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

CONTENTS

Revision history of this document

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

ANAEROBIC DIGESTION SWINE WASTEWATER TREATMENT WITH ON-SITE POWER PROJECT (ADSW RP1003)
-Version 1
-Completed 01 October 2007

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

The Anaerobic Digestion of Swine Wastewater Treatment With On-Site Power Project (ADSW RP1003) (hereafter, the "Project") that is being developed by Philippine Bio-Sciences Co., Inc. (hereafter referred to as the "Project Developer" or "PhilBIO") is an anaerobic digestion swine wastewater treatment project coupled with an on-site power generator at Sorosoro Ibaba Development Cooperative (SIDC), Barangay Dagatan, Taysan, Batangas (hereafter referred to as the "SIDC Farm" or the "Farm").

The farm, located at Barangay Dagatan, Taysan, Batangas, employs a scraping and hose-down waste management system with a series of open lagoons. Such lagoon-based treatment is standard practice in the South East Asian region. The waste material is left to decay in the facility's open lagoon system, producing significant amounts of biogas (mostly methane) that is emitted directly to the atmosphere. Emissions of biogas contribute to significant air and water pollution in the areas close to the farms.

PhilBIO introduced a method of utilizing biological treatment to enhance the farm's wastewater treatment. The Project has four principle objectives:

(a) Manage the farms wastewater, and reduce the organic loading of the wastewater
(b) Reduce odour and other emissions that are a significant issue for local people
(c) Generate power from captured biogas
(d) Reduce harmful emission of greenhouse gases

The 'Covered In-Ground Anaerobic Reactor' (or 'CIGAR®[1]'), effectively breaks down organic pollutants in a multi-stage biological treatment process in the absence of oxygen. A high density polyethylene (HDPE) liner and cover are used to provide an 'air tight' seal and to prevent leachate from percolating through the ground and polluting local groundwater supplies. As a result, Biochemical Oxygen Demand (BOD) is reduced by up to 95%, and Chemical Oxygen Demand (COD) by 80%. Suspended solids and colour are also reduced in the CIGAR® system. The digester is designed to maintain a 30 day hydraulic retention time (number of days in the CIGAR®), and this continued exposure to anaerobic processes effectively reduces pathogens. The treated effluent is then sent to a final treatment lagoon where aerobic and photosynthetic

[1] CIGAR is a duly registered trademark owned by PhilBIO with the Intellectual Property Office (IPO) of the Philippine Bureau of Trademarks.

processes predominate. If there is any necessity to discharge to the local watercourse, it will be done within the Department of Environment and Natural Resources (the 'DENR') standards.

In this system, PhilBIO ensures biogas is recovered through its CIGAR® design. Methane, a potent greenhouse gas and potential energy source, is between 55-75% of the biogas emitted and captured. In the farm's CIGAR®, the effluent is expected to produce an average of 743 m^3 of biogas per day from the system all year around.

The biogas produced in the farm's anaerobic digester will be used to generate electricity for use on-site. A 75 KW generator, fuelled with biogas, will be installed to produce 575 MWh of electricity annually (conservative estimate). The generator will provide 100% of the farm's power needs. Any surplus biogas, where produced, will be flared rather than released to the atmosphere, until such time as structural barriers are removed to allow the export of surplus electrical energy to the local distribution grid.

The Project will make a significant contribution to helping the Host Country meet its sustainable development goals outlined in the Philippine Agenda 21. The following benefits will be realised:

Macro Level Benefits

- Clean technology, both in waste management and in renewable energy, will be demonstrated and may be replicated throughout the country's livestock sector as well as in the Asian region;
- National energy self-sufficiency is increased with the use of inexpensive, renewable and indigenous energy resources, which decreases dependence on imported fossil fuel and a reduction in negative impacts of fuel imports on the nations balance of payments;
- Global environmental protection is supported by the capture of fugitive GHGs, specifically methane, and the reduction in displaced energy related emissions;
- A new financial mechanism for financing in the renewable energy and waste management sectors is positively demonstrated via the Clean Development Mechanism (CDM), and is shown to present an alternative development path by improvement in the financial viability of marginal projects; and
- Incremental reduction on the need for "new build" power plants at a national level.

Micro Level Benefits

- Control of lagoon leachate that would otherwise pollute groundwater resources;
- Reduction in pollution potential of wastewater emissions to local water resources;
- A Healthier and Safer Work Place is developed with improvements in local air quality, and control of potentially combustible methane emissions;
- Considerable reduction in odour from the existing treatment facilities that currently affects local communities;
- Improvement in the viability of rural enterprises which support local employment in the agricultural sector; and
- Generation of locally produced electricity to provide a more reliable energy source than the current grid system.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
The Philippines (host)	Sorosoro Ibaba Development Cooperative	No
The United Kingdom	Equity + Environmental Assets Ireland Limited	No

Equity + Environmental Assets Ireland Limited is the official contact for the CDM project activity and Focal Point for all communications with the CDM EB. Further contact information for the project participants are provided in *Annex I* of this document.

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

Figure 1 Lagoon, The Local Common Practice

PhilBIO proposes a novel animal waste management system to recover methane gas emissions as an alternative to current open lagoon systems. Wastewater treated in these lagoons is often at an ambient temperature of around 35ºC, and under anaerobic conditions. The result of this is that biogas (mostly methane) is emitted continuously to the atmosphere, as can be seen in this typical farm lagoon system image.

