CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

>> Pig City confined swine feeding operations methane capture and combustion from improved animal waste management system (version 7-4 : 14 March 2008)

A.2. Description of the small-scale project activity:

>> Cavite Pig City Inc. owns and manages a highly efficient swine farrow to finish facility. The current infrastructure involved is perhaps one of the most advanced in the Philippines. Pig City now operates a total population of 64,000 heads in a farrow to finish confined facility. The purpose of the project activity is to upgrade the current waste treatment facility capacity to accommodate the expansion as well as to utilize current and more effective waste water treatment techniques. The current waste management system uses seven separate basic anaerobic lagoons into which swine slurry/waste water is transported. The wastewater flows and resides in the seven-stage lagoon for a period of at least 30 days then flows to the nearest streams with substantial concentrations of organic nutrients in the treated water outflow. The project activity is defined as the upgrading of the current waste water system by building an enclosed anaerobic digester into which the animal waste slurry will flow (hereafter referred to as "project activity"). In the process of anaerobic decomposition of swine waste in the digester, biogas is produced. Since the digester is enclosed, biogas is trapped, collected, and used as a fuel to generate electricity for use by the facility. A biogas generator will be used to generate electricity to be consumed by the entire facility. Moreover, excess biogas will be flared within the Pig City premises. While biogas is a mixture of gases, the interest of the project activity is specifically the capture and combustion of methane (CH_4) component of the biogas.

The project participants envision the CDM project to contribute to sustainable development in several ways. Financially, CERs and long-term reduced electricity costs will substantially contribute to the Pig City's balance sheet in terms of better Internal Rate of Return (IRR) and project investment Net Present Value (NPV). Technologically, the waste treatment design - will be one of the largest of its kind in the Philippines. A digester of this size and design will allow other animal feeding operations to clearly see how such technology works and how financial instruments can be used to support such technologies.

Environmental sustainability through this project is achieved in several levels. From a standpoint of water pollution, the project manages large volumes of hog waste, treats it and disposes of it with no impact to the surrounding environment. This is achieved because the facility is a closed-system design whereby treated water is re-used within the facility. The project significantly reduces BOD/COD levels that would otherwise flow into the surrounding water bodies with a real possibility of reaching the water tables and threatening the drinking water of both humans and animals in the area. Without this system, nutrients from manure run-offs can also enter the water table creating a condition for micro-organic plantlife such as algae to bloom. This process of eutrophication of natural water passageways can deplete the water of oxygen that may cause fishes to suffocate with the lack of oxygen (anoxia) in the water. This condition of anoxia can permanently damage and kill living waterways. The project activity contributes in mitigating such a condition.

On another significant level, the project allows for the control of air pollution caused by ammonia, which is released when the nitrogen from the hog waste mixes with air. As an enclosure, the biogas digester captures all intense air borne pollution caused by the facility with a negligible amount of leakage.

A clear environmental impact will be created through this project by using the enclosed digesters as a more efficient form of water treatment. Through this, downstream water bodies will be healthier and cleaner. Moreover the biodigester/waste treatment facility reduces the area's susceptibility to mosquito breeding which may be the cause of local health concerns.

The project contributes to the social sustainability of the area in several ways. As the project expands the swine population level from 60,000 to 80,000, additional employment is needed. In fact, employment is seen to double to 180 employees as the facility expands and reaches its design potential. Most, if not all hired hands will come from the surrounding area. In short, jobs will be created for the direct benefit of the community. Because of the nature of the project design, no stagnant water will be available for bacteria and mosquitoes to breed. As the project is located in the vicinity of three residential developments, this is indeed a health benefit for the current and future residents of the area. On a larger scale, given that the facility is at the leading edge of technology of the swine industry, the farm is in itself a potential for education. Students of animal husbandry, veterinary medicine, and agricultural engineering may benefit from a short site visit to learn of the most advance practices in this field. Overall, these conditions provide an improved well-being for the communities affected by the project and to society as a whole.

A.3. Project participants:

>>

Name of Party involved (*) ((host) indicates a host Party)	Private and or public entity(ies) project participants (*) (as appplicable)	Kindly indicate if the Party involved wishes to be considered as project participant (yes/no)
Philippines (host)	Private entity: Cavite Pig City Inc. Private entity: CaFiS Inc	No

A.4. Technical description of the small-scale project activity:

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

>>

A.4.1.1. Host Party(ies):

