**Component project activity design document form**

**(Version 09.0)**

*Complete this form in accordance with the instructions attached at the end of this form.*

| BASIC INFORMATION | |
|---|---|
| **Title of the CPA** | CPA-1: Methane recovery and combustion with renewable energy generation from anaerobic animal manure management systems under the Land Bank of the Philippines' (LBP) Carbon Finance Support Facility |
| **Scale of the CPA** | ☐ Large-scale<br>☒ Small-scale |
| **Version number of the CPA-DD** | 14 |
| **Completion date of the CPA-DD** | 29/05/2020 |
| **Title and UNFCCC reference number of the registered CDM PoA** | PoA 5979: Methane recovery and combustion with renewable energy generation from anaerobic animal manure management systems under the Land Bank of the Philippines's (LBP) Carbon Finance Support Facility |
| **Title and reference number of the corresponding generic CPA** | 5979-P1-00XX-CP1: Methane recovery and combustion with renewable energy generation from anaerobic animal manure management systems under the Land Bank of the Philippines' (LBP) Carbon Finance Support Facility |
| **Coordinating/managing entity** | Land Bank of the Philippines (LBP) |
| **Host Party** | Republic of the Philippines |
| **Applied methodologies and standardized baselines** | AMS-III.D. version 21, Methane recovery in animal manure management systems<br>AMS-I.F version 3, Renewable electricity generation for captive use and mini-grid |
| **Sectoral scopes** | Sectoral scope 13: Waste handling and disposal<br>Sectoral scope 1: Energy industries (renewable / non-renewable sources) |
| **Estimated amount of annual average GHG emission reductions** | **36,692 $tCO_2$** |

## SECTION A. Description of component project activity (CPA)

### A.1. Purpose and general description of CPA

(a) The location of the CPA: Marcela Farms is located in the Province of Bohol at Barangay Lourdes in town of Cortes, Philippines.

(b) The technologies/measures to be employed and/or implemented by the CPA: The CPA replaces an open anaerobic manure management system with an anaerobic digestion system with methane recovery and combustion in the Philippines. Through construction of the wastewater methane recovery systems, the CPA will reduce GHG emissions from methane compared to the emissions that would have occurred with the open anaerobic system. With the installation of electricity generation units, GHG emissions will be further reduced by replacing grid electrical power sourced from fossil fuel plants with renewable energy from the recovered methane.

(c) The project boundary; The spatial extent of the project boundary encompasses the physical and geographical site of the methane recovery facility and of the renewable generation unit.

(d) The baseline scenario; Prior to the project implementation, Marcela Farms implemented an open anaerobic treatment system that comprised a series of cement reactors and an anaerobic lagoon. The enclosed reactors released the methane to the atmosphere at a venting tank while the anaerobic lagoons released methane directly into the atmosphere.

(e) The annual average GHG emission reductions is **36,692 $tCO_2$**, and the total GHG emission reductions for the chosen crediting period is **256,849 $tCO_2$**.

2. A full description of 1(a)–(e) above are provided in sections A.2, A.3, B.2, B.3 and B.4 below, respectively.

3. The small-scale project Type I, and Type III are applicable to the CPA in accordance with the corresponding generic CPA.

4. Corresponding to the generic CPA, AMS-III.D. version 21, Methane recovery in animal manure management systems and AMS-I.F version 3, Renewable electricity generation for captive use and mini-grid are indicated for this CPA.

### A.2. Location of CPA

Marcela Farms is located in the Province of Bohol at Barangay Lourdes in town of Cortes.
Latitude: 9.690278 Longitude: 123.870833


Figure A.1: Map and situation of Bohol in the archipelago of the Philippines

## A.3. Technologies/measures

The CPA replaces an open anaerobic manure management system with an anaerobic digestion system with methane recovery and combustion. The project consists of the following:

Anaerobic digestion system:

The waste produced from the piggery will be treated in an enclosed anaerobic system that will prevent the release of methane. Marcela will use a system which consists of two lagoons run in parallel that are covered by 1 mm HDPE to collect the biogas and prevent atmospheric gases from leaking into the tank and with a bottom liner of HDPE. The anaerobic digestion system might be modified during the crediting period.

Biogas recovery and combustion system:

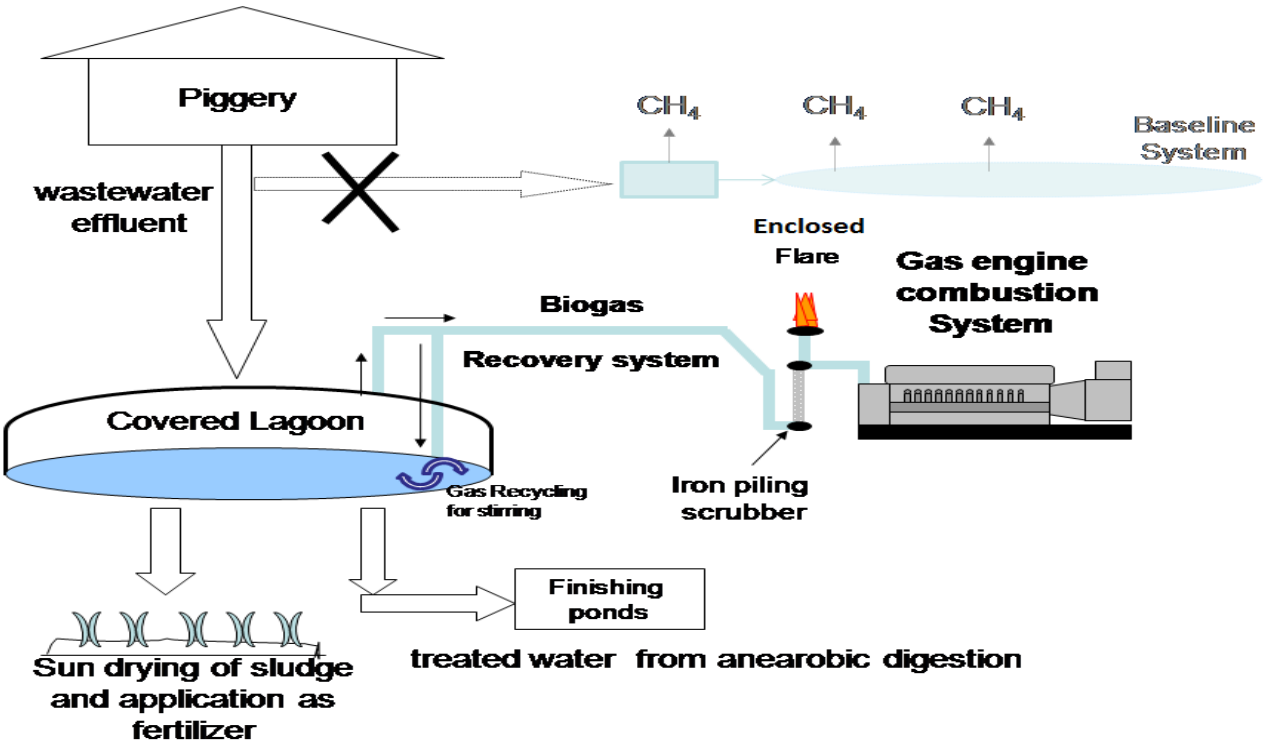
The proposed CPA includes a system of collecting the biogas produced by the reactor and combusting it. Each of the two lagoon systems to be used includes a blower system, piping to collect the gas, a scrubber containing iron pilings to remove $H_2S$. The system will include tubing to allow a portion of the gas to be recycled into the biogas digesters for agitation. The biogas will be combusted in gas engines and a flare. The biogas recovery system might be modified during the crediting period.

Sludge management system:

The treatment system will produce sludge. The sludge will be removed from a drainage pipe at the bottom of the biodigester by using a vacuum pump and placed in a flat layer for sun drying and applied to soil as fertilizer in a manner that ensures aerobic conditions and avoids methane emissions.

Other components:

After the anaerobic digester, digested wastewater will be discharged to aeration and settling ponds. All power to run the project activity will be provided by the gas engine and as a result no fossil fuel based electricity or other fuel will be used.




### A.4. Coordinating/managing entity

Land Bank of the Philippines (LBP)

### A.5. Parties and CPA implementers

| Parties involved | CPA implementers | Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No) |
|---|---|---|
| The Philippines (host) | Marcela Farms, Inc.<br>(Private entity) | No |

### A.6. Public funding of CPA

There is no public funding involved in the CPA

### A.7. History of CPA

a. This is to confirmation that:
   i. The proposed CPA is neither registered as a CDM project activity nor included in another registered CDM PoA;
   ii. The proposed CPA is not a project activity that has been deregistered.

b. This is to declare that:
   i. The proposed CPA was not a CPA that has been excluded from a registered CDM PoA;
   ii. A registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) does not exist in the same geographical location as the proposed CPA.

### A.8. Debundling

The proposed CPA is not a de-bundled component of a large project activity as the activity implementer, Marcela Farms, has not registered or applied to register another small-scale CPA of any PoA, and has not registered a CDM project activity.

## SECTION B. Application of methodologies and standardized baselines

### B.1. References to methodologies and standardized baselines

The CPA will consider the Small-Scale Methodology AMS III.D version 21.0: Methane Recovery in Animal Manure Management Systems (EB 96) and the small-scale Methodology AMS I.F. version 3.0: Renewable electricity generation for captive use and mini-grid (EB 81).
The combination of these two approved methodologies has been approved by the CDM EB on its 59th meeting, paragraph 11a), and included in the list of combinations of methodologies that can be applied in a PoA without a pre approval.

Both methodologies are available at the UNFCCC website at the following links respectively:
https://cdm.unfccc.int/methodologies/DB/H9DVSB24O7GEZQYLYNWUX23YS6G4RC
https://cdm.unfccc.int/methodologies/DB/9KJWQ1G0WEG6LKHX21MLPS8BQR7242.
The CPA will also use the tools: "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" version 3.0, Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation version 3.0, Project and leakage emissions from anaerobic digesters version 2.0, and "Project emissions from flaring" version 3.0.

These mentioned tools are available at the UNFCCC website at the following links:
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v3.0.pdf
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-14-v2.pdf.

### B.2. Project boundary, sources and greenhouse gases (GHGs)

The spatial extent of the project boundary encompasses the physical and geographical site of the methane recovery facility and of the renewable generation unit. In terms of GHG emissions, the project is limited to $CH_4$ emissions from leakage, and $CO_2$ and $CH_4$ from the generator set or flare. As the project activity includes the generation of renewable energy and does not include many electrical appliances except for blowers of minimal electricity consumption that is to be supplied by the system itself, the anthropogenic emission from use of fossil fuel-based electricity is considered to be zero.

