CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

CONTENTS

Annexes

NOTE:

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

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1,2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

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[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

>> Methane Capture, Combustion and Possible Electricity Generation from AWMS in Mexico –CPA (number)
Version 5
07/12/2012

A.2. Description of the small-scale CPA:

>>
The proposed small-scale CDM Programme Activity (SSC CPA) consists in the replacement of the current open anaerobic lagoon with a new closed anaerobic digester that will capture the generated biogas in order to utilize it as fuel for electricity generation, all of these activities installed under the Methane Capture, Combustion and Possible Electricity Generation from AWMS in Mexico (hereafter referred to as the PoA) across the host country.

This PoA project involves all Mexican territory with swine farms (market and breeding) and cattle farms generating a large amount of GHG emissions.

The CPA participant, (name of the CPA Participant), has taken voluntary initiative in participating in this PoA.

In the proposed CPA an anaerobic digester will be constructed, this anaerobic digester will be 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 and generation of biogas. Pre-project lagoons could be adapted to operate as anaerobic digesters or could be used as secondary open lagoons where the effluent of the new digester lagoons will be directed to.

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%[3]) 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:

1. Supply electricity to another consumer facility via national grid through a contractual arrangement as wheeling.

3 See: "Methane from integrated biological systems.pdf"

2. Sell it to the National Grid.

In the case of incise b) CERs from surplus of electricity sold to/via the National grid **will not be claimed.**

The proposed CPA falls within project activity **Scenario (A or B)** specified in the PoA DD, comprising a flaring system and an electricity generation system. {for scenario B; modify as applicable}

The biogas combustion system would consist of an enclosed, high-efficient flare, where the CH_4 oxidizes to CO_2, thus reducing GHG emissions. Commonly the flare is built with stainless steel, and is covered with insulation for the flame to operate at a high temperature, ensuring the destruction of methane; the insulation also helps protect other equipment from high temperatures.

Since produced biogas usually presents small concentration of hydrogen sulphide (H_2S), which is very corrosive, a scrubber system will be implemented in order to remove this gas as well as reduce the humidity of the biogas extracted, and prior to use or flaring.

In case of Scenario B, the technology for generating electricity would 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 generally be consumed at the local installations where the animal manure is generated. However, if a surplus power is generated, 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 CPA participant has considered .

AWMS equipment used in the project activity will be provided by (name of provider). Electricity generation systems will be provided by (name of provider).

Equipments from these providers can be used since they comply with the technical aspects required by Financiera Rural to participate in this PoA.

Personnel working at the farms will receive training and good practice guidance by the technology provider in order to ensure that the technology will be operated appropriately and successfully while guaranteeing efficient capture and flaring procedures.

In this way, the CPA project activity will contribute to local and national sustainable development.

A.3. Entity/individual responsible for the small-scale CPA:

>>

The entity responsible of the proposed CPA is (name of the CPA Participant)

A.4. Technical description of the small-scale CPA:

A.4.1. Identification of the small-scale CPA:

>>

A.4.1.1. Host Party:

>>

The host party for this CPA is Mexico

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

>>

The specific tagging of CPA (number) is given in the following table:

Table 1. CPA (number) **data**

Farm Name	Farm Owner	Number of animals and type of livestock	Town / State	GPS Coordinates	Anaerobic Digester ID Number

Figure 1. CPA Location

Next, a brief description of the farm(s):

{Brief description including: number of animals, type of animals, current manure management system, expected growth during the crediting period}

Table 2. {Name of the farm}**Sequential anaerobic lagoons dimensions**

Anaerobic Lagoon	Length (m)	Width (m)	Depth (m)
(number)			
(number)			

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

>>
(dd/mm/yyyy), or when construction related to the project activity starts; whichever occurs later (but not prior to the submission of the PoA-DD submitted to Global Stakeholders Consultation).
.

A.4.2.2. Expected operational lifetime of the small-scale CPA:

>>
The expected operational lifetime of the project is years, according to the technology provider.

A.4.3. Choice of the crediting period and related information:

Renewable crediting period;

A.4.3.1. Starting date of the crediting period:

>>
The starting date of a crediting period of this CPA shall be the date of its inclusion in the registered PoA or any date thereafter and the duration of the crediting period shall not exceed the end date of the PoA.

(dd/mm/yyyy) the date the CPA is included in the registered PoA.

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

>>

The duration of crediting period of any CPA is limited to the end of the PoA.