>> Republic of the Philippines

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

>>Cavite

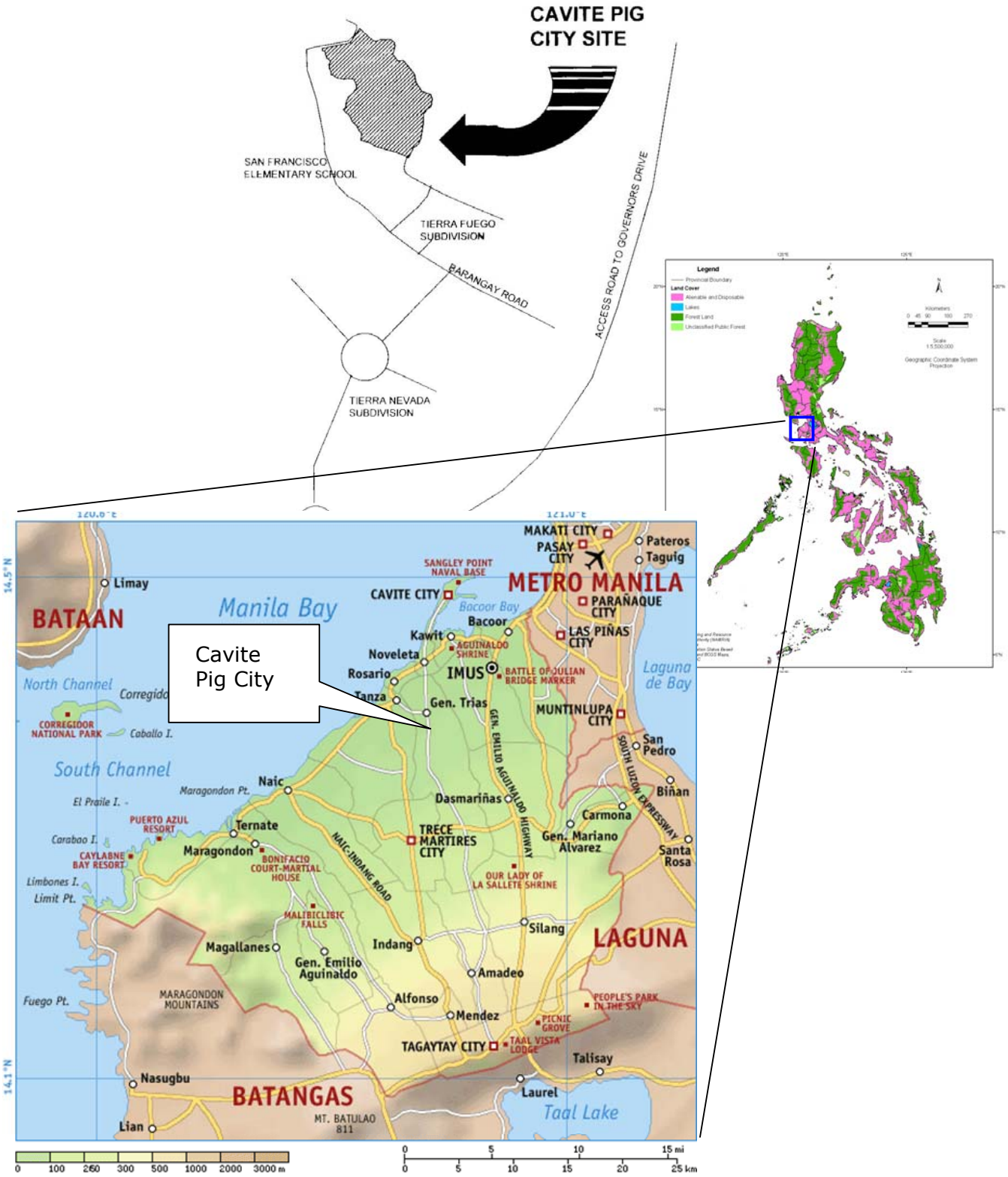
A.4.1.3. City/Town/Community etc:

>> General Trias / Barangay San Franciso / Sitio Kilo, Rosa Street

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

>> Like many pig farms in the Philippines, the project lies in the immediate vicinity of Metro Manila to meet the large demand for pork in the metropolis. The project is situated in Barangay San Franciso,

municipality of General Trias, in the province of Cavite which is an hour and 20mins away by car from Manila. Below is a site map indicating the exact location of the project.
(14°19'35.09"N ; 120°55'30.44"E)



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

>> Waste Management / Methane Capture Project
Type III.D (reference AMS-III.D) – "Methane recovery in agricultural and agro industrial activities"
Version 12 (EB31). This project activity is considered under Sectoral Scope 15: Agriculture.

The project conforms to project category III.D because the project reduces emissions by less than 60 kilotonnes of carbon dioxide equivalent annually.

While the technology for capturing methane from swine waste is not entirely new in the Philippines, the use of HDPE (high-density polyethylene) is. The material is imported from Thailand and handling it is part of the technological transfer involved in the project. The mixing and water flow design is as well unique since it will be the first time that these concepts will be used with the HDPE material. The material is safe and inert. It will not chemically react with any of the organic/inorganic chemicals that it will come in contact with. Because of its widespread use in other countries as a leachate barrier and waste containment membrane, the material has been proven to be environmentally and physically safe.

A solids pre-filter shall remove material that does not easily decompose in the digester such as hairs and non-organic solids. This procedure ensures the efficiency of the digester to decompose materials at a higher efficiency.

Besides the material used, the schematic of the biodigester shows an inherent safety feature due to the redundancy and increased reliability of its two-chamber balloon-type design. In the unlikely event of a leak, fissure, tear in the balloon-type design of the digester, the other chamber will still function and waste water will still be treated albeit in a less efficient manner. The redundancy and reliability of the two-stage design minimizes the risk of an environmental hazard and increases the environmental safety of the proposed project activity.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

>> The entire facility will run on electricity generated through the combustion of captured methane. All electrical requirements will use this electricity and no electricity will be taken from the grid.

Year	Annual emission reduction in tCO2e
1 June 2008 – 31 May 2009	37,845.41
1 June 2009 – 31 May 2010	44,944.80
1 June 2010 – 31 May 2011	47,311.26
1 June 2011 – 31 May 2012	47,311.26
1 June 2012 – 31 May 2013	47,311.26
1 June 2013– 31 May 2014	47,311.26
1 June 2014 – 31 May 2015	47,311.26
Sum over crediting period	272,035.25
Annual average over the crediting period of estimated reductions (tCO2e)	45,620.93

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

>> The project owner and developer fund the project entirely. The project has not received and is not seeking public funding.