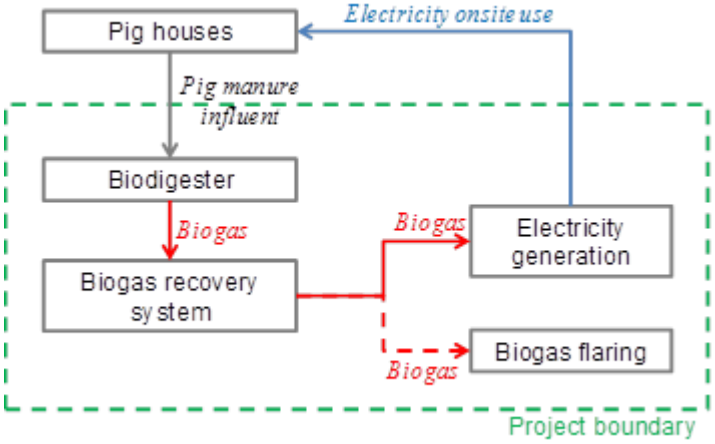
In line with AMS III.D, the following sources and gases are included in the project boundary:

| Source | | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Anaerobic digestion in the open lagoons | $CO_2$ | Excluded | Excluded for simplification. |
| | | $CH_4$ | Included | The major source of emissions in the baseline. |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| | Emissions from Electricity | $CO_2$ | Excluded | Excluded for simplification. This is conservative. |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative. |

| Source | | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| | Consumption from the Grid | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| | Emissions from heat generation | $CO_2$ | Excluded | Excluded for simplification. This is conservative |
| | | CH4 | Excluded | Excluded for simplification. This is conservative |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| Project activity | On-site fossil electricity or fuel use due to the project activity | $CO_2$ | Excluded/ Included | It will be [excluded/included] since it has been demonstrated by the CPA that the level of anthropogenic emissions from use of fossil fuel for electricity use can be considered [negligible/ significant]. |
| | | $CH_4$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |
| | | $N_2O$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |
| | Physical leakage | $CO_2$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |
| | | $CH_4$ | Included | Estimated with conservative assumptions based on AMS-III.D. |
| | | $N_2O$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |
| | Flaring | $CO_2$ | Included | Calculated with the flaring gas tool. |
| | | CH4 | Included | Calculated with the flaring gas tool. |
| | | $N_2O$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |

In line with AMS I.F, the following sources and gases are included in the project boundary:

| Source | | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| | Emissions from Electricity consumption from the Grid | $CO_2$ | Included | The major source of emissions in the baseline. |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative |
| Project activity | On-site fossil electricity or fuel use due to the project activity | $CO_2$ | Excluded | Engine used will not require fossil fuel and/or fossil fuel-based electricity during start-up or at any stage of generation. |
| | | $CH_4$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |
| | | $N_2O$ | Excluded | Excluded for simplification. Emissions assumed to be very small. |




## B.3. Establishment and description of baseline scenario

Prior to the project implementation, Marcela farms implemented an open anaerobic treatment system that comprised a series of cement reactors and an anaerobic lagoon. The reactors included 8 enclosed cement reactors and 3 open reactors each measuring 20 m x 3 m and 3 meters deep.

The chambers held the waste for 5-7 days before sending to the open lagoon that has an area of about 7,000 square meters and a depth of 10-15 m where it was stored indefinitely.

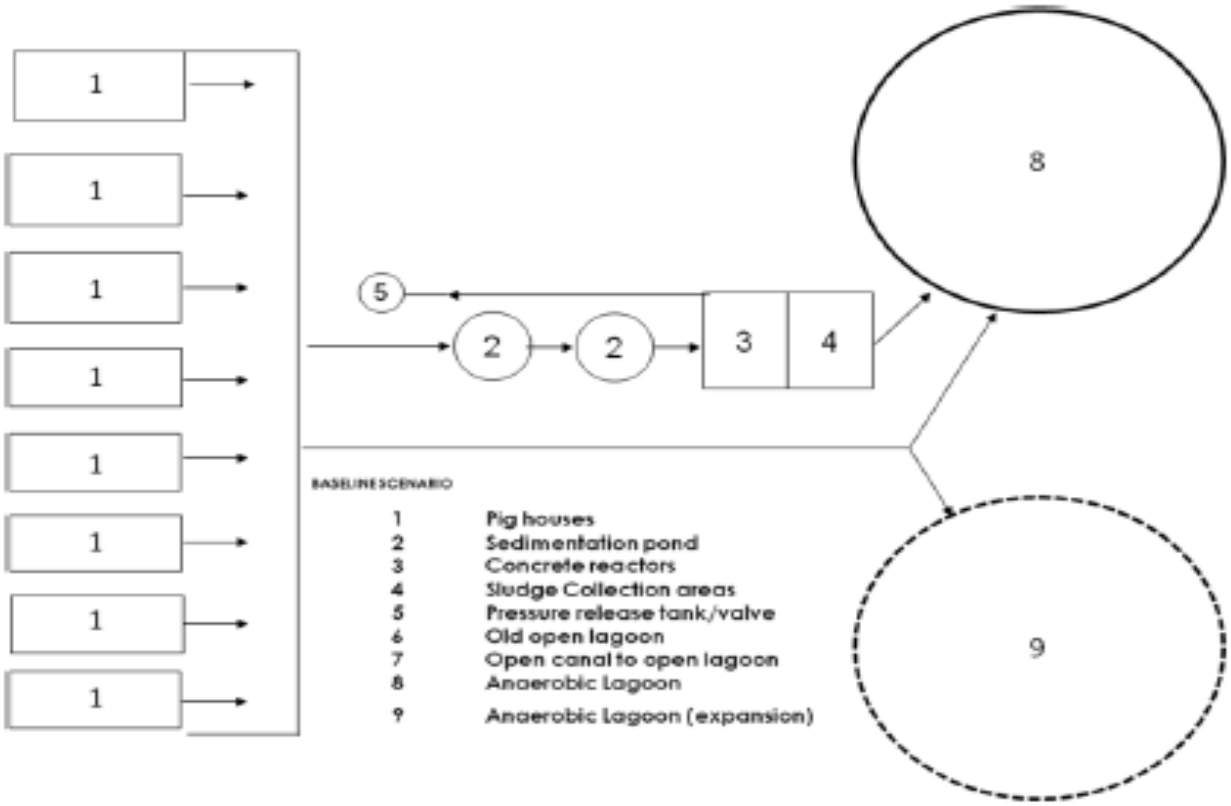
The enclosed reactors released the methane to the atmosphere at a venting tank while the anaerobic lagoons released methane directly into the atmosphere.

Cement Reactors Venting Tank



Open Anaerobic Lagoon


The piggery has operated its wastewater treatment system since 1998 without any environmental violations. The continued operation of the treatment technology for the piggery would require costs for operation and maintenance of the system and to accommodate the expansion of the piggery population the digging of an additional open lagoon.




## B.4. Estimation of emission reductions

### B.4.1. Explanation of methodological choices

The emissions reductions were estimated ex-ante using the equations and procedures outlined in the PoA-DD and detailed in section B.4.3. below. These parameters were optimized to the situation of the Marcela CPA. In particular:

*Use of sequential manure management systems*: Marcela Farms' manure management system will not be sequential and therefore no special calculation (using RVS) for treatment stages is necessary.

*Emissions from power*: The calculation of the emissions from power will depend on the source of energy used in powering the system. In this case, all power used in the project activity will come from the biogas fuel produced by the project activity and therefore it is not necessary to calculate electricity use or fuel use by the project activity or use the associated emissions factors to do so.

*Use of Annex I country VS and Bo:* Marcela Farms will use VS and Bo values from Annex I countries and therefore the genetic source of the livestock will need to be monitored.
*Adjustment of VS for site specific animal weight:* The default VS will be adjusted for site specific animal weight.

*2015-2017 National Grid Emission Factor Operating Margin Methodology:* The national grid emission factor published by the Philippine Department of Energy found in link https://www.doe.gov.ph/electric-power/2015-2017-national-grid-emission-factor-ngef for the Luzon-Visayas electricity grid is used.

### B.4.2. Data and parameters fixed ex ante

| Data/Parameter | $W_{site}$ |
|---|---|
| Data Unit | kg |
| Description | Average site animal weight for defined population (market and breeding) |
| Source of data | Marcela Farms data recording system. |
| Value(s) applied | 62 for market; 185 for breeding |
| Choice of data or Measurement methods and procedures | Used for calculating $VS_{LT,y}$ adjusted for animal weight. Based on average weight of breeding and market pigs based on the pig census for Marcela |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| Data/Parameter | $W_{default}$ |
|---|---|
| Data Unit | kg. |
| Description | Default animal weight for defined population (market and breeding). |
| Source of data | IPCC default Tables 10 A-7 & A-8, of IPCC 2006 Vol 4 Chapter 10 Emissions from livestock and manure management |
| Value(s) applied | 50 for market; 198 for breeding. |
| Choice of data or Measurement methods and procedures | Based on Western European breeds as justified under the methodology and described in this section under the parameters $B_{o,LT}$ and $VS_{LT,y}$. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| Data / Parameter | $N_{da,y}$ |
|---|---|
| Data Unit | Days |
| Description | Number of days animal is alive in the farm in the year “y” |
| Source of data | Based on farm records and estimates. |
| Value(s) applied | 150 days for market; 365 for breeders |
| Choice of data or Measurement methods and procedures | Used in the calculation of $N_{LT,y}$ as per AMS III.D. |
| Purpose of data | Calculation of baseline emissions |
| Choice of data or Measurement methods and procedures | Used in the calculation of $N_{LT,y}$ as per AMS III.D. |

| Data / Parameter | $N_{p,y}$ |
|---|---|
| Data Unit | Number |
| Description | Number of animals produced annually of type “LT” for the year “y” |
| Source of data | Farm records |

| | |
|---|---|
| Value(s) applied | N breed 4,127<br>N market 115,016 |
| Choice of data or Measurement methods and procedures | Based on actual farm data |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| **Data / Parameter** | **$MCF_j$** |
|---|---|
| Data Unit | Fraction |
| Description | Annual methane conversion factor (MCF) for the baseline animal waste management system "j" |
| Source of data | Table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10, "Uncovered Anaerobic Lagoon" |
| Value(s) applied | 0.8 |
| Choice of data or Measurement methods and procedures | Corresponds to 'uncovered anaerobic lagoon' manure management systems with a mean annual temperature of greater than 26°C. According to the Philippine Atmospheric Geophysical & Astronomical Services Administration (PAGASA[1]), mean annual temperature is >26°C. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| **Data / Parameter** | **$B_{o,LT}$** |
|---|---|
| Data Unit | $m^3$ $CH^4$/kg dm |
| Description | Maximum methane producing potential of the volatile solid generated for animal type "LT". |
| Source of data | The genetic source of the production operations livestock originates from an Annex I country, and the CPA will use default values corresponding to Annex I species found in Table 10A-7 (market animals) & 10A-8 (breeding animals) of IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, Chapter 10. |
| Value(s) applied | $B_{o,breed}$ = 0.45 ; $B_{o,market}$ = 0.45 |
| Choice of data or Measurement methods and procedures | The use of Annex I species defaults for $B_o$ is justified based on the requirements of AMS III.D as follows: (i) Marcela farms uses formulated feed rations (FFR) which are optimized for the various stages of animal growth, category, weight gain, productivity and genetics evidence of which is available for review by the DOE.<br>(ii) The project's specified animal weight (48 kg for market pigs and 200 kg for breeding pigs) is more similar to developed country IPCC default values (50 kg for market and 198 kg for breeding) than to Asian default values (28 kg for market and breeding). |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