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

>>
The estimated amount of emission reduction is calculated according to section B.5.3.

Table 3. Estimated amount of emission reductions over crediting period

Year	Annual Estimation of Emission Reductions (tCO2e)
Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
...	...
Total Emission Reductions (tCO2e)	
Total Number of Crediting Years	
Annual Average over the Crediting Period of Estimated Reductions	

A.4.5. Public funding of the CPA:

>>
No public funding from Parties included in Annex I of the UNFCCC will be used in this CPA. The entity involved with the funds is the coordinating entity of the PoA, Financiera Rural.

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

>>
The compendium of guidance on the de-bundling for SSC project activities (EB54) is used to demonstrate that the SSC CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

According to EB54, Annex 13: Guidelines on assessment of debundling for SSC project activities (Version 03), article 8:

8. For the purposes of registration of a Programme of Activities (PoA),6 a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity,7 which satisfies both conditions (a) and (b) below:

(a) Has the same activity implementer as the proposed small scale CPA or has a coordinating or managing entity, which also manages a large scale PoA of the same technology/measure, and;
(b) The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

There is no other registered small-scale CPA of a PoA, an application to register another small-scale CPA of a PoA or another registered CDM project activity which:

a. Has Financiera Rural as the activity implementer, also Financiera Rural does not manage a small scale PoA of the same sectoral scope.
b. The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

>>
The SSC CPA is neither registered as an individual CDM project activity nor is it part of another registered PoA.
Information about each CPA compiled ensures that all CPAs in the proposed PoA are uniquely defined, thereby avoiding double counting of emissions reductions.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

>> Methane Capture, Combustion and Possible Electricity Generation from AWMS in Mexico

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA :

>>
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.*
   The proposed CPA is located in

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.*
   The proposed CPA participates voluntarily in the SSC-PoA without requiring financial help from Financiera Rural (and/or) receiving 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.*
   The proposed CPA considers the implementation of an anaerobic digester technology as animal waste management system, an enclosed flaring system and also considers the implementation of an electricity generation system, therefore, complies with the requirements stated in the PoA.

4. *SSC-CPAs will have anaerobic lagoons as baseline scenario treatment.*
   The proposed CPA has (number) anaerobic lagoon(s) as baseline treatment. {Optionally, describe the conditions of the anaerobic lagoon(s)}

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 project 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.
   The proposed CPA falls within the category of **Scenario (A or B)**, therefore it will follow the methodologies AMS-III.D. and AMS-I.D. Applicability criteria of AMS-III.D. and AMS-I.D. is/are analyzed in section B.5.2.

6. *A de-bundling check shall be assessed, according to Annex 13 of EB 54, for SSC-CPA to be included in the PoA.*
   A de-bundling check is realized in section A.4.6. following Annex 13 of EB 54.

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.*
   The proposed CPA is not registered as another CDM project activity. It is not part of any other PoA. There are no other PoAs in Mexico involving AWMS.

8. *SSC-CPAs shall have a project starting date after the PoA-DD is submitted to Global Stakeholders Consultation.*
   Starting date of the proposed CPA is (dd/mm/yyyy), or when construction related to the project activity starts.

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 Assesment (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.*
   The proposed CPA complies with all laws and regulations available. {If applicable, describe any environmental analysis performed}

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.*
    Demonstration through investment analysis is realized in section B.3.

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.*

Since this SSC-CPA falls within the category of **Scenario (A or B)**, it will stay within the small scale threshold criteria of the Type III (expected emission reductions of the project activity, in CERs per year<60,000 CERs per year), and it will stay within the small scale threshold criteria of the Type I (expected installed capacity for the project activity, in MW <15 MW).

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.*
This SSC-CPA {select one as applicable}:
☐ Does not involve funding from Annex I parties
☐ Involve funding from Annex I parties, but does not result in a diversion of official development assistance.

Since the proposed CPA fulfills the requirements it is clear that is eligible to participate in the PoA.

B.3. Assessment and demonstration of additionality of the small-scale CPA , as per eligibility criteria listed in the Registered PoA:

>> Financiera Rural is responsible for financing and implementing CPA- .

Therefore, all the barriers to implementation of the *Methane Capture, Combustion and Possible Electricity Generation from AWMS in Mexico*, provided in detail in the PoA-DD, apply to CPA- .

