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		

SECTION A. General description of small-scale project activity

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

Anaerobic Digestion Swine Wastewater Treatment at the farms

Document Version:

Date:

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

The Anaerobic Digestion Swine Wastewater Treatment at the farms (referred to as, the "Project") is an anaerobic digestion of swine wastewater and the installation of on-site biogas power generator at the five existing farms and the six under-Construction farms.

The eleven farms as the project site is rented and managed by four companies - Charoen Pokphand Northeastern Public Co., Ltd. B.P.Food Products Co.,Ltd., Rajburi Foods Co. Ltd., Bangkok Food Products Co.,Ltd. (hereafter, "CP"). Each managed company for Existing Farms and Under-Construction Farms are shown at Table 1-Managing Company.

Even if the five Existing farms are located in different locations, the management systems in the five farms contain no significant differences. Each farm uses the same process to capture the methane (CH_4) rich swine urine and feces from the barn's flushing wash-water. The farms use the normal scraping and hose-down cleaning of waste, mixing the manure with the urine and wastewater leading to the closed lagoons. The closed lagoons on the five existing farm are built only to reduce the effect of the air (odor) pollution to the nearby communities, workers, and staffs in the operating farms. The waste materials are left to decay in the closed lagoon system, producing certain amount of CH_4 that are released into the atmosphere to reduce the gas pressure inside the closed lagoon system. The emission of the CH_4 into the atmosphere contributes significantly to global warming.

The six under-construction farms uses the same process for the manure with the urine and wastewater, and is supposed to be constructed the same anaerobic open lagoon with the five existing Farms. Therefore the waste materials are left to decay in the closed lagoon system, producing certain amount of CH_4 that are released into the atmosphere to reduce the gas pressure inside the closed lagoon system there.

Table 1 - Managing Company

Farm	Location	Managing Company
Udornthani	Udornthani	Charoen Pokphand Northeastern Public Co.,Ltd.
Chaturat	Chaiyapoom	-ditto-
Nakornratsrima	Nakornratsima	-ditto-
Chokchai	Nakornratsima	-ditto-
Chumpoung	Nakornratsima	-ditto-
Bo-Tong	Lopburi	B.P.Food Products Co.,Ltd.
Bo-Ploy	Kanchanaburi	Rajburi Foods Co.,Ltd.
Sa-Kaew	Sa-Kaew	B.P.Food Products Co.,Ltd.
Nadee	Prachinburi	-ditto-
Chaiyapoom	Chaiyapoom	Bangkok Food Products Co.,Ltd.
U-Tong	Suphanburi	B.P.Food Products Co.,Ltd.

*No.1-5 : the existing farm, No.6-11: the under-construction farm

The project investment initiative has been driven by the potential monetary benefit from the sale of CERs to the buyers from the developed world that ratified Kyoto Protocol. The revenue from the sale of CERs will compromise some of the significant financial, managerial, and technical cost of the project.

The project introduces a method of utilizing cover lagoon with two aeration ponds for the farm's wastewater treatment and management. The principle objectives of the project are:

- Treatment of the swine barn flushing wastewater to improve the quality of the effluent to the level that it can be safely use for the farm operating and cleaning purposes;
- Capture the CH_4 to generate electricity from the installed biogas power generator, thus lower the farm's electricity cost;
- Reduce the harmful greenhouse gas emission of CH_4 into the atmosphere;
- Use of CDM mechanism to compromise the financial, managerial, and technical cost of investing in clean technology through the sale of CERs to the buyers from the developed world.

The Project is expected to make great contribution to the Host Country (Thailand) to meet its sustainable development goal and His Majesty the King's royal guidance on the sufficient economy:

Macro Level Benefits:

- Utilization of clean technology for wastewater management and production of electricity from the renewable resources will demonstrate and set a good precedence throughout the host country's livestock sector, its neighboring countries, and Southeast Asia region;
- Reduction of GHG emissions from capturing and utilization of CH_4;

- Decrease the nation's dependence on imported foreign fossils fuel to generate electricity, which significantly increase the national energy self-sufficiency with the use of indigenous and renewable energy;

- Reduction on the nation needs to purchase electricity from neighboring countries or construct the new power plants, which will indirectly reduce the global energy-generating related emissions;

- Demonstrate and promote the benefit of clean development mechanism (CDM) that can provide the additional financing source to livestock farms, thus promoting the development of utilization of clean technology throughout Southeast Asia region;

- Promoting the environmental friendly technology development in Thailand.

Micro Level Benefits:

- Reduction in wastewater emission to the local water resources;

- Promoting access to low-cost and clean electricity for swine producers;

- Promoting alternative renewable energy source to the current grid system;

- A better and safer workplace for workers and staffs due to complete utilization of highly combustible CH_4 gas;

- Support local employment;

- Increasing the local's productivity and finance through cheap or free distribution of treated water and dried sludge as a fertilizer to locals for use in their own farms and

- Elimination of problem related to solid waste disposal through improvement of sludge handling system.

A.3. Project participants:

Nameof Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants(*)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Thailand (host)	Charoen Pokphand Northeastern Public Co., Ltd. B.P.Food Products Co.,Ltd. Rajburi Goods Co., Ltd. Bangkok Food Products Co.,Ltd	**No**
Thailand	A.T. Tri Co., Ltd.	**Yes**
Japan	Sumitomo Mitsui Banking Corporation	**Yes**
Japan	Chuo Fukken Consultants Co., Ltd.	**Yes**

Contact information of each project participant is provided in Annex 1.

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

Figure 1
Lagoon, current method used in the farms

The proposed manure waste management system to recover the methane gas emission in the current lagoon system is to cover the lagoon with an HDPE layer. The wastewater treated in these lagoons is often at an ambient mean annual temperature of 22.0 to 33.7 ^{o}C under anaerobic condition. Please see *Table 2 - Weather Information of the eleven farms* for more detailed of climatic information for each farm's region. The result of this is the biogas methane is emitted continuously from lagoons, which are stored under the HDPE layer.

The biogas recovered from each farm will be used as fuel for each farm's on-site electricity generation on the 70 or 100-kilowatt-generator, which will provide an approximation of up to 30% saving on electricity the farm's operating electricity cost. At the same time, the project activities will provide many benefits from the wastewater treatment system in terms of odor, reduction in BOD and COD, reduction in the amount of flies in the area and many useful by-products for the community nearby, such as the organic fertilizer from the dried sludge and the nutrient-rich water from the first aeration pond for agricultural purposes.

The cover lagoon breaks down organic contaminant biologically under anaerobic condition where wastewater is treated in the absence of oxygen. The biogas by-product will be used to fuel the generator to generate the electricity for the farm. The sludge obtained from the system will be pumped out of the lagoon to the drying area where the sludge will be dried, bagged, and transported to the front of the farm where local community can purchase to use as the organic fertilizer. The effluent will be transferred to the first aeration pond then to the second aeration pond for further treatment.

Table 2 - Weather Information for the eleven Farms

Farm	Location	Max Avg. Temp (C^{o})	Min Avg. Temp (C^{o})
Udornthani	Udornthani	32.1	22.0
Chaturat	Chaiyapoom	32.6	22.5
Nakornratsima	Nakornratsima	32.9	22.3
Chokchai	Nakornratsima	32.9	22.3
Chumpoung	Nakornratsima	32.9	22.3
Bo-Tong	Lopburi	33.7	23.6
Bo-Ploy	Kanchanaburi	34.1	23.3
Sa-Kew	Sa-Keaw	33.4	23.2
Nadee	Prachinburi	33.4	23.6
Chaiyapoom	Chaiyapoom	32.6	22.5
U-Tong	Suphanburi	33.5	23.5

The covered lagoon is covered with 1.0 mm HDPE for 100% of the time. The average retention time for biogas creation from the wash-water is approximately 30 – 45 days. The system lead to a removal of 70% BOD and 70% COD from the wastewater. The methane gas makes up at least 80% of the biogas by volume. The biogas produced in the farm will be used to generate electricity through the 70 or 100 kilowatt electricity generation unit located within the farm's boundary.

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

A.4.1.1. Host Party(ies):

The Kingdom of Thailand

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

Nakhonratchasima, Udonthani and Chaiyaphum province

A.4.1.3. City/Town/Community etc:

Farm	Location
Udornthani	Udornthani
Chaturat	Chaiyapoom
Nakornratsima	Nakornratsima
Chokchai	Nakornratsima
Chumpoung	Nakornratsima
Bo-Tong	Lopburi
Bo-Ploy	Kanchanaburi
Sa-Keaw	Sa-Keaw
Nadee	Prachinburi
Chaiyapoom	Chaiyapoom
U-Tong	Suphanburi

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

(1) The Udornthani Farm

The Udornthani Farm is located at the Tumbon Sang Paen, Amphoe Phen, Province Udornthani. The GPS coordinates are N 17°30'23.08" and E 102°57'0.49". Please refer to *Figure 2,3 – Udornthani Farm* for the specific location.

Udornthani is located in the center of the Khorat Plateau between the provinces of Khon Kaen to its south, and Nong Khai to its north. Northeast is connected to Nong Khai and Sakhon Nakhon. It has an area of around 11,730.3 square kilometers. With the population of over 1,530,686 people, Udornthani is agricultural province where primary income of the locals derived from rice farming and swine farming.

The Sang Paen district has the population of 5,736 people, consist of 2,944 males and 2,792 females. Most people in the district are farmers and herders.

Figure 2,3 – Maps of the Udornthani Farm

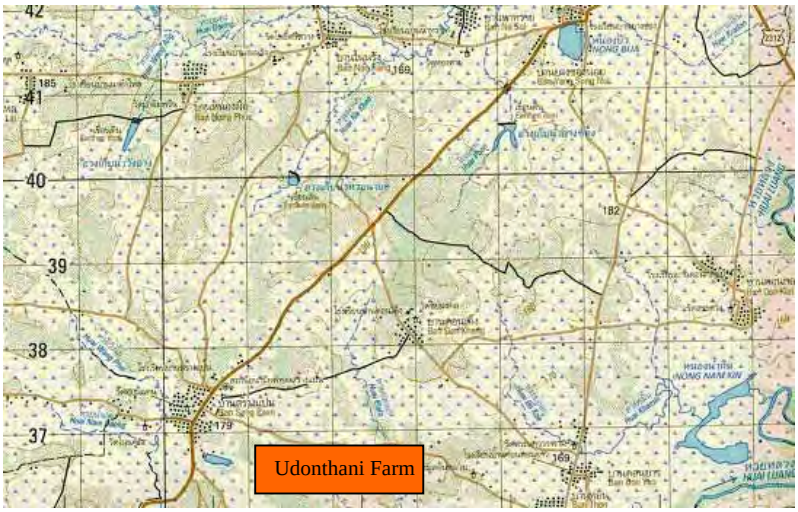

Figure 4 – Maps of the Udornthani Farm

(2) The Chaturat Farm

The Chaturat Farm is located at Tumbon Nong Chim, Amphoe Noen Sa-nga, Province Chaiyapoom. The GPS coordinates are N 15°21'25.46" and E 101°59'25.70". Please refer to *Figure 5,6* for more specific location

Chaiyapoom is cut into two halves by the Phetchabun mountain range where east of the province belongs to the Khorat Plateau. With an area of around 12,783 square kilometers, Chaiyapoom northeast is connected to Khon Ken and Nakornratsima in the south. The primary income of the locals derived from principal crops, such as rice, tapioca, sugar cane and taro roots.

There are total of 2 villages close to the farm location where most of the people in the villages are mainly farmers.