Using an optimised anaerobic process, the CIGAR®, the biogas recovered from each farm will be used to provide fuel for each farm's on-site electrical power plant.

The CIGAR® process breaks down organic pollutants in a complex biological treatment process where effluent is treated by microorganisms in the absence of oxygen. The effluent is retained in the reactor where complex microbial consortia breakdown the waste to methane and carbon dioxide which is used as biogas for electricity generation on site (*Figure 2 the CIGAR® System*). The biogas stored in the CIGAR® will be used to start-up the biogas engine, eliminating the need to use grid-fed electricity or diesel fuel, during start-ups.

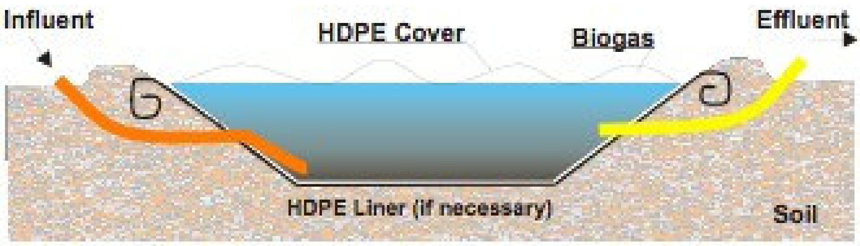

Figure 2 The CIGAR® System

The CIGAR® system incorporates a 1mm HDPE cover to provide an 'air-tight' system to prevent biogas from escaping to the atmosphere, and an HDPE liner is used to prevent liquor leaching to any underground water systems.. As a result, Biochemical Oxygen Demand (BOD) is reduced by up to 95%, and Chemical Oxygen Demand (COD) by 80%. Suspended solids and colour are also reduced in the CIGAR® system. The digester is designed to maintain a 30 day hydraulic retention time (number of days in the CIGAR®), and this continued exposure to anaerobic processes effectively reduces pathogens. The treated effluent is then sent to a final treatment lagoon where aerobic and photosynthetic processes predominate. Methane, is between 55-75% of the biogas emitted and captured.. The biogas produced from the farm will be used to generate electricity through the electricity generation unit located within the farm.

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

A.4.1.1. Host Party(ies):

Philippines

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

Region IV, Southern Luzon, Batangas

A.4.1.3. City/Town/Community etc:

Taysan, Barangay Dagatan

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

The project is located at SIDC Farms at Barangay Dagatan, Taysan, Batangas . Please refer to *A.2. Description of the small-scale project activity* and *Figure 3 Location Maps* for each farm's specific location.

Batangas is a province of the Philippines located on the southwestern part of Luzon in the CALABARZON Region (IV-A), 110Km from Metro Manila. Its capital is Batangas City and it is bordered by the provinces of

Cavite and Laguna to the north and Quezon to the east. Across the Verde Island Passages to the south is the island of Mindoro and to the west lies the South China Sea.
The 31 municipalities and 3 cities province is known for its livestock (home of country's best breed) and agriculture (pineapples and its textile product, gusi). The province has a population of more than 180,000people.

Taysan is a 4th class municipality in the province of Batangas. It has a population of 29,836 people in 5,823 households., which is subdivided into 20 barangays.

Figure 3 Location Maps[2]

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

The categories for the project activities according to the UNFCCC's published Appendix B of the simplified modalities and procedures for small-scale CDM project activities are:

- Type I.D (reference AMS-I.D v.12) – "*Grid connected renewable electricity generation*" – for the electricity generation component; and,

- Type III.D (reference AMS-III.D v.13) – *"Methane recovery in agricultural and agro industrial activities"* – for the methane recovery component.

The project activities conform to project category III.D since the Project will reduce anthropogenic emissions by sources, directly emit less than 15kt of carbon dioxide equivalent annually, and result in emission reductions lower than or equal to 60ktCO_2e annually. The project activities conform to project category I.D since the renewable generating units will displace electricity from an electricity distribution system and

[2] Source: Wikepedia, The Free Encyclopedia, www.en.wikepedia.org

supply an individual user with a small amount of electricity and the capacity will not exceed 15 MW. A detailed discussion of the technology of the project activities can be found in *Section A.4*.

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

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 2007	2,788
Year 2008	2,788
Year 2009	2,788
Year 2010	2,788
Year 2011	2,788
Year 2012	2,788
Year 2013	2,788
Total estimated reductions (tonnes of CO_2e)	15,519
Total number of crediting years	7 (renewable up to 21 years)
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	2,788

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

The host farm for the project and the project developer will fund the Project entirely. The Project has not received and will not seek public funding.

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

Based on the information provided in Appendix C of the simplified modalities and procedures for small-scale CDM project activities, this project activities is not a debundled component of a larger project activity since the project participants have not registered nor operated another project in the region surrounding the project boundaries.

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 I.D (reference AMS-I.D/version 12) – *Grid connected renewable electricity generation*; and,

Project activity type III.D (reference AMS-III.D/version 13) – *Methane recovery in agricultural and agro industrial activities.*

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

The Project conforms to project category III.D since the Project will reduce anthropogenic emissions by sources, directly emit less than 15kt of carbon dioxide equivalent annually, and result in emission reductions lower than or equal to 60ktCO_2e annually. The Project conforms to project category I.D. since the renewable generating unit will displace electricity from an electricity distribution system and supply an individual user with a small amount of electricity and the capacity will not exceed 15 MW. A detailed discussion of the technology of the project activity can be found in *Section A.4*.