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

>> The project activity shall apply for validation, registration and eventually CER issuance as a single project and without any other projects attached, combined or bundled to it. It is not a debundled component of a large scale project activity since there is no registered small-scale CDM project activity nor an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology

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

>> Project activity type III.D (reference AMS-III.D) – Methane Recovery in agricultural and agro industrial activities (Version 12: EB31)

B.2 Justification of the choice of the project category:

>> The project category selected for the project activity is small-scale project activity "III.D Methane recovery in agricultural and agro industrial activities". This project category was chosen for the baseline methodology because the project activity being a methane capture from a manure management system is appropriate for the technology/measure and applicability conditions of the methodology. Technology measures involved for such a technology is worded in the small scale methodology III.D as follows:

> *This project category comprises methane recovery from manure and wastes from agricultural and agro-industrial activities by:*
>
> *(a) installing methane recovery and combustion system to an existing source of methane emissions, or*

The project activity will construct and install a biogas digester within the farm premises to recover methane from the decomposition of agricultural waste. The system will recover biogas methane and technical measures will be used to destroy the gas through a gas flare and gas engine.

> *(b) changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.*

The project activity will switch from an 8-stage open-pit anaerobic lagoons to an enclosed two-stage biogas digester that will recover methane and combust methane gas in a flare and gas engine.

The project activity fits into paragraph (b) of the above description whereby the open-pit lagoons will be replaced by an enclosed anaerobic digester.

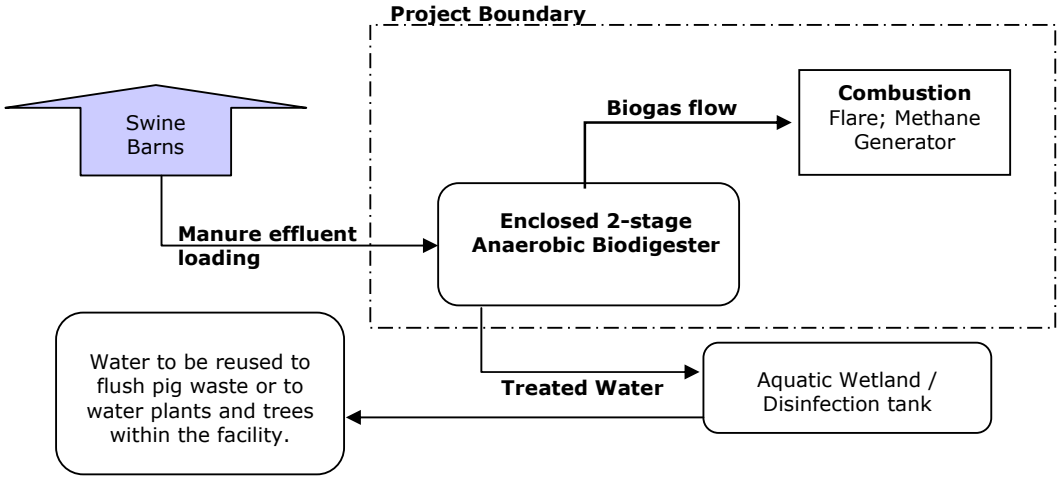
In accordance with conditions of section 2 of AMS III.D, sludge from the project activity will be handled aerobically. Moreover, it shall be ensured that proper conditions and procedures will be in place to avoid the emission of methane from sludge handling. Furthermore technical measures shall be used to ensure that all biogas produced will be destroyed either through a flare or through combustion in a gas engine.

Biogas from the project is not derived from a landfill or urban wastewater facility and will therefore not use AMS III-G and AMS III.H.

As seen from the table in section A.4.3, the project emission reductions will not exceed the allowable limit of 60KtCO2e per year, for a small scale project. As maximum capacity of the facility is reached, emission reduction will not exceed 60KtCO2e.

B.3. Description of the project boundary:

>> The project boundary is the conceptual area in which GHG emission reductions occur. For the project activity, this is as well the physical boundary of the swine facility where methane is captured and destroyed through combustion. This is illustrated in the diagram below. It must be noted that the current anaerobic lagoons will be rendered obsolete by the anaerobic digester and hence no longer included as part of the project. Likewise, project emission reduction is achieved specifically through the combustion of methane generated by the enclosed 2-stage anaerobic digester and therefore, the swine barns are not included as part of the project boundary of the project activity. Treated water flowing from the enclosed two-stage digester will flow into an aquatic wetland and finally into a disinfection tank. The treated water will then either be used again to flush the pig waste in the swine barns or be used to water trees and plants within the facility. Ultimately, for water-use and treatment, a closed system has been designed for the facility.



B.4. Description of baseline and its development:

>>7. The emission baseline is the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the project activity. For each year during the crediting period, emissions are calculated as specified in paragraph a and paragraph b below and lower of the two values is used:

(a) Actual monitored amount of methane captured and destroyed by the project activity.

(b) The methane emissions calculated ex ante using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach.

From documents and on-site visit, it is clear that without the proposed project activity, the baseline scenario is the continuation of the existing system of a 8-stage open-pit anaerobic lagoon with a total volume of 10,198m^3.

This PDD will calculate the ex ante using the amount of waste or raw material that would decay anaerobically in the absence of the project activity using data available for another region of the Philippines that is similar to the conditions project site.

While electricity will be generated by the project, the project will not claim emission reductions from this component of the project.

The baseline was revised and completed on 11/02/2008.