[1] For details and record of annual mean temperature http://kidlat.pagasa.dost.gov.ph/cab/stats2.htm

| Data / Parameter | $VS_{LT,y}$ |
|---|---|
| Data Unit | Kg dm/animal/year |
| Description | Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year). |
| Source of data | (i) Default values: The genetic source of the production operations livestock originates from an Annex I country, and the CPA will use default values corresponding to Annex I species found in Table 10A-7 (market animals) & 10A-8 (breeding animals) of IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, Chapter 10.<br>(ii) Adjustment for animal weight: VS is adjusted for animal weight according to the calculations outlined in AMS III.D and shown in section B.4.3. |
| Value(s) applied | $VS_{,breed}$ = 156.5; $VS_{,market}$ = 136.8; |
| Choice of data or Measurement methods and procedures | The use of Annex I species defaults for VS is justified based on the requirements of AMS III.D as follows:<br>(i) Marcela farms uses formulated feed rations (FFR) which are optimized for the various stages of animal growth, category, weight gain, productivity and genetics evidence of which is available for review by the DOE (ii) The project's specified animal weight (62 kg for market pigs and 185 kg for breeding pigs) is more similar to developed country IPCC default values (50 kg for market and 198 kg for breeding) than to Asian default values (28 kg for market and breeding). |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Calculations are shown in Section B.4.3. |

| Data / Parameter | FE |
|---|---|
| Data unit | % |
| Description | Flare efficiency |
| Source of data | Based on defaults defined in tool for "Project emissions from flaring" |
| Value(s) applied | 80 |
| Choice of data or Measurement methods and procedures | As per the Tool for "Project emissions from flaring" the value will be set depending on the following conditions:<br>For enclosed flares, Flare efficiency is 90% if<br>(a) the temperature of the flare and the flow rate of the residual gas to the flare is within the manufacturer's specification for the flare in minute m; and<br>(b) The flame is detected in minute m.<br>Otherwise flare efficiency, m is 0%.<br>For enclosed flares that are defined as low height flares, the flare efficiency shall be adjusted, as a conservative approach, by subtracting 10 percentile points. For example, the default value applied shall be 80%, rather than 90%.<br><br>In the case of open flares, the flare efficiency in the minute m is 50% when the flame is detected in the minute m ($Flame_m$), otherwise $FE_{,m}$ is 0%. |

| | |
|---|---|
| Purpose of data | Calculation of project emissions |
| Additional comment | Enclosed flare is a low height flare since its height is between 10 to 2 times of its diameter |

| **Data / Parameter** | **$SPEC_{flare}$** |
|---|---|
| Data unit | Temperature - °C<br>Flow rate or heat flux - kg/h or m3/h<br>Maintenance schedule - number of days |
| Description | Manufacturer's flare specifications for temperature, flow rate and maintenance schedule |
| Source of data | Flare manufacturer |
| Value(s) applied | Temperature > 500 $^{o}$C and/or flow above 20 Nm3/hr<br>Flow rate max to 100 Nm3/hr<br>Maintenance schedule-burners/flare must be cleaned at least every three months |
| Choice of data or Measurement methods and procedures | The flare specifications set by the manufacturer for the correct operation of the flare for the following parameters:<br>(a) Minimum and maximum inlet flow rate, if necessary, converted to flow rate at reference conditions or heat flux;<br>(b) Minimum and maximum operating temperature; and<br>(c) Maximum duration in days between maintenance events [not applicable for Option A]. |
| Purpose of data | Calculation of project emissions |
| Additional comment | Only applicable in case of enclosed flares. The maintenance schedule is not required if Option A is selected to determine flare efficiency of an enclosed flare |

| **Data / Parameter** | **$GWP_{CH4}$** |
|---|---|
| Data Unit | $tCO_2$-e/$tCH_4$ |
| Description | Global warming potential for $CH_4$ |
| Source of data | IPCC |
| Value(s) applied | 25 |
| Choice of data or Measurement methods and procedures | |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| **Data / Parameter** | **$MS\%_{Bl,j}$** |
|---|---|
| Data Unit | Fraction |
| Description | Fraction of manure handled in the baseline animal manure management system "j" |

| | |
|---|---|
| Source of data | Based on baseline system operation. |
| Value(s) applied | 1.0 |
| Choice of data or Measurement methods and procedures | All manure was treated in the open lagoons. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| **Data / Parameter** | **$W_{CH4,y}$** |
|---|---|
| Unit | mass fraction |
| Description | Methane content in biogas in year “y” |
| Source of data | Based on options provided in AMS III D |
| Value(s) applied | 60% |
| Choice of data or Measurement methods and procedures | As per the methodology. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| **Data / Parameter** | **$nd_{,y}$** |
|---|---|
| Unit | Days |
| Description | Number of days in year “y” where the treatment plant is operational |
| Source of data | Based on farm records |
| Value(s) applied | 365 |
| Choice of data or Measurement methods and procedures | If farm has no operations on a given day it needs to be documented (e.g. logbook) and taken into account for the calculation of $BE_{ex\ post}$ |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| **Data / Parameter** | **$EG_y$** |
|---|---|
| Unit | MWh |
| Description | Net quantity of electricity estimated to be generated in the project plant during the year y |
| Source of data | Estimated based on project design and as outlined in this CPA-DD |
| Value(s) applied | 3,323 MWh/yr for 2019-2020; 4,526 MWh/yr for 2021-2026 |
| Choice of data or Measurement methods and procedures | Based on requirements of AMS I.F and dependent on the particulars of the CPA; whether addition on capacity, retrofit, or otherwise as per AMS I.F. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | None |

| Data / Parameter | $EF_{CO2,y}$ |
|---|---|
| Unit | $tCO_2$ / MWh |
| Description | Emission factor of the Luzon-Visayas grid |
| Source of data | National grid emission factor from the Philippines Department of Energy (DOE). See https://www.doe.gov.ph/electric-power/2015-2017-national-grid-emission-factor-ngef for complete details |
| Value(s) applied | 0.6265 |
| Choice of data or Measurement methods and procedures | Calculated using tool from Published 2015-2017 OM and BM by the Philippine Department of Energy for the Luzon-Visayas grid. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | |

### B.4.3. Ex ante calculation of emission reductions

*Ex ante* emission reductions of the project activity were calculated using the following formula:

$$PER_y = MER_y + GER_y$$

Where:

$MER_y$ Emission reduction in year "y" ($tCO_2$-e) from methane recovery (as per AMS III.D)
$GER_y$ Emission reduction in year "y" ($tCO_2$-e) from renewable electricity generation (as per AMS I.F)

*Ex ante* emissions from methane recovery were calculated using the following formula:

$$MER_y = MBE_y - (MPE_y + MLeakage_y)$$

Where:

| | |
|---|---|
| $MER_y$ | Emission reduction in year "y" ($tCO_2$-e) |
| $MBE_y$ | Baseline emissions in year "y" ($tCO_2$-e) |
| $MPE_y$ | Project emissions in year "y" ($tCO_2$-e) |
| $MLeakage_y$ | Project leakage in year "y" ($tCO_2$-e) |

Baseline emissions ($MBE_y$), project emissions ($MPE_y$) and leakage ($MLeakage_y$) were calculated based on AMS III D as shown below:

***Baseline Emissions from methane recovery and destruction ($MBE_y$)***

Baseline emissions are calculated using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity. The following formula was used:

$$MBE_y = GWP_{CH4} * D_{CH4} * Uf_b * \sum j,LT\ MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j}$$

Where:

| | |
|---|---|
| *MBEy* | baseline emissions in year "y" ($tCO_2$-e/yr) |
| $GWP_{CH4}$ | Global Warming Potential (GWP) of $CH_4$ |
| *DCH4* | $CH_4$ density (0.00067 t/$m^3$ at room temperature (20 ºC) and 1 atm pressure). |
| *LT* | Index for all types of livestock |
| *j* | Index for animal waste management system |
| $MCF_j$ | Annual methane conversion factor (MCF) for the baseline animal waste management system "j" in percentages (digester in project scenario). |
| $B_{0,LT}$ | Maximum methane producing potential of the volatile solid generated for animal type "LT" ($m_3$ $CH_4$/kg dm) |
| $N_{LT,y}$ | Annual average number of animals of type "LT" in year "y" (numbers) calculated using the formula below. |
| $VS_{LT,y}$ | Volatile solids for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year) |

$MS\%_{BL,j}$ Fraction of manure handled in baseline animal manure management system "j"
$Uf_b$ Model correction factor to account for model uncertainties (0.94)

The annual average animal population ($N_{LT,y}$) in this CPA is determined from a pig census and calculated using equation (4) of AMS-IIID ver. 21.