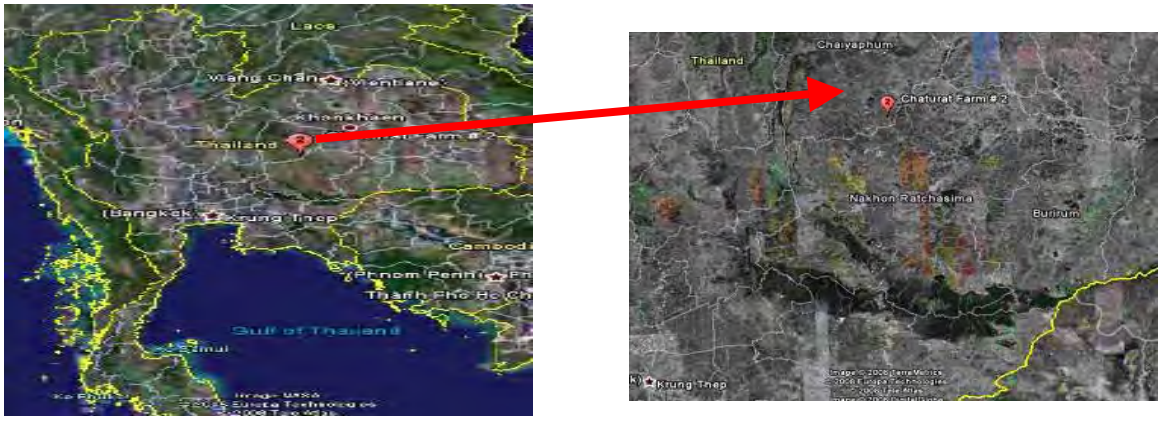

Figure 5, 6 – Chaturat Farm

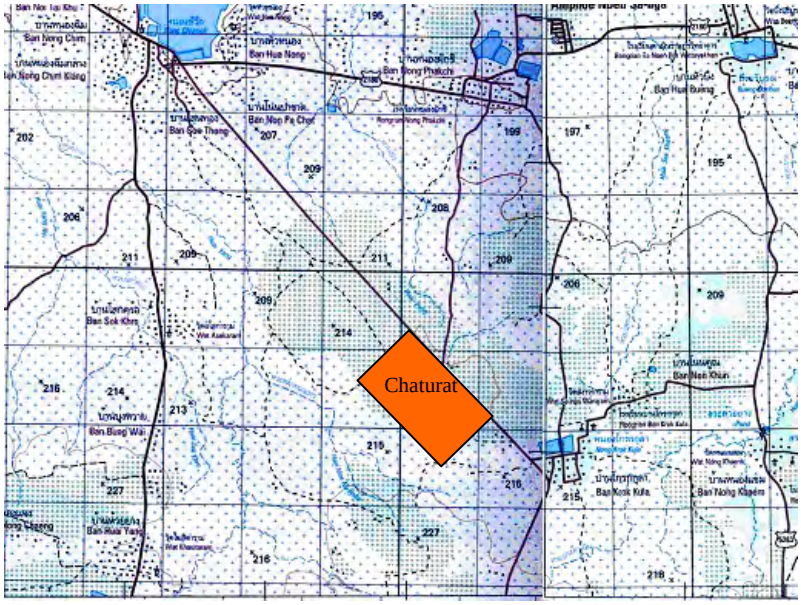

Figure 7 – Chaturat Farm

(3) The Nakornratsima Farm

The Nakornratsima Farm is located at the Tumbon Nong Ya Khao, Amphoe Sikhio, and Province Nakornratsima. The GPS coordinates are N 17°30'23.08" and E 102°57'0.49". Please refer to *Figure 8,9* for detailed location.

The Nakornratsima province, or "Khorat," is located on the western end of the Khorat Plateau, separated from the Chao Phraya river valley by the Phetchabun and Dong Phaya Yen mountain ranges. Two national parks are in the province - the Khao Yai in the west and the Thab Lan in the south. It is 259 kilometers from Bangkok and has an area of around 20,494 square kilometers. Khorat is traditionally an agricultural province where most of the population works in farming such as: rice, sugar cane, tapioca, corn, jute, peanuts, sesame and fruits.

The province Nakornratsima is the province where the last three farms are located, which are the Nakornratsima Farm, Chokchai Farm, and Chumpoung Farm.

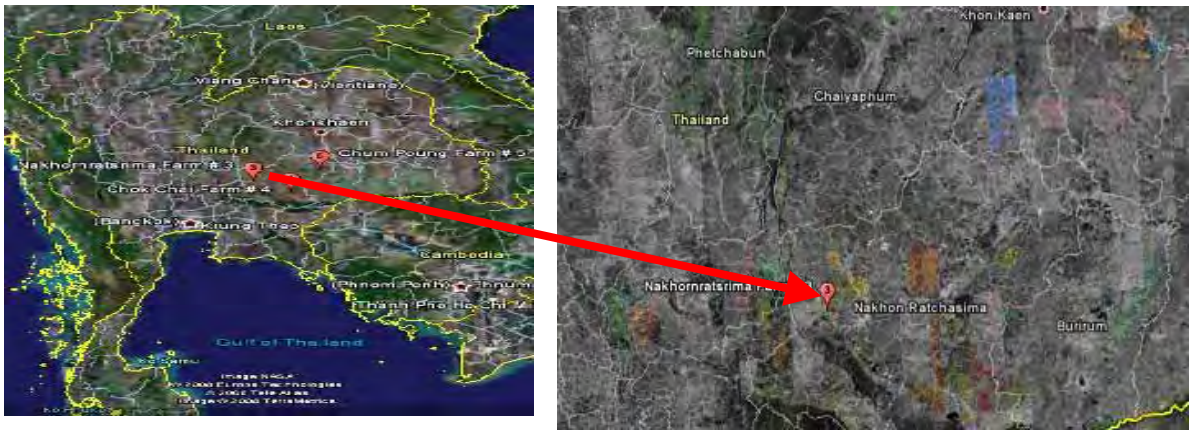

Figure 8, 9 – Nakornratsima Farm map

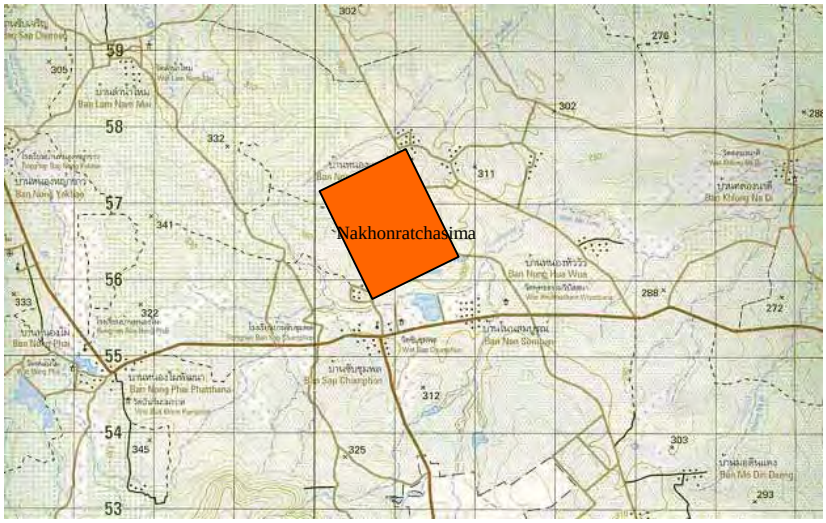

Figure 10 – Nakornratsima Farm map

(4) The Chokchai Farm

The Chokchai Farm is located in Tumbon Thung Arun, Amphoe Chokchai, Province Nakornratsima. The farm's GPS coordinates are N 14°36'49.69" and E 103°12'18.85". Please see *Figure 11* for detailed location of the farm.

(Map of Thailand and the farm is already shown in *Figure 8*)

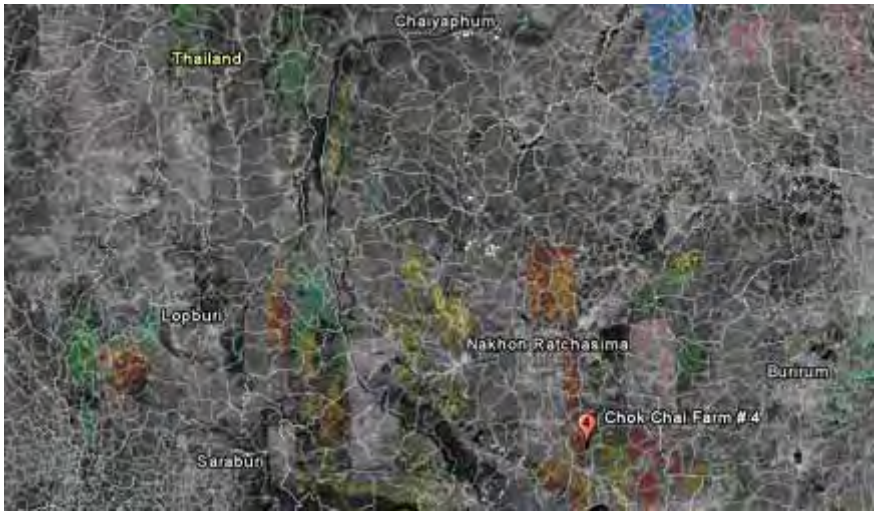

Figure 11 – Chokchai Farm

(5) The Chumpoung Farm

The Chumpoung Farm is located in Tumbon Tha Lat, Amphoe Chokchai, Province Nakornratsima. The GPS coordinates are N 15°16'26.14" and E 102°15'37.41". Please see *Figure 12 – Chumpoung Farm* for detailed location of the farm.

Figure 12 – Chumpoung Farm map

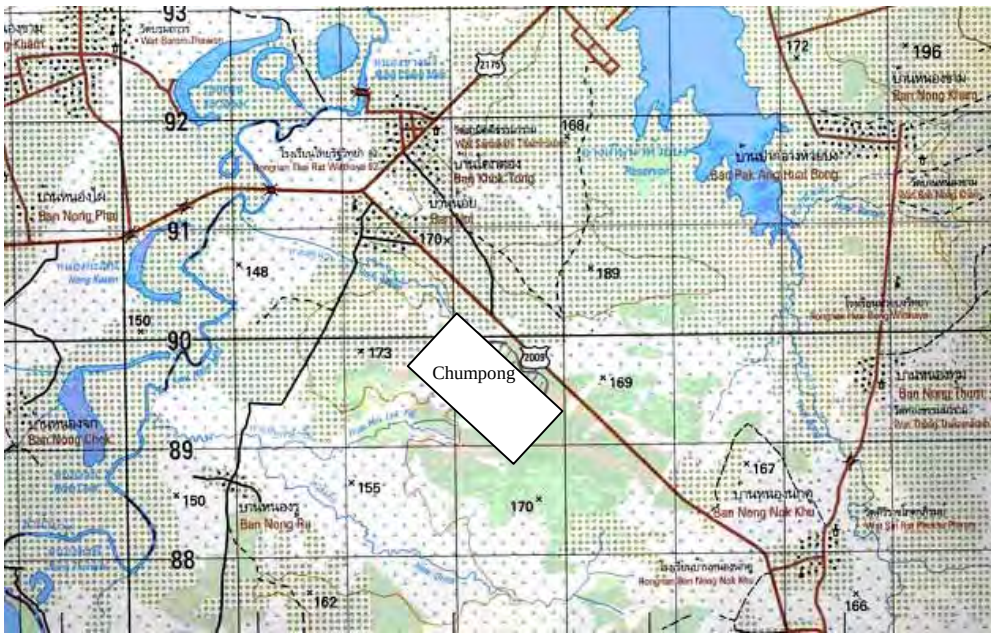

Figure 13 – Chumpoung Farm map

(6) The Bo-Tong Farm

The Bo-Tong Farm is located in Tumbon Bo-Tong, Aumphoe Nong Muang, Lopburi Province. Please refer to Figure 14.15 - Bo-Thong Farm for the specificic location.
Lopburi Province is a province in the central region of Thailand. Covering an area of 6,199 square kilometers, the province is situated on the western end of the Khorat Plateau. The population of Lopburi province is 745,506.

The Bo-Tong sub-district where the Bo-Tong Farm is located has the total population of 6,553 people; consisting of 3,255 males and 3,298 females. The majority of residences in the Bo-Tong sub-district are corn, sugar cane, and sesame farmers.

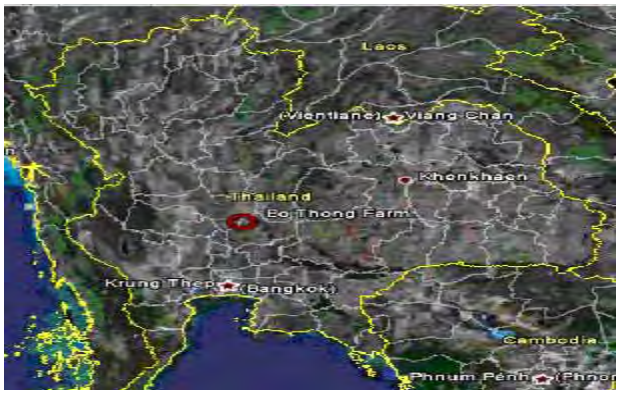

Figure 14 – The location of the Bo-Tong Farm

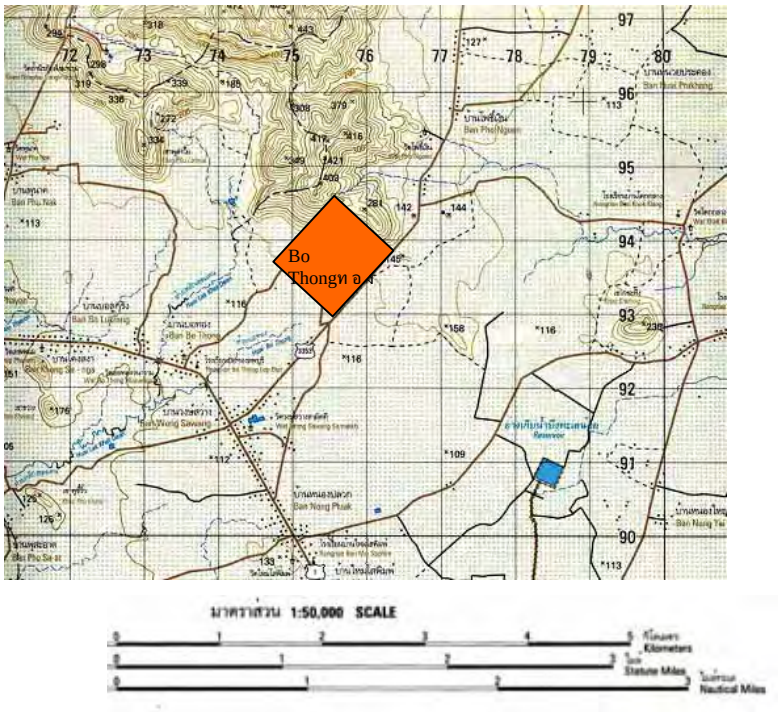

Figure 15 – The specific location of the Bo-Tong Farm

(7) The Bo-Ploy Farm

The Bo-Ploy Farm is located in Kanchanaburi Province, Bo-Ploy district, Chong Dan sub-district. Please refer to Figure 16,17 – Bo-Ploy Farm for the specific location.
Kanchanaburi Province is located in the west of Thailand and covers a total area of approximately 19,483 km². The population of Kanchanaburi is 734,394 people.