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 the CPA is demonstrated through the application of an investment comparison analysis. Considering the *Tool for the demonstration and assessment of additionality version 06.1.0,* investment analysis is realized using a relevant financial indicator such as IRR or NPV and considering that no debt is used for the project; therefore it follows a project IRR/NPV calculation. Net Present Value shall be calculated when project IRR could not be estimated.

{Modify as required for the investment analysis, as well as for the sensitivity analysis}

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

>> The PoA project involves all Mexican territory with swine farms (market and breeding) and cattle farms generating a large amount of GHG emissions.

This CPA is located in , within Mexican territory.

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

Table 4. Baseline and project emissions

	Source	Gas	Included?	Justification/Explanation

	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 energy consumption / generation	CO_2		If yes; ☐ Please tick if electricity is consumed from the grid ☐ Please tick if electricity is generated onsite in the baseline scenario.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from thermal energy generation	CO_2		If yes; ☐ Please tick if thermal energy generation is included in the project activity.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activity	Emissions from physical leakage	CH_4	Yes	The anaerobic digester is the major source of methane emissions. Minor CH_4 emissions from secondary anaerobic lagoon are accounted.
	Emissions from flaring biogas	CO_2	Yes	Emissions from the flaring or combustion of biogas
		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	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	Estimated according to AMS-III.F.
		CH_4	No	This is a negligible emission source. Excluded for simplification

	Source	Gas	Included?	Justification/Explanation
		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	Estimated according to AMS-III.D.
		N_2O	No	This is a negligible emission source. Excluded for simplification

The project boundary is defined in the following figure:

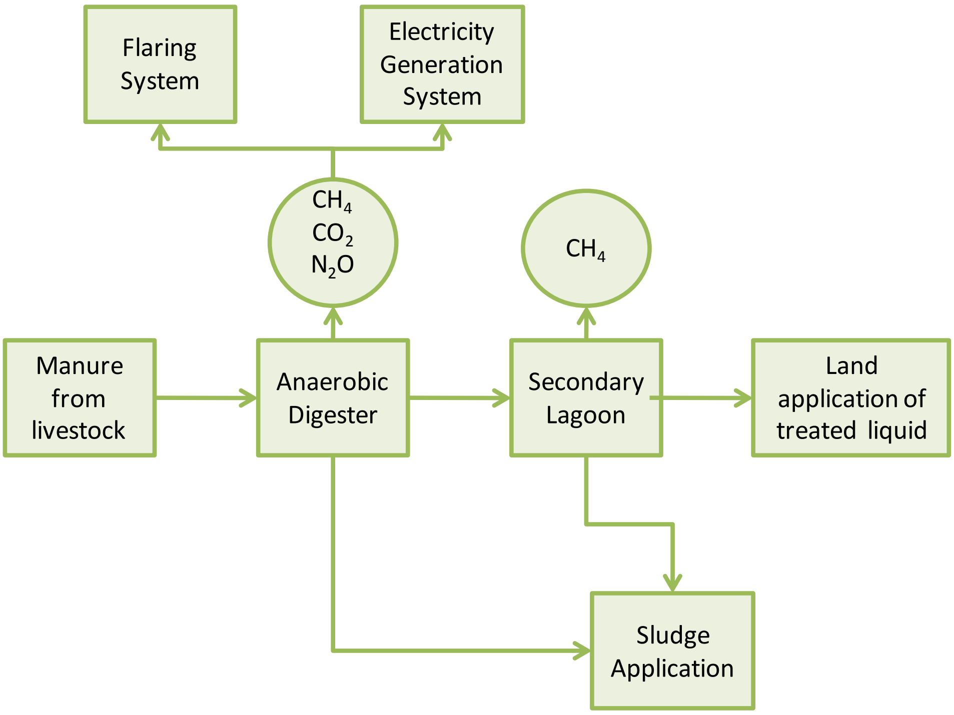

Figure (number). Project boundary

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

>>

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:	$\mathbf{D_{CH4}}$
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:	$\mathbf{MCF_j}$
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:	
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. Temperatures were obtained from , available at: Temperature applied is °C ({Name of the City/State} average temperature from {period evaluated})
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:	Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10
Value applied:	