$N_{LT,y} = N_{da,y} * (N_{p,y} /365)$

where:

$N_{da,y}$ Number of days animal is alive in the farm in the year "y" (numbers)
$N_{p,y}$ Number of animals produced annually of type "LT" for the year "y" (numbers)

*Annual average animal population* ($N_{LT,y}$) for breeding and market pigs is determined from pig census for Marcela using equation (4), :

Population projections (based on January- July 2019 population)

| **Breeding Swine** | | | | **Market Swine** | |
|---|---|---|---|---|---|
| Sow | | Boar | | Finisher | |
| Average population | Average weight (kg) | Average population | Average weight (kg) | Average population | Average weight (kg) |
| 4,019 | 183 | 108 | 248 | 47,267 | 62 |

*Calculation of VS:* VS are calculated by adjusting default VS using site specific animal weights as follows:

$VS_{site,LT,y} = (W_{site} / W_{default}) \times VS_{default} * nd_y$

Where:

$VS_{site, LT,y}$ Adjusted volatile solid excretion for livestock "LT" entering the animal manure management system in year "y" (on a dry matter weight basis, kg dm/animal/year)
$W_{site}$ Average site animal weight for defined population, in kg
$W_{default}$ Default average animal weight for defined population, in kg.
$VS_{default}$ Default value (IPCC) for the volatile solid excretion per day on a dry- matter basis for defined livestock population, in kg-dm/animal/day
$nd_y$ Number of days in year "y" where the treatment plant was operational

| **Parameter** | **$W_{site}$ (kg)** | **$W_{default}$ (kg)** | **$VS_{default}$ (kg-dm/animal /day)** | **$Nd_y$ (days)** | **Calculated value ($VS_{LT,y}$) (kg dm/animal/year)** |
|---|---|---|---|---|---|
| **$VS_{breed,y}$** | 184.5 | 198 | 0.46 | 365 | 156.5 |
| **$VS_{market,y}$** | 62 | 50 | 0.3 | 365 | 136.8 |

*Summary of Calculation of Annual Baseline Emissions*: Summarized below are the constants and outcome of the calculation from the formula above for MBEy.

| Parameter | **Value** |
|---|---|
| $GWPCH_4$ | 25 |
| $DCH_4$ | 0.00067 |
| Ufb | 0.94 |
| MCFj | 0.80 |
| Bo breed,y | 0.45 |
| Bo market,y | 0.45 |
| VS breed,y | 156.5 |
| VS market,y | 136.8 |
| N breed,y | 4,127 |
| N market, y | 47,267 |
| MS%Bl, j | 1.0 |
| **MBEy** | **40,323 $tCO_2$-e/yr** |

***Project Emissions from methane recovery and destruction ($MPE_y$)***
Project emissions are calculated using the following formula:

$MPE_y = PE_{PL,,y} + PE_{flare,y} + PE_{power,y}$

Where:
$MPE_y$ Project emissions in year "y" ($tCO_2e$)
$PE_{PL,y}$ Emissions due to physical leakage of biogas in year "y" ($tCO_2e$)
$PE_{flare,y}$ Emissions from flaring of the biogas stream in the year "y" ($tCO_2e$)
$PE_{power,y}$ Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year "y" ($tCO_2e$)

*Emissions due to physical leakage ($PE_{PL,y}$)* are estimated as per AMS III.D as 10% of: the maximum methane producing potential of the manure fed into the management systems implemented by the project activity. As the Marcela Farms system is not a sequential treatment system no adjustment (RVS) is necessary to account for sequential stages.

$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum j,LT\ B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,j}$

| Parameter | **value** |
|---|---|
| GWPCH4 | 25 |
| DCH4 | 0.00067 |
| Bo breed,y | 0.45 |
| Bo market,y | 0.45 |
| VS breed,y | 156.5 |
| VS market,y | 136.8 |
| N breed,y | 4,127 |
| N market, y | 47,267 |
| MS%Bl, j | 1.0 |
| **$MPE_{PL,y}$** | **5,362 $tCO_2$-e/yr** |

*Emissions due to flaring ($PE_{flare,y}$)* The Marcela Farms system will flare gas when the energy generator is not in use. The ex-ante project emissions are calculated using the calculated amount of gas that will be sent to the flare during downtime of the energy generator. Ex-post, these will be calculated using the methodological tool "Project emissions from flaring" through the following formula:

$PE_{flare} = \Sigma\ FCH_{4,RG,m} * (1 - FE_{,m}) * GWP_{CH4} / 1000$

Where:

| | |
|---|---|
| $F_{CH4,RG,m}$ | is the mass flow rate of methane in residual gas in minute, m |
| FE, *m* | is the flare efficiency in minute m |
| $GWP_{CH4}$ | is the GWP of methane according to IPCC. |

Mass flow of methane in the residual gas in the minute *m*

$$F_{CH4\ RG,m} = FV_{RG,m} * fv_{CH4,RG,m} * \rho_{CH4,n}$$

Where:

| | |
|---|---|
| $FV_{RG,m}$ | Volumetric flow rate of the residual gas in dry basis at normal ($Nm^3$) conditions in minute, m (also volumetric flow rate of gas going to the flare) |
| $fv_{CH4,RG,m}$ | Volumetric fraction of methane in the residual gas on dry basis in min, *m* (this corresponds to $w_{CH4}$). |
| $\rho_{CH4,n}$ | Density of methane at normal conditions (0.716 $kg/m^3$) |

As per methodology AMS III.D. (version 21 paragraph 6), "If recovered methane is used to power auxiliary equipment of the project it should be taken into account accordingly, using zero as its emission factor." Thus, when the project activities include the generation of electricity using the recovered methane to power auxiliary equipment i.e. blowers of minimal consumption, electricity generation will be taken into account and zero will be used as its emission factor. The power is derived from the biogas system which emits no greenhouse gases relative to the baseline.

$PE_{power,y} = EC_{AE} * 0$

In the event that there is not enough gas, or for any other reason the energy generator is not operating, the project activity shall monitor the energy consumption from the grid $EC_{PJ,y,}$ and shall consider it as project activity emissions, where the emission factor will be that for the Philippine grid it is connected to. Where:

$PE_{power,y} = EC_{PJ,y} * EF_y$

*Emission for power use ($PE_{power,y}$)* is conservatively estimated at 14 from the average yearly value reported of the first verification report for Marcela .The power is derived from the biogas system which emits no greenhouse gases relative to the baseline.

***Total project emissions from methane recovery and destruction ($MPE_y$)***

| Parameter | Value |
|---|---|
| $PE_{PL,,y}$ | 5,362 |
| $PE_{flare,y}$ | 920 |
| $PE_{power,y}$ | 14 |
| ***MPEy*** | **6,296 $tCO_2$-e/yr** |

***Leakage from methane recovery and destruction ($MLeakage_y$)***

The Marcela CPA does not involve replacement of equipment and therefore leakage is zero. There are no leakage emissions associated with storage of digestate as determined by following the relevant procedure in the methodological tool "Project and leakage emissions from anaerobic digesters".

**The annual emission reduction from methane recovery** is estimated as:

$MER_y = MBE_y - (MPE_y + MLeakage_y)$
$MER_y = 40,323\ tCO_2\text{-}e/yr - (6,296\ tCO_2\text{-}e/yr + 0)$
$MER_y = 34,027\ tCO_2\text{-}e/yr$

***Ex ante* emissions from renewable electricity generation** are calculated using the following formula:

$GER_y = GBE_y - (GPE_y + GLeakage_y)$

Where:

| | |
|---|---|
| $GER_y$ | Emission reduction in year "y" ($tCO_2$-e) from electricity generation |
| $GBE_y$ | Baseline emissions in year "y" ($tCO_2$-e) from renewable electricity generation |
| $GPE_y$ | Project emissions in year "y" ($tCO_2$-e) from renewable electricity generation |
| $GLeakage_y$ | Project leakage in year "y" ($tCO_2$-e) from renewable electricity generation |

Baseline emissions ($GBE_y$), project emissions ($GPE_y$) and leakage ($GLeakage_y$) from renewable electricity generation are to be calculated based on AMS I. F as shown below:

***Baseline Emissions from electricity generation ($GBE_y$)***

Baseline emissions related to the use of the recovered methane for electricity generation that displaces electricity from a fossil fuel-based electricity distribution system are equivalent to the amount of electricity (MWh/yr) produced by the project activity multiplied by the emission factor ($tCO_2$/MWh) of the relevant electrical grid.

$GBE_y = (EG_y - EG_{baseline}) * EF_{CO2,\ y}$

Where:

| | |
|---|---|
| $GBE_y$ | Baseline emissions in year y ($tCO_2$) from renewable electricity generation |
| $EG_y$ | Electricity generated by the project in year y (MWh/yr) |
| $EG_{baseline}$ | Baseline electricity supplied to the grid in case of modified or retrofit units (MWh/yr) |
| $EF_{CO2,y}$ | Baseline emissions factor ($tCO_2$-e/MWh) |

*Electricity generated by the project ($EG_y$)* where estimated based on the rated capacity of 1 x 300 kW and 1 x 280 kW gas engines (with a backup engine 1 x 280 kW) that will be used for electricity generation utilizing the recovered methane. The engines are assumed to run 24 hours a day, (365-n) days a year, where n=24 is the amount of days that the generator is expected to be on maintenance, for a total of 8,184 hours a year at an operating rate of 70%. The total annual amount of electricity displaced from the grid (until 2020) by the project activity is estimated as:

$EG_y = 1 * 0.3\ MW * 70\% * 8,184 hours + 1 * 0.28 MW * 70\% * 8,184 hours$
$EG_y = 3,322.7\ MWh / year$

In the future (estimated starting 2021), there is a plan to use 2 x 395 kW gas engines that will be used for electricity generation utilizing the recovered methane. The engines are assumed to run 24 hours a day, (365-n) days a year, where n=24 is the amount of days that the generator is expected to be on maintenance, for a total of 8,184 hours a year at an operating rate of 70%. The other engines will be used as back up engines.

The average annual $EG_y$ for the crediting period is estimated at 4,253 MWh.

*Baseline electricity generated ($EG_{baseline}$)* is considered zero as the project does not involve any modification / retrofit or addition to an existing generating facility.

$EG_{baseline} = 0$ MWh

*Baseline emissions factor ($EF_y$)* are from the published National Grid Emission Factor by the Philippine Department of Energy using the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'. The electricity system considered is the Luzon-Visayas grid.

$EF_y$ = 0.6265 $tCO_2$-e/MWh

The total annual baseline emission to be considered in electricity generation for 2019-2020 is estimated as:

GBEy = (3,322.7 MWh - 0 MWh) * 0. 0.6265 $tCO_2$-e/MWh

GBEy = 2,082 $tCO_2$-e / year

The average annual baseline emission for the crediting period is estimated at 2,664 $tCO_2$-e / year.

***Project emission from electricity generation ($GPE_y$)***

As per methodology AMS III.D. (version 21 paragraph 6), "If recovered methane is used to power auxiliary equipment of the project it should be taken into account accordingly, using zero as its emission factor." Thus, when the project activities include the generation of electricity using the recovered methane to power auxiliary equipment i.e. blowers of minimal consumption, electricity generation will be taken into account and zero will be used as its emission factor.