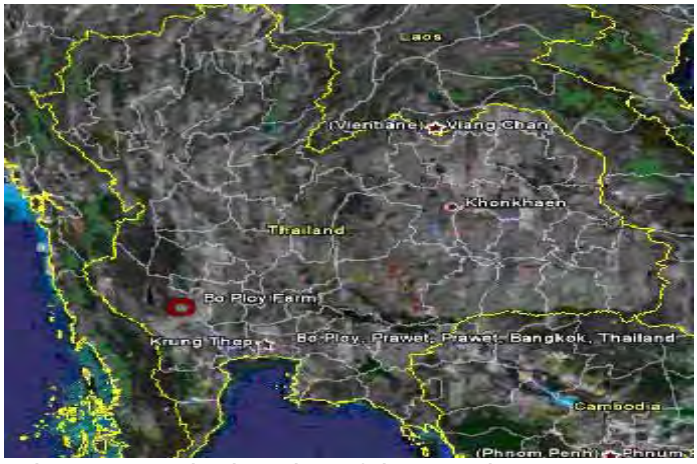

Figure 16 – The location of the Bo-Ploy Farm

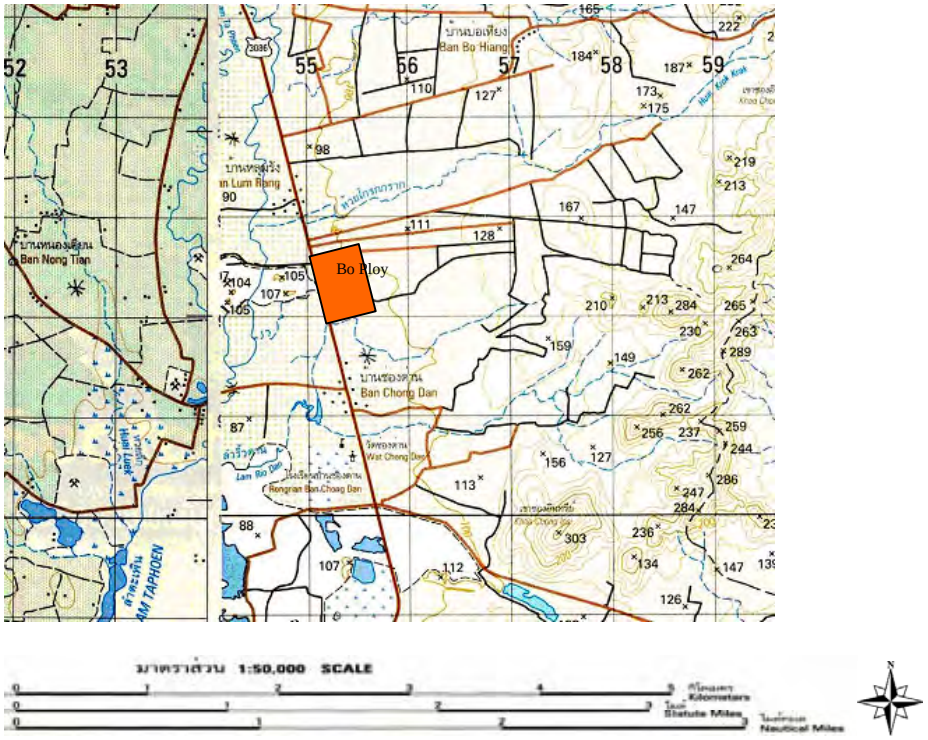

Figure 17 – The specific location of the Bo-Ploy Farm

(8) The Sa-Keaw Farm

The Sa-Keaw Farm is located in Sa-Keaw, Sa-Keaw City district, Kohk Pi Khong. Please refer to Figure 18,19 - Sa-Keaw Farm for the specific location.

Sa-Keaw Province is located in the east of Thailand. Neighboring provinces are Chanthaburi, Chachoengsao, Prachin Buri, Nakhon Ratchasima and Buri Ram and covers a total area of 7,195.1 kilometers square.

The Khog Pi Khong sub-district where Sa-Keaw Farm is located has the total population of 12,513 people consisting of 6,210 males and 6,303 females. Because of the suitable climate and environment, the

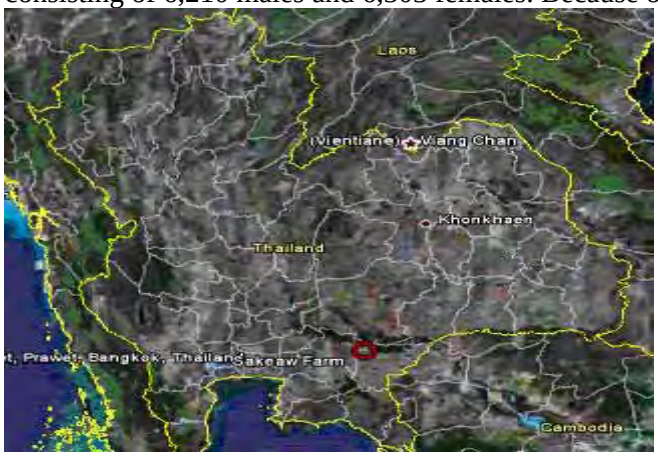

Figure 18 – The location of the Sa-Keaw Farm

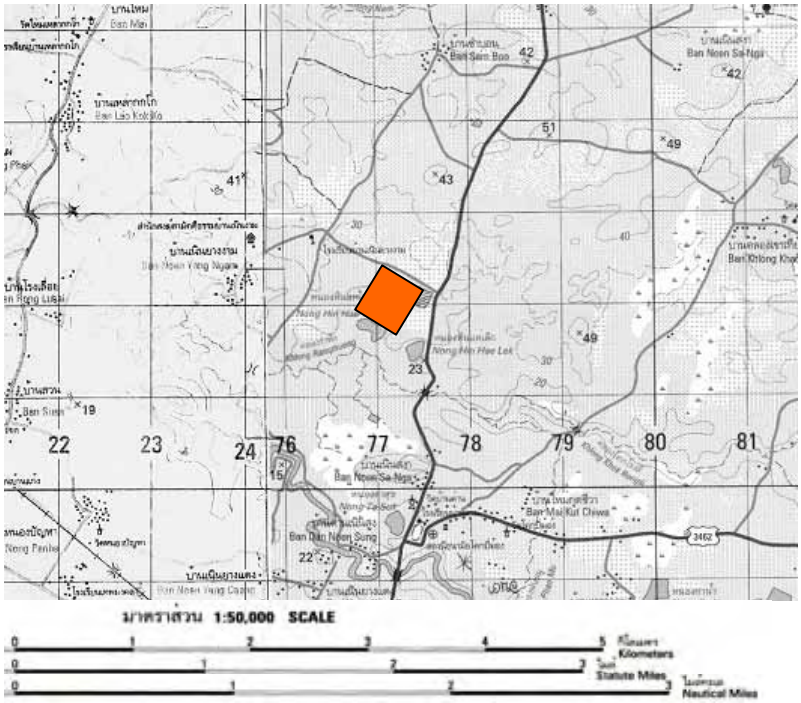

Figure 19 – The specific location of the Sa-Keaw Farm

(9) The Nadee Farm

The Nadee Farm is located in Prachinburi Province, Nadee district, and Na Dee sub-district.
Please refer to Figure 20,21 - Nadee Farm for the specific location.

Prachinburi Province is located in Eastern Thailand, covers a total area of 406,732 square kilometres. The neighboring provinces are Nakorn Ratchasima, Sa Kaeo, Chachoengsao and Nakorn Nayok. The population of Prachinburi is approximately 406,732 inhabitants.

In the Nadee sub-district where Nadee Farm is located has the total population of 7,063 inhabitants, consisting of 3,537 males and 3,526 females. Most of the inhabitants are involved in agriculture business farming rice, cassava, local fruits, Eucalyptus tree for paper farming, and herding local animals such as cows, buffalo, and chickens.

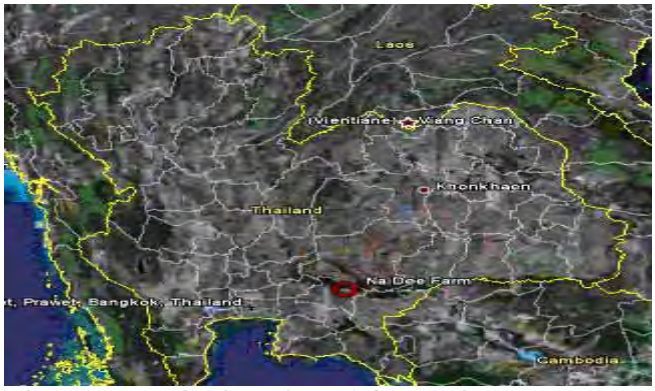

Figure 20 – The location of the Nadee Farm

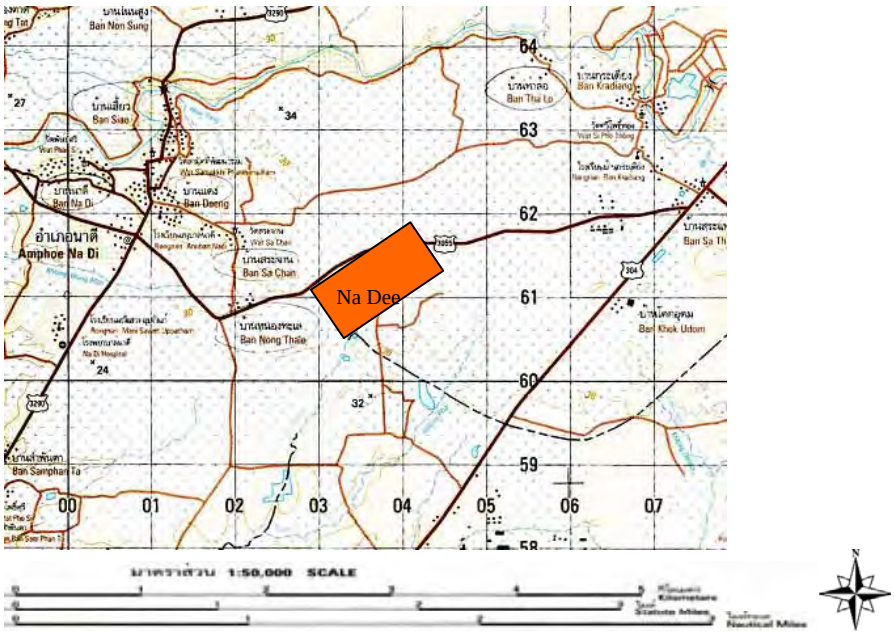

Figure 21 – The specific location of the Nadee Farm

(10) The Chaiyapoom Farm

The Chaiyapoom Farm is located in Chaiyapoom Province in the Kang Kro district Lubka sub-district. Please refer to Figure 22,23-Chaiyapoom Farm for the specific location.

Chaiyapoom is cut into two halves by the Phetchabun mountain range where east of the province belongs to the Khorat Plateau. With an area of around 12,783 square kilometers, Chaiyapoom northeast is connected to Khon Ken and Nakornratsima in the south. The primary income of the locals derived from principal crops, such as rice, tapioca, sugar cane and taro roots.

The Lup Kha sub-district where Chaiyapoom Farm is located has the total population of 6,236 inhabitants, consisting of 3,136 males and 3,100 females. Majority of the population in the Lup Kha sub-district are rice and sugar cane farmers due to the suitable location and the environment of the sub-district; while some inhabitant herd cows, buffalo, and swine as a secondary occupation.