The baseline was developed and completed by:

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B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The livestock sector in the Philippines has been growing steadily throughout the 1990s at a rate of 4.6% per annum. This constitutes the strongest source of agricultural growth throughout this decade even through the Asian financial crisis. Hog raising among the different livestock industries has been growing

at an even faster pace than poultry, or cattle.[1] The growth of these farms has concentrated themselves on the north and south of Metro Manila. This is because of the significant market demand that the most populated and dense area of the Philippines creates.

Traditionally, hog waste disposal involves using water to flush waste out of pens. This is then allowed to flow into the nearest creek, carrying waste downstream creating a significant impact on water pollution. Unlike poultry waste which has developed a market as organic fertilizer, swine waste has been a nuisance to hog farmers. [2]

The project activity was planned to be implemented as early as 2004. However due to changes in the technological design of the digester, the rainy season and more importantly financial constraints, the project had to be put on hold. Recently however, because of the added financial potential of the CDM, the project developer is able to push through with the final plans and design for the project.

As mentioned in section A.4.2, the project is small scale because all methane captured and combusted is produced from the bioorganic decomposition of biogenic material and as such is carbon neutral.

As prescribed in attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM projects, the following is an explanation showing why the project activity would not have occurred without the CDM:

Barrier due to prevailing practice:

Prior to 1990 and the enforcement of Department Administrative Order No. 35 providing water quality standards for water discharge, common practice has allowed pig farms especially smaller swine feeding facilities to dump the waste to the nearest body of water. This practice is still prevalent in some remote areas due to the difficulties in enforcing current laws. Today however, several environmental laws are in place that regulate larger projects such as those by Pig City. An example is the Clean Water Act, which has set measurable water discharge standards by which operators must comply with. None of the laws however require that a biodigester be built and that the methane from the waste be captured. As such, the least cost option is as well the common practice. Currently, the common practice that would comply with existing laws is an open anaerobic lagoon into which waste is allowed to flow, settle and stabilize before excess water is discharged to the nearest creek, stream or river. With this technology however, methane produced from the anaerobic decomposition of waste is simply allowed to bubble in the lagoon and be released into the atmosphere. It is only recently, through the financial augmentation provided by the CDM, that the project activity can proceed.

[1] Delgado, C.L. et.al, (2003). Policy, Technical, and Environmental Determinants and Implications of the Scaling-Up of Livestock Production in Four Fast-Growing Developing Countries: A Synthesis. LEAD, Washington [http://www.fao.org/WAIRDOCS/LEAD/X6170E/x6170e00.htm#Contents]

[2] Costales et.al (2001) "Livestock to 2020, the Next Food Revolution - Implications to Southeast Asia: The Case of the Philippines". Paper presented at the international workshop on: "Sustainable Animal Production and Food Supply to 2020", School of Veterinary Medicine, Hannover, Federal Republic of Germany, 9-10 August 2000.

Investment barrier

An analysis of costs and electricity savings for power generated by the project activity yields an Internal Rate of Return of -1%. Compared to any benchmark rate, such an investment is clearly financially un-attractive. (see table below)

	unit	(costs)
Project Initial Investment (including digester, engine and flare)	php	(67,476,182.00)
Annual electricity savings	php	9,383,946.00
IRR (over seven year period)		-1%

Technological barrier:

Swine farm operators in the Philippines are still hesitant to have enclosed biodigesters installed because there is a lack of awareness regarding its effectiveness. Even if it is found to be effective, there is no compelling reason for business owners to invest in a newer, more effective technology. The new technology is often perceived as both risky and expensive. It is perceived to be a risk because operators are uncertain about the long-term effects of such technology to their operations. Moreover, there are only a few large enclosed biodigesters installed in the Philippines that capture methane, thus many farm operators are still hesitant in having one installed.

As mentioned, HDPE as a material for the digester is very new to the swine industry in the Philippines. This material is not produced in the Philippines and is imported from Thailand. As such the material itself, as a new technology, poses specific barriers to its usage since there are only very few people who can handle the material. Moreover, since it is imported, related import costs make it more expensive than other possible materials of lesser quality available in the market.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
A tier II approach was taken to calculate a weighted average of volatile solids (VS) . The resulting value for VS used in the PDD is 0.3 kg/day corresponding to IPCC default values for Asia.

In the absence of national values for Methane Conversion Factors (MCF) IPCC default values have been used and a 80% MCF is used in the calculation.

Methane conversion capacity for manure (BOi) also uses IPCC default values. From ACM0010:
Developed countries $B_{0,LT}$ values can be used provided the following conditions are satisfied:
• The genetic source of the production operations livestock originate from an Annex I Party

• The farm use formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics
• The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.)
• The project specific animal weights are more similar to developed country IPCC default values

Pig City swine conforms to the above conditions. All swine come from US and European stock. Pig city have their own feed mill to optimize FFR. Swines at the site are more similar to developed country IPCC default values.

Note that while electricity will be generated by the project, the project will not claim emission reductions from this component of the project.