$PE_{power,y}$ = $EC_{AE}$ * 0

In the event that there is not enough gas, or for any other reason the energy generator is not operating, the project activity shall monitor the energy consumption from the grid $EC_{PJ,y,}$ and shall consider it as project activity emissions, where the emission factor will be that for the Philippine grid it is connected to. Where:

$PE_{power,y}$ = $EC_{PJ,y}$ * $EF_y$

***Leakage from electricity generation ($GLeakage_y$)***

As per AMS-I.F version 3 paragraph 25,"General guidance on leakage in biomass project activities shall be followed to quantify leakages pertaining to the use of biomass residues". [not applicable] . There is no leakage to be considered as the energy generating equipment is not transferred equipment from another activity
The annual emission reduction by the generation of electricity from recovered methane that displaces fossil fuel based electricity from the grid is estimated as:

$GER_y$ = $GBE_y$ - ($GPE_y$ + $GLeakage_y$)
$GER_y$ = 2,664 $tCO_2$-e - (0 + 0)
$GER_y$ = 2,664 $tCO_2$-e / year

**The total annual emission reduction of the project activity is estimated as:**

$PER_y$ = $MER_y$ + $GER_y$
$PER_y$ = 34,027 $tCO_2$-e/yr + 2,664 $tCO_2$-e/year
**$PER_y$ = 36,692 tCO2-e/yr**

### B.4.4. Summary of ex ante estimates of emission reductions

| Year | Baseline emissions (t $CO_2e$) | Project emissions (t $CO_2e$) | Leakage (t $CO_2e$) | Emission reductions (t $CO_2e$) |
|---|---|---|---|---|
| 01/06/2019 to 31/12/2019 | 24,859 | 3,691 | 0 | 21,169 |
| 2020 | 42,406 | 6,296 | 0 | 36,110 |
| 2021 | 43,159 | 6,296 | 0 | 36,864 |
| 2022 | 43,159 | 6,296 | 0 | 36,864 |
| 2023 | 43,159 | 6,296 | 0 | 36,864 |
| 2024 | 43,159 | 6,296 | 0 | 36,864 |
| 2025 | 43,159 | 6,296 | 0 | 36,864 |
| 01/01/2026 to 31/05/2026 | 17,855 | 2,605 | 0 | 15,250 |
| **Total** | 300,917 | 44,070 | 0 | 256,847 |
| **Total number of crediting years** | 7 | | | |
| **Annual average over the crediting period** | 42,988 | 6,296 | 0 | 36,692 |

## B.5. Monitoring plan

### B.5.1. Data and parameters to be monitored

| **Data / Parameter:** | **$BG_{burnt,y}$** |
|---|---|
| Data unit: | $Nm^3$ |
| Description: | Biogas flared or combusted in year “y” |
| Source of data: | flow meters on site |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | The amount of biogas recovered and fueled, flared or used gainfully shall be monitored ex post, using flow meters. If the biogas flared and fueled (or utilized) is continuously monitored separately, the two fractions can be added to determine the biogas recovered. In that case, recovered biogas need not be monitored separately. The system should be built and operated to ensure that there is no air ingress into the biogas pipeline. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place, and on the same basis (wet or dry) If default value for methane content is used, this will be reported on dry basis. |
| Monitoring frequency: | Annually, based on continuous flow measurement with accumulated volume recording (e.g. hourly/daily accumulated reading) |
| QA/QC procedures | Flow meters shall be subject to regular maintenance, testing and calibration.<br>Calibration will be done as per the equipment’s manufacturer specifications. |
| Purpose of data | Calculation of baseline emissions |

| | |
|---|---|
| Additional comment | Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider applying the flare efficiency to the portion of the biogas used for energy, if separate measurements of the respective flows are not performed. When the amount of methane that is combusted for energy and that is flared is separately monitored, a destruction efficiency of 100% can be used for the amount that is combusted for energy<br>Data will be kept for two years after the end of the crediting period.<br>Alternatively, if the CPA utilizes the recovered methane for power generation and if no flow meter is installed on site, this parameter will not be reported for monitoring. |

| **Data / Parameter:** | **$FV_{RG,m}$** |
|---|---|
| Data unit: | $Nm^3$ |
| Description: | Parameter related to project emissions from flaring of the residual gas stream in year y -Volumetric flow rate of the residual gas in dry basis at normal conditions in minute, m; also volumetric flow rate of gas going to the flare |
| Source of data: | Flare flow meter, or if combined, total biogas flow meter on site |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | Used to calculate $PE_{flare,y}$. As per the tool "Project emissions from flaring" |
| Monitoring frequency: | Annually, based on continuous flow measurement with accumulated volume recording (e.g. hourly/daily accumulated reading) |
| QA/QC procedures: | Flow meters shall be subject to regular maintenance, testing and calibration. |
| Purpose of data | Calculation of project emissions |
| Additional comment: | Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider applying the flare efficiency to the portion of the biogas used for energy, if separate measurements of the respective flows are not performed. Data will be kept for two years after the end of the crediting period. |

| **Data / Parameter:** | **T** |
|---|---|
| Data unit: | $^oC$ |
| Description: | Temperature of the biogas |
| Source of data: | Project implementer |
| Value(s) applied | - |
| Measurement methods and procedures: | Measured continuously. No separate monitoring is necessary when using flow meters that automatically measure the temperature and pressure, expressing biogas volumes in normalized cubic meters |
| Monitoring frequency: | Monitored continuously |

| | |
|---|---|
| QA/QC procedures: | Measuring instruments shall be subject to a regular maintenance and testing regime, based on the manufacturer/supplier's recommendations |
| Purpose of data | Calculation of baseline emissions |
| Additional comment: | Alternatively, if the CPA utilizes the recovered methane for power generation and if no flow meter is installed on site, this parameter will not be reported for monitoring.<br>Data will be kept for two years after the end of the crediting period |

| **Data / Parameter:** | **P** |
|---|---|
| Data unit: | Pa |
| Description: | Pressure of the biogas |
| Source of data: | Project implementer |
| Value(s) applied | - |
| Measurement methods and procedures: | Measured continuously. No separate monitoring is necessary when using flow meters that automatically measure the temperature and pressure, expressing biogas volumes in normalized cubic meters |
| Monitoring frequency: | Monitored continuously. |
| QA/QC procedures: | Measuring instruments shall be subject to a regular maintenance and testing regime, based on the manufacturer/supplier's recommendations |
| Purpose of data | Calculation of baseline emissions |
| Additional comment: | Alternatively, if the CPA utilizes the recovered methane for power generation and if no flow meter is installed on site, this parameter will not be reported for monitoring.<br>Data will be kept for two years after the end of the crediting period |

| **Data / Parameter:** | **FE** |
|---|---|
| Data unit: | % |
| Description: | Flare efficiency in the year "y" |
| Source of data: | Default will be used as per the Tool "Project emissions from flaring" |
| Value(s) applied | 80 |

| | |
|---|---|
| Measurement methods and procedures: | As per the Tool for "Project emissions from flaring" the value will be set depending on the following conditions:<br>For enclosed flares<br>0.9 If (a)the temperature of the flare and the flow rate of the residual gas to the flare is within the manufacturer's specification for the flare in minute m; and<br>(b) The flame is detected in minute m.<br>0 otherwise.<br>Otherwise flare efficiency, m is 0%.<br>For enclosed flares that are defined as low height flares, the flare efficiency shall be adjusted, as a conservative approach, by subtracting 10 percentile points. For example, the default value applied shall be 80%, rather than 90%.<br><br>For open flares,<br>0.5 flare efficiency in the minute m is 50% when the flame is detected in the minute m<br>0 otherwise |
| Monitoring frequency: | Continuous |
| QA/QC procedures: | Regular maintenance shall be carried out to ensure optimal operation of flares as per manufacturer/supplier recommendations. |
| Purpose of data | Calculation of project emissions |
| Additional comment: | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter:** | **$T_{EG,m}$** |
|---|---|
| Data unit: | $^{o}C$ |
| Description: | Temperature in the exhaust gas of the enclosed flare in minute *m* |
| Source of data: | Measurements by farm owners. |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance.<br>Flare manufacturers must provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare.<br>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 manufacturer's specifications for temperature |
| Monitoring frequency: | Once per minute |
| QA/QC procedures: | Temperature measurement equipment should be replaced or calibrated in accordance with their maintenance schedule<br>. |
| Purpose of data | Calculation of project emissions |

| | |
|---|---|
| Additional comment: | Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue.<br>Monitoring of this parameter is applicable in case of enclosed flares. 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: | Project participants |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | Measure using a fixed installation optical flame detector: Ultra Violet detector or Infra-Red or both |
| Monitoring frequency: | 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: | Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations |
| Purpose of data | Calculation of project emissions |
| Additional comment: | Applicable to all flares |

| **Data / Parameter:** | $nd_y$ |
|---|---|
| Data unit: | Days |
| Description: | The number of days that the animal manure management system was operational. |
| Source of data: | Recorded on farm based on actual operation. |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | If any farm has no operations on a given day it needs to be documented (e.g. logbook) and taken into account for the calculation of BEex post |
| Monitoring frequency: | Annually, based on daily records and monthly aggregation |
| QA/QC procedures: | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comment: | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter:** | $MS\%_{i,y}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Fraction of manure handled in system i in project activity in year y |
| Source of data: | Recorded on farm based on actual operation. |

| | |
|---|---|
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | If animal manure is treated in different treatment systems manure weight delivered to each system shall be directly measured or alternatively manure volume can be measured together with the density determined from representative sample (90/10 precision). The quantity of animal manure from different farms and different animal types shall be recorded separately for cross-check. Recording of the baseline animal manure management system where the animal manure would have been treated anaerobically is also required |
| Monitoring frequency: | Annually, based on daily measurement and monthly aggregation |
| QA/QC procedures: | - |
| Purpose of data | Calculation of baseline emissions ex-post |
| Additional comment: | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter** | **$N_{p,y}$** |
|---|---|
| Data Unit | Number |
| Description | Number of animal produced annually of type “LT” for the year *y* |
| Source of data | Farm records |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures | Based on animal census in each farm |
| Monitoring frequency | Annually, based on monthly records. |
| QA/QC procedures | Cross checked against indirect information (records of sales and food purchases for example). |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter** | **$N_{da,y}$** |
|---|---|
| Data Unit | Days |
| Description | Number of days animal is alive in the farm in the year “y” |
| Source of data | Farm recorded data keeping system |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures | As per farm records |
| Monitoring frequency | Continuously, aggregated as required for the period used for the verification of the PoA |
| QA/QC procedures | Cross checked records for sale of animals |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter:** | **$W_{site}$** |
|---|---|
| Data unit: | Kg |
| Description: | Average animal weight of the farm’s livestock population. |
| Source of data: | Farm recorded data keeping system |

| | |
|---|---|
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures: | Weighed on site. The weight will be monthly monitored with the scale installed at the farm by project owner<br>The entire population will be weighed or alternately sampling procedures may be used to estimate this variable as per the latest "Standard for sampling and surveys for CDM project activities and Programmes of Activities", using a 90/10 confidence/precision as the criteria for reliability of sampling efforts for small-scale project activities. Stratified random sampling approach will be preferred. The sample size will be determined depending on the animal population at each CPA. |
| Monitoring frequency: | Annually |
| QA/QC procedures: | Every technician to monitor the sampled animal type will fill in the date and signature; the monitor forms will be collected, summarized and kept by the project participant. In addition, the scale will be calibrated annually. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment: | If current practice of farm is not to weigh sow/boar to avoid stressing them, an alternative method used by the farm to determine weights with same sample size required will be used. Data will be kept for two years after the end of the crediting period |

