA following the farms internal procedures.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**$MS\%_l$**
Data unit:	%
Description:	Fraction of volatile solids (%) handled by storage device *l*
Source of data to be used:	CPA inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Fraction of volatile solids (%) handled by storage device *l* shall be defined according to the characteristics on each one of the project sites
Description of measurement methods and procedures to be applied:	The value will be estimated according the inventory of each CPA. Data will be transferred to a spreadsheet. In case the manure is stored more than 24 hrs before entering the digester, this parameter shall be monitored.
QA/QC procedures to be applied:	The proper procedures will be implemented in order to fulfill the data accuracy and control requirements
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**AI_l**
Data unit:	Days
Description:	Annual average interval between manure collection and delivery for treatment at a given storage device *l*
Source of data to be used:	CPA inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	The value will be estimated according the inventory of each CPA. The monitoring frequency will be determined each time manure is sent to digester inlet. Data will be transferred to a spreadsheet In case the manure is stored more than 24 hrs before entering the digester, this parameter shall be monitored.
QA/QC procedures to be applied:	The proper procedures will be implemented in order to fulfill the data accuracy and control requirements

Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	**Q_y, $Q_{treatmen,y}$**
Data unit:	tonnes
Description:	Quantity of solid waste(excluding manure), produced compost
Source of data to be used:	Monitored monthly
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Quantities of solid waste values shall be defined according to the characteristics on each one of the project sites.
Description of measurement methods and procedures to be applied:	On-site data sheets recorded monthly using weigh bridge.
QA/QC procedures to be applied:	Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier), also cross check with sales of compost
Any comment:	Monitoring of this parameter shall be subjected to the specific characteristics of each CPA participant.

Data/Parameter:	**CT_y, $CT_{treatmen,y}$**
Data unit:	Tones/truck
Description:	Average truck capacity for transportation
Source of data to be used:	Onsite measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Average trucks capacities values shall be defined according to the characteristics on each one of the project sites.
Description of measurement methods and procedures to be applied:	On-site data sheets recorded every time solid waste is transported
QA/QC procedures to be applied:	-
Any comment:	Monitoring of this parameter shall be subjected to the specific characteristics of each CPA participant.

Data/Parameter:	**DAF_w, $DAF_{treatmen,y}$**
Data unit:	km/truck
Description:	Average incremental distance for raw solid or product transportation
Source of data to be used:	Onsite measurement, assumption to be approved by DOE
Value of data applied for the purpose of	To be determined according to the characteristics on each one of the project sites.

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	To be monitored annually
QA/QC procedures to be applied:	-
Any comment:	Monitoring of this parameter shall be subjected to the specific characteristics of each CPA participant.

Data/Parameter:	**Proper soil application**
Data unit:	Numeric frequency
Description:	Sludge removal count
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	The proper conditions and procedures to ensure the soil application of the sludge will not result in methane emissions are being considered. This will be monitored every time the sludge is taken out from the digester. Data will be transferred to a spreadsheet.
QA/QC procedures to be applied:	The final sludge will be properly applied to the soil, by handling it aerobically and avoiding the formation of big piles that could generate anaerobic conditions.
Any comment:	Monitored data will be kept for two years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

Data/Parameter:	$EG_{PJ,j,y}$
Data unit:	MWh/y
Description:	Quantity of net electricity consumed by the project electricity consumption source *j* in year *y*
Source of data to be used:	• If continuous monitoring is selected -- hourly measurement and at least monthly recording using electrical meter(s). • If assumed full rated capacity – with information of the total rated capacity of the electrical equipments installed for project activity ($CP_{i,j}$).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined according to the biogas production from each one of the project sites.
Description of measurement methods and procedures to be	-

applied:	
QA/QC procedures to be applied:	In case of use of electricity meters, these will be subject to maintenance and testing regime to ensure accuracy requirements. The frequency of equipment maintenance and calibration shall be done considering the manufacturer or provider specifications.
Any comment:	In the continuous monitoring, measurements are undertaken using electrical meters. Calibration should be undertaken as prescribed in the relevant paragraph of General Guidelines to SSC Methodologies. If applicable, measurement results shall be cross checked with records for sold/purchased electricity (e.g., invoices/receipts) The net electricity export/supplied to a grid is the difference between the measured quantities of the grid electricity export and the import.