Project activity emissions, as specified in AMS III.D, consist of CO_2 emissions from use of fossil fuels or electricity for the operation of the facility. It must be noted that for the case of this project activity, no fossil fuel will be used. A minimal amount of electricity will be used to operate the circulation pumps and this will be taken into consideration in the calculation of the ex-ante project emissions.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**Population**
Data unit:	Heads of swine
Description:	Number of sows in a facility determines the facility design, the amount of waste generated and the capacity of the digester.
Source of data used:	In-house data
Value applied:	64,000 increasing annually to 80,000 heads of swine
Justification of the choice of data or description of measurement methods and procedures actually applied :	Current number of heads of swine is at 64,000 and will expand to 80,000 heads. This number will be the basis for calculating the baseline emissions of the project
Any comment:	

Data / Parameter:	**Vs**
Data unit:	kg/head/day
Description:	daily volatile solids excreted for an animal within the population,
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-7
Value applied:	0.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data collected from the study by Catelo et. al, shows that manure production from 91 sampled farms show a that for a sow heard production system (as in Pig City) weanlings produce 0.88Kg of waste per day while Finishing hogs produce 1.65 kg of waste per day. A weighted average is taken based on population data of Pig City.
Any comment:	

Data / Parameter:	**MCF**

Data unit:	fraction
Description:	Methane Conversion Factor
Source of data used:	2006 IPCC vol.4 Ch.10 (table 10.17)
Value applied:	80%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Baseline case is the use of uncovered anaerobic lagoons in warm regions with climates ≥ 28°C
Any comment:	

Data / Parameter:	**BOi**
Data unit:	m^3/kg of VS
Description:	maximum CH_4 producing capacity for manure produced by an animal within defined population i.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-7
Value applied:	0.48
Justification of the choice of data or description of measurement methods and procedures actually applied :	From ACM0010 ver. 3 (page 10): Developed countries $B_{0,LT}$ values can be used provided the following conditions are satisfied: • The genetic source of the production operations livestock originate from an Annex I Party • The farm use formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics • The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.) • The project specific animal weights are more similar to developed country IPCC default values
Any comment:	Pig City swine conforms to the above conditions. All swine come from US and European stock. Pig city have their own feed mill to optimize FFR. Swines at the site are more similar to developed country IPCC default values.

Data / Parameter:	**D_{CH4}**
Data unit:	Tones/m^3
Description:	Density of methane at the temperature and pressure of the biogas in year y.
Source of data used:	density of methane at STP
Value applied:	0.67
Justification of the choice of data or description of measurement methods and procedures actually applied :	

Any comment:	

Data / Parameter:	**GWP_{CH4}**
Data unit:	
Description:	Global Warming Potential of Methane
Source of data used:	Intergovernmental Panel on Climate Change 2006
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Internationally accepted value for the global warming potential of methane in relation to CO_2.
Any comment:	

Data / Parameter:	**M_y**
Data unit:	kg
Description:	Amount of waste or raw material that would decay aerobically in the absence of the project activity per year
Source of data used:	Calculated from the number of heads at the site, the default value for volatile solids and the number of days in a year
Value applied:	7,008,000 kg/yr
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

The basic formula used to calculate ex-ante emission reduction through the capture and combustion of methane from AMS III.D is the following:

$$ER_{y,estimated} = BE_y - PE_y - Leakage$$

Where

$ER_{y,estimated}$	=	total emissions reductions in tCO_2e/yr
BE_y	=	baseline emissions from manure management, for a defined population, in year y (tCO_2)
PE_y	=	project emissions, in year y (tCO_2e)
Leakage	=	Leakage emissions in year y (tCO_2)

Baseline Emissions (BE)

To calculate for the amount of methane that would have been emitted to the atmosphere as part of the baseline the following basic formula was used, adopted from equation 10.23 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories:

$$CH_4 \text{ Emissions}_{(BE)} = EF_{CH4} * \text{Population} / (10^3 \text{ kg/tonne})$$

where:

CH_4 Emissions$_{(BE)}$	=	baselineCH_4 emissions from manure management, for a defined population (kgCH_4/yr)
EF_{CH4}	=	Emission factor for the defined livestock population, kg/head/year
Population	=	the number of heads in the defined livestock population

The methane emission factor above was calculated using the following formula, taken from equation 10.23 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories:

$$EF_{CH4} = VS * 365 \text{ days/year} * [B_{oi} * D_{CH4} * \Sigma_{(jk)} MCF_{jk} * MS_{ijk}]$$

where:

EF_{CH4}	=	annual emission factor for defined livestock population i, in kgCH_4/head/yr
VS	=	daily volatile solids excreted for an animal within the Pig City population, in kg (2006 IPCC)
BO_i	=	maximum CH_4 producing capacity for manure produced by an animal within defined population i, m^3/kg of VS
D_{CH4}	=	density of methane at STP. (0.67 kg/m^3)
MCF_{jk}	=	CH_4 conversion factors for each manure management system j by climate region k (2006 IPCC)
MS_{ijk}	=	fraction of animal species/category i's manure handled using manure system j in climate region k. (100% since the project activity is focused on a single facility)

Baseline emission emission factor: EF_{CH4} = VS * 365 days/year * Boi * D_{CH4} * Σ(jk) MCFjk * Msijk							
parameter	VS	days/yr	BO_i	D_{CH4}	MCF_{jk}	$MS_{i,jk}$	EF_{CH4}
unit	kg/head/day	days	m^3CH_4/kg VS	kg/m^3	%	%	kg CH_4/head
value	0.30	365.00	0.480	0.67	80%	100%	**28.17**
source	2006 IPCC Vol.4, Ch.10. Table 10A-7	established	2006 IPCC Vol.4, Ch.10. Table 10A-7	established	2006 IPCC Vol.4, Ch.10. Table 10.17		

Baseline Emissions						
parameter	EF_{CH4}	population	CH_4 emissions	GWP	BE	BE
unit	kgCH_4/head	heads	ktCH_4		kgCO_2e	tCO_2e
value	28.17	64,000.00	1,803,018.24	21	37,863,383.04	**37,863.38**
source	calculated	site data	calculated	established	calculated	calculated

Emissions Reduction			
parameter	BE	PE	**ER**
unit	tCO_2e	tCO_2e	**tCO_2e**
value	**37,863.38**	0.00	**37,863.38**
source	calculated	calculated	calculated

Project Emissions (PE)

Project activity emissions consist of CO2 emissions from use of fossil fuels or electricity for the operation of the facility. No fossil fuels will be used for the operation of the facility.