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. The chosen value corresponds to: ☐ Developing countries (such as Latin America values) ☐ Developed countries (such as North America values) In case of developed countries values; the reason is that the farm(s) present characteristics as in developed countries, e.g.: • The genetic source originates from Annex I countries. • They use formulated feed rations (FFR) which are optimized for the animal stage of growth, category, and genetics of the animal type *LT* at the project farm(s); • The project specific animal weights are more similar to the IPCC default values.
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-8, page 81, and Table 10A-7, page 80, as indicated in AMS-III.D, p. 4.
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	Baseline volatile solid for livestock type *LT* will be determined according to the type of animals involved on each one of the project sites. The chosen value corresponds to: ☐ Developing countries (such as Latin America values) ☐ Developed countries (such as North America values) In case of developed countries values; the reason is that the farm(s) present characteristics as in developed countries, e.g.: • The genetic source originates from Annex I countries. • They use formulated feed rations (FFR) which are optimized for the animal stage of growth, category, and genetics of the animal type *LT* at the project farm(s); The project specific animal weights are more similar to the IPCC default values.
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:	
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-8, page 81, and Table 10A-7, page 80, as indicated in AMS-III.D, p. 4
Value applied:	
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 CPA participant
Value applied:	
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 of data 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 $BE_{ex-post}$ 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 CPA participant
Value of data applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	To be collected for each swine and cattle 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:	$\mathbf{N_{p,y}}$
Data unit:	Number
Description:	Number of animals produced annually of type *LT* for the year y
Source of data:	Livestock inventory system from CPA participant
Value of data 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:	$\mathbf{EF_{grid,OM,y}}$
Data unit:	tCO_2/MWh
Description:	Operating margin CO_2 emission factor for the project electricity system in year y
Source of data:	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 of data applied:	0.6293
Justification of the	-

choice of data or description of measurement methods and procedures actually applied:	
Any comment:	Value fixed for the 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:	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 of data applied:	0.3390
Justification of the choice of data or description of measurement methods and procedures actually applied:	-
Any comment:	Value fixed for the crediting period

Data/Parameter:	**$EF_{grid,CM,y}$ (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:	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 of data applied:	0.4841
Justification of the choice of data or description of measurement methods and procedures actually applied:	-
Any comment:	Value fixed for the crediting period

Data/Parameter:	**$CP_{i,j}$**
Data unit:	MW
Description:	Rated capacity of electrical equipment i used for project activity in year y
Source of data:	Equipment at site according to technology provider specifications
Value of data applied:	
Justification of the choice of data or	The values to be considered are the ones stated by the technology provider.

description of measurement methods and procedures actually applied:	
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:	$\boldsymbol{SPEC_{flare}}$
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) Range of temperature : Range of flow rate :
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.

B.5.2. Ex-ante calculation of emission reductions:

>>
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.

Methodology AMS-III.D.

This methodology is only applicable under the following conditions:

a. *The livestock population in the farm is managed under confined conditions;*
The proposed CPA's livestock population is managed under confined conditions.

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;*
In the proposed CPA, manure is not discharged into natural water resources.

c. *The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C;*
The proposed CPA's annual average temperature on the site is .

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;*
The proposed CPA has anaerobic lagoons as baseline treatment. The hydraulic retention time (HRT) of manure in the lagoons are days and lagoons have a depth of m[4].

[4] See Section A.4.1.2.

e. *No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario.*
   In the proposed CPA no destruction, combustion or gainful use of methane takes place in the baseline scenario {explain baseline situation}.

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;*
   In the proposed CPA, 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 and utilize it for electricity generation.

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.*
   In the proposed CPA, the storage time of the manure after removal from the barns does not exceed 45 days, {explain baseline situation}.

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).
.

In addition, as mentioned in 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. {Explain the situation that will prevail in the project activity situation}.

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).*
   Not applicable for this Scenario (A) / The proposed CPA's 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 {select as applicable}

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 proposed CPA.

d. Combined heat and power (co-generation) systems are not eligible under this category.
Not applicable for this Scenario (A) / The proposed CPA will only generate electricity; therefore this restriction is no applicable to the project activity {select as applicable}

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.

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 fulfillled.

Ex-ante calculation of project emissions

This section aims to provide a transparent *ex-ante* calculation of project emissions, baseline emissions (or, where applicable, direct calculation of emission reductions) and leakage emissions expected during the crediting period, applying all relevant equations.

The methodology AMS-III.D. procedures describe how emission reductions from methane recovery in animal manure management systems are to be determined.
Emission reductions are calculated *ex-ante* using data from the CPA operator and default values from the methodology and the IPCC Guidelines 2006 respectively.