Data/Parameter:	$\mathbf{V_{t,wb}}$
Data unit:	m^3 wet gas/h
Description:	Volumetric flow of the gaseous stream in time interval *t* on a wet basis
Source of data to be used:	Monitored data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	Volumetric flow measurement should always refer to the actual pressure and temperature. Instruments with recordable electronic signal (analogical or digital) are required. Monitoring of frequency shall be continuously, if not specified in the underlying methodology.
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications
Any comment:	This parameter will be only monitored if Options B or C of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant.

Data/Parameter:	$\mathbf{V_{t,db}}$
Data unit:	m^3 dry gas/h
Description:	Volumetric flow of the gaseous stream in time interval *t* on a dry basis
Source of data to be used:	Monitored data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be	Volumetric flow measurement should always refer to the actual pressure and temperature. Calculated based on the wet basis flow measurement plus water concentration measurement.

applied:	Monitoring of frequency shall be continuously, if not specified in the underlying methodology.
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications
Any comment:	This parameter will be only monitored if Option A of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant.

Data/Parameter:	$\mathbf{v_{i,t,db}}$
Data unit:	m³ gas *i*/m³ dry gas
Description:	Volumetric fraction of greenhouse gas *i* in a time interval *t* on a dry basis
Source of data to be used:	Either from monitored data or standard value from the methodology AMS-III.D version 18
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	In case of monitored data, continuous gas analyser operating in dry-basis shall be used. Volumetric flow measurement should always refer to the actual pressure and temperature. Also, monitoring of frequency shall be continuously, if not specified in the underlying methodology.
QA/QC procedures to be applied:	In case of monitored data, the calibration should include zero verification with an inert gas (e.g. N_2), and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Any comment:	This parameter will be only monitored if Options B or E of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant. It should be noted that $v_{i,t,db}$ is referred to the parameter $w_{CH4,y}$ of the methodology AMS-III.D version 18, and based in its paragraph 26, No. 6: the fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) *or*, with periodical measurements at a 90/10 confidence/precision level by following General guidelines for sampling and surveys for SSC project activities, *or*, alternatively a default value of 60% methane content can be used. This parameter is monitored if Option B or E of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant, and may be monitored in Options A and D.

Data/Parameter:	$\mathbf{v_{i,t,wb}}$
Data unit:	m³ gas *i*/m³ wet gas
Description:	Volumetric fraction of greenhouse gas *i* in a time interval *t* on a wet basis
Source of data to be used:	Either from monitored data or standard value from the methodology AMS-III.D version 18

Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	Calculated based on the dry basis analysis plus water concentration measurement or continuous in-situ analyzers if not specified in the underlying methodology. Also, in case of monitoring the frequency shall be continuously, if not specified in the underlying methodology.
QA/QC procedures to be applied:	In case of monitored data, the calibration should include zero verification with an inert gas (e.g. N_2), and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Any comment:	This parameter will be only monitored if Options C or F of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant. It should be noted that $v_{i,t,wb}$ is referred to the parameter $w_{CH4,y}$ of the methodology AMS-III.D version 18, and based in its paragraph 26, No. 6: the fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) *or*, with periodical measurements at a 90/10 confidence/precision level by following General guidelines for sampling and surveys for SSC project activities, *or*, alternatively a default value of 60% methane content can be used. This parameter is monitored if Option C or F of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant, and may be monitored in Options A and D.

Data/Parameter:	**$M_{t,wb}$**
Data unit:	kg/h
Description:	Mass flow of the gaseous stream in time interval *t* on a wet basis
Source of data to be used:	Monitored data (e.g. flow meters) from the CPA participant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	Instruments with recordable electronic signal (analogical or digital) are required. Also, monitoring frequency shall be continuously, if not specified in the underlying methodology
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications
Any comment:	This parameter is monitored if Option E or F of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant.

Data/Parameter:	$\mathbf{M_{t,db}}$
Data unit:	kg/h
Description:	Mass flow of the gaseous stream in time interval *t* on a dry basis
Source of data to be used:	Monitored data (e.g. flow meters) from the CPA participant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	Calculated based on the wet basis flow measurement plus water concentration Measurement. Also, monitoring frequency shall be continuously, if not specified in the underlying methodology
QA/QC procedures to be applied:	Calibration and frequency of calibration is according to manufacturer's specifications
Any comment:	This parameter is monitored if Option D of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant.