$PE_{EC,y} = EC_{P,y} * EF_{grid,y} * (1+ TDLy)$

Where:

$PE_{EC,y}$	are the project emissions from electricity consumption by the project activity during the year *y* (tCO_2 / yr);
$EC_{P,y}$	is the quantity of electricity consumed by the project activity during the year *y* (MWh);
$EF_{grid,y}$	is the emission factor for the grid in year *y* (tCO_2/MWh)
TDLy	are the average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site (4.8%)

The project activity will utilize two (2) circulation pumps of 3.75KW capacity running for 12 hours per day.

$EC_{P,y}$ = 3.75KW * 2 units * 12 hours/day * 365 days/year * (1MWh/1000KWh)
$EC_{P,y}$ =*32.85 MWh*

Grid emission factor for the Luzon grid is taken from the combined margin of 0.522 tCO2/MWh.[3]

Project emissions from electricity consumption is therefore:

PE_{EC} = 32.85 MWh * 0.522 tCO2/MWh * (1.048)

PE_{EC} = 17.97 tCO2e/year

B.6.4 Summary of the ex-ante estimation of emission reductions:

	a	b	c	d	e = a * c * d	f	g = e - f
Year	Baseline Emission Factor kgCH4/head	Population	GWP	Annual baseline emission in kgCO2e	Annual baseline emission in tCO2e	Annual project emission in tCO2e	Annual emission reduction in tCO2e
1 June 2008 – 31 May 2009	28.17	64,000	21	37,863,383.04	37,863.38	17.97	37,845.41
1 June 2009 – 31 May 2010	28.17	76,000	21	44,962,767.36	44,962.77	17.97	44,944.80
1 June 2010 – 31 May 2011	28.17	80,000	21	47,329,228.80	47,329.23	17.97	47,311.26
1 June 2011 – 31 May 2012	28.17	80,000	21	47,329,228.80	47,329.23	17.97	47,311.26
1 June 2012 – 31 May 2013	28.17	80,000	21	47,329,228.80	47,329.23	17.97	47,311.26
1 June 2013– 31 May 2014	28.17	80,000	21	47,329,228.80	47,329.23	17.97	47,311.26
1 June 2014 – 31 May 2015	28.17	80,000	21	47,329,228.80	47,329.23	17.97	47,311.26
						Total -->	272,035.25
						Ave. --->	45,620.93

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EC_{p,y}$**
Data unit:	MWh
Description:	Electricity to be consumed by the project activity in year y
Source of data to be used:	Electricity meter to be installed within the project boundary to monitor electricity consumed by the project activity.
Value of data	32.85 MWh
Description of measurement methods	2 units of 3.75KW pumps will be utilized for the circulation of waste water in the system.

[3] CDM Baseline Construction for the Electricity Grids in the Philippines.

and procedures to be applied:	
QA/QC procedures to be applied:	Electricity meters shall be maintained according to manufacturer's specifications to ensure optimal operations of the device.
Any comment:	

Data / Parameter:	**$BG_{burnt,y}$**
Data unit:	m^3
Description:	Biogas flared or used as fuel in year y
Source of data to be used:	Continuous Digital Flow meter to the flare and Continuous Digital flow meter to the gas generator at Standard Temperature and Pressure
Value of data	
Description of measurement methods and procedures to be applied:	measured on a dry basis data from flow meter downloaded quarterly or as recommended by manufacturer Data will be stored electronically and printed quarterly and archived
QA/QC procedures to be applied:	Flow meters shall be calibrated as recommended by the manufacturer. Flow meters shall be subject to regular maintenance, testing and calibration to ensure accuracy.
Any comment:	

Data / Parameter:	**$Flow_{BG}$**
Data unit:	m^3/sec
Description:	Biogas flow rate from digester to the combustion equipment
Source of data to be used:	Continuous Digital Flow meter to the flare and Continuous Digital flow meter to the gas generator at Standard Temperature and Pressure
Value of data	
Description of measurement methods and procedures to be applied:	measured on a dry basis data from flow meter downloaded quarterly or as recommended by manufacturer Data will be stored electronically and printed quarterly and archived
QA/QC procedures to be applied:	Flow meters shall be calibrated as recommended by the manufacturer. Flow meters shall be subject to regular maintenance, testing and calibration to ensure accuracy.
Any comment:	

Data / Parameter:	**FE**
Data unit:	%
Description:	Rated flare efficiency based on manufacturer's rating. Fraction of time in which gas is combusted in the flare multiplied by the efficiency of the flaring process.
Source of data to be used:	
Value of data	90%
Description of	Project proponents will ensure that the manufacturer's specification for the use of

measurement methods and procedures to be applied:	the flare device will be followed. This includes ensuring that the parameters of temperature and biogas flow rate are within the range of the manufacturer's specifications.
QA/QC procedures to be applied:	Regular maintenance will ensure optimal operation of flares
Any comment:	