The table below illustrates all default values and data sources used to determine the baseline emissions:

Table (number)**. Default values used to determine baseline emissions for {animal type LT}**

Variable	Description	Chosen Value	Source
$W_{default}$	Default average animal weight of a defined population		
$VS_{default}$	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population		
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system @ °C		
$B_{o,LT}$	Maximum methane producing potential of the volatile solid generated for animal type LT		

{Repeat the Table above for each animal type *LT* involved in the proposed CPA}

Baseline emissions

Baseline emissions (BE_y) are calculated following option (a), therefore the baseline emissions are calculated as follows:

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

Since no country-specific data is available for the parameter $B_{O,LT}$ and *VS*, the values were selected from the 2006 IPCC Guidelines. These values shall correspond to (developed/developing countries).

Fraction of manure handled in baseline animal manure management system ($MS\%_{Bl,j}$) adopted a value of % since (explain prevailing situation).

The following table shows the figures from month-year to month-year farm inventories regarding the number of animals and animal weight.

Table (number). Number of animal produced annually by type ($N_{p,y}$) and average animal weight at the project site (W_{site}) from month-year to month-year

Farm	Finishers		Gilts		Nursers		Sows	
	W_{site} (kg)	$N_{p,y}$ (animals)	W_{site} (kg)	$N_{p,y}$ (animals)	W_{site} (kg)	$N_{p,y}$ (animals)	W_{site} (kg)	$N_{p,y}$ (animals)

Farm	Dairy Cattle		Other Cattle	
	W_{site} (kg)	$N_{p,y}$ (animals)	W_{site} (kg)	$N_{p,y}$ (animals)

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

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

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

As an example, the results of the mentioned baseline emission calculations for "{animal type LT}" in (name) farm are summarized below:

Table (number). Fixed parameters

Variable	Value	Units	Description
GWP_{CH4}	21	tCO_2/tCH_4	Global Warming Potential (GWP) of CH_4
D_{CH4}	0.00067	t/m^3	CH_4 density
UF_b =	0.94	(dimensionless)	Model correction factor to account for model uncertainties

Table (number). Example for ex-ante estimation of GHG baseline emissions at (name of farm).

Variable	Units	j = (Farm Name)
MCF_j	%	
$B_{o,LT}$	m^3CH_4/kg dm	
$N_{LT,y\ (2009)}$	Animals	
$VS_{LT,y}$	kg/animal	
$MS\%_{BI,j}$	%	
Product	m^3CH_4/yr	
Baseline emissions	**tCO_2e/yr**	

Project activity emissions

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

a) Physical leakage of biogas emissions in the AWMS:

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

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

Since the proposed CPA will have sequential treatment stages, emissions from the next treatment stage are then calculated with the following equation:

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

Table (number). Used values for ex-ante estimation of project emissions from physical leakage in the secondary treatment.

Variable	Units	Value
W_{site} =	kg	
$W_{default}$ =	kg	
$VS_{default}$ =	kg dm/animal/day	
RVS	%	
n_{dy} =	days	
$VS_{LT,y}$	kg/animal	

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

Table (number). Total project emissions from physical leakage in the treatments

Variable	Units	Physical leakage of biogas emissions in the AWMS	Physical leakage of biogas emissions in the secondary treatment
$B_{o,LT}$	m^3CH_4/kg dm		
$N_{LT,y\ (2009)}$	Animals		
$VS_{LT,y}$	kg/animal		
$MS\%_{BI,j}$	%		
Leakage	m^3CH_4/yr		
Project emissions	**tCO_2e/yr**		

b) 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 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 [5]:

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

Where:

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

The components present in the residual gas (biogas) produced at anaerobic digesters are mainly CH_4 and CO_2.[6] It can be assumed that a typical biogas composition consists of 60 to 70% of CH_4[7]. However, for

[5] Following equation was proposed by the Project developer

[6] 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.

[7] U.S. EPA. Managing Manure with Biogas Recovery Systems: Improved Performance at Competitive Cost, AgStar Program. (2006) 3.

ex-ante estimation and according to the tool´s simplified approach[8], it was assumed that the residual gas composition consists of 60% CH_4 in volume and 40% N_2.

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%.

As mentioned earlier, the proposed CPA considers electricity generation; therefore, part of the biogas produced through anaerobic digestion will be utilized as fuel for electricity generation.

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

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.