These selections are appropriate because the alternative to the project activities would be to continue with the business-as-usual scenario. This scenario would continue to manage wastewater through the existing aerobic pond system, and would continue to use electricity from the electricity distribution system in the area.

B.3. Description of the project boundary:

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

- The project boundary for type I.D (AMS-I.D) is the physical, geographical site of the renewable generation source.

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

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

- Electricity and Fuel Oil Displacement/Emissions: The boundaries are assumed to be the physical, geographical site of the generating unit.

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

B.4. Description of baseline and its development:

As specified in Appendix B:

- The appropriate baseline for project category Type I.D (AMS-I.D) is found in paragraphs 9.
- The appropriate baseline for project category Type III.D (AMS-IIID) is found in paragraphs 7 and 8.
- Date of completing the final draft of this baseline section: 01/10/07

For AMS-I.D:
Baseline electricity generation emissions are given by:

$$E_{baseline} = EP_{BIO} \text{ x } CEF_{grid}$$

Where:
$E_{baseline}$: Baseline electricity generation emissions (tCO_2e/year)
EP_{BIO}: Electricity produced by the biogas generator unit for grid electricity replacement (MWh)
CEF_{grid}: Emission coefficient for electricity grid (kg CO_2e/kWh). The calculation of CEF is provided in a separate spreadsheet.

For AMS-III.D:
Baseline fugitive GHG emissions are:

$$FE_{baseline} = FM_{baseline} \text{ x } GWP$$

Where:
$FE_{baseline}$: Baseline fugitive GHG emissions (tCO_2e/year)
$FM_{baseline}$: Baseline fugitive methane emissions (t/year)
GWP: Global warming potential for methane (tCO_2e/t)

Baseline fugitive methane emissions are:

$$FM_{baseline} = EF_i \text{ x } Pop$$

Where:
$FM_{baseline}$: Baseline fugitive methane emissions (tCO_2e/year)
EF_i: Annual emission factor of the animal type i (i.e. swine for this document) (kg)
Pop: Swine population

Annual emission factor for swine is:

$$EF_i = VS_i \text{ x } 365 \text{ days/year x } B_{oi} \text{ x } 0.67 \text{ kg/m}^3 \text{ x } \sum MCF \text{ x } MS\%$$

Where:

EF_i: Annual emission factor for swine (kg)
VS_i: Daily volatile solid excreted for swine (kg)
B_{oi}: Maximum methane producing capacity (m^3/kg of VS) for manure produced by swine
MCF: Methane conversion factor for the swine manure management system
MS%: Fraction of swine manure handled using manure system

$$VS = [GE \times (1\text{-}DE\%/100) + (UE \times GE)] \times (1\text{-}ASH\%/18.45)$$

Where:
VS: Volatile solid excretion per day on a dry weight basis (kg)
GE: Estimated daily average feed intake (MJ/day)
UE x GE: Urinal energy expressed as fraction of GE (MJ/day)
DE%: Digestibility of the feed (%)
ASH%: Ash content of the manure (%)

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

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

The baseline study was prepared by:
Philippine Bio-Sciences Co., Inc.
Tel: +632 638 2074/6092

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:

Market Situation & National Policies

The Philippines has approximately 5 million farms, covering approximately 9.7 million hectares and over 12.14 million pigs, with a total weight of 1.78 million metric tonnes of pork. The bulk of the pig population comes from smallholder farms, which account for about 85% of the total hog inventory. According to the Philippine Bureau of Agricultural Statistics, the livestock sub-sectors grew by about 2.37 percent in 2005 from the previous year. Hog production represents about 80 percent of the total Philippine livestock industry. Among the regions, Central Luzon accounted for the biggest contribution in swine production. In 2005, the swine sector grew by 3.6 percent. Due to continued strong domestic consumption of pork, the sector is likely to continue to grow at a rate of 3 to 4 percent in 2006 and beyond, despite increased feed cost in the world markets. The early part of 2006 showed a 7.5% increase in feed costs from 2005. Filipinos are large consumers of pork meat and are known to generally prefer pork to chicken or beef[3], and significant quantities can be exported to the Chinese market.

[3] Moog, F. A., "Promotion and utilization of polyethylene biodigester in small hold farming systems in the Philippines", Research Division, Bureau of Animal Industry, Manila, Philippines, 1997

The industry faces a number of obstacles including the spread of economically devastating diseases as experienced in 2004 and 2005, high marketing and transaction costs, erratic supply of imported feed ingredients, supplements, and the limited availability of genetically superior breeding stock.[4]

The main regulatory agencies that monitor the industry are the Bureau of Animal Industry (BAI) and the National Meat Inspection Commission (NMIC) under the Philippine Department of Agriculture (DA). Environmental regulations are monitored and enforced by the Department of Environment and Natural Resources (DENR). The primary environmental laws applicable to the project are the Clean Water Act (2003) and the Clean Air Act (1999).

Additionality

Evidence as to why the proposed projects are additional is offered under the following categories of barriers: (a) investment barrier, (b) technological barrier and (c) common practice.

a) Investment Barrier

Small swine farms, such as these, have a difficult time securing financing for the implementation of biogas waste management projects. The following factors contribute to the investment barriers that these kinds of projects face:

- Perceived Risk – Most local financial institutions are not interested in these projects, primarily because of lack of knowledge and experience with the technology.