| **Data / Parameter** | **Genetic source of the production operations livestock originating from an Annex I Party** |
|---|---|
| Data Unit | - |
| Description | Genetic source of the production operations livestock originating from an Annex I Party. |
| Source of data | Based on documentation of purchases of livestock. |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures | - |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter** | **FFR** |
|---|---|
| Data Unit | -- |
| Description | Use of formulated feed rations. |
| Source of data | Based on on-farm record keeping, feed supplier and other documentation. |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures | Information collected will validate that the farm is using formulated feed rations which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics. |

| | |
|---|---|
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter** | **$EG_y$** |
|---|---|
| Data Unit | MWh |
| Description | Total electricity generated from the recovered biogas in the year y |
| Source of data | Power plant |
| Value(s) applied | Please refer to calculation spreadsheet |
| Measurement methods and procedures | Measurement using energy meter(s). Only required for project activities that utilize the recovered methane for power generation |
| Monitoring frequency | Continuously, aggregated as required for the period used for the verification of the PoA |
| QA/QC procedures | Equipment shall be maintained as per manufacturer/supplier specifications |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Data will be kept for two years after the end of the crediting period |

| **Data / Parameter:** | **$EC_{AE}$** |
|---|---|
| Data unit: | kWh |
| Description: | Electricity consumed by the auxiliary equipment within the project activity during the year y |
| Source of data: | Electricity sub-meter |
| Value(s) applied | Actual measurement |
| Measurement methods and procedures: | To be measured from electrical sub-meters installed at the site. Data will be archived electronically. |
| Monitoring frequency: | - |
| QA/QC procedures: | internal audits, capacity assessments, equipment monitoring & performance standards, equipment calibration, process control |
| Purpose of data | Calculation of project emissions |
| Additional comment: | Only to be monitored if the recovered biogas is used to power auxiliary equipment of the project activity.<br>Data will be kept for two years after the end of the crediting period |

| **Data / Parameter** | **$EC_{PJ,j,y}$** |
|---|---|
| Data Unit | MWh |
| Description | Quantity of electricity from the grid consumed by the project activity during the year |
| Source of data | Project participants, electricity meter to be installed |
| Value(s) applied | To be provided by CPA implementer |
| Measurement methods and procedures | Electricity meter. Measured |

| | |
|---|---|
| Monitoring frequency | Continuously, aggregated as required for the period used for the verification of the PoA |
| QA/QC procedures | Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.<br>Calibration will be done as per the equipment's manufacturer specifications |
| Purpose of data | Calculation of project emissions |
| Additional comment | As per the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption";* scenario A<br>Data will be kept for at least two years after the end of the crediting period<br>Alternatively, in case no separate electricity meter is installed to monitor the electricity consumption of the project, it will be estimated based on the relevant equipment operating at full rated capacity plus 10% to account for distribution losses, for 8760 hours per annum", in accordance with para. 26 of the methodology. |

| **Data / Parameter:** | **$EE_y$** |
|---|---|
| Data unit: | % |
| Description: | Energy conversion efficiency of the project equipment |
| Source of data: | AMS-IIID version 21 |
| Value(s) applied | 40% |
| Measurement methods and procedures: | Specification provided by the equipment manufacture. The equipment shall be designed to utilize biogas as fuel, and efficiency specification is for this fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation |
| Monitoring frequency: | - |
| QA/QC procedures: | - |
| Purpose of data | - |
| Additional comment: | Report this parameter for monitoring only if default value of 40% is not applied |

### B.5.2. Sampling plan

*A sampling plan* may be applied for the parameter $\mathbf{W_{site}}$ (average animal weight for defined population). The sampling design described below is in line with the requirements of the "Standard for sampling and surveys for CDM project activities and programme of activities":

- *Target population*: categories of pigs: breeding / market / sow / boar / finisher / nursery / suckling etc.

- *Sampling method*: stratified random sampling approach with a level of confidence and precision of 90/10. This method is applicable because population is homogeneous within each category of pigs

- *Sample size*: it will depend on the total number of heads per category in the farm during the monitoring period (parameter to be monitored as $N_{LT}$)

- *Parameter of interest*: average value of animal weight per type of animal ($W_{site}$)
- *Target value*: it will depend on the practice of the farm during the monitoring period

- *Data to be collected:* total number of heads per type of animal, animal weight per type and number of samples.

### B.5.3. Other elements of monitoring plan

The approved monitoring methodology follows the "General guidelines for SSC CDM methodologies", version 23 and the approved methodologies for AMS-III.D version 21 and AMS-I.F version 3.

CPA Operations Plan: Marcela will develop an operations plan that defines a standard against which the project performance will be measured in terms of its emission reductions (ER) and conformance with all standards and criteria under the PoA. It will assist Marcela Farms in establishing a credible, transparent, and adequate data measurement, collection, recording and management system to coordinate all the monitoring requirements for generating certified emission reductions from their project and for ensuring compliance with the obligations with LBP under the PoA.

The CPA Operations Plan outlines the following plan:

Monitoring: To be monitored are those parameters described in the tables above which also detail the means of measurement and QA/QC procedures. These parameters were adapted to the situation of this CPA. In particular:

*Type of flare or combustion system:* The type of combustion system affects the default flare efficiency used as outlined below. Marcela will use a gas combustion engine(s) with an enclosed flare. Marcela will monitor and record the use and compliance with manufacturers specifications as described in the monitoring plan.

*Use of sequential manure management systems*: Marcela farm manure management system will not be sequential and therefore no special monitoring protocols for treatment stages are necessary.

*Type of fuel used*: The monitoring of the emissions from power will depend on the source of energy used in powering the system.

*Use of Annex I country VS and Bo:* Marcela will use VS and Bo values from Annex I countries and therefore the genetic source of the livestock will need to be monitored.

Quality Assurance and Quality Control: The proponent will have a quality assurance and quality control plan in order to ensure that monitoring is done accurately and with properly calibrated instruments. The basic requirements are outlined in the tables in the monitoring plan section. In particular, scales, methane measurement devices, waste flow measurement devices, biogas flow meters, thermometers, pressure meters and electricity meters will be calibrated as per manufacturer specifications.

Data recording: Proper management processes and systems records will be required by the operator, as the auditors will request copies of such records to judge compliance with the required management systems. All data recording of the monitored data will include paper and/or electronic versions, backup systems and periodic checking for data entry mistakes.

Reporting: Monitoring data will be reported quarterly to LBP along with any major issues related to the monitoring system that may need attention. The estimation of emission reductions and reporting of the data for verification purposes will be done annually by LBP.

Calculation of emissions reductions: Based on the monitoring data the emission reductions will be calculated ex-post using the following approach:

$PER_y = MER_{y,\text{ ex-post}} + GER_{y,\text{ ex-post}}$

Where:

| | |
|---|---|
| $MER_{y,\text{ ex-post}}$ | Emission reduction in year "y" ($tCO_2$-e) from methane recovery (as per AMS III.D) |
| $GER_{y,\text{ ex-ost}}$ | Emission reduction in year "y" ($tCO_2$-e) from renewable electricity generation (as per AMS I.F) |

The emission reductions achieved in any year from methane recovery are the lowest value of the following:

$MER_{y,ex\text{-}post} = \min [(MBE_{y,ex\text{-}post} - MPE_{y,ex\text{-}post}) , (MD_y)]$

Where:

| | |
|---|---|
| $MER_{y,ex\text{-}post}$ | Emission reductions achieved by the project activity based on monitored values for year "y" ($tCO_2$ e) |
| $MBE_{y,ex\text{-}post}$ | Baseline emissions calculated using the formula found in Section B.4.3 using *ex post* monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$ |
| $MPE_{y,ex\text{-}post}$ | Project emissions calculated using the formula found in Section B.4.3 using *ex post* monitored values of $N_{LT,y}$, $MS\%_{i,y}$ and if applicable $VS_{LT,y}$ |
| $MD_y$ | Methane captured and destroyed or used gainfully by the project activity in year "y" ($tCO_2e$) |

$MD_y = BG_{burnt,y} * W_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$

Where:

| | |
|---|---|
| $BG_{burnt,y}$ | Biogas flared or combusted in year "y" ($m_3$). |
| $W_{CH4,y}$ | Methane content in biogas in the year "y" (mass fraction) |
| $FE$ | Flare efficiency in the year "y" (fraction) when biogas is flared |

*Methane content in biogas,* $W_{CH4:}$ As per AMS-III.D version 21 there are three options to monitor/determine the fraction of methane in the biogas: a) should be measured with a continuous analyzer or alternatively, b) with periodical measurements at a 90/10 confidence/precision level or, alternatively c) a default value of 60% methane content can be used. For all CPAs under this PoA option c) will be adopted: a default value of 60% methane content

*Flare efficiency* will be determined using default values. $PE_{flare,y}$ will be calculated using this default flare efficiency value.

Ex-post, these will be calculated using the Tool for "Project emissions from flaring"' through the following formula:

$PE_{flare} = \Sigma F_{CH4\ RG,m} * (1 - FE,_{m)} * GWP_{CH4} / 1000$

Where:

| | |
|---|---|
| $F_{CH4\ RG,m}$ | is the mass flow rate of methane in residual gas in minute m |
| $FE,_{m}$ | is the flare efficiency in minute m |
| $GWP_{CH4}$ | is the GWP of methane according to IPCC. |

$PE_{flare,y}$ is calculated using an ex-ante default value of 80% for flare efficiency.

Alternatively, if the CPA utilizes the recovered methane for power generation, $MD_y$ may be calculated as follows, based on the amount of monitored electricity generation, without monitoring methane flow and concentration:

$MD_y = EG_y \times 3600 / (NCV_{CH4} \times EE_y) \times D_{CH4} \times GWP_{CH4}$

Where:

| | |
|---|---|
| $EG_y$ | Total electricity generated from the recovered biogas in year *y* (MWh) |
| 3600 | Conversion factor (1 MWh = 3600 MJ) |
| $NCV_{CH4}$ | NCV of methane (MJ/$Nm_3$) use default value: 35.9 MJ/$Nm_3$) |
| $EE_y$ | Energy conversion efficiency of the project equipment, which is determined by adopting one of the following criteria:<br>- Specification provided by the equipment manufacture. The equipment shall be designed to utilize biogas as fuel, and efficiency specification is for this fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation;<br>- Default efficiency of 40% (more likely option to be used by the proposed CPA) |

As per AMS III.D version 21 § 33 "Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider applying the flare efficiency to the portion of the biogas used for energy, if separate measurements of the respective flows are not performed. When the amount of methane that is combusted for energy and that is flared is separately monitored, or when only the biogas flow to the flare is monitored and the biogas used for energy is calculated based on electricity generation, a destruction efficiency of 100% can be used for the amount that is combusted for energy".