From the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream",* 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):

Option	Flow of gaseous stream	Volumetric fraction
A	Volume flow - dry basis	dry or wet basis[9]
B	Volume flow . wet basis	dry basis
C	Volume flow . wet basis	wet basis
D	Mass flow . dry basis	dry or wet basis
E	Mass flow . wet basis	dry basis
F	Mass flow . wet basis	wet basis

For this SSC-CPA, it has been selected option **A/B/C/D/E/F** to determine the mass flow of methane in the biogas.

Determination of the absolute humidity of the gaseous stream

[8] *"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)..

[9] Flow measurement on a dry basis is not feasible at reasonable costs for a wet gaseous stream, so there will be no difference in the readings for volumetric fraction in wet basis analyzers and dry basis analyzers and both types can be used indistinctly for calculation Options A and D.

The absolute humidity is a parameter required for Options B and E. It can be determined from measurement of the moisture content (Option 1), or by assuming the gaseous stream is dry or saturated in a simplified conservative approach (Option 2). For the purpose of the simplification of the monitoring, **the CPA-DD shall follow Option 2** (assuming the gaseous stream is dry or saturated in a simplified conservative approach).

Option 2: Simplified calculation without measurement of the moisture content

This option provides a simple and conservative approach to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation[10].

Since the purpose of the use of this tool is to calculate further project emissions from flaring gases, it is conservative to assume that the gaseous stream is dry overestimated (applicable for calculating project emissions), **then $m_{H2O,t,db}$ is assumed to equal to 0 (zero)**.

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 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.

Next, it is described the steps and the guidance for option **(A/B/C/D/E/F)** selected:

{Modify as Option selected, following the steps of the selected option of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 02.0.0}

As an example, the results the application of the previous equations for the calculation of $F_{CH4,m}$ for farm (name) are summarized below:

Table (number). Determination of methane mass flow rate in the residual gas calculations

Variable	Value	Units
$F_{CH4,m} = F_{i,t}$		kg/min
($V_{t,db}$ / $V_{t,wb,n}$)		m^3/min
($v_{i,t,db}$ / $v_{i,t,wb}$)		m^3 gas CH_4 / m^3 gas
($\rho_{i,t}$ / $\rho_{i,n}$)		kg gas CH_4 /m^3 gas CH_4

STEP 2- Determination of flare efficiency.

[10] An assumption that the gaseous stream is saturated is conservative for the situation that the mass flow of greenhouse gas *i* is underestimated (applicable for calculating baseline emissions). Conversely, an assumption that the gas stream is dry is conservative for the situation that the greenhouse gas i is overestimated (applicable for calculating project emissions).

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*

As an example, the results these calculations for (name)farm are summarized below:

Table (number). Calculation of project emissions from flaring biogas

Variable	Value	Units
$PE_{flare,y}$ =		tCO_2e
$F_{CH4,RG,m}$ =		Kg/min
$\eta_{flare,m}$ =		%
GWP_{CH4} =	21	tCO_2e/tCH_4

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

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), 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)
$EC_{CO2,grid,y}$	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 case 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:

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

Table (number). Project activity relevant electrical equipment

Equipment	Demand (HP)[11]	Operational Time per year (h)
....	...	...

According to AMS-I.D, the Emission Factor $EF_{CO_2,grid,y}$ 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 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) [12].

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.

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[11] 1 HP = 0.746 kW

[12] 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

(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 (number). Power generation in Mexico[13]

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
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 (number). 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:*

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

- *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 {for the crediting period or 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 (number). Electricity exportation and importation[14] (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:

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

Table (number). 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 (number). Fossil fuel consumption for power generation.[15]

	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
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 (number). CO_2 emission coefficient of each fuel

Fuel	CO_2 emission factor[16] (tCO_2/TJ)
Residual fuel oil	77.40
Natural gas	56.10
Diesel	74.10
Coal	94.60

[15] 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

[16] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 1, Table 1.4, Pages 1.23 and 1.24.

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 (number). 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 (number). 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 run (GWh)	178,368	171,656	182,364
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 (number). Identified five power units[17]

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.

[17] See: Mexican_Grid_EF_June_2011.xls

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

Table (number). New power plants installed[18]

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	1 and 2	750.0	HYD	1,829,000	0.00%	1,829,000	9,462,701

[18] 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)
	Alcaine)							
	Coyotepec (LFC)	2	32.0	GT	-	1.00%	0	9,462,701
	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

Year	Plant	Unit	Capacity (MW)	Technology	Power generation (MWh)	Self consumption	Net power generation (MWh)	Cumulative power generation (MWh)
	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
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 $AEG_{SET-\geq 20\%}$, 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 (number) are used.