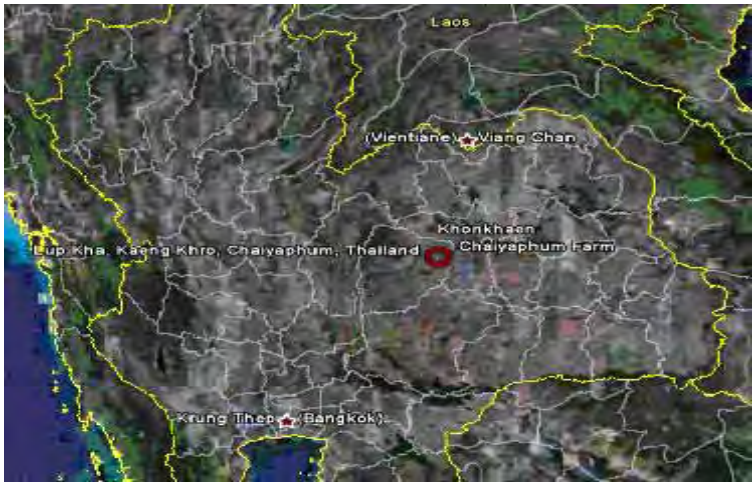

Figure 22 – The location of the Chaiyapoom Farm

Figure 23 – The specific location of the Chaiyapoom Farm

(11) The U-Tong Farm

The U-Tong Farm is located in Suphanburi Province, Au-Thong district, and Ban Khong sub-district. Please refer to Figure 24,25 - The Au-Throng Farm for specific location.

Suphanburi Province is one of the central provinces of Thailand that covers an area of 5,358 kilometers square. The neighboring provinces are Uthai Thani, Chai Nat, Sing Buri, Ang Thong, Phra Nakhon Si Ayutthaya, Nakorn Pathom and Kanchanaburi. Suphanburi has approximately 855,949 inhabitants from various descendants.

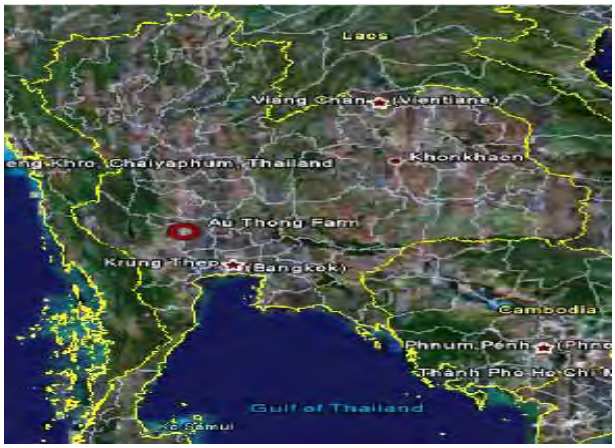

Figure 24 – The location of the U-Tong Farm

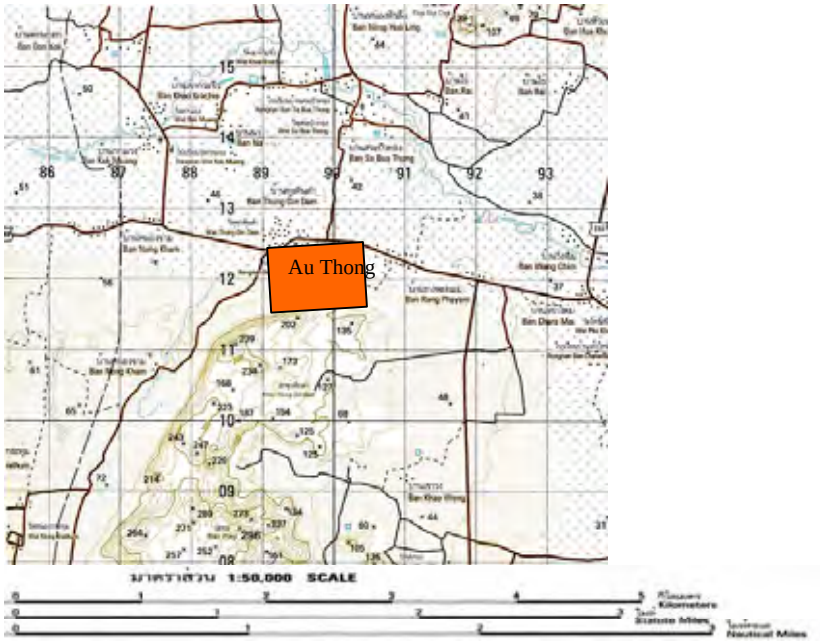

Figure 25 – The specific location of the U-Tong Farm

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.13) – "Grid connected renewable electricity generation" – for the electricity generation component; and,

- Type III.D(reference AMS-III.D. v.14) – "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 45kt of carbon dioxide equivalent annually, and result in emission reductions lower that 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 be consumed in the site with entire volume and the capacity will not exceed 15MW.
A detailed discussion of the technology of the project activities can be found the followings.

Type I.D(reference AMS-I.D v.13)

By installing 70kW or 100kW generators in each of the described farms running at 18 hours/day. All of the generated electricity is going to be used in the farm to displace their electricity cost. Please refer to *Table 3 - The Number and Maximum electricity output of Generator* regarding the outline of the generator installed at each farm.

Table 3 - The Number and Maximum electricity output of Generator

Farm	Location	Maximum electricity output (kW)	Number of installing (unit)	Overall maximum electricity output (kW)
Udornthani	Udornthani	70	1	70
Chaturat	Chaiyapoom	70	1	70
Nakornratsrima	Nakornratsima	70	1	70
Chokchai	Nakornratsima	100	1	100
Chum Poung	Nakornratsima	70	1	70
Bo-Tong	Lopburi	100	1	100
Bo-Ploy	Kachanaburi	70	1	70
Sa-Kaew	Sa-Kaew	70	1	70
Nadee	Prachinburi	100	1	100
Chaiyapoom	Chaiyapoom	100	1	100
U-Tong	Suphanburi	100	1	100

Type III.D(reference AMS-III.D. v.14)

The project is to reduce CO_2 from the recovery and destruction of biogas methane that would otherwise be decaying under anaerobic condition.

The livestock population in the farm is managed under a confined condition. The manure or the streams obtained after treatment are not discharged into natural water sources. The depth of the anaerobic lagoon is 4 – 5 meters deep. And no methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario. The two farms out of five existing farms already have the High Density Polyethylene (HDPE) covering over the first lagoon only to prevent the smell from dispersing to the community nearby. Please see *Table 4 – Farm Lagoon Situation* for more information.

Table 4 – Farm Lagoon Situation

	Farm	Location	First Lagoon Situation
Existing Farm	Udornthani	Udornthani	Covered
	Chaturat	Chaiyapoom	Covered
	Nakornratsima	Nakornratsima	Not Covered
	Chokchai	Nakornratsima	Not Covered
	Chum Poung	Nakornratsima	Not Covered
Under-Construction Farm	Bo-Tong	Lopburi	Not Covered
	Bo-Ploy	Kanchanaburi	Not Covered
	Sa-Keaw	Sa-Keaw	Not Covered
	Nadee	Prachinburi	Not Covered
	Chaiyaphum	Chaiyapoom	Not Covered
	U-Tong	Suphanburi	Not Covered

Technology Used in the Project Activity

The Project utilizes the cover lagoon method to treat the wastewater and capture biogas. The biogas obtained is captured and stored under a High Density Polyethylene (HDPE) placed over the cover lagoon where the biogas is then transferred into the biogas electricity generators. CP is looking to install 6 units of 70kW and 5 units of 100kW of biogas generators that will produce electricity to use in the electrical power appliances in the farm, such the water irrigation system, fan, lighting, cooling, auto-feeders and etc. The electricity produced from the Project activity will replace electricity that CP has to purchase from the national grid (PEA).

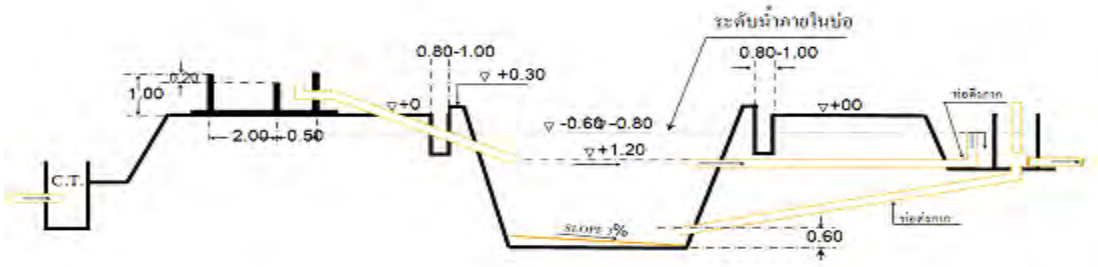

Figure 26 – The Cover Lagoon Diagram (Side View)

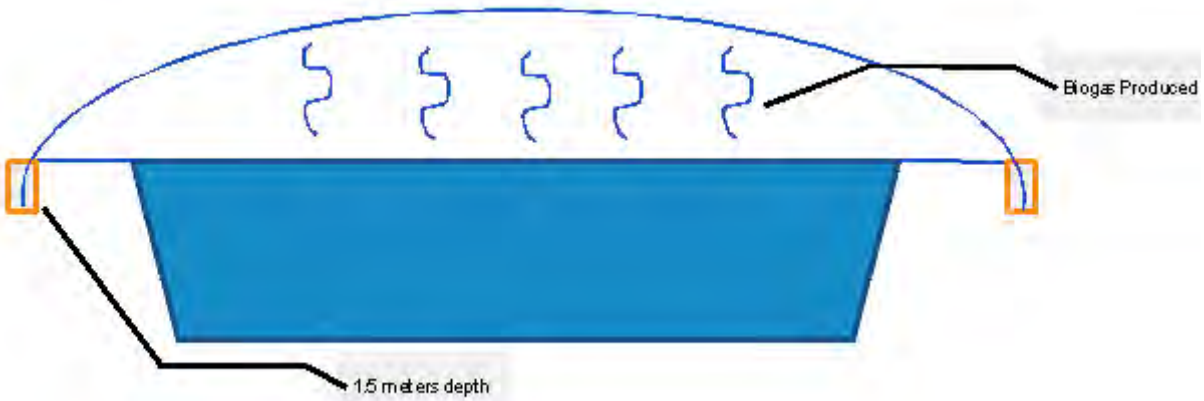

Figure 27 – The Cover Lagoon

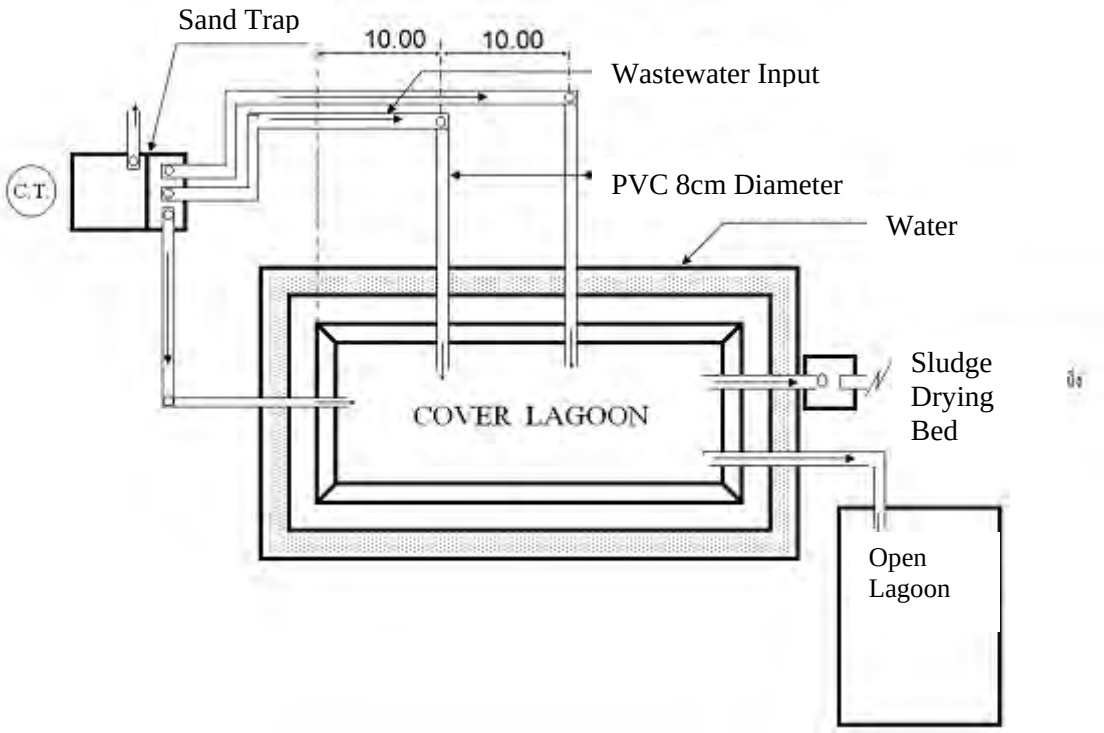

Figure 28 - The Cover Lagoon Diagram (Top View)

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

THE TOTAL ESTIMATE OF EMISSIONS REDUCTION OVER THE 10 YEAR CREDITING PERIOD	
Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 2010	23,726
Year 2011	23,726
Year 2012	23,726
Year 2013	23,726
Year 2014	23,726
Year 2015	23,726
Year 2016	23,726
Year 2017	23,726
Year 2018	23,726
Year 2019	23,726
Total estimated reductions (tonnes of CO_2e)	237,260
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	23,726

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

CP is the main investor of the project who manages this project. The Project has not received and will not seek public funding from the Thai government.