- Bias Against Renewable Energy Projects – Renewable energy projects do not have access to government guarantees like conventional energy projects do, receiving low priority in financing programmes due to the absence of an integrated programme for the development of renewable energy sources. There is also an unfair financing treatment accorded to renewable energy technologies. Most of the attractive financing packages such as an extended repayment period apply only to conventional energy projects. Shorter repayment periods for renewable energy projects effectively increase the front-end costs for potential renewable energy project investors. Few renewable energy projects, with the exception of some large-scale hydro and geothermal projects, have reached financial closure because of lack of participation of local lending institutions.[5]

- Current Practice – The current lagoon-based treatment methods are considered standard operating practice in the Philippines and in the region for manure treatment. Moreover, for the project owners, the current lagoon system (business-as-usual scenario) is extremely financially attractive, given that it works to required specification and requires virtually no management input or investment capital to achieve the key

[4] Abuel-Ang, Pia, "Philippines Livestock and Products Annual 2004", USDA Foreign Agricultural Service, September 2004

[5] J.C. Elauria, M.L.Y. Castro and M.M. Elauria, "Biomass Energy Technologies in the Philippines: A Barrier and Policy Analysis", Energy for Sustainable Development, Volume VI, No. 3, September 2002, pp.45-46

parameters. All required lands are appropriated and the current system has sufficient capacity to handle additional waste.

- Lowest Cost – The current system represents the lowest cost option, with the only cost being the opportunity cost of alternative land use.

- General Culture – The project requires investment capital into a part of the business that is not seen as core to the farmers. Culturally, the often family-owned farm holdings will see investment prioritised into areas that directly benefit the farm and it's expansion of inventory.

The inclusion of CER revenues has therefore become an important part of the Project Developer's implementation and financing strategy. The lack of appetite of the project host to undertake this project and hence the project's additionality, is further demonstrated through the need to attract third party, international, finance through foreign investment in this project, whose objective is to seek access to CERs.

b) Technology Barrier

The predominant and established technology for pig waste management in the Philippines is to use a series of treatment lagoons. Biological treatment of wastewater to produce biogas is a new and relatively unknown technology here. The lack of available expertise and confidence in the technology, especially among small, privately owned pig farms, makes this type of project difficult to develop. As a result, most swine farm owners view this technology as risky and prefer to maintain their farms in the traditional fashion. This risk is reflected in the fact that there are not many projects of this type in the Philippines. Moreover, many farmers are concerned that anaerobic digester projects are too complex to operate and maintain. The anaerobic digestion and biogas systems that will be used in the Project are quite different to those previously experienced in the Philippines in relation to pig waste treatment. The project activities represent a more technologically advanced alternative to the business-as-usual scenario, and one that carries higher perceived risks.

Overall, the project scenario involves higher perceived risks due to the performance uncertainty and a low market share of the new technology. Anaerobic digestion systems are perceived as relatively high risk, being based upon the function of a complex biological system. The biological system is often perceived as being at risk of chemical shocks that can hinder biological activity (and subsequently, the waste management and energy production regimes, which are both keys to commercial operation). Anaerobic digestion systems require careful management of a variety of parameters - flows, pH, etc. and in general, are perceived as a risky solution.

c) Common Practice

The CIGAR® technology that will be utilized in the project is not common in the Philippines and represents a higher risk alternative to the business-as-usual scenario. At present, lagoon-based treatment is the standard practice in the Philippines and in the regions for pig farms. There is little experience in using specific aerobic or anaerobic processes in the Philippine context, and therefore, these are not considered a high priority. The highest priority for most in the sector is the management of their effluent discharge to simply maintain compliance with local regulations. From the operator's perspective, the lagoon system is a cheap and practical way to clean the wastewater.

Summary

The current and expected practice in the host nation relies almost exclusively on lagoon-based wastewater treatment facilities for pig farms. In combination with the lack of access to financing, and the perceived risks of the selected technology, the additionality of this Project can be clearly demonstrated. The prohibitive barriers that exist in the Philippines are confirmed by the observed trend in current pig waste management practices.

The barrier analysis above, clearly demonstrates that the most plausible baseline scenario is the prevailing practice of lagoon-based wastewater treatment. The most significant barriers facing the Project are technology awareness, perceived risk of the technology, and the relative lack of investment interest shown by the key business constituency.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission reductions

AMS-I.D:
The electricity generated by the biogas times the CO_2 emission coefficient for the displaced electricity from the grid and of the displaced fossil fuel.

AMS-III.D:
The lower of the two values of (1) actual monitored amount of methane captured and destroyed by the project activity (2) the methane emissions calculated ex ante using the amount of waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach.

Project direct emissions

AMS-I.D:
As the Project is utilising biogas with biogenic origins to produce renewable energy, and the design of the system does not include many electrical appliance except for one blower (consuming 3.2 MWh per annum supplied by the system itself). The anthropogenic emissions from this component are considered to be zero.

AMS-III.D:
Project emissions consist of CO2 emissions from use of fossil fuels or electricity for the operation of the facility. As stated in the paragraph above, the system only utilizes one blower, from which the anthropogenic emissions are considered negligible.

A number of potential sources are taken into consideration for project emissions, including:

- Physical leakage from the system

The methane recovery facility, the Project, is designed and constructed to collect all the biogas from the digester. First of all, the digester is designed to operate under negative pressure, when the biogas is sent to the generator. Secondly, the perimeter of the digester employs an 'anchor-trench' design, where the liner and cover of the digester exceed the perimeter by approximately one metre. The liner and cover are then sealed at the perimeter of the digester and the overlapped portion (approximately one meter) is then anchored with steel pins and buried and compacted with soil, to further anchor the liner and cover. It is very unlikely that any biogas generated in the digestion process will escape the cover system of the CIGAR.