Data/Parameter:	$\mathbf{T_t}$
Data unit:	K
Description:	Temperature of the gaseous stream in time interval *t*
Source of data to be used:	Monitored data from the CPA participant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	273.15
Description of measurement methods and procedures to be applied:	Instruments with recordable electronic signal (analogical or digital) are required. Examples include thermocouples, thermo resistance, etc. The monitoring frequency is continuously unless differently specified in the underlying methodology.
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications
Any comment:	It should be noted that T_t is referred also in the parameter *Temperature of biogas* of the methodology AMS-III.D version 18. Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency). However, if the applicability condition related to the gaseous stream flow temperature being below 60ºC is adopted, this parameter must be monitored continuously to assure the applicability condition is met.

Data/Parameter:	**P_t**
Data unit:	Pa
Description:	Pressure of the gaseous stream in time interval *t*
Source of data to be used:	Monitored data from the CPA participant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	101,325
Description of measurement methods and procedures to be applied:	Instruments with recordable electronic signal (analogical or digital) are required. Examples include pressure transducers, etc. The monitoring frequency is continuously unless differently specified in the underlying methodology.
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications
Any comment:	It should be noted that P_t is referred also in the parameter *Pressure of biogas* of the methodology AMS-III.D version 18. Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency)

Data/Parameter:	**$p_{H2O,t,Sat}$**
Data unit:	Pa
Description:	Saturation pressure of H_2O at temperature Tt in time interval *t*
Source of data to be used:	From CPA participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	This parameter is solely a function of the gaseous stream temperature Tt and can be found at reference [1] or any other similar literature, for a total pressure equal to 101,325 Pa
QA/QC procedures to be applied:	-
Any comment:	[1] Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4º Edition 1994, John Wiley & Sons, Inc. Parameter used for the simplified calculation without measurement of the moisture content (Option 2 from the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 02.0.0)

Data/Parameter:	$\mathbf{v_{k,t,db}}$
Data unit:	m³ gas k/m³ dry gas
Description:	Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis
Source of data to be used:	Either from monitored data or standard value from the methodology AMS-III.D version 18
Value of data applied for the purpose of calculating expected emission reductions in section B.5	(value provided if proper Option has been selected)
Description of measurement methods and procedures to be applied:	When measured continuously, using a gas analyzer operating in dry-basis.
QA/QC procedures to be applied:	When measured, Calibration should include zero verification with an inert gas (e.g. N2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Any comment:	It should be noted that $v_{k,t,db}$ is equivalent to the parameter $w_{CH4,y}$ of the methodology AMS-III.D version 18, and based in its paragraph 26, No. 6: the fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) *or*, with periodical measurements at a 90/10 confidence/precision level by following General guidelines for sampling and surveys for SSC project activities, *or*, alternatively a default value of 60% methane content can be used. The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (*k*) in the gaseous stream. However as a simplification, the volumetric fraction of only the gases *k* that are greenhouse gases (in this case, the methane {CH_4}) and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen (N_2). This parameter is monitored if Option B, D or E of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant, and may be monitored in Option 2 (Simplified calculation without measurement of the moisture content) if calculating baseline emissions.

Data/Parameter:	$\mathbf{v_{k,t,wb}}$
Data unit:	m³ gas k/m³ wet gas
Description:	Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a wet basis
Source of data to be used:	Either from monitored data or standard value from the methodology AMS-III.D version 18
Value of data applied for the purpose of calculating expected	(value provided if proper Option has been selected)

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Calculated based on the dry basis analysis plus water concentration measurement, or when measured continuously, using in-situ analyzers.
QA/QC procedures to be applied:	When measured, calibration should include zero verification with an inert gas (e.g. N2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Any comment:	It should be noted that $v_{k,t,wb}$ is equivalent to the parameter $w_{CH4,y}$ of the methodology AMS-III.D version 18, and based in its paragraph 26, No. 6: the fraction of methane in the biogas should be measured with a continuous analyser (values are recorded with the same frequency as the flow) *or*, with periodical measurements at a 90/10 confidence/precision level by following General guidelines for sampling and surveys for SSC project activities, *or*, alternatively a default value of 60% methane content can be used. The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (*k*) in the gaseous stream. However as a simplification, the volumetric fraction of only the gases *k* that are greenhouse gases (in this case, the methane {CH_4}) and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen (N_2). This parameter is monitored if Option F of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" is selected by the CPA participant.