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

The project is not part of the debundled component of the larger project activities. 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:

AMS-I.D – Grid connected renewable electricity generation (Version 13)

AMS-III.D – Methane Recovery in animal manure management systems (Version 14)

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

AMS-I.D – Grid connected renewable electricity generation

The Project conforms to project category AMS-I.D. since the renewable generating unit will *"displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit*". The electricity obtained from the renewable biogas generator will supply the farm with a small amount of the electricity of which the generating capacity will not *"exceed the limit of 15MW"*.

AMS-III.D – Methane Recovery in animal manure management systems

The Project conforms to the project category AMS-III.D. since the installation of methane recovery and combustion systems "*involving the replacement or modification of existing anaerobic manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane"*. The project also will result in "*emission reduction of les than or equal to 60ktCO_2e annually"*. The project also satisfies other requirements of AMS-III.D.

A detailed discussion of the technology of the project activity and conformity for both methodologies can be found in *Table 5* and *Table 6.*

Table 5 The Requirements Consistency between AMS-I.D and the Project

Requirements of AMS-I.D	Conditions of the project
This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	• The electricity produced from the Project activity will replace electricity that CP has to purchase from the national grid (PEA). • The resource of renewable energy is the renewable biomass.
If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel1, the capacity of the entire unit shall not exceed the limit of 15MW.	• The total install capacity of 920 kW (70kW x 6 and 100kW x 5 generators) is less than 15 MW.
Combined heat and power (co-generation) systems are not eligible under this category.	• The project is not combined heat and power (co-generation) system.
In the case of project activities that involve the addition of renewable energy generationunits at an existing renewable power generation facility, the added capacity of the units added bythe project should be lower than 15 MW and should be physically distinct2 from the existing units.	• In the eleven farms as the project site no renewable energy generation units are existing.
Project activities that seek to retrofit or modify an existing facility for renewable energygeneration are included in this category. To qualify as a small-scale project, the total output of themodified or retrofitted unit shall not exceed the limit of 15 MW.	• Project activities do not seek to retrofit nor modify an existing facility for renewable energy generation.

Table 6 The Requirements Consistency between AMS-III.D and the Project

Requirements of AMS- III.D	Conditions of the project
The livestock population in the farm is managed under confined conditions.	• The project activity is managed the livestck population under confined conditions in site.
Manure or the streams obtained after treatment are not discharged into naturalwater resources (e.g. river or estuaries), otherwise AMS III.H. shall be applied.	• Manue or the streams obtained after treatment are discharged into two additionalaeration open lagoon with cleaning purpose.
The annual average temperature of baseline site where anaerobic manure treatmentfacility is located is higher than 5°C.	• The wastewater treated in these lagoons is often at an ambient mean annual temperature of 22.0 to 33.7 °C under anaerobic condition.
Iin the baseline scenario the retention time of manure waste in the anaerobictreatment system is greater than 1 month, and in case of anaerobic lagoons in thebaseline, their depths are at least 1 m.	• The retention time for manure waster in the anaerobic treatment system is 45-60 days. • In case of anaerobic laggons in the baseline, their depths are at least 4 - 5m.
No methane recovery and destruction by flaring, combustion or gainful use takesplace in the baseline scenario.	• No methane recovery and destruction by flaring, combustion or gainful use takesplace in the baseline scenario.
The final sludge must be handled aerobically. In case of soil application of thefinal sludge the proper conditions and procedures (not resulting in methaneemissions) must be ensured.	• The sludge obtained from the system will be pumped out of the lagoon to the drying area where the sludge will be dried for use as the organic fertilizer.
Technical measures shall be used (including a flare for exigencies) to ensure thatall biogas produced by the digester is used or flared	• Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared

B.3. Description of the project boundary:

The project is in accordance with the definition of project boundary in AMS-I.D. which *"encompasses the physical, geographical site or the renewable generation sources"* and in AMS-III.D. which *"the physical, geographical site of the livestock and manure management systems, and the facilities which recovers and flare/combust or use methane"*.

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 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 where methane is recovered and combusted.

B.4. Description of baseline and its development:

There is a common baseline for the eleven farms in terms of emission reductions from the methane recovery component, i.e. without the project activity, the methane from the covered lagoon will be released into open air to reduce the pressure built up inside the covered lagoon as the only purpose for covering up the lagoon in the farm is to prevent the foul smell from affecting the well-being of the workers and houses nearby. In the absence of carbon income, there is no financial incentive for the five farms to change this practice to one where the methane is recovered for gainful uses. In addition, there is no legislation or policy in Thailand that would prohibit CP farms from releasing CH_4 into the atmosphere.

As a result, there are two possible scenarios:

- The continuation of status quo where methane is released into the atmosphere.
- The installation of biogas electrical generator where CH_4 is recovered and destroyed, make possible by the financial aid from selling of CERs.

It is important to take into account that without the financial aid from selling of CERs, the farm would continue practicing their status quo.

As specified in Appendix B:

- The appropriate baseline for project category Type I.D (AMS-I.D) is found in paragraphs 11

- The appropriate baseline for project category Type III.D (AMS-III.D) is found in paragraphs 9 and 8

- Date of completing the final draft of this baseline section (DD/MM/YYYY): _____

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

$$E_{baseline} = EP_{BIO} \times CEF_{grid}$$

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:

$$FE_{baseline} = 21 \times 0.00067 t/m^3 \times 0.94 \times \sum_{LT} MCF \times B_{O,LT} \times Pop_{,LT} \times VS_{LT} \times MS\%_{Bl}$$

Where:

$FE_{baseline}$: Baseline emissions in year (tCO_2e/year)
LT : Index for all types of livestock
MCF : Annual methane conversion factor (MCF) for the baseline animal waste management system
$B_{O,LT}$: Manimum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)
$Pop_{,LT}$: Annual average number of animals of type "LT" in year (numbers)
VS_{LT} : Volatile solids for livestock "LT" entering the animal manure management system in year (on a dry matter weight basis, kg dm/animal/year)
$MS\%_{Bl}$: Fraction of manure handled in baseline animal manure management system

$$VS_{LT} = \left[\frac{W_{site}}{W_{default}}\right] \times VS_{default} \times nd$$

Where:

W_{site} : Average animal weight of a defined livestock population at the project site (kg)
$W_{default}$: Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)
$VS_{default}$: Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)
nd : Number of days in year where the treatment plant was operational.

Therefore, total baseline emissions (TBemissions) are:

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

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:

Farm Situation and National Policies

As of status quo, swine farming operation in Thailand broadly adopt four strategies for manure management and barn flushing:

1.) Collection of the solid waste from the slatted floor barns for sale, donation or own use followed by barn flushing, with the treatment of barn flushing wastewaters in open anaerobic lagoons;

2.) Direct flushing of the solid wastes to the open anaerobic lagoon;

3.) Treatment of the manure or the wash-water with or without the collection of biogas;

4.) Direct discharge into the local canal or natural water source;

5.) Combination of the methods mentioned above

The CP-existing farm current adopted the second strategy (2), which is one of the most environmentally friendly methods for the swine farms. However, the collection of the biogas for gainful use does not occur in the farm.

Based one the Thai's *Industrial Effluent Standards for Industrial Plants and Industrial Estates* and the *Effluent Standards* for swine farms (need citation + correct information) the effluent must have suspended solids (ss) of less than 150 mg/L and BOD of less than 60 mg/L. Nonetheless, there is no prescriptive approach to identifying how this is to be achieved. As a result, the open lagoons are cheaper and generally sufficient method comparing to the more expensive biodigester method. Furthermore, there is also no regulation regarding the amount CH_4 releasing into the atmosphere; consequently, the CH_4 produce from the swine-waste are released into the atmosphere.

Barrier Approach

As prescribed in Attachment A to Appendix B of the simplified modalities and procedure for CDM small-scale project activities, evidence as to why the proposed project is additional is offered under the following categories of barriers: (a) investment barrier, (b) technological barrier and (c) common practice.

a) Investment Barriers

Internal Rate of Return without CER

- In order to generate the electricity from biogas, it is required investment own resources by Project Participants, as they can not expect the financing nor fund from the third party, for example, the local banks or government etc. because of lack of knowledge and experience with the technology in Thailand.
- Concretely it is planed to install one of 70kW or 100kW generator in accordance with electricity consumption at each site. In the case to utilize all electricity generated within sites, it can be

obtained the essential revenue in efficiency to save the electricity cost. The grand total amount at eleven farms shall be approximately 14,154,000Baht.

- IRR (Internal Rate of Return) of the project is shown Table 5. In order to secure the profitable project, it is essential to revenue from trading of CER. Therefore the project's additionality is clearly demonstrated in view of the investment barrier.

Table 5 The calculation of IRR of the project

	WITHOUT CER	WITH CER		
		5 (US$/t-CO2e)	10 (US$/t-CO2e)	15 (US$/t-CO2e)
IRR (for 10 years)	-	-9.5%	6.1%	14.7%

Baseline scenario identification

- The following three cases shall be considered as Baseline scenario.
  case A：The independent project scenario without CER by installation of additional electricity generator
  case B：The project scenario to utilize the heat resource by flaring
  case C：The current scenario (to emit the biogas methane from open lagoons into the atmosphere)
- In case A there are two designs – one is to sell all electricity generated to the grid and to sell the surplus electricity to the grid after prior to utilize within sites. Either way is worse cash flow in comparison with the project design to be implemented because the selling price to the grid is lower than purchasing one from PEA (Provincial Electricity Authority) and also it must be invested additionally for facility. Therefore, case A (The independent project scenario without CER by installation of additional electricity generator) should not be identified with Baseline scenario
- Since there are no needs to utilize of heat resource within sites and the utilization of electricity is more attractive design for farm managers, case B (The project scenario to utilize the heat resource by flaring) should not be identified with Baseline scenario.
- As mentioned above, it is demonstrated the most plausible baseline scenario for the project should be case C (The current scenario).

b) Technological Barriers

Most of small-to-medium size swine farm operators in Thailand are still hesitant to have enclosed biogas generator system installed due to lack of knowledge and awareness regarding its benefit. Even if it is found to be very beneficial and effective, there is still no compelling reason for the owner to pay extra cost in the complete biogas generator system where the benefit are long-term and requires technological skill and capital to maintain the optimal operation of the machine after installation. The biogas generator system is often perceived to be risky and cost the swine barn owner extra unnecessary burden. In addition, the biogas system is also quite new technology in Thailand. There are many uncertainties for this technology, i.e. the amount of biogas that the system will be able to produce or the lack of experience the farmer has toward maintaining the machine that may increase the cost of machine operation. Furthermore, there are only a few emergences of skilled biogas plant

designers in Thailand recently, contributing to difficulty in finding and allocating skilled personals to educate, maintain, and optimize this technology.

c) Common Practice:

In Thailand, there are many introductions of series of environmental regulations requiring that wastewater must comply with the national water discharge standard before entering the natural water body. The swine farms are categorized as one of the polluting industries, whose discharge must be controlled and monitored according to the Enhancement & Conservation of National Environment Quality Act B.E.2535 (1992). In accordance with the Act, the discharge from pig farms must comply with the *Industrial Effluent Standards for Industrial Plants and Industrial Estates* and the *Effluent Standards* for swine farms. The standards do not only specify the qualities and characteristics of the effluent, but also the analytical methods that shall be used in measuring such indicators. Nonetheless, none of the laws requires that the methane from the waste be captured or calculated. As a result, the least cost option is as well the common practice, the current pond system. The common practice is comply with the existing laws where the methane produces from anaerobic decomposition of the waste is simply allowed to bubble in the lagoon and be released into the atmosphere. Because the current pond system is the least cost option and completely complies with national regulation, it is why the financial incentive provided by CDM is highly desirable to motivate Thai swine barns owners to move to a more environmental-friendly practice from their common practice.

d) Other Possible Barriers

Since the Project will also involve the installation of the electrical generator, the possible occurrence of noise from the generator to the community nearby may be unavoidable. The Project may cause disturbance to the community nearby. As a result, the silencer will be installed to every generator in the Project.

B.6 Emission reductions:

B.6.1. Explanation of methodological choices:

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:

Because the project is utilizing the biogas with origin from the swine wash water to produce electricity, the system design also does not include many electrical appliances. The anthropogenic emissions from this component are considered to be zero.