Physical leakage from the pipeline is considered to be zero, as the pipeline from the collection point to the combustion points is short (less than 1km, and is used for on-site delivery only).

- Methane captured and not flared

It is unlikely that there will be any leakage from the flares, as the flares will only be in use when there is more biogas than can be combusted in the generator. Nonetheless, *ex post* determination will be defined after the measurement of the flare efficiency is attempted.

It is unlikely that there will be any un-combusted methane from the generator, given the generator has been designed for high performance. A Combustion efficiency test will be conducted on the generator each year.

- CO2 emission from combustion of non-biogenic methane

Not applicable. No other fuel than biogas will be used.

- If the sludge is treated and/or disposed anaerobically, the resulting methane emissions shall be considered as project emissions.

Not applicable to *ex ante* estimates. No sludge is anticipated to leave the system during the crediting period based on the developer's experience. However, the aerobic treatment and/or land application of the sludge leaving the digester in the project activity shall also be ensured and monitored.

Leakage

AMS-I.D, paragraph 12, states that no leakage calculation is required since the equipment is not being transferred to or from another activity.

AMS-III.D, paragraph 9, states that no leakage calculation is required.

Baseline

The total baseline emissions ($TB_{emissions}$) are:

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

Therefore, the total emission reductions are:

$$ER = FE_{baseline} + E_{baseline} - PE_{project}$$

Refer to section B.4 for details of the calculations of each source.

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

Data / Parameter:	**CEF_{grid}**
Data unit:	tCO_2/MWh
Description:	Emission coefficient of the electricity distribution system
Source of data used:	Philippine Department of Energy (PDOE) – www.doe.gov.ph
Value/s applied:	0.557 (Luzon grid)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated according to the most recent ACM0002, using publicly available statistic data.
Any comment:	Computations of grid CEFs are attached as a separate excel spreadsheet.

Data / Parameter:	**Pop**
Data unit:	Heads
Description:	Animal population in the Farm
Source of data used:	Farm Specific
Value/s applied:	5,000
Justification of the choice of data or description of measurement methods and procedures actually applied:	The animal population of the farm is used for the ex-ante estimation of emission reductions. For each year during the crediting period, emission reductions will be the lower value of the two, (1) the monitored methane captured and destroyed and (2) the ex-ante estimate number.
Any comment:	

Data / Parameter:	**Capacity**
Data unit:	kW

Description:	Installed generator capacity in the Farm
Source of data used:	Project design
Value/s applied:	75
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**Manure management system usage**
Data unit:	%
Description:	Fraction of manure being treated by the system
Source of data used:	Project design
Value/s applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**Operation rate**
Data unit:	%
Description:	Fraction of time generator is operational
Source of data used:	PhilBIO's experience
Value/s applied:	87.5
Justification of the choice of data or description of measurement methods and procedures actually applied:	To enhance conservativeness, the operation rate adopted is at 87.5% based on project developer's experience.
Any comment:	

Data / Parameter:	**Feed mass intake**
Data unit:	kg/day
Description:	The average mass of feed intake per head per day
Source of data used:	Philippine Department of Agriculture http://www.geocities.com/zambo_da9/tip_swine_raising.html

Value/s applied:	2.66
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:

AMS-I.D:

Baseline emissions are calculated as the following:

Based on the Project Developers assumptions and observations on the project's engine running time, the total annual amount of electricity from the grid displaced is estimated at 575 MWh.

The Farm will utilise a 75 kW generator engine, which is connected to the Luzon Grid[6], therefore,

Table B.6.3.a AMS-I.D Baseline

	Value	**Source**
a. Installed Capacity (kW)	75	Project
b. Genset Operating Rate	87.50%	Measured
c. Daily Electricity Generation (kWh/day)	1,575	Calculated (a x b x 24 hrs)
d. Annual Electricity Generation (MWh/year)	575	Calculated (c x 365/1000)
e. Emissions Coefficient (tonne CO2e/MWh)	0.557	CEF Spreadsheet
Annual CO2 emission reductions from electricity generation (tonne CO2e/year)	**320**	Calculated (d x e)

Estimated annual baseline emission of the electricity displacement component of the project activities is 320 **tonnes CO_2e/year.**

[6] Source of the emission coefficient factors of the electricity grids of the Philippines: (1) "CDM Baseline Construction for the Electricity Grids in the Philippines", prepared by the Klima Climate Change Center of the Manila Observatory for the Environmental Management Bureau of the DENR; and (2) 2005 energy date published by the Philippine Department of Energy on http://www.doe.gov.ph/power/Power%20Stat%202005%20update042406.htm

Project emissions:
As the Project is utilising biogas with biogenic origins to produce renewable energy, and the design of the system does not include many electrical appliances except for one blower (consuming 3.2 MWh per annum supplied by the system itself). The anthropogenic emissions from this component are considered to be zero.

Leakage:
AMS-I.D, paragraph 12, states that no leakage calculation is required since the equipment is not being transferred to or from another activity.