Data and parameters to be monitored by CPAs from Scenario B

Same data and parameters to be monitored by CPAs from scenario A, plus the following:

Data/Parameter:	$EG_{BL,,y}$
Data unit:	MWh/y
Description:	Quantity of net electricity supplied to the grid in year y
Source of data to be used:	Continuous monitoring, hourly measurement and at least monthly recording
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined according to the biogas production from each one of the project sites.
Description of measurement methods	-

and procedures to be applied:	
QA/QC procedures to be applied:	In case of use of electricity meters, these will be subject to maintenance and testing regime to ensure accuracy requirements. The frequency of equipment maintenance and calibration shall be done considering the manufacturer or provider specifications.
Any comment:	Measurements are undertaken using energy meters. Calibration should be undertaken as prescribed in the relevant paragraph of General Guidelines to SSC Methodologies. If applicable, measurement results shall be cross checked with records for sold/purchased electricity (e.g., invoices/receipts) The net electricity export/supplied to a grid is the difference between the measured quantities of the grid electricity export and the import.

Data/Parameter:	$\mathbf{V_f}$
Data unit:	m^3 biogas/year
Description:	Biogas to electricity generation system
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Value depending on manure production.
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	Biogas flow will be continuously measured and electronically recorded. The continuously monitored data will be downloaded and recorded every monthly, and archived electronically. The system will be built and operated to ensure that there is no air inflow into the biogas pipeline.
Any comment:	Proper procedures including maintenance will be implemented in order to fulfill the data accuracy and control requirements. When the equipment requires to be sent directly to the technology provider due specific maintenance, the flow meter will be replaced with another for the necessary time. The data from this temporal flow meter will be collected manually and later will be uploaded to the data base

E.7.2. Description of the monitoring plan for a SSC-CPA:

>>
The emission reduction compared with the yearly methane generation potential will be limited by the minimum value of the comparison.

The purpose of the monitoring plan is to describe the criteria for maintaining the equipment and to report on the failure of any equipment in the system, in addition to maintaining the project's sustainability. Also, criteria are defined for data collection for determining GHG emissions reductions. This monitoring plan is applicable to the project activity related to mitigating GHG emissions.

Monitoring of the system (waste discharge, biodigester, alternative use and enclosed flare) is performed by local technicians. When it is necessary to repair or replace any equipment, pipeline, leakage, tear or anything incorrect in the combined system, the technician in charge of monitoring the farm will supply register the events and, when possible, register the data in order to keep the database updated. Databases can be used to identify what kind of improvement is needed and in which farms.

The implementation of the biodigestor requires labour activities such as:

Daily Operation: Performed by the farm personnel of each SSC-CPA participant.

Biodigester operations: Each SSC-CPA participant and their farm operators will be responsible for proper maintenance and operation of the biodigester system. The Coordinating Entity (Financiera Rural), in collaboration with the technology providers, will develop a monitoring manual that establishes the proper procedures that shall be followed in order to operate and maintain the technology in a proper way fulfilling the data accuracy and control requirements.

The general management structure in the operation is given as follows:

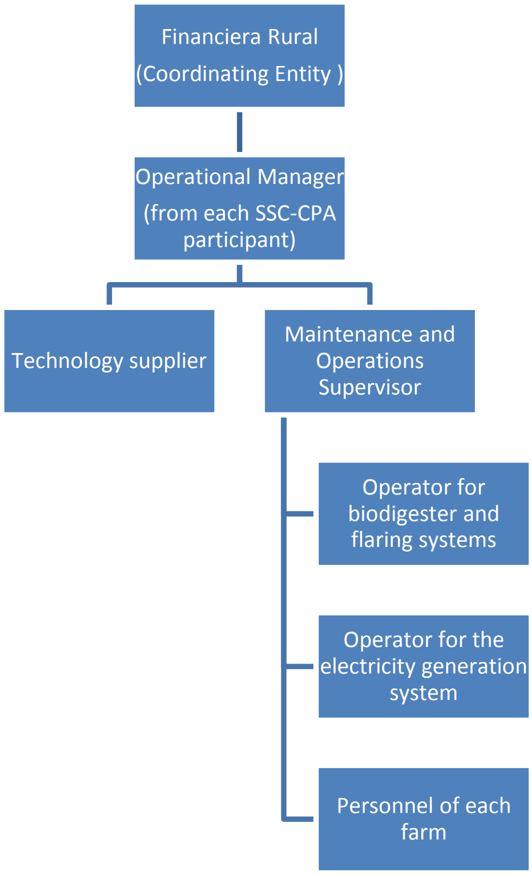

Figure 6. General Operation Management Structure.

Descriptions of general functions are described as follows:

- Financiera Rural (as Coordinating Entity): Responsible to start-up, supervise and coordinate the Program. Also, it will be responsible to promote the Program at national level. It will be also responsible to standardize the types of technologies to be used for the Program. This entity will recompile all the data generated from all the SSC-CPA participants in their proposed project activities for the elaboration of monitoring reports and emissions reduction calculations for verification purposes.

In each SSC-CPA participant;

- Operational Manager: Responsible for coordination of environmental and maintenance activities. He will coordinate the monitoring activities together with the Supervisor to ensure that the monitoring plan is performed according to the methodology. This includes also the supervision of the monitoring procedures and the responsibility for the data transfer to an integrated database for CER verification. He is also responsible for periodic inspections at the farm.
- Maintenance and Operations Supervisor: Responsible for maintenance and operation of biodigester, flare and other associated equipment. He will take the lead for prevention and attention of problems that may occur in relation with the equipment and request external maintenance and calibration support according to the manufacturer's recommendation.
- Technology supplier: Will provide the maintenance and calibration services to the biodigestor, flaring system and other associated equipments on request of the Operational Manager. They will also provide training to the SSC-CPA participants' personnel to ensure proper operation of biodigester, flaring, generators and monitoring equipment.
- Operator for biodigester and flaring systems: Responsible of the biodigester and flaring systems (piping, biodigestion, measurements, torch, etc). He will identify the needs of calibration and maintenance of the equipments and manage their calibrations in order to obtain the proper documentation.
- Operator for the electricity generation system: Responsible of the operation of the electricity generation system (piping, measurements, interconnection to the national grid, etc). He will identify the needs of calibration and maintenance of the equipments and manage their calibrations in order to obtain the proper documentation.
- Personnel of each farm: They will support the operation of the biodigester and monitoring procedures. In addition, these personnel are responsible of the manure cleaning system that will be sent to the biodigestor. Also, they will confirm if 100% of the manure has been sent to the biodigestor.

In comparison with the baseline animal waste management system (i.e. anaerobic lagoons),

One goal to achieve with the technology to be implemented in each SSC-CPA due to the project activity (i.e. an anaerobic digester system as a new animal waste management system) is that the new system shall be able to operate over a period of several years. To accomplish this, and since efficient biogas utilization is a key to an anaerobic digester's economic return and practicality[67], it is required to include many monitoring instrumentation (e.g. temperature, pressures and flow rates of the biogas, among others discussed in this PoA) than it would normally not be required in the baseline animal waste management system (i.e. anaerobic lagoons). In this sense, Financiera Rural identifies the need to have qualified

[67] Herringshaw, Brian. *A study of biogas utilization efficiency highlighting. Internal combustion electrical generator units*. The Ohio State University. 2009. Available at <https://kb.osu.edu/dspace/bitstream/handle/1811/36946/Brian_Herringshaw_Thesis.pdf;jsessionid=AE343517D586F8867A2BCFB7DEE86B12?sequence=1>

personnel (such as supervisors with the support of the technology providers) in order to ensure the continuity of the operation and good performance of the anaerobic digesters. Not to mention that since an anaerobic digester system is a 'live' system, caution is necessary when working with captured biogas. Adequate ventilation, appropriate precautions, good work practices, vigilance, engineering controls, and adequate personal protective equipment will minimize the dangers associated with captured biogas.