AMS-III.D:

Project emissions due to physical leakage of biogas from the animal manure management systems used to produce, collect and transport the biogas to the point of flaring or gainful use is estimated as 10% of the maximum methane producing potential of the manure fed into the management systems implemented by the project activity2, as follows.

$$PE_{project} = 0.10 \times 21 \times 0.00067 t/m^3 \times \sum_{LT} B_{O,LT} \times Pop_{,LT} \times VS_{LT} \times MS\%$$

Where:

$PE_{project}$: Project emissions

$B_{O,LT}$: Manimum methane producing potential of the volatile solid generated for animal type "LT" (m^3 CH_4/kg dm)

$Pop_{,LT}$: Annual average number of animals of type "LT" in year (numbers)

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

$MS\%_{Bl}$: Fraction of manure handled in baseline animal manure management system

Leakage

AMS-I.D, paragraph 12:

"*If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered"*

Since the equipment is not being transferred to or from another activity, the leakage calculation is not required.

AMS-III.D, paragraph 21:

"*no leakage calculation is required"*

Baseline

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

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

For calculation of each of the stated source, refer to section B.4

Emission reductions

Therefore, the total emission reductions are:

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

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

Data / Parameter:	**CEF**
Data unit:	tCO_2/MWh
Description:	Grid Carbon Emission Factor
Source of data used:	Calculated value
Value applied:	.495 (For the year 2008)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according to AMS I D methodology (*Grid connected renewable electricity* generation) based on the weighted average of the emissions of the current generation mix in tCO_{2e}/MWh.
Any comment:	The value may changes every year, based on the national EGAT grid mix.

Data / Parameter:	**$Pop_{Udonthani}$**
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,744
Justification of the choice of data or description of measurement methods and procedures actually applied :	The current animal population of the farm is used for the ex-ante estimation of the 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:	**$Pop_{Chaturat}$**
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm

Value applied:	2,434
Justification of the choice of data or description of measurement methods and procedures actually applied :	The current animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{Nakhonratchasima}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,492
Justification of the choice of data or description of measurement methods and procedures actually applied :	The current animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{Chokchai}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,743
Justification of the choice of data or description of measurement methods and procedures actually applied :	The current animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{Chum\ Phuang}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,633
Justification of the choice of data or description of measurement methods and procedures actually applied :	The current animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{\text{Bo-Thong}}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,671
Justification of the choice of data or description of measurement methods and procedures actually applied :	The target animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{\text{Bo-Ploy}}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,435
Justification of the choice of data or description of measurement methods and procedures actually applied :	The target animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{\text{Sa-Keaw}}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	2,430
Justification of the choice of data or description of measurement methods and procedures actually applied :	The target animal population of the farm is used for the ex-ante estimation of the 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:	**Pop**$_{\text{Nadee}}$
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	14,300
Justification of the choice of data or description of measurement methods	The target animal population of the farm is used for the ex-ante estimation of the 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

and procedures actually applied :	ex-ante estimate number.
Any comment:	

Data / Parameter:	**$Pop_{Chaiyapoom}$**
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	12,354
Justification of the choice of data or description of measurement methods and procedures actually applied :	The target animal population of the farm is used for the ex-ante estimation of the 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:	**$Pop_{U\text{-}Tong}$**
Data unit:	Heads
Description:	Animal population in Farm
Source of data used:	Data provided by the farm
Value applied:	12,436
Justification of the choice of data or description of measurement methods and procedures actually applied :	The target animal population of the farm is used for the ex-ante estimation of the 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:	Data provided by the farm and project design
Value applied:	70
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 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:	Data provided by the Project
Value applied:	75%
Justification of the choice of data or description of measurement methods and procedures actually applied :	n/a
Any comment:	

Data / Parameter:	**Bo**
Data unit:	m^3CH_4/kg VS
Description:	Maximum methane producing capacity for manure produced by livestock category
Source of data used:	IPCC 2006 Table A 10-8
Value applied:	.29
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value for Asia
Any comment:	

Data / Parameter:	**MCF**
Data unit:	%
Description:	Methane Correction Factor
Source of data used:	IPCC 2006 Table A10-8
Value applied:	80
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default factor for Lagoon-based manure management system at 27 C annual average temperature in Thailand
Any comment:	

Data / Parameter:	**T**
Data unit:	^{o}C
Description:	Average annual temperature of Thailand
Source of data used:	Thai Meteorological Department http://www.tmd.go.th/en/climate.php?FileID=7
Value applied:	27
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average temperature value obtained from the Thai Meteorological Department
Any comment:	

Data / Parameter:	**UE*GE**
Data unit:	%
Description:	Urinary energy expressed as fraction of energy intake
Source of data used:	IPCC 2006 page 10.42
Value applied:	2%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Typically 0.04GE can be considered urinary excretion by most ruminants (reduce to 0.02 for ruminants fed with 85% or more grain in the diet or for swine).
Any comment:	

Data / Parameter:	**DE**
Data unit:	%
Description:	Digestibility
Source of data used:	IPCC 2006 Table 10.2
Value applied:	80%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The lower end of the feed digestibility for growing swine has been selected.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Annual average number of swine and average swine weight as the evidence of ex-ante estimation of emission reductions can be found in the below *Table 8 - Annual average number of swine* and *Table 9 – Average swine weight.*

Table 8 - Annual average number of swine

Farm	Annual average number of swine (Heads)				
	Breeding swine		Market swine		total
	Boar	Sow	Nursery (baby pig)	Finisher (teen pig for market)	
Udornthani	44	2,700	-	-	2,744
Chaturat	34	2,400	-	-	2,434
Nakornratsrima	32	2,460	-	-	2,492
Chokchai	43	2,700	-	-	2,743
Chumpoung	33	2,600	-	-	2,633
Bo-Tong	71	2,600	-	-	2,671
Bo-Ploy	35	2,400	-	-	2,435
Sa-Kaew	30	2,400	-	-	2,430
Nadee	-	-	5,500	8,800	14,300
Chaiyapoom	34	1,320	4,400	6,600	12,354
U-Tong	36	2,000	3,200	7,200	12,436
total	392	23,580	13,100	22,600	59,672

Table 9 – Average swine weight

Farm	Average swine weight (kg)			
	Breeding swine		Market swine	
	Boar	Sow	Nursery (baby pig)	Finisher (teen pig for market)
Udonthani	200	180	-	-
Chaturat	200	180	-	-
Nakornratsrima	200	180	-	-
Chokchai	230	200	-	-
Chumpoung	200	180		
Bo-Tong	200	200	-	-
Bo-Ploy	200	180	-	-
Sa-Kaew	180	160	-	-
Nadee	-	-	30	100
Chaiyapoom	200	180	30	100
U-Tong	200	180	25	100

AMS-I.D:

Annual CO2 Emission reductions are calculated as the following:

Please see the *Table 10 - Annual CO2 Emission reductions* in details. Baseline emission of recently grid electricity generation is 2,595(t-CO2e/year).

Table 10 - Annual CO2 Emission reductions(AMS-I.D)

Farm	Electricity generated		Emission reductions	
	Daily Electricity Generation (kWh/day)	Annual Electricity Generation (MWh/year)	Emissions Coefficient (t-CO_2e/MWh)	Annual CO2 Emission reductions (t-CO_2e/year)
Udonthani	1,151	420	0.517	217
Chaturat	1,018	372	0.517	192
Nakornratsrima	1,043	381	0.517	197
Chokchai	1,147	419	0.517	217
Chumpoung	1,103	403	0.517	208
Bo-Tong	1,106	404	0.517	209
Bo-Ploy	1,019	372	0.517	192
Sa-Kaew	899	328	0.517	170
Nadee	1,753	640	0.517	331
Chaiyapoom	1,753	640	0.517	331
U-Tong	1,753	640	0.517	331
total	13,745	5,019	-	2,595

AMS-III.D:

Annual CO2 Emission reductions are calculated as the following:

Please see the *Table 11 - Annual CO2 Emission reductions* in details. Baseline emission of recently grid electricity generation is 21,131(t-CO2e/year).

Table 11 - Annual CO2 Emission reductions (AMS-III.D)

Farm	Baseline emissions (t-CO_2e/year)		Project Emissions (t-CO_2e/year)		Annual CO2 Emission reductions (t-CO_2e/year)
	Breeding Swine	Market Swine	Physical leakage	Unrecoverable methane	
Udonthani	1,998	-	266	-	1,732
Chaturat	1,772	-	236	-	1,536
Nakornratsrima	1,814	-	241	-	1,572
Chokchai	2,220	-	295	-	1,925
Chumpoung	1,916	-	255	-	1,661
Bo-Tong	2,157	-	287	-	1,870
Bo-Ploy	1,772	-	236	-	1,537
Sa-Kaew	1,572	-	209	-	1,363
Nadee	-	10,896	405	7,846	2,645
Chaiyapoom	987	8,258	405	6,195	2,645
U-Tong	1,483	8,342	405	6,775	2,645
total	17,691	27,496	3,240	20,816	21,131

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

Table 12 shows that the project will be able to reduce approximately 23,726 t-CO2e per year. Over the CERs 10 years trading period, the project are expected to reduce approximately 237,260 t-CO2e.

Table 12 – Summary of ex-ante estimation of emission reductions

Years	Baseline (t-CO2e)		Project Emissions (t-CO2e)	Leakage (t-CO2e)	Emission Reductions (t-CO2e)
	Methane Capture	Power			
Year 2010	45,187	2,595	24,056	0	23,726
Year 2011	45,187	2,595	24,056	0	23,726
Year 2012	45,187	2,595	24,056	0	23,726
Year 2013	45,187	2,595	24,056	0	23,726
Year 2014	45,187	2,595	24,056	0	23,726
Year 2015	45,187	2,595	24,056	0	23,726
Year 2016	45,187	2,595	24,056	0	23,726
Year 2017	45,187	2,595	24,056	0	23,726
Year 2018	45,187	2,595	24,056	0	23,726
Year 2019	45,187	2,595	24,056	0	23,726
Total	451,870	25,950	240,560	0	237,260

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

The baseline of the project will be assessed each year through out the period where the project will generate emission reduction. The lower of the two value described below is used as the baseline for that particular year.

1) The actual monitored amount of methane captured and destroyed by the Project activity.

2) The *ex ante* methane emission calculate using the amount of waste or raw material the would otherwise decay anaerobically in absence of the Project activity based on the most recent IPCC tier 2 approach

Metering the electricity generated and monitoring the amount of methane used as fuel or combusted as described in Appendix 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, paragraph 13:

"Monitoring shall consist of metering of the electricity generated by the renewable technology."

AMS-III.D, paragraph 22:

"The emission reductions achieved by the project activity will be determined ex-post through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (MCF) than the MCF for the manure treatment systems used in the baseline situation, therefore the emission reductions achieved by the project activity is limited to the ex-post calculated baseline emissions minus project emissions using the actual monitored data for the project activity ($N_{LT,y}$, $MS\%_{i,y}$ and in case adjusted values for animal weight are used as defined in paragraph 12: $VS_{LT,y}$). The emission reductions achieved in any year are the lowest value of the following:

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

Where:

$ER_{y,ex\text{-}post}$ Emission reductions achieved by the project activity based on monitored values for year "y" (tCO_2e)

$BE_{y,ex\text{-}post}$ Baseline emissions calculated using formula in Section B.4 using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$

$PE_{y,ex\text{-}post}$ Project emissions calculated using formula in Section B.6 using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$ and if applicable $VS_{LT,y}$

MD_y Methane captured and destroyed or used gainfully by the project activity in year "y" (tCO_2e)

$PE_{power,y,ex\text{-}post}$ Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year "y" (tCO_2e)

In case of flaring/combustion MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \quad (7)$$

Where:

$BG_{burnt,y}$ Biogas[3] flared or combusted in year "y" (m^3)

$w_{CH4,y}$ Methane content[3] in biogas in the year "y" (mass fraction)

FE Flare efficiency in the year "y" (fraction)"

paragraph 25:

"*The amount of biogas recovered and fuelled, flared or used gainfully shall be monitored ex-post, using flow meters. The fraction of methane in the biogas she be measured with a continuous analyzer or, alternatively, with periodical measurement at a 95% confidence level. Temperature and pressure of the biogas are required to determine the density of the methane combusted.*"

Paragraph 27:

"*Flow meters, sampling devices and gas analysers shall be subject to regular maintenance, testing and calibration to ensure accuracy.*"

Paragraph 33:

"*The monitoring plan should include on site inspections 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. The maintenance and calibration shall be conducted based on the supplier's specification.
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:	The project's 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 every using a data logger
QA/QC procedures to be applied:	The flow meters will be subject to regular maintenance and testing regime to ensure accuracy once a year. The maintenance and calibration shall be conducted based on the supplier's specification.
Any comment:	

Data / Parameter:	**Methane content**
Data unit:	%
Description:	The fraction of methane in the biogas
Source of data to be used:	Geotech CDM biogas analyser

Value of data	
Description of measurement methods and procedures to be applied:	The will be monitored through the use of a gas analyzer at the farm. In the event that the methane content of the samples varies significantly, the sample will be taken on a more frequent basis. The project participant will conduct frequent methane sampling at the initial operational stage of the project to assure the 95% confidence level of the monitoring. In the case where 95% confidence level cannot be achieved during the initial stage, the project participant will adjust the monitoring frequency throughout the crediting period
QA/QC procedures to be applied:	The Geotech CDM Flow meter and analyser will be subject to regular maintenance and testing to ensure accuracy once a year. The maintenance and calibration shall be conducted based on the supplier's specifications.
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	100%
Description of measurement methods and procedures to be applied:	Continuous check of compliance with manufacturer's specification the generator set will be done. Since all of the methane will be destroyed to generate electricity for use in the farm, it can be assumed that 100% of the methane will be destroyed.
QA/QC procedures to be applied:	Maintenance of the generator will be conducted based on the supplier's requirements.
Any comment:	

B.7.2 Description of the monitoring plan:

The illustrated monitoring plan is shown in *Figure 29 – Monitoring Points*

The monitoring system mainly comprise of monitoring instruments to routinely monitor the volume of biogas utilized and destroyed in the system. The meters used in the system will be from the industry standard with best accuracy available. All of the instruments will be calibrated in accordance with the manufacturer's specifications at regular intervals so that the accuracy of the measurement can be ensured all the time. The calibration frequency is a part of the monitoring and verification parameters. All measurements will be reported monthly in reports that will be kept for the crediting period plus two years

The number of swine and the average weight will be randomly measured and recorded by the CP personnel. Using the available data from the purchase record where the weight of swine are measured and data from CP database, the average weight of the boar and saw can be calculated. The number of the swine in the farm will be obtained through the available data, such as farm capacity and available farm report.