AMS-III.D:
Baseline emission is calculated as follows:

Country specific value for feed intake per day is:
Feed mass (kg/day) x energy per mass unit (kcal/lb) x conversion factor
Therefore,
GE (MJ/day) = 2.66 (kg/day) x 3250 (kcal/kg) x 0.0041868 (MJ/kcal) = **36 (MJ/day)**[7],

Table B.6.3.b AMS-III.D Baseline

	Value	Source
Pig population	5,000	Farm
Daily Intake per Head (MJ/day)	36	Calculated
Digestibility	80%	IPCC 2006 T10.2
Urinary Energy	0.02	IPCC 2006 page10.42
Ash Content	4%	IPCC 1996 page4.23
Daily Volatile Solids Excretion (kg/day)	0.41	Calculated based on IPCC 2006 tier 2
Bo, Maximum Methane-Producing Capacity (m3/kg VS)	0.29	IPCC 2006 T10.A
MCF, Methane Conversion Factor	80%	IPCC 2006 T10.A
EF, Annual Emission Factor (kg)	23.51	Calculated
Annual Methane Capture (tonnes)	118	Calculated

[7] Source of the daily feed intake: (1) Philippine daily feed mass, Deparment of Agriculture (Zamboanga Region, Philippines) http://www.goecities.com/zambo_da9/tip_swine_raising.html; (2) energy per mass unit, Herr et al. (2000), Evaluating Variable Feed Energy Levels for Grow-Finish Pigs, http://www.ansc.purdue.edu/swine/swineday/sday00/8.pdf; (3) mass unit conversion factor, www.onlineconversion.com; (4) feed intake rate affected by temperature, Effect of Environment on Nutrient Requirements of Domestic Animals, http://www.fermat.nap.edu/openbook.php?record_id=49638&page=32)

Methane Density (kg/m3)	0.667	Default
Methane Content	65%	Project specific
Daily Biogas Offtake (m3/day)	743	Calculated
GWP Methane	21	Approved Global Warming Potential for CH4
Annual Baseline (tonnes CO2e/year)	**2,468**	**Calculated**

Estimated annual baseline emissions of the methane component of the project activities is **2,468 tonnes CO_2e/year**

Project emission due to project activities is:

Table B.6.3.c AMS-III.D Project Emissions

	Value	**Source**
CO2 emissions from use of fossil fuel (tCO2e/year)	0	Negligible. Please refer to section B.6.1. for detailed justification.
Total project emissions (t CO2/year)	**0.0**	**Calculated**

Direct project emissions are **negligible.**

Leakage:
AMS-III.D, paragraph 9, states that no leakage calculation is required.

Total emission reductions are:

320 (AMS-I.D) + 2,468 (AMS-III.D) **-** 0 (Project Emissions) **= 2,788 tonnes CO_2e/year**

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

Year	**Baseline (tCO2)**		**Project Emissions (tCO2e)**	**Leakage (tCO2e)**	**ER (tCO2e)**
	Methane Capture	**Power**			
2007	2,468	320	0.0	0.0	2,788
2008	2,468	320	0.0	0.0	2,788
2009	2,468	320	0.0	0.0	2,788
2010	2,468	320	0.0	0.0	2,788
2011	2,468	320	0.0	0.0	2,788
2012	2,468	320	0.0	0.0	2,788
2013	2,468	320	0.0	0.0	2,788

Total	**17,276**	**2,240**	**0.0**	**0.0**	**19,516**

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

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

AMS-I.D Grid Connected Renewable Electricity Generation – (13) Monitoring shall consist of metering the electricity generated by the renewable technology.

AMS-III.D Methane Recovery in Agricultural and Agro Industrial Activities – (11) The amount of methane recovered and fuelled or flared shall be monitored ex-posed, using flow meters. The fraction of methane in the biogas should be measured with a continuous analyser or, alternatively, with a 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; (15) Flow meters, sampling devices and gas analyzers shall be subject to regular maintenance, testing and calibration to ensure accuracy; and (17) The monitoring plan should include on site inspection for each individual farm included in the project boundary where the project activity is implemented for each verification period.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**Electricity**
Data unit:	kWh
Description:	Actual electricity generated by the project
Source of data to be used:	Electricity meter
Value of data	
Description of measurement methods and procedures to be applied:	Electricity will be metered through the use of an electricity meter at each farm everyday.
QA/QC procedures to be applied:	Electricity meters will be subject to regular maintenance and testing regime to ensure accuracy once a year.
Any comment:	

Data / Parameter:	Biogas
Data unit:	m3
Description:	Amount of biogas captured and used as fuel for the generator
Source of data to be used:	Flow meter
Value of data	
Description of measurement methods and procedures to be applied:	Biogas used by the generator will be monitored through the use of biogas flow meter at each farm everyday.
QA/QC procedures to be applied:	Gas flow meters will be subject to regular maintenance and testing regime to ensure accuracy once a year.
Any comment:	

Data / Parameter:	Methane content
Data unit:	%
Description:	The fraction of methane in the biogas
Source of data to be used:	Gas analyzer
Value of data	
Description of measurement methods and procedures to be applied:	Methane content of biogas will be monitored through the use of a gas analyser at each farm quarterly. In the event that the methane content of the quarterly samples vary significantly, monthly samples will be taken.
QA/QC procedures to be applied:	Gas analyser will be subject to regular maintenance and testing regime to ensure accuracy once a year.
Any comment:	