Unlike this, in the anaerobic lagoons of the baseline scenarios, most of the activities required are focused only to assure that liquid waste streams are disposed properly in the lagoon. Hence, fewer personnel are required to perform this task.

The monitoring plan shall include on-site inspections in order to guarantee correct data collection and monitoring performance during the crediting period. A typical checklist would include the following tasks:

- General cleaning in the biodigestor area;
- Maintenance of the pipes that conduct manure to the biodigester;
- Maintenance of pumps;
- Calibration of the control and measurement equipment;
- Leak checks; and
- Maintenance of all related equipment.

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

>> Date of completion of the application of the methodology: 15/07/2011

Eduardo Rivera (Financiera Rural)
Agrarismo 227 | Col. Escandón | 11800 | México, D.F.

Tel: + 52 555 - 230 - 1600 Ext. 1279

E-mail: erivera@financierarural.gob.mx

Financiera Rural is a project participant.

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	Financiera Rural
Street/P.O.Box:	Agrarismo
Building:	227, 4th floor
City:	Mexico City
State/Region:	Mexico City
Postfix/ZIP:	11800
Country:	Mexico
Telephone:	+52.55.5230.1600
FAX:	-
E-Mail:	-
URL:	www.financierarural.gob.mx
Represented by:	Sergio Mingramm de la Garza
Title:	Structure Manager
Salutation:	Mr.
Last Name:	Mingramm
Middle Name:	-
First Name:	Sergio
Department:	-
Mobile:	-
Direct FAX:	-
Direct tel:	+52.55.5230.1600 Ext. 2103
Personal E-Mail:	smingramm@financierarural.gob.mx

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Parties included in Annex I of the UNFCCC in the sense of any deviation of funds for Official Development Assistance (ODA).

Annex 3

BASELINE INFORMATION

Described in section E.

Annex 4

MONITORING INFORMATION

The following figure represents the identified primary sampling units to be utilized in the multi-stage sampling method.