Data / Parameter:	w_{CH4}
Data unit:	Mass fraction
Description:	Methane content in the biogas in year y
Source of data to be used:	Results of sampled biogas or Results of measurements based on a continuous gas analyser.
Value of data	
Description of measurement methods and procedures to be applied:	One of two available methods will be used: 1. Biogas samples will be taken periodically to the department of science and technology for analysis. Measurements will be taken at a 95% confidence level 2. A continuous analyser will be used to measure methane content in biogas. Gas will be analysed on a dry basis.
QA/QC procedures to be applied:	Regular maintenance of analysers will be done in accordance to the manufacturer's recommendation.
Any comment:	

Data / Parameter:	T_{biogas}
Data unit:	°C
Description:	Biogas temperature inside the digester
Source of data to be used:	A thermometer will be used to measure temperature of gases inside the digester.
Value of data	
Description of measurement methods and procedures to be applied:	Biogas temperature will be measured at site prior to combustion
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	T_{flare}
Data unit:	°C
Description:	flare temperature
Source of data to be used:	A temperature probe will be used to measure temperature of the flare to ensure that temperature is not below 500°C
Value of data	
Description of	Flare temperature will be measured by a temperature probe and recorded

measurement methods and procedures to be applied:	continuously.
QA/QC procedures to be applied:	Measured continuously according to manufacturer's recommendations
Any comment:	

Data / Parameter:	**P_{biogas}**
Data unit:	MPa
Description:	Pressure of biogas inside the enclosed biogas digester
Source of data to be used:	Measured as a parameter of the flow meter.
Value of data	
Description of measurement methods and procedures to be applied:	Biogas pressure will be measured at site prior to combustion.
QA/QC procedures to be applied:	Measuring devices will be maintained to ensure optimal operation.
Any comment:	

Data / Parameter:	**Soil application**
Data unit:	Qualitative observation
Description:	Soil application of solid material from the project activity
Source of data to be used:	Site observation
Value of data	
Description of measurement methods and procedures to be applied:	Solid material taken from project activity shall be handled aerobically. Proper conditions and procedures will be used to ensure that no methane emissions will take place.
QA/QC procedures to be applied:	Fertilizer treatment enzymes will be used. And aerobic conditions will be applied to ensure that no methane emissions will take place.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The approved monitoring methodology is taken from the "Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories", version 12; the approved monitoring methodology is from *III.D. Methane recovery*:

> *10. Emission reductions achieved by the project activity in each year will be assessed ex-post through direct measurement of the amount of methane fuelled or flared. The maximum emission reduction in any year is limited to the yearly methane generation potential calculated in the project design document for that year.*
>
> *11. The amount of methane recovered and fuelled or flared shall be monitored ex-post, using flow meters. The fraction of methane in the biogas should be measured with a continuous*

analyzer or, alternatively, with periodical measurements at a 95% confidence level. Temperature and pressure of the biogas are required to determine the density of methane combusted.

12. Regular maintenance should ensure optimal operation of flares. The flare efficiency, defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process, shall be monitored. One of the two following options shall be used to determine the efficiency of the flaring process in an enclosed flare:

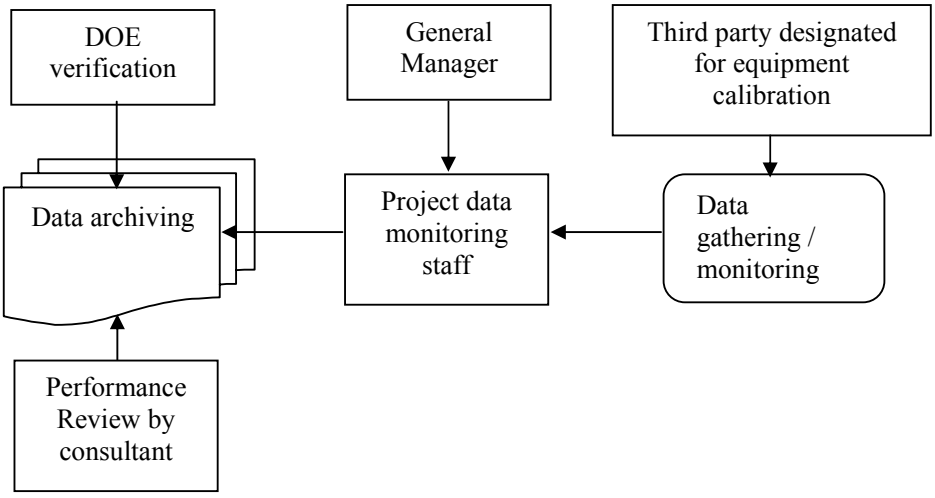
a. to adopt a 90% default value or

b. to perform a continuous monitoring of the efficiency.[1]

If option (a) is chosen, continuous check of compliance with the manufacturer's specification of the flare device (temperature, biogas flow rate) should be done. If in any specific hour any of the parameters is out of the range of specifications, 50% of default value should be used for this specific hour. For open flare 50% default value should be used, as it is not possible in this case to monitor the efficiency. If at any given time the temperature of the flare is below 500ºC, 0% default value should be used for this period.

Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider to apply the flare efficiency to the portion of the biogas used for energy, if separate measurements are not performed.

The general manager is tasked to ensure that the project activity is implemented according to plan and that all monitoring activities are carried out on a timely basis, making certain of the integrity and quality of data. A project data monitoring staff will be assigned to monitor the data on a daily basis. The project monitoring staff is also responsible for archiving the data in an orderly manner. Data archived will be inspected and verified by the DOE on a regular basis. A third party will be designated to calibrate equipment if and when necessary. Moreover, a regular performance review will be conducted by the consultant, to ensure the quality of data collected and the optimum performance of the project activity.