Data / Parameter:	Biogas flared
Data unit:	m3
Description:	Amount of biogas sent to the flare
Source of data to be used:	Flow meter
Value of data	
Description of measurement methods and procedures to be applied:	Biogas sent to the flare will be monitored through the use of biogas flow meter.
QA/QC procedures to be applied:	This parameter will only be monitored when there is surplus gas from the Project and a flare is installed.
Any comment:	

Data / Parameter:	Flare efficiency

Data unit:	%
Description:	The fraction of methane destroyed. The flare efficiency is defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process.
Source of data to be used:	Default value from the methodology
Value of data	90% or 50%
Description of measurement methods and procedures to be applied:	Continuous check of compliance with the manufacturers specification of the flare device (temperature, biogas flow rate) should be done. If in any specific hour any parameters is out of the range of specification 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 500 °C, 0% default value should be used for this period.
QA/QC procedures to be applied:	Maintenance of the flare is to be conducted once a year to ensure optimal operation.
Any comment:	

Data / Parameter:	**Generator combustion efficiency**
Data unit:	%
Description:	The fraction of methane destroyed.
Source of data to be used:	Methodological default value
Value of data	90%
Description of measurement methods and procedures to be applied:	Continuous check of compliance with manufacturers specification of the generator set will be done. 90% will be used as combustion efficiency for ex-post CER estimate. Based on the approved methodology ACM0008, the efficiency of methane destroyed through power generation is 99.5%. As conservative approach, 90% is adopted for this small scale project activity.
QA/QC procedures to be applied:	Maintenance of the generator set will be conducted based on supplier's requirements.
Any comment:	

Data / Parameter:	**Sludge from the CIGAR**
Data unit:	kg
Description:	It is not anticipated desludging will be take place during the crediting period based on the developer's experience. However, if in any case sludge is removed from the system, it shall be weighed and recorded.
Source of data to be used:	Farm record
Value of data	

Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Farm manager's signature is required on the record.
Any comment:	

Data / Parameter:	**CIGAR cover**
Data unit:	n/a
Description:	CIGAR cover check
Source of data to be used:	Onsite monitoring record
Value of data	
Description of measurement methods and procedures to be applied:	The operation should walk over the CIGAR daily to conduct leakage inspection. Observation should be logged and submitted to the farm manager.
QA/QC procedures to be applied:	Farm manager's signature is required on the record. This will be used for cross-checking with the gas flow meter reading on the quantity of gas captured and sent to the generator.
Any comment:	

During crediting period, the certified emission reduction will be claimed based on the lower one of the ex-ante estimate or the amount of methane used as fuel or combusted monitored as described above.

B.7.2 Description of the monitoring plan:

Shift Operator → Shift Manager → Farm General Manager

Project Participants monitor biogas production and electricity generation as part of standard operating procedure for the project activities. PhilBIO has developed a monitoring workbook that the farm owners must use to rigorously input and monitor these data. Project participants will keep electronic copies and paper copies for back-up purposes.

Furthermore, the operator personnel will be trained in equipment operation, data recording, reporting, and operation, maintenance, and emergency procedures.

A monitoring team will make regular site audits to ensure that monitoring and operational procedures are being observed in accordance with the monitoring plan and monitoring protocol.

B.8 Date of completion of the application of the baseline and monitoring methodology and the

name of the responsible person(s)/entity(ies)

01/10/2007 by Philippine Bio-Sciences Co., Inc.
Tel: +632 638 2074/6092

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:

01/03/2007

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

21y-0m

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:

01/02/2008

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

Not selected

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

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 an analysis of the environmental impacts of the project activities. The host country has issued each farm an Environmental Clearance Certificate (ECC).

It should be noted, however, that the project activities will generate considerable environmental benefits. The CIGAR® system decreases GHG emissions through two significant avenues. Prior to the project activity, the Farms rely on the grid for provision of electricity. With the implementation of the project activities, biogas collected from the degradation of pig waste is used for electricity generation, thus eliminating the demand for grid electricity supplies. In addition to directly reducing the emission of GHGs by eliminating a source of fossil fuel combustion, the project activities will capture methane (CH_4) from an agro-industrial source, preventing its release into the atmosphere. Methane is an extremely potent GHG whose global warming potential (GWP) is 21 times that of carbon dioxide (CO_2).

In addition to reducing GHG emissions, this closed system of energy production results in considerable improvements in waste management at each farm. Wastewater discharge from swine farms can have a serious impact on aquatic ecosystems. The extent to which effluent discharge threatens aquatic ecosystems depends on the amount of organic material and solid material contained within the wastewater as measured by Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), suspended solids, and colour indicators. The CIGAR® system, incorporates a sophisticated anaerobic process which can reduce COD by more than 80%, and BOD by 95% as well as reducing suspended solids and reduces the colour of the wastewater. The CIGAR® system also reduces potential odour issues, which are a common nuisance to the surrounding residents of swine farms.

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:

Not applicable

SECTION E. Stakeholders' comments

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

PhilBIO, in cooperation with Sorosoro Ibaba Development Cooperative, conducted a stakeholders' meeting for the farm's Covered In-Ground Anaerobic Reactor (CIGAR) biogas project's Clean Development Mechanism (CDM) application. Details of this meeting are as follows:

- Date: 30 May 2006
- Time: 10:00 am

- Barangay Hall, Brgy. Dagatan, Taysan, Batangas

PhilBIO's Corporate Social Responsibility Manager, Mr. Ferdinand Larona, gave the presentation and Ms. Marge Javillonar, also from PhilBIO, facilitated the meetings.