The amount of biogas generated from the covered lagoon will be continuously measured with the Geotech CDM Portable Biogas Check gas analyzer. The farm manager or the assigned trained personnel will take photos of the gas analyzer's display from the supplied digital camera three times a day (morning, afternoon, and evening) throughout the Project activity period. The farm managers will be trained and instructed by the supplier's personnel to correctly operate the gas analyzer to provide accurate data recording for validation. Temperature and pressure of biogas will also be measured using gas analyzer to determine the density of the density of methane in the biogas.

The gas analyzer will be calibrated once a year to maintain the optimum operating environment for the analyzer as according to the manufacturer's specifications. The flow meter will be an online flow meter from Endress and Houser with an automatic data logger to record the flow data of the CH_4 simultaneously for accurate flow information. The flow meter will also be calibrated once a year to maintain optimum operating environment accordingly to the manufacturer's recommendation.

The flow rate of the biogas recovered from the anaerobic digester will be measured using a continuous on-line industry standard gas flow meter. The frequency of testing will be reduced if there are no wide variations in value or increased in if there are wide variations in the values.
The electricity meters installed with the generator will monitor the electricity generated from the plant. Continuous electricity meter will be installed with data captured and registered in monthly reports that will be kept for the crediting period plus two years. The electricity meter will be calibrated in accordance with the manufacturer's specifications. The engine will be maintained as supplier's specified to ensure optimal operation. The generator will be maintained as per the supplier's specification with will ensure optimal combustion. The biogas generator will be operated 18 hours/day.

Description of the responsible authority:

Project Management:
The day-to-day operation of the plant will be conducted by CP personnel. The responsibility for the operation and maintenance of the plant will be the responsible of the farm manager.

Registration, Monitoring, Measurement and Reporting:
CP personnel will take monthly reading of all meters and report the results in a spreadsheet to the designated Compliance officer.

Training of monitoring personnel:
The instruments manufacturers will take responsible for training of the monitoring personnel.

Procedures for calibration of monitoring equipment
The instrument manufacturers will responsible for preparing and delivering procedures for calibration of monitoring equipment

Procedures for maintenance of monitoring equipment and installations
CP sub-contract engineering tem will responsible for preparing and delivering procedures for maintenance of monitoring equipment and installations

Procedures for monitoring, measurements and reporting

CP personnel will responsible for monitoring, measurements and reporting of the required factors.

Procedures for day-to-day records handling

(including what records to keep, storage area of records and how to process performance documentation)

CP personnel will responsible for preparing and delivering procedures day-to-day records handling.

Procedures for internal review of reported results/data

(Including a system for corrective actions as needed, in order to provide for more accurate future monitoring and reporting.)

CP personnel will be responsible for preparing and delivering procedures for internal review of reported results/data.

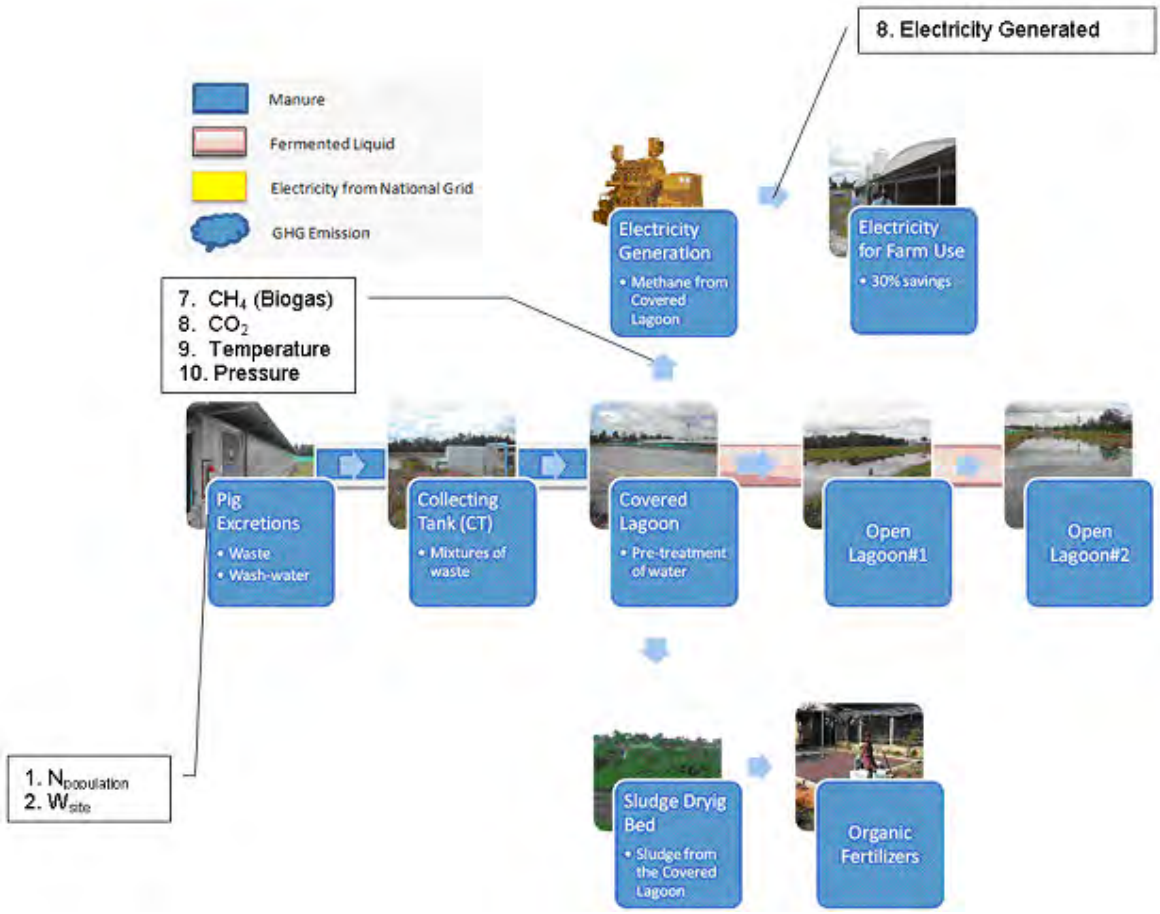

Figure 29 – Monitoring Points

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

Date of completion of the methodology: 28 March 08

Contact information of the person(s)/entity (ies) responsible for the application of the baseline and monitoring methodology to the project activity:

Organization	
Contact person	
Telephone no.	
E-mail address	
Date of completion	

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:

April 2009

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

20 years from April 2009 – April 2029

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

Fixed crediting period

C.2.1. Renewable crediting period

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

Not Applicable

C.2.1.2. Length of the first crediting period:

Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

January 2010

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

As required by Thai law and the Thailand Greenhouse Organization (TGO), the Initial Environmental Evaluation (IEE) is needed for this type of project to ensure that initial environmental evaluation of the project and area would create least impact to the environment and communities of the designated project location. The IEE also helps establishing the possible basic mitigation or compensation measure if the impacts are significant.

Five major aspects of environmental impacts were identified as a result of the waste water treatment and electricity generating operation, which are:

- **Noise –** since the project utilizes the generator for electricity generation that produces noise level below the limit of the national regulation, the noise from the generator poses no effect to the nearby houses;

- **Wastewater Pollution –** the wastewater treatment system can remove more than 70% of COD and organic matters in the wastewater, consequently the possible environmental impact from the contamination from overflow of the lagoon during the rainy season or the underground water is significantly reduced;

- **Solid waste disposal –** the project's system has prepared sludge separation pump and the sludge drying bed, which will improve handling and utilization of the solid waste from the system. The dried sludge will be used as organic fertilizer that will be distributed to communities nearby. As a result, the environmental impact from solid waste and sludge from the Project will be significantly reduced.

- **Odor –** the project's system operates in a closed system, unwanted odor will be significantly reduced.

- **Safety –** since the project utilizes biogas (CH_4) for electricity generation, the safety issue from the gas explosion may be a noticeable concern. However, because the CH_4 has the quality to disperse upward very quickly into the atmosphere, the risk of unwanted explosion is unlikely.

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 yet answerable)

SECTION E. Stakeholders' comments

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

Five local stakeholders' public hearings were conducted for each project activity, one for each farm of the bundles. The following table summarizes the details of the five meetings

Bundle Name:	*Date:*	*Location of Meeting:*	*Number of Participants*
Udonthani Farm	November 19, 2008	Public Hall of Sang Paen's SOA	Approx 99 Participants
Chaturat Farm	November 21, 2008	Public Hall of Nong Chim's SOA	Approx 70 Particiants

The following were the standard program of activities followed during the conduct of the meetings:

1. Introduction of the participants and welcoming remarks
2. Presentation on
    a. Project overview (project background, status and plans for the farm regarding the technology to be used)
    b. Project benefit to the local communities (how the local communities can benefit from the Project activities and the Project's contribution to sustainable development)
3. Discussion and open forum (Q&A)
4. Summary and closing
5. Food and refreshment

Stakeholders' comments at Udonthani Farm

The stakeholders' comments were held at the Sub-district Organization Authority (SOA) of the Sang Paen Sub-district Organization Authority's public hall. With 101 participants that represents people from local villages, school, hospital, SOA itself and representatives from governmental energy agency and agriculture agency, the public hear consisted of participants with diverse backgrounds and opinions. The presentation was showed to the participants from CP personnel for better understanding of the benefit of the project to the community and potential concerns.

The participants were satisfied with the benefits the Project can give to the community. Some of the participants also showed interest by volunteering to participate in distributing the benefits from the Project to the community.

Figure 30,31 – Public Hearing at Sang Paen's SOA, Udonthani

Stakeholders' comments at Chaturat Farm

The stakeholders' comments were held at the Sub-district Organization Authority (SOA) of the Nong Chim sub-district's public hall. With 65 participants that represents people from local villages, school, hospital, SOA itself and representatives from governmental energy agency and agriculture agency, the public hear consisted of participants with diverse backgrounds and opinions. The presentation was showed to the participants from CP personnel for better understanding of the benefit of the project to the community and possible threats.

The participants were satisfied with the benefits the Project can give to the community. Some of the participants intended to participate in check and balance of the farm.

E.2. Summary of the comments received:

Questionnaire is divided into sections. Section 1 and 2 is to be filled before explanation of project in details while section 4 is to be completed after such explanation. Results of public survey are shown below:

In general, no negative reaction or significant comment against the Project activity was received in all three meeting conducted. In fact, local communities and participants were generally happy and agreed that the Project activities will contribute significantly to the local environment and economic of the local communities. There was a consensus that the sooner project can be started, the better it will be for the economic and environmental of the local communities around the Project sites.

Question aimed to clarify the presentation were discussed and revolved around the following topics:

- Impact of the Project activity to reduce foul smell

- Waste-water treatment system
- The distribution of the by-product from the Project activities (the fertilizer from dried sludge from cover lagoon and water from first open lagoon)
- Possibility of replicability of the project in other pig farms

The specific questions and answers were properly documented, voice recorded and included in the minutes of the meetings submitted to the Thai Greenhouse gas Organization in the form of Initial Environmental Evaluation (IEE) as part of the requirements for the host country national approval before issuing Letter of Approval (LoA).