In the case of § 33 wherein no separate flows are performed, and flare efficiency is applied on $BG_{burnt,y}$ , $BG_{burnt,y} = FV_{RG,m}$ and corresponding $PE_{flare}$ will be calculated.

*Project emissions* are estimated using the equations given in section B.4.3. of the PoA-DD.

The Physical leakage ($PE_{PL,y}$) calculation will be based on monitored parameters of $MS\%i,y$, $N_{LT,y}$, $VS_{LT,y}$.

For $PE_{power,y}$ as per the methodology methane used to power auxiliary equipment of the project ($EC_{AE}$) will be taken into account accordingly, using zero as its emission factor.

In the event that there is not enough gas, or for any other reason the energy generator is not operating, the project activity shall monitor the energy consumption from the grid $EC_{PJ,y}$, and shall consider it as project activity emissions, where the emission factor will be that for the Philippine grid it is connected to. Where:

$PEpower,y = EC_{PJ,y} * EFy$

The emission reductions achieved in any year from renewable electricity generation are the following:

$GBE_{y,ex\text{-}post} = (EG_{y,\ ex\text{-}post} - EG_{baseline}) * EF_{y,ex\text{-}ante}$

Where:

| | |
|---|---|
| $GBE_{y,\ ex\text{-}post}$ | Baseline emissions based on monitored values for year "y" ($tCO_2$) from renewable electricity generation |

| | |
|---|---|
| $EG_{y,ex\text{-}post}$ | Electricity generated based on monitored values and calculated using the formula found in Section B.4.3. for year "y" (MWh/yr) |
| $EG_{baseline}$ | Baseline electricity supplied to the grid in case of modified or retrofit units based on monitored values and calculated using the formula found in Section B.4.3 |
| $EF_{y,ex\text{-}ante}$ | Baseline emissions factor calculated using the formula found in Section B.4.3 (tCO2-e/MWh) *ex-ante* values applied throughout the crediting period |

## SECTION C. Start date, crediting period type and duration

### C.1. Start date of CPA

12/07/2007, when the first real investment of the project was made.

### C.2. Expected operational lifetime of CPA

25 years

### C.3. Crediting period of CPA

### C.3.1. Type of crediting period

Renewable

### C.3.2. Start date of crediting period

01/06/2019

### C.3.3. Duration of crediting period

Seven (7) years

## SECTION D. Environmental impacts

### D.1. Analysis of environmental impacts

The CPA will contribute to the improvement of the local environment by reducing odor and air pollution by containing liquid waste slurry in an enclosed digester. The enclosure ensures the capture of biogas and minimizes the leakage of ammonia as a form of air pollution caused by the facility. The impact is a direct benefit to the local community living around the area who will smell nothing in the vicinity of the project activity. The only risk of the system is related to proper operation to ensure no water pollution occurs in the local area and also safe operation of the gas collection and combustion system to ensure no explosion or fires occur. These are considered in Marcela Farm's design and operation.

In the case of Marcela Farms, the digester is covered by the ECC and discharge permit issued to the piggery farm.

### D.2. Environmental impact assessment

No environmental compliance certificate (ECC), Initial Environmental Examination, or Environmental Impact Assessment (EIA) are necessary for the project activity (e.g., biodigester, methane capture facility) under Philippine law.

## SECTION E. Local stakeholder consultation

### E.1. Modalities for local stakeholder consultation

The Stakeholders' Consultation was conducted at the Coralandia Resort and Restaurant on 22/02/2008 at about 9:00AM. Key stakeholders are listed below and include representatives of the people living in the vicinity and those that have administrative, social or political interest in the project or its vicinity. They were invited by letter.

a. Barangay Captain of Barangay Lourdes, Cortes, Bohol
b. Barangay Councilors of Barangay Lourdes, Cortes, Bohol
c. Vice Mayor, Municipality of Cortes, Bohol
d. Chairman, Committee on Environment, Municipal Council, Municipality of Cortes, Bohol
e. Representative, Small Coconut Farmers Association, NGO
f. President, Samahang Nayon (community-based NGO)
g. Provincial Environment and natural Resources Officer, Bohol
h. Representative, Environmental Management Bureau Region 7
i. Account Officer, Land Bank of the Philippines, EPMD

To set the stage for the consultation, the following were initially presented/discussed:

- Climate Change
- Clean Development Mechanism
- Process of CDM
- LBP Carbon Finance Support Facility
- Marcela Farm, Inc. CDM Project

Comments/concerns of the stakeholders were subsequently solicited in an open manner and discussed.

### E.2. Summary of comments received

| Issues Raised | Responses/ Recommended Measures to Address Response |
|---|---|
| Will the water coming out from the treatment facility emit greenhouse gas. | It was explained by Mr. Terec that the design of the digester was to primary treat the effluent waste and capture methane. Mr. Creserva added that the digester is similar of that of a household septic tank. Discharge flows to a leaching and digestive chamber. Treatment already occurs while it passes to several compartments. The manure generated by the pigs are collected in the digester, to generate gas for conversion to electricity. |
| Since there are new developments inside Marcela farms, can you provide the Municipal Planning & Engineering Office a copy of the master plan of the farm? Can we also request for a site visit to better appreciate the project. | Mr. Terec committed that he will provide a copy of the development plan and schedule a field visit in the farm for the LGUs |
| Is the digester already operational? | Yes, the digester is already receiving effluent waste. But due to the size of the lagoon, we are still filling it. It is already generating methane, but there is not enough pressure. We have already purchased the generators from the U.S. |
| What are the requirements to avail for a loan financing with LBP regarding the digester. | The loan will be treated just like any other bank loan. Equity and collateral will be required. The only add-on value if you plan to loan for the construction of the digester is that LBP can enroll it as a CDM project, provided that the farm has an adequate pig population that will sustain the CDM transaction costs. LBP can bundle it together with other farms to minimize the cost as well as assist in the preparation of the project design document needed for CDM registration. |

### E.3. Consideration of comments received

See above

## SECTION F. Eligibility for inclusion

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| | Project Baseline | | | |

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 1 | As per PoA Guidelines, CPA is not a component of another CDM programme, has not been registered as a project activity of another CDM project, is undergoing validation within another CDM project, nor is a debundled component of a large-scale project activity. | LBP CFSF Reply Form, with confirmation statement by the farm owner, indicating that the CPA is not a component of another CDM programme, has not been registered as a project activity of another CDM project, is undergoing validation within another CDM project, nor is a debundled component of a large-scale project activity. | Signed Letter of Intent (LOI) and confirmation statement by Marcela Farms | LOI & confirmation statement is as per PoA Guidelines |
| 2 | Livestock farms from livestock populations managed under confined conditions. | As per AMS-III.D, para 3. | Documented evidence from site visit by LBP staff. | Documented evidence from Marcela site visit dated 11/04/2019 by LBP staff as per AMS-III.D, para 3. |
| 3 | Livestock farms where manure or the streams obtained after treatment is not discharged into natural water resources (e.g. rivers and estuaries). | As per AMS-III.D, para 3. | Documented evidence from site visit by LBP staff. | Documented evidence from Marcela farms as per AMS III.D, para 3. |
| 4 | Annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5$^{o}$C | As per AMS-III.D, para 3. | The Philippines has a mean annual temperature over 5$^{o}$C. The mean annual temperature for the country is 26.6$^{o}$C and Baguio is the coldest place in the country and has a mean annual temperature of 18.3$^{o}$C. | http://bagong.pagasa.dost.gov.ph/information/climate-philippines |
| 5 | For anaerobic treatment systems in the baseline, the retention time of manure waste must be greater than 1 month. | As per AMS-III.D, para 3 | Documented evidence on site visit along with information provided by CPA implementer: Dimension of existing lagoon/s and water consumption and/or farm discharge permits | Documented evidence on site visit along with information provided by CPA implementer: Dimension of existing lagoon/s and water consumption and/or As per para 3. AMS-III.D |
| 6 | For anaerobic lagoons in the baseline the depth is at least 1 meter. | As per AMS-III.D, para 3 | Documented evidence provided by CPA implementer. | Depth of anaerobic lagoon is 3 m. as described in section B.3. As per para 3. AMS-III.D |

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 7 | The baseline system of waste management is an open anaerobic system with no methane recovery and destruction by flaring, combustion or gainful use. | As per para 3. AMS-III.D | Documented evidence from site visit by LBP staff or document provided by CPA implementer. | As per para 3. AMS-III.D, farm had an open anaerobic system with no methane recovery and destruction by flaring, combustion or gainful use in the baseline |
| 8 | Connection to an electricity distribution system that is supplied by at least one fossil fuel generating unit. | As per para 2. AMS-I.F. v3 | Documented evidence on site visit and provided by CPA implementer: grid electricity consumption receipts of the site. | As per para 2. AMS-I.F. v3, CPA is connected to an electricity distribution system that is supplied by at least one fossil fuel generating unit, records are provided. |
| | Project Activity | | | |
| 9 | The project objective is the replacement of existing open lagoons and anaerobic ponds in livestock farms for anaerobic digesters with combustion equipment to destroy methane by utilizing either open or standardized enclosed stainless steel flares, sized to handle the generated biogas design volume to ensure high combustion efficiency, and/or use of the recovered methane for electricity generation with gas engines | As per para 2. AMS-III.D | Documented as per project design | As per para 2. AMS-III.D, CPA provided project design documents during registration. |
| 10 | The sludge is handled aerobically, and final application is made in proper conditions (i.e., not resulting in methane emissions). | As per AMS-III.D, para 4. | Documented as per project design | As per AMS-III.D, para 4., this is documented in farm records |
| 11 | Technical measures are used (e.g. flared, combusted) to ensure that all biogas produced by the digester is utilized and combusted. | As per AMS-III.D, para 4. | Documented as per project design | This is documented by LBP staff noting on-site flare and engines. |

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 12 | 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. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply. | As per AMS-III.D, para 4. | Documented as per project design | This is documented by LBP staff noting that storage time of manure after removal from the barns is less than 45 days for Marcela Farms. |
| 13 | New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the General Guidelines to SSC CDM methodologies | As per AMS-III.D, para 7. | Documented as per project design | As per AMS-III.D, para 7. Farm records are available |
| 14 | The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the General Guidelines to SSC CDM methodologies. | As per AMS-III.D, para 8. | Documented as per project design | Not applicable. |
| 15 | Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt $CO_2$ equivalent annually from all Type III components of the project activity. | As per AMS-III.D, para 9; | Documented as per project design and ER spreadsheet calculation. | As per AMS-III.D, para 9; ER spreadsheet calculation are provided. |
| 16 | Renewable electricity generation from the recovered methane emissions with a maximum output capacity of 15 MW. | As per AMS-I.F v3 para 16 | Documented as per project design | Total installed capacity of gensets documented on site are less than 2 MW. |

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 17 | The maximum capacity of the renewable energy component (in cases where it is a combination of renewable and non-renewable) is 15 MW | As per AMS-I.F v3 para 8 | Documented as per project design | Not applicable |
| 18 | Installation of additional generation units utilizing the recovered methane emissions at an existing renewable energy facility provided that the added capacity of the project should be lower than 15 MW and is physically distinct[2] from the existing units. | As per AMS-I.F v3 para 6 | Documented as per project design | Not applicable |
| | Additionality | | | |
| 19 | Retrofitting or modification of an existing electricity generation facility to utilize the recovered methane emissions as fuel with the total output of the modified or retrofitted generating unit not exceeding 15 MW | As per AMS-I.F v3 para 7 | Documented as per project design | Not applicable |

[2] Physically distinct units are those that are capable of generating electricity without the operation of existing units and that do not directly affect the mechanical, thermal or electrical characteristics of the existing facility.