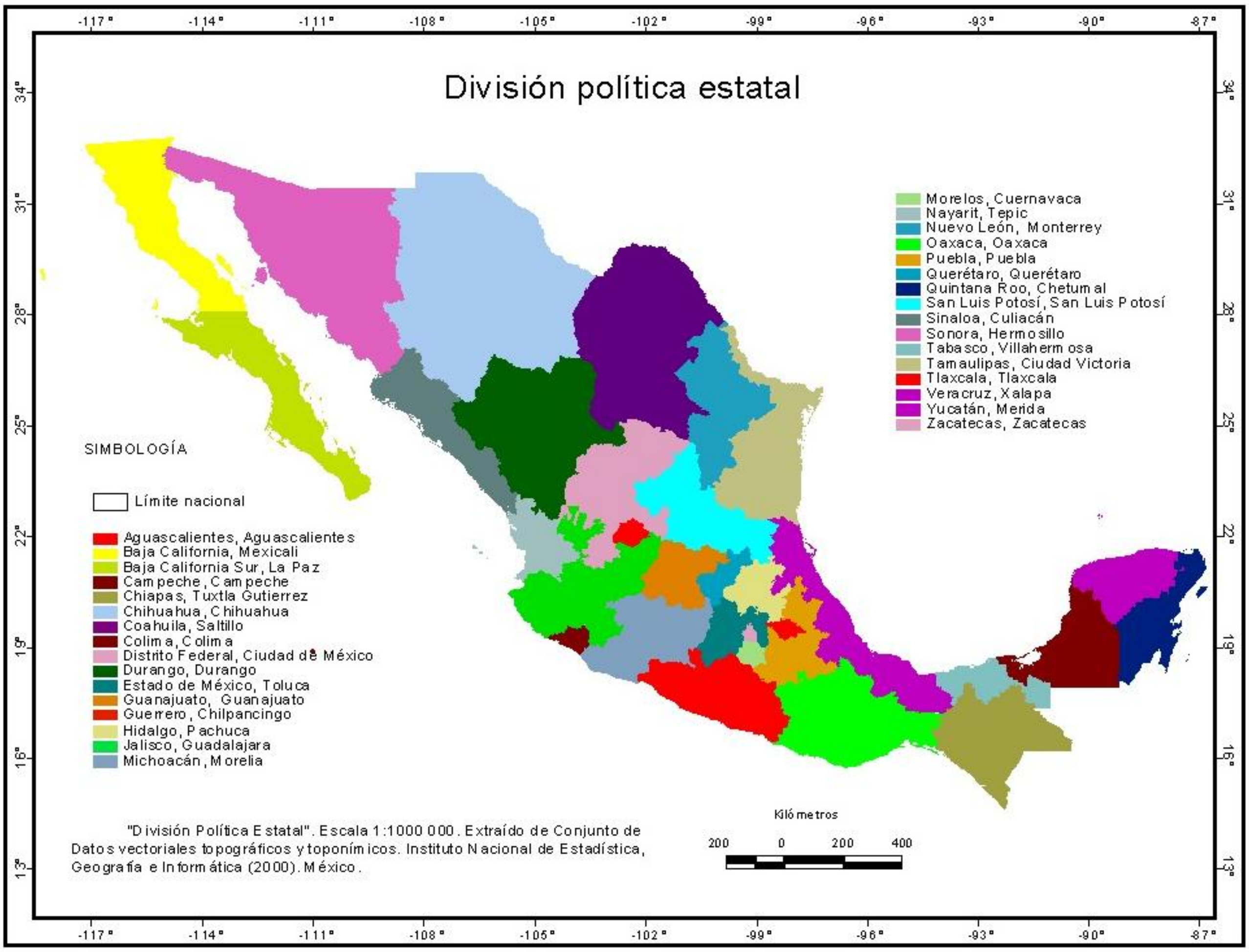

Figure 7. Geographical location of defined PSUs.

<u>More information of the monitoring plan can be found in sections A.4.4.2.and E.7.2 of the present document.</u>

Annex 5

STAKEHOLDERS' CONSULTATION

The Coordinating Entity invited stakeholders in order to present the program activity. The public stakeholder consultation invitation was submitted via email[68] to personnell from Financiera Rural, producers, technology providers and personnel from Federal public entities such as FIRCO, SAGARPA, SEMARNAT, BANCOMEXT and CRE were invited. The press was also convened to the event[69]

The consultation was held in Fiesta Inn Hotel in Mexico City, on March 16th 2011[70].

In this presentation the PoA was described, presenting the main program aspects and the benefits for the producers and the environment. Furthermore, an introduction about global warming and climate change was given. In the presentation the importance of mitigating climate change were shown, and the details of the CDM process for PoAs was explained.

The following table summarizes the people invited to the SHC of the PoA.

Table A5.1.List of guests invited to the SHC of the PoA

Name	Organization
Alejandra Espinosa	British Embassy
Andres Flores Montalvo	National Institute of Ecology
Antonio Ruiz García	ALPURA
Bernd Indlekofer	TuvRheinland
Carlos A. Ramayo Navarrete	Yucatan's Porcine Iindustry Group
Carolina Garayzar Gomez	SE
Darlene Frias Ruelas	Nu-3
Dolores Barrientos	Interamerican Development Bank
Emilio Vales	Kent & Sorensen
Enrique Guzmán Lara	Energy Regulation Comission
Enrique Peña Ortiz	EnerAll
Esther Girón	Mexican Confederation of Porcine Industry
Gerardo Rojas Robles	Mexican Confederation of Porcine Industry
Germán Rojas Arredondo	ITAM
Ing. Enrique Nieto	NAFIN
Ing. Francisco Javier Cañizarez	NAFIN
Irene Rivadeneyra	ITAM

[68] See: "Financiera Rural, SHC invitation.pdf"

[69] See: "Press release March 16th 2011 FR PoA.pdf"

[70] See: "Financiera Rural, SHC invitation.pdf"