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

Table (number). CO_2 emissions of the sample group of power plants[19]

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

[19] 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)
		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
	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

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)
	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
	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 (number). 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:

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

d) Emissions due to incremental transport distances

Project emissions due to incremental transport distances ($PE_{y,transp}$) 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.

$$PE_{y,transp} = (Q_y / CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment} / CT_{y,treatment}) * DAF_{treatment} * EF_{CO2}$$

{Explain the situation that will prevail in the proposed CPA}.

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:

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

{Explain the situation that will prevail in the proposed CPA}.

__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:

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

For Scenario B, 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 otherwise been 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.

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

Emission Factor is calculated in a transparent and conservative manner according to the procedures prescribed in the *'Tool to calculate the Emission Factor for an electricity system'*

Procedures for the calculation of the grid emission factor are presented above in the current section.

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

{Explain the situation that will prevail in the proposed CPA}.

Project emissions

For this renewable energy project activity, $PE_y = 0$

B.5.3. Summary of the ex-ante estimation of emission reductions:

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Table (number). Estimated amount of emission reductions over crediting period

Year	**Estimation of project activity emissions (tonnes of CO_2 e)**	**Estimation of baseline emissions (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of overall emission reductions (tonnes of CO_2 e)**
Year 1				

Year	**Estimation of project activity emissions (tonnes of CO_2 e)**	**Estimation of baseline emissions (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of overall emission reductions (tonnes of CO_2 e)**
Year 2				
Year 3				
Year 4				
Year 5				
Year 6				
Year 7				
...	...	...	...	...
Total (tonnes of CO_2 e)				

B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

>>

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	Value depending on each farm manure production.
Description of measurement methods and procedures to be applied:	Biogas flow will be continuously measured and electronically recorded. Biogas flow will also be measured to determine the flare efficiency default values. The continuously monitored data will be downloaded every 15 days, and archived electronically. 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	Temperature sensor

used:	
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 fulfilll 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 fulfilll 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 fulfilll 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 used:	Monitored from project participant(s)
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 used:	Default value according to the Tool *"Project emissions from flaring gases"*.
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:	Farm 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 biodigester is described as follows): Instrument used: ________ Procedure(s): ________ Project Proponent considers realizing visual inspections in order to check that there are no leaks and also that 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 registers from this visual inspections in which will account the days the leaks remained unfixed, according to these registers, 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:	$\mathbf{N_{LT,y}}$
Data unit:	Number
Description:	Annual average number of animals of type *LT* in year *y*
Source of data used:	Farm inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Calculated from data on the different farm inventories. Calculation according to AMS-III.D. version 18.
Description of measurement methods and procedures to be applied:	The value will be estimated according the inventory of each farm. Data will be 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 farm.
Value of data applied for the purpose of	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.

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The value will be estimated according to the inventory of each farm. Data will be transferred to a spreadsheet on a yearly 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 farm. 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:	Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81 from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	kg for kg for
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	N/A

be applied:	
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:	Table 10A-4 page 77, Table 10A-5 page 78, Table 10A-7 page 80 and Table 10A-8 page 81 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10
Value of data applied for the purpose of calculating expected emission reductions in section B.5	kg/animal/day for kg/animal/day for
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	$Vs_{default}$ values for calculation of $VS_{LT,y}$ will be obtained from the most recent IPCC Guidelines for National Greenhouse Gas Inventories.
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:	N/A
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 to be used:	Farm 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:	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 farm
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:	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.
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	80%

emission reductions in section B.5	
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%[20] was chosen.
QA/QC procedures to be applied:	N/A
Any comment:	-

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:	**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.