The meetings were conducted in conformity with the requirement of the *United Nations Framework Convention on Climate Change (UNFCCC)* that clean technology projects that wish to be considered for CDM should have public consultations or stakeholders meetings.

Participants:

The stakeholders meeting was attended with participants coming from the LGUs and residents from each farm's location. The LGUs consisted of representatives from the following:

- Municipal Heads of Government (Mayor, Vice-Mayor and/or Councilor)
- Municipal Government Offices
- Barangay Local Government Units (Barangay Captain/Chairman and Councilors)
- Local Organizations (Women's Group/Sangguniang Kabataan/Senior Citizens Group)

There were also participants from other farms who are interested to adopt an environmentally friendly technology such as the CIGAR and know more about the CDM.

Purpose of the Meeting

The purpose of the stakeholders meetings was to present the benefits of the CIGAR biogas project to the environment, swine farm owners and the communities where each farm is located and to explain what CDM is and its processes, aims and benefits. The meetings wished to stress the conformity of the projects in attaining the sustainable development goals of the country through the enhanced wastewater treatment system that will be utilized by these swine farms. More importantly, the meetings served as venues for stakeholders and other interested swine farmers to ask questions or give comments about the projects and CDM.

Agenda

The meetings started with an invocation led by a selected local participant. Then, a representative from the municipal government or LGU gave a brief message to welcome the participants.

The highlight of the meetings was a presentation on CDM by Mr. Ferdinand Larona. The presentation gave an overview of the issues concerning climate change; CDM and its processes, aims and benefits; and the CIGAR project and why it is considered as a CDM project. The presentation focused on the following topics:

- Climate Change
- Clean Development Mechanism (CDM)

- The Process of CDM
- PhilBIO's Methane Gas Mitigation Technology
- The CDM Project

After the presentation, Mr. Larona conducted an open forum where a number of questions were asked and comments were voiced out. Further details will be found in succeeding texts.

After the open forum, the facilitator thanked the participants and adjourned the meetings.

E.2. Summary of the comments received:

The stakeholders' consultation was attended by SIDC Farm representatives, Municipal Officials, Local Officials and Residents of Barangay Taysan, Non-Governemnt Organizations (NGO) and PhilBIO. The stakeholders focused mainly on community health security and CIGAR's design and its capabilities.

Issue/Concern Raised	Response / Recommended Measure to address the issue
Can the farm share the biogas with the neighbouring households?	Yes. However, the Project will use the biogas as fuel for the generator to produce electricity. Sharing of this electricity outside the farm is not yet allowed under Philippine laws and we also want to minimize potential fugitive emissions if we direct the biogas through additional pipelines leading to households.
Will there be less emission once you use the biogas in the farm?	The purpose of the Project is to reduce emission by capturing and utilizing the gas. The captured gas will go directly to the generator. If ever there would be excess gas produced, this will be directly burned by the flare system that will be installed there.
What will you do with the effluent? Will it be used as liquid fertilizer?	It is SIDC's decision to either discharge or recycle the effluent. The effluent will pass through a series of aerobic lagoons after the CIGAR. The effluent should meet the standards of the DENR before they could discharge to the creek. SIDC has its own organic farm and they can use the effluent as fertilizer there. If there would be excess, they could probably share that with the nearby farms. It would be an option for the treated wastewater to be used to clean the pigpens. Again, this is up to the management of the farm.
How do you reduce the risk of seepage from the system?	The material that will be used is called HDPE, high-density polyethylene. DENR and other environmental protection

	agencies recommend the use of this material for this application. This material is even used as liners in landfills for leachate control as a standard practice. This project is to address these concerns.
Is there a possibility that the cover might explode?	Unlikely. Since the system operate with negative pressure, it is unlikely to happen.
Who will conduct the wastewater analyses? How can we be assured that the tests really passed the standards of DENR?	Wastewater analyses are done on a yearly basis by the DENR. In other regions, they do spot checks, they visit the farms, unannounced, to get samples. Also, they need to get the Permit to Discharge from DENR once the project is in place. SIDC will not conduct these tests but rather independent laboratory accredited by the DENR.
Will you also conduct testing in the creek where your wastewater is being discharged?	The Cooperative frequently conducts wastewater testing. We even use the services of two laboratories to have a basis for comparison. We also test the area where the effluent flows or settles.

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

No comments opposing the projects were received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Sorosoro Ibaba Development Cooperative (SIDC)
Street/P.O.Box:	Barangay Dagatan
Building:	
City:	Taysan, Batangas
State/Region:	Region IV-A: CALABARZON
Postfix/ZIP:	
Country:	Philippines
Telephone:	+63 43 3004058 to 59
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Geron
Middle Name:	
First Name:	Rico
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Equity + Environmental Assets Ireland Limited
Street/P.O.Box:	70 Sir John Rogerson's Quay
Building:	
City:	Dublin 2
State/Region:	
Postfix/ZIP:	
Country:	Ireland
Telephone:	+353 1490 7176
FAX:	+44 20 7553 2351
E-Mail:	ireland@eeafm.com
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	Gallagher
Middle Name:	

First Name:	Norbert
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	ireland@eeafm.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable.

The hosts farm for each individual project and the project developer will fund the Project entirely. The Project has not received and will not seek public funding.

Annex 3

BASELINE INFORMATION

Refer to section B.4 and the relevant baseline estimation in section B.6.

Annex 4

MONITORING INFORMATION

Refer to section B.7.