Name	Organization
Jacqueline Sanchez	British Embassy
Jaime Arturo del Rio Monges	CDM-MEX
José Antono Urteaga Dufour	Natural Resources and Environment Ministry (SEMARNAT)
Julio Cesar Gonzalez Villaseñor	Avi-G
Julio Valle Pereña	Ministry of Energy
Katharina Siegmann	Interamerican Development Bank
Larissa Mora Aguilar	United Nations Development Program (UNDP)
Lucrecia Martin Chavez	Natural Resources and Environment Ministry (SEMARNAT)
Luis Fernando Ramirez Yañez	CO_2 Solutions
Luis Fernando Rodriguez Castañeda	Integral Economic Factor
Luis Miguel Galindo	UNAM
Magdalena Barba	ITAM
María Teresa Crespo Chiapa	FOMECAR
Mauricio Gonzalez	MGM Innova
Nelson Arizmendi	Alfa
Octavio Montufar	FIRCO
Pamela Tadeo	MGM Innova
Paola del Rio	First Climate Group
Pedro Frausto	Environmental Fabrics Mexico
Ramiro Caballero Baqueiro	Kekén – Kuo Group
Rodolfo Efraín López Ruiz	FIRCO
Rodolfo Lacy	Mario Molina Center
Siddharta Eduardo Bustamante	AMEG
Vaca Beatriz	French Development Agency
Vanessa Zabroky	CO_2 Solutions
Alejandra Argaez	Financiera Rural
Miguel Angel Espinoza	Financiera Rural
Cesar Augusto Segundo Escalante	Financiera Rural
Hector Edgar Huerfano	Newspaper “El Economista”
Sergio Mingramm	Financiera Rural
Octavio Pineda	Financiera Rural
Juan Garcia Heredia	Newspaper “El Sol de México”
Carmen Fernandez	Financiera Rural
Howard Avila Jimenez	Financiera Rural
David Aguilar Juarez	Newspaper “El Universal”
Ariane Diaz Becerra	Newspaper “La Jornada”

Name	Organization
Erika Muller García	SEDEREK
Nuria Sefchovich	Financiera Rural
Fernando Castillo	Financiera Rural
David Gonzalez	Financiera Rural
Francisco Carbajal	Financiera Rural
Jose Ramòn	Financiera Rural
Eduardo Rivera	Financiera Rural
Elizabeth Carbo Campillo	Financiera Rural
Israel Victor Ballesteros	Financiera Rural

Some of the people who participated in the presentation are:

Table A5.2. List of participants

Name	Organization
Alejandra Espinosa	British Embassy
Andres Flores Montalvo	National Institute of Ecology
Antonio Ruiz García	ALPURA
Bernd Indlekofer	TuvRheinland
Darlene Frias Ruelas	Nu-3
Dolores Barrientos	Interamerican Development Bank
Gerardo Rojas Robles	Mexican Confederation of Porcine Industry
Jacqueline Sanchez	British Embassy
Jaime Arturo del Rio Monges	CDM-MEX
Julio Valle Pereña	Ministry of Energy
Katharina Siegmann	Interamerican Development Bank
María Teresa Crespo Chiapa	FOMECAR
Pamela Tadeo	MGM Innova
Paola del Rio	First Climate Group
Pedro Frausto	Environmental Fabrics Mexico
Siddharta Eduardo Bustamante	AMEG
Hector Edgar Huerfano	Newspaper “El Economista”
Sergio Mingramm	Financiera Rural
Octavio Pineda	Financiera Rural
Juan Garcia Heredia	Newspaper “El Sol de México”
Carmen Fernandez	Financiera Rural
Howard Avila Jimenez	Financiera Rural
David Aguilar Juarez	Newspaper “El Universal”

Name	Organization
Ariane Diaz Becerra	Newspaper "La Jornada"
Erika Muller García	SEDEREK
Nuria Sefchovich	Financiera Rural
Fernando Castillo	Financiera Rural
David Gonzalez	Financiera Rural
Francisco Carbajal	Financiera Rural
Eduardo Rivera	Financiera Rural
Elizabeth Carbo Campillo	Financiera Rural
Israel Victor Ballesteros	Financiera Rural

A questionnaire was developed by Financiera Rural and was delivered to the assistants at the end of the presentation in order to meet the assistant's comments and opinions concerning the PoA.

The assistants were invited to answer the following questions:

1. With reference to the information available and your knowledge about topics such as: environment, climate change, Kyoto Protocol and Clean Development Mechanism; please express briefly your opinion about the "Methane capture, combustion and possible electricity generation from AWMS in Mexico" Program.

2. Would you recommend private and public entities to develop GHG emissions reductions projects under the CDM scheme?

3. Do you consider that the Program will contribute to the social, economic, environmental and sustainable development of the region and Mexico?

4. Additional comments that you wish to express

All the assistants answered the questionnaire. The questionnaires are available upon request.