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

QA/QC procedures to be applied:	Feed intake level will be monitored for each farm 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:	**GS**
Data unit:	N/A
Description:	Genetic source
Source of data to be used:	Farms inventory
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Genetic source of the production operations livestock originate from an Annex I Party
Description of measurement methods and procedures to be applied:	Genetic source will be monitored each time animal type *LT* 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 farm 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:	$\mathbf{MS\%_l}$
Data unit:	%
Description:	Fraction of volatile solids (%) handled by storage device *l*
Source of data to be used:	Inventory farm
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:	The proper procedures will be implemented in order to fulfilll the data accuracy and control requirements. Data will be transferred to a spreadsheet. The proper procedures will be implemented in order to fulfilll the data accuracy and control requirements.
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:	$\mathbf{AI_l}$
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:	Farms 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 farm. 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:	$EG_{PJ,j,y}$
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:	**$V_{t,wb}$**
Data unit:	m³ 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:	**$V_{t,db}$**
Data unit:	m³ 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 applied:	Volumetric flow measurement should always refer to the actual pressure and temperature. Calculated based on the wet basis flow measurement plus water concentration measurement. 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:	**$v_{i,t,db}$**

Data unit:	m^3 gas *i*/m^3 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:	m^3 gas *i*/m^3 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	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,

applied:	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:	**$M_{t,db}$**
Data unit:	kg/h
Description:	Mass flow of the gaseous stream in time interval *t* on a dry basis
Source of data to be	Monitored data (e.g. flow meters) from the CPA participant.

used:	
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:	$\mathbf{P_t}$
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:	**$v_{k,t,db}$**

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 ($MM_{t,wb}$) 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:	**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::	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.
QA/QC procedures to be applied:	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
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).

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:

☐ Please tick if this information is provided at the PoA level. In this case sections C.2. and C.3. need not be completed in this form.

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

>> The environmental impacts and benefits of this activity are limited to the local farms in Mexico. Some of these positive environmental effects to be achieved by the PoA implementation are:

- An overall decrease in the amount of GHGs emitted into the atmosphere
- Improvement in the quality of the water that will be used for irrigation by the farms' crops and neighbours
- Avoiding potential dumping of waste into clean sources of water

The proposed program can contribute to local sustainable development due to its positive effects on the local environment by improving air quality (i.e., reducing the emission of volatile organic compounds (VOCs) and odour) and will set the stage for future on-farm projects (i.e., changes in land application practices) that will have an additional positive impact on GHG emissions with attendant potential for reducing groundwater contamination problems. Regarding the social well being the program will help creating direct and indirect employment opportunities for skilled/semi-skilled manpower, during the design, fabrication, erection, commissioning and operation of the project activity. Indirect employment will be generated for the equipment supplier, contractors and technical consultants.

There are no significant negative impacts; only benefits are relevant, such as:

- Reduction in GHG emissions
- Reduction in foul odours ensuing from methane emissions to the atmosphere
- Reduction of insects and other vector diseases
- Increase of local bio-safety
- Reduction of disease dissemination

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

>> 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[21].

Environmental legislation associated with livestock operations in Mexico is framed by the "General Law for Ecological Equilibrium and Environmental Protection" (LGEEPA by its Spanish acronym), 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 in the soil or are infiltrated in the sub-soil should comply with the necessary conditions to prevent water and soil contamination. To that end, the National Water Commission (CONAGUA by its Spanish acronym), in coordination with state

[21] Available at: www.diputados.gob.mx/LeyesBiblio/pdf/148.pdf

and municipal governments, are 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[22], which sets the maximum contamination limits for wastewater discharge in water sources and other national resources; and "NOM-002-SEMARNAT-1996[23], which establishes the maximum contaminant limits for wastewater discharges into urban and municipal sewage systems.

It is not a requirement for swine or cattle producers to implement an anaerobic digester technology as a measure related to wastewater treatment.[24] The analysis of manure management practices in Mexico identified no regulations that obligate livestock owners to invest in a manure biogas control system. In consequence, the prevailing practice for manure treatment is the usage of open anaerobic lagoons, which lead to higher GHG emissions than the project activity.

SECTION D. Stakeholders' comments

>>

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

☒ Please tick if this information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

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

>>

D.3. Summary of the comments received:

>>

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

>>

[22] See "NOM-001-ECOL.pdf". Also available at:
http://www.semarnat.gob.mx/leyesynormas/Normas%20Oficiales%20Mexicanas%20vigentes/NOM-001-ECOL.pdf

[23] See "NOM-002-ECOL.pdf". Also available at:
http://www.semarnat.gob.mx/leyesynormas/Normas%20Oficiales%20Mexicanas%20vigentes/NOM-ECOL-002.pdf

[24] http://www.cmp.org/apoyos/gestionambiental.htm (10 Mar. 2010)

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

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

Annex 4

MONITORING INFORMATION

Complementary information can be found in CDM SSC-PoA-DD format, sections A.4.4.2.and E.7.2 .