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 20 | The farm is operating an open anaerobic wastewater system in the baseline and the project technology involves higher costs of installation and operation to the farm owner coupled with higher technical requirements for construction, operation and maintenance than continued operation of the open system. Hence this shall be demonstrated through:<br>1- Project technology involves the installation of a biogas collection and flare/use system<br>2- Project needs to be financed with future carbon revenues, used as securities to repay the loan. | .As per "General guidelines for SSC CDM methodologies" | Documented evidence on site visit and provided by CPA implementer:<br><br>1. Project design with biogas collection system and<br>2. Confirmation letter from the financial institution providing the loan, where future carbon revenues have been presented for the loan evaluation and are partial security to repay the loan | Onsite visits of project staff confirm project design with biogas collection system; and Confirmation letter for loan of Marcela Farms from Landbank is available. |
| 21 | The farm is compliant with the applicable Philippine environmental rules and regulations | As per Philippine environmental regulations | Copy of the environmental compliance certificate to be provided by the project implementer | Environmental compliance evidenced by ECC |
| | Requirement to be part of the programme | | | |
| 22 | After all the above conditions have been met and documented, the project proponent must have signed an MOA with LBP to be in a CPA in this program. | Project proponent must have signed an MOA with LBP to be in a CPA in this program | Signed MOA between LBP and each CPA implementer | Evidence: Signed MOA between LBP and Marcela Farms |

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 23 | Emission reductions claimed under the CPA are those derived only from gas use for electricity generation and/or flared. No credits shall be claimed for any other uses of the gas. | Emission reductions claimed under the CPA are those derived only from gas use for electricity generation and/or flared | Documented as per project design | CPA provided project design documents,equipment list (flare and gensets) and monitoring records. |
| | Environmental and Social Issues | | | |
| 24 | The project must have undertaken an environmental analysis as outlined in section E and a stakeholder consultation as outlined in Section F. | Conduct of Environmental impact assessment and Stakeholder's consultation as per CDM project standard | ECC at CPA level; Stakeholder comments done at the CPA level | Invitation, list of attendees and Stakeholder comments for Marcela farms are available. ECC available. |
| | General Conditions | | | |
| 25 | Geographical boundaries of CPAs should be consistent with the geographical boundary of the PoA | As per CDM project standard for programmes of activities (version 2), paragraph 124 | Geographical location of farm/project; documented evidence from site visit by LBP staff. | Confirmation of Geographical location of farm/project by LBP staff |
| 26 | Double counting of GHG emission reductions or net anthropogenic GHG removals, should be avoided through measures such as unique identifications of product and end-user locations (e.g. programme logo) | As per CDM project standard for programmes of activities (version 2), paragraph 124 | Documented as per project design | CPA provided project design documents |
| 27 | Start date of CPA should be checked through documentary evidence | As per CDM project standard for programmes of activities (version 2), paragraph 124 | Documented evidence provided by CPA implementer. | CPA provided project design documents as evidence to start date of 12/07/2007, when the first real investment of the project was made |
| 28 | Compliance with the applicability of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents | As per CDM project standard for programmes of activities (version 2), paragraph 124 | Documented as per project design | CPA provided project design documents |

| No. | Eligibility criterion - Category | Eligibility criterion - Required condition | Supporting evidence for inclusion | Description of this CPA in relation to the criterion and supporting evidence |
|---|---|---|---|---|
| 29 | If the generic CPA is small-scale or microscale, conditions for the de-bundling check based on the "Methodological tool: Assessment of de-bundling for small-scale project activities". However, if the generic CPA consists solely of units that qualify as "microscale CDM units", these conditions are not required. | As per CDM project standard for programmes of activities (version 2), paragraph 124 | Documented as per project design | CPA provided project design documents |

# Appendix 1. Contact information of CPA implementers

| | |
|---|---|
| **Organization name** | The Marcela Farms, Inc. |
| **Country** | Philippines |
| **Address** | **Street/P.O. Box** MH del Pilar Street<br>**Building** 2nd Floor Altura MH Grocery Building<br>**City** Tagbilaran City<br>**State/Region** Bohol<br>**Postcode** 6300 |
| **Telephone** | +63-38 411-387 |
| **Fax** | +463-38 411-3556 |
| **E-mail** | agc@bohol-online.com |
| **Website** | |
| **Contact person** | Mr. Marlito Uy |

# Appendix 2. Affirmation regarding public funding

There is no public funding involved in the project at Marcela Farms.

## Appendix 3. Further background information on ex ante calculation of emission reductions

2015-2017 National Grid Emission Factor published by the Philippine Department of Energy Tables below shows the computed grid emission factor derived using the 2015-2017 power statistics**.**

Table 1. Summary of the NEG for Luzon-Visayas Grid

**a. Simple Operating Margin (OM) Emission Factor**

| Parameters | (t-$CO_2$/MWh) |
|---|---|
| 2015-2017 Average $EF_{grid, OMsimple,y}$ | 0.7122 |

**b. Build Margin (BM) Emission Factor**

| Parameters | (t-$CO_2$/MWh) |
|---|---|
| BM Emission Factor | 0.5979 |

**c. Combined Margin (CM) Emission Factor**

| Parameters | (t-$CO_2$/MWh) |
|---|---|
| 2015-2017 $EF_{grid, CM,y}$ (Wind and solar) | 0.6836 |
| 2015-2017 $EF_{grid, CM,y}$ (Other projects) | 0.6265 |

## Appendix 4. Further background information on monitoring plan

Please refer to section B.5.3.

## Appendix 5. Summary report of comments received from local stakeholders

Please refer to section E.2.

## Appendix 6. Summary of post-registration changes

Post registration changes at PoA level have been approved on 29/06/2015.

PRC requested for this CPA: approved on 26/06/2015

Corrections
- Calculation formula for of ex-ante project emissions from flaring has been clarified to use the default flare efficiency of 0.9.
- Nomenclature of parameters between sections has been corrected for consistency
- It has been clarified that if the recovered biogas is combusted for electrical energy

production or for other gainful use, the methane destruction efficiency can be considered as 100%, as long as the flow is being monitored.
- Parameter GWPCH4 has been clarified to include the value to be used in the second commitment period of the Kyoto Protocol.

Permanent changes from the registered monitoring plan or applied methodology:
- Measurement methods have been added to parameter $BG_{burnt,y}$
- Parameters T and P, temperature and pressure of the biogas, have been added
- The flare Efficiency parameter name has been corrected for consistency within the document and text has been added to comply with the "Tool to determine project emissions from flaring gases containing methane".
- References to specific equipment have been deleted in parameter $T_{flare.}$
- Text has been clarified for parameter "other flare operation parameters".
- Parameter EGy has been clarified following that in version 19 of AMS III.D.
- An alternative has been included for the monitoring of grid electricity consumption, following the provision on paragraph 26 of the methodology (AMS III.D version 17), to monitor the farms electricity consumption when there is no separate electricity meter.
- Possible use of sampling methods and procedures for parameter $W_{site}$ has been added.

PRC requested for this CPA: approved on 13/08/2017:
Corrections
- Editorial corrections including typo mistakes, incorrect sentences and inconsistencies.
- Permanent changes from the registered monitoring plan or applied methodology: An alternative has been included for the monitoring of $MD_y$, where continuous monitoring of flow (and related temperature and pressure) is not necessary. When the CPA utilizes the recovered methane for power generation, $MD_y$ may be calculated based on the amount of monitored electricity generation, without monitoring methane flow and concentration grid electricity consumption, following the provision on paragraph 29 of the methodology AMS-III.D version 20.1.

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## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 09.0 | 31 May 2019 | Revision to:<br>• Ensure consistency with version 02.0 of the “CDM project standard for programmes of activities” (CDM-EB93-A07-STAN);<br>• Make editorial improvements. |
| 08.1 | 20 October 2017 | Editorial revision to remove appendix “Applicability of methodologies and standardized baselines” from the main part of the form which had been mistakenly kept in the previous version. |
| 08.0 | 28 June 2017 | Revision to:<br>• Remove appendix “Applicability of methodologies and standardized baselines” as the appendix is not relevant at the CPA level;<br>• Make editorial improvement. |
| 07.0 | 7 June 2017 | Revision to:<br>• Improve consistency with the “CDM project standard for programmes of activities” and with the PDD and PoA-DD forms;<br>• Make editorial improvement. |
| 06.0 | 24 May 2017 | Revision to:<br>• Ensure consistency with the “Standard: CDM project standard for programme of activities” (CDM-EB93-A07-STAN) (version 01.0);<br>• Incorporate the “Component project activity design document form for small-scale component project activities” (CDM-SSC-CPA-DD-FORM);<br>• Make editorial improvement. |
| 05.0 | 15 April 2016 | Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0). |
| 04.0 | 9 March 2015 | Revision to:<br>• Include provisions related to statement on erroneous inclusion of a CPA;<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to local stakeholder consultation;<br>• Provisions related to the Host Party;<br>• Make editorial improvement. |
| 03.0 | 25 June 2014 | Revisions to:<br>• Include the Attachment: Instructions for filling out the component project activity design document form for CDM component project activities (these instructions supersede the "Guidelines for completing the component project activity design document form" (Version 01.0));<br>• Include provisions related to standardized baselines; |

| *Version* | *Date* | *Description* |
|---|---|---|
| | | • Add contact information on a CPA implementer and/or responsible person/ entity for completing the CDM-CPA-DD-FORM in A.13. and Appendix 1;<br>• Add general instructions on post-registration changes in paragraph 4 and 5 of general instructions and Appendix 6;<br>• Change the reference number from F-CDM-CPA-DD to CDM-CPA-DD-FORM;<br>• Make editorial improvement. |
| 02.0 | 13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the component project activity design document form" (EB 66, Annex 16). |
| 01.0 | 27 July 2007 | EB 33, Annex 42<br>Initial adoption. |

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: component project activity, project design document