Metering devices used are designed to continuously and accurately measure biogas flow and are specially designed for corrosive environments. Meters are received from the factory fully-calibrated and retain calibration for the service life of the unit. Volumetric accuracy of the meter is permanent and nonadjustable. Accuracy is not affected by low or varying line pressures. Accuracy of the flowmeters utilized exceeds 99 percent across the entire measured rate curve with an uncertainty range of less than +1 percent. Periodic maintenance will be performed based on manufacturer specifications.

Uncertainty will be minimized by having all parameters operate within the specifications of the flow meter. Should any of the parameters be out of range at any point, a 50% default value will be used. Lastly uncertainty is managed by measuring flare temperature and noting that if at any point in time flare is below 500°C, a 0% default value will be used in that period.

Proper soil application of the final sludge will be monitored to ensure that this will not result in methane emissions.

Further detail on the monitoring parameters to be monitored can be seen from Annex 4 of this PDD.

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

>>
The baseline was revised and completed on 11/12/2007

The baseline was developed and completed by:

Alan Silayan
CaFiS Inc.
asilayan@cafisinc.com
+632 426 6001 loc. 4669

CaFiS Inc. is a project participant

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

1/12/2007 (dd/mm/yyyy)

C.1.2. Expected operational lifetime of the project activity:

>>25 years 0 months

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

C.2.1. Renewable crediting period

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

>>1/6/2008

C.2.1.2. Length of the first crediting period:

>> Seven-year (7) crediting period renewable twice for a total of 21 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

>>

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

>>

The host country does not require a detailed, independent environmental impact assessment for such a project. On the basis of the project design and the application procedure for a Permit to Operate, an environmental compliance certificate (ECC) has been issued to Pig City for the proposed project. This indicates that the project is in compliance with existing environmental regulations of the host party.

It must be noted that the project will have a positive impact on the environment in three significant areas.

First, swine manure as a solid waste pollution externality, will be addressed through the project activity by processing all volatile solids that are generated by the facility. The result is a neutralized substance very suitable for soil enhancement and nutrition.

Secondly, the project activity directly addresses the potential for 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 third and perhaps the most significant impact is the eradication of water pollution through the two-stage biodigester and water treatment facility. The two stages ensure the minimization of BOD / COD contents of the wastewater by at least 85%. The treated water will not flow directly into surrounding waterways but instead will be re-used in the farm as waste flush-water and fishpond water. This closed system design further ensures the minimization of environmental impacts to the local area.

The standards for environmental quality will be further cross-checked by the Department of Natural Resources and Environment, Environmental Management Bureau (DENR-EMB) through a quarterly self monitoring report (SMR) to be submitted as a requirement of the Environmental Compliance Certificate by the Pollution Control Officer (PCO) of Cavite Pig City Inc.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>Environmental impacts are not considered significant and therefore an environmental impact assessment is not necessary.

SECTION E. Stakeholders' comments

>>

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

>>

As required by law for environmental compliance, a local stakeholder discussion was initiated by Pig City among the key barangay (village) officials informing them of the intentions of the project. This was conducted as early as June 15 2004.

An announcement was made by a sign at the local barangay (village) hall inviting interested stakeholders to attend the stakeholder consultation. This was done a week before the said event. More than 20 people attended the event including local councilors and local environment officials.

Detailed attendance and minutes of the meeting are available if needed.

E.2. Summary of the comments received:

>> In summary, the local stakeholders are pleased with the continued efforts of Pig City to minimize the environmental impacts of their operations. The local leaders fully support any effort to reduce foul odors normally emitted by such facilities. In full recognition of this support, local officials have signed a stakeholder approval document stating that the local stakeholders, represented by the barangay council, have no objection to the project.

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

>>

The local leaders of Barangay San Francisco have documented the expression of approval and no-objection in a signed manifesto. This has been documented in the minutes of the meeting

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Cavite Pig City Inc.
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Salutation:	

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Direct FAX:	
Direct tel:	
Personal E-mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no official development assistance being provided for this project. Furthermore no public funding is utilized for the project activity.

Annex 3

BASELINE INFORMATION

Baseline information and calculations are foune in “calculation ver. 7-2.xls’

Annex 4

MONITORING INFORMATION

ID number	Data type	Data variable	Data unit	Measured (m) calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived (electronic / paper)	For how long is archived data to be kept	Comment
1	Electricity Generated by the Project Activity	$EC_{p,y}$	MWh	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	A standard electricity meter will be installed at the facility
2	Biogas flared or used as fuel	$BG_{burnt,y}$	m^3	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	Standard gas flow meters will be used measured at STP.
3	Biogas flow rate from digester to the combustion equipment	$Flow_{BG}$	m^3/sec	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	
4	Flare efficiency	FE	%	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	Rated efficiency calculated based on manufacturer's rating.
5	Methane content of biogas	w_{CH4}	Mass fraction	M	Quarterly or continuous	Sampled (with a 95% confidence interval) or 100% continuous measurement	Electronic and paper	Crediting period plus 2 years	Biogas samples will be taken to the Department of Science and Technology for analysis or a continuous gas analyser will be used
6	Biogas Temperature	T_{biogas}	°C	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	Must be within flow meter specifications
7	Flare Temperature	T_{Flare}	°C	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	Must be greater than or equal to 500°C
8	Biogas Pressure	P_{biogas}	MPa	M	Continuous	100%	Electronic and paper	Crediting period plus 2 years	Must be within flow meter specifications