Summary of the result of the questionnaires received from public hearing are as contain following information: (*this is the public hearing result from only Chaiyaphum and Udonthani farm area)

	Questionaire	%	Sum
	Sample		**166**
	Male	61.03%	101
	Female	39.45%	65
	Section 1		
1	**Your position in your place**		
	Owner	65.66%	109
	Tenant	2.50%	4
	Cousin of the owner	15.06%	25
	Other	16.88%	28
2	**You have been living here for**		
	Since I was born	66.27%	110
	Moved from other place	33.74%	56
3	**Occupation**		
	Farmers	41.12%	68
	Governmental employee	16.96%	27
	Employee	33.34%	55
	Retailer	6.26%	10
	Other	9.09%	6
4	**Source of information you obtain**		
	Newspaper	14.51%	48
	Television	36.12%	123
	Place for announcement in the community	20.24%	67
	Radio	21.20%	72
	Neighbors	6.57%	21
	Others	2.93%	10
5	**Have you ever heard of biogas-to-electricity project in swine farm?**		
	Nhong Bua Farm	9.18%	16

	SPM Farm	3.88%	7
	Veerachai Farm	1.15%	2
	Biogas powerplant in other countries	11.15%	20
	Others	32.50%	57
	I never heard about it	45.44%	79
	Section 2		
1	**Do you know that there will be biogas-to-electricity project in swine farm in your area?**		
	I know	49.42%	75
	I do not know	58.31%	91
2	**Do you know that manure from swine farm can be used in electricity generation?**		
	I know	68.98%	113
	I do not know	31.26%	51
3	**How much do you understand the project?**		
	Very well	14.36%	22
	Fairly	40.19%	66
	Little	26.56%	43
	Very little	7.94%	13
	Not at all	14.97%	22
4	**What is the fuel for electricity generation in the project?**		
	Coal	1.83%	3
	Natural gas	7.04%	10
	Fuel oil	4.35%	3
	Manure from swine	72.62%	122
	I do not know	17.89%	30
4.1	**Do you agree that this project is in the line with "sufficient economy" of King Bhumiphol?**		
	Totally agree	77.73%	129
	Quite agree	13.41%	21
	No comment	11.51%	16
	I do not agree	0.00%	0
5	**Benefit of the project to cummunity**		
5.1	**Reduce GHG emission**		
	Very good	61.56%	102
	Good	35.05%	58
	A little	1.01%	1
	No comment	3.49%	5
5.2	**Reduce the amount of imported fuel**		
	Very good	64.49%	107
	Good	31.01%	51
	A little	4.04%	4

	No comment	2.50%	4
5.3	**Reduce amount of waste and pollution from wastewater**		
	Very good	76.95%	127
	Good	22.89%	34
	A little	1.84%	3
	No comment	2.99%	2
5.4	**Raise development in the community as an example of good practise**		
	Very good	73.56%	122
	Good	24.85%	41
	A little	1.01%	1
	No comment	1.25%	2
5.5	**Better environment in the community**		
	Very good	61.01%	100
	Good	34.76%	57
	A little	1.03%	1
	No comment	3.74%	6
6	**Your concern for the project**		
6.1	**Dust**		
	A lot	20.49%	34
	Moderate	25.30%	42
	A little	20.28%	29
	Not at all	37.93%	61
6.2	**Odor**		
	A lot	24.85%	41
	Moderate	21.67%	35
	A little	29.10%	44
	Not at all	29.32%	46
6.3	**Noise**		
	A lot	18.69%	31
	Moderate	25.82%	42
	A little	29.52%	49
	Not at all	26.79%	44
6.4	**Quality of raw water in the area**		
	A lot	20.15%	33
	Moderate	24.96%	41
	A little	28.03%	46
	Not at all	27.44%	45
6.5	**Insufficient water to use in agriculture area**		
	A lot	8.99%	14
	Moderate	25.71%	42
	A little	30.39%	50

	Not at all	36.84%	59
6.6	**Traffic and damages of road surface**		
	A lot	13.40%	22
	Moderate	18.17%	30
	A little	31.46%	50
	Not at all	39.60%	64
6.7	**The project will not be implemented as committed**		
	A lot	28.36%	47
	Moderate	23.60%	39
	A little	19.18%	31
	Not at all	29.77%	49
7	**Do you want to be a part of project validation?**		
	A lot	28.39%	44
	Fairly	42.42%	69
	A little	6.06%	6
	No comment	37.35%	47
	Section 4		
1	**Do you get better understanding in this project?**		
	Very well	78.88%	130
	Not quite	14.54%	23
	Not at all	7.28%	12
2	**What is the fuel used for electricity generation in the project?**		
	Coal	1.96%	2
	Natural gas	8.26%	14
	Fuel oil	1.23%	2
	Manure from swine	89.41%	152
	I do not know	0.00%	0
3	**After you heard about preventive practises, are you still worried about the project?**		
	I am not worried about it anymore	75.01%	125
	I am still worried	25.63%	42
4	**What is/are benefits from the project for this area?**		
	More employment	23.65%	107
	Farmers get higher income indirectly	17.80%	80
	Community will be the same as before	7.57%	33
	Price of the land will increase	11.71%	53
	General facilities will be improved	13.37%	60
	Odor from swine farm will be reduced	26.50%	120
5	**Do you want the project to be implemented in your community?**		
	I want	74.52%	136
	I do not want	1.32%	1

No comment	2.43%	4
Up to decision of community leaders	10.94%	20
Up to decision of the whole community	13.55%	22

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

The comment received during the public hearing:

“

- Impact of the Project activity to reduce foul smell
- Waste-water treatment system
- The distribution of the by-product from the Project activities (the fertilizer from dried sludge from cover lagoon and water from first open lagoon)
- Possibility of replicability of the project in other pig farms ”

Since one of the Project’s main benefit is to reduce the smell generated from the swine feces, the impact of the Project to reduce foul smell is significant.

The owner of the CP farm promised the distribution of the by-product from the Project activities to the nearby local stakeholder at a low cost. The social responsibility is part of the CP mission to provide the benefits to the local stakeholders.

As of today, some of the nearby local farms show interests to learn about the biogas technology use in the CP farm.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Charoen Pokphand Northeastern Public Co., Ltd. (Branch Udonthani)
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

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

Direct tel:	
Personal E-Mail:	

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

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

Personal E-Mail:	

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

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

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

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NOT APPLICABLE. THERE IS NO PUBLIC FUNDING FROM ANNEX I COUNTRIES INVOLVED IN THE PROJECT ACTIVITIES.

Annex 3

BASELINE INFORMATION

A. Grid Emission Factor for Thailand

Power Generation by Fuel ($EG_{m,y}$) (GWH/year)				
Year	2004	2005	2006	2007
Natural Gas	90,289	94,468	94,344	
Lignite	17,994	18,335	18,028	
Coal	2,411	2,280	6,441	
Fuel Oil	5,468	7,640	7,808	
Diesel	233	177	77	
Sub Total	116,394	122,899	126,698	
Hydro	5,896	5,671	7,950	
Imported	3,378	4,372	5,152	
Others	1,842	1,856	2,065	
Total	127,510	134,798	141,865	

Source: http://www.eppo.go.th/info/stat/T05_02_04-2.xls

	Emission Factor $EF_{EL,m,y}$ (tCO2/MWh)	Emission from Power Generation by Fuel $EG_{m,y} * FE_{EL,m,y}$ (tCO2e/year)			
Year		2004	2005	2006	2007
Natural Gas	0.5009	45,225,810	47,318,871	47,257,110	
Lignite	1.1268	20,275,188	20,659,315	20,313,612	
Coal	1.1268	2,716,602	2,568,879	7,257,381	
Fuel Oil	0.8297	4,536,551	6,338,908	6,478,629	
Diesel	0.8297	193,320	146,774	63,804	
Sub Total		72,947,472	77,032,746	81,370,536	
Hydro					
Imported					
Others					

Low Cost 11% Therefore, simple Operating Margins (OM) method can be used

$$EF_{grid,CM,y} = (EF_{grid,OM,y} * W_{OM}) + (EF_{grid,BM,y} * W_{BM})$$

$$EF_{grid,CM,y} = 0.517 \ tCO2e/MWh$$

Where:

W_{ON} = 50%

* The project other than Wind and Solar power generation project activities WOM = 0.5 (or 50%) for the first crediting period (for second and third crediting period WOM = 0.25)

W_{BN} = 50%

* The project other than Wind and Solar power generation project activities WBM = 0.5 (or 50%) for the first crediting period (for second and third crediting period WOM = 0.75)

$$EF_{grid,OM,y} = (\Sigma EG_{m,y} * EF_{EL,m,y}) / (\Sigma EG_{m,y})$$

$EF_{grid,OM,y}$ = Average of $EF_{grid,OM,y\ (2004-2006)}$ = 0.632

CDM – Executive Board

$$EF_{grid,BM,y} = (\Sigma EG_{m,y} * EF_{EL,m,y}) / (\Sigma EG_{m,y})$$

$EF_{grid,BM,y}$ = Factor of IPP Emission/Generation = .0403

Annex 4

MONITORING INFORMATION

The list of monitoring Equipments used in the Project:

1. Geotech CDM Biogas Check: Gas Analyzer
2. Endress and Houser Flowmeter
3. Endress and Houser Data Logger

Information of the Geotech CDM Biogas Check: Gas Analyzer

Geotech
A subsidiary of LANDTEC

BIOGAS ✓
PORTABLE GAS ANALYSER
INSTRUMENTATION

Product Specifications

Gases Measured	CH_4, CO_2 by dual wavelength infrared cell with reference channel O_2 by internal electrochemical cell and H_2S by optional external gas pod		
Range			
CH_4	0-100% Reading		
CO_2	0-100% Reading	Additional gas pods on request	
O_2	0-25%	H_2S	0-50,0-200,0-1000,or 0-5000ppm

Gas Accuracy*	CH_4	CO_2	O_2
0-5%	±0.5%	±0.5%	±1.0%
5-15%	±1.0%	±1.0%	±1.0%
15% - Full Scale	±3.0%	±3.0%	±1.0%

*With proper Field Calibration

Other Parameters	Unit	Range	Comments
Gas Pressure	mbar	± 500 mbar	Direct Measurement
Differential Pressure	mbar	± 125 mbar	Direct Measurement (less barometric)

Operating Temperature Range	0°c - 40°c
Relative Humidity	0-95% non-condensing
Barometric Pressure Range	700 - 1200 mbar
Barometric Pressure Activity	± 5 mbar absolute
Battery Life	Typical use 10 hours from fully charged
Charge Time	Approximately 2 hours from complete discharge
Recommended Field Calibration Gas Mix	65% CH_4 / 35% CO_2

Endress and Houser: Flow meter

t-mass 65I - Thermal mass flowmeter for gases.
Insertion type for circular pipes and rectangular ducts.

Endress and Houser: Data Logger

Ecograph T RSG30

Recorder, colour grafic, paperless., 3x digital input., 4x relay. Multi-channel display mode. 7x operation button, display 4.7 inch., and CF drive, lead seal option.

Monitoring Information:

The monitoring system mainly comprise of monitoring instruments to routinely monitor the volume of biogas utilized and destroyed in the system. The meters used in the system will be from the industry standard with best accuracy available. All of the instruments will be calibrated in accordance with the manufacturer's specifications at regular intervals so that the accuracy of the measurement can be ensured all the time. The calibration frequency is a part of the monitoring and verification parameters. All measurements will be reported monthly in reports that will be kept for the crediting period plus two years

The amount of biogas generated from the covered lagoon will be continuously measured with the Geotech CDM Portable Biogas Check gas analyzer. The farm manager or the assigned trained personnel will take photos of the gas analyzer's display from the supplied digital camera three times a day (morning, afternoon, and evening) throughout the Project activity period. The farm managers will be trained and instructed by the supplier's personnel to correctly operate the gas analyzer to provide accurate data recording for validation. Temperature and pressure of biogas will also be measured using gas analyzer to determine the density of the density of methane in the biogas.

The gas analyzer will be calibrated once a year to maintain the optimum operating environment for the analyzer as according to the manufacturer's specifications. The flow meter will be an online flow meter from Endress and Houser with an automatic data logger to record the flow data of the CH_4 simultaneously for accurate flow information. The flow meter will also be calibrated once a year to maintain optimum operating environment accordingly to the manufacturer's recommendation.

The flow rate of the biogas recovered from the anaerobic digester will be measured using a continuous on-line industry standard gas flow meter. The frequency of testing will be reduced if there are no wide variations in value or increased in if there are wide variations in the values.

The electricity meters installed with the generator will monitor the electricity generated from the plant. Continuous electricity meter will be installed with data captured and registered in monthly reports that will be kept for the crediting period plus two years. The electricity meter will be calibrated in accordance with the manufacturer's specifications. The engine will be maintained as supplier's specified to ensure optimal operation. The generator will be maintained as per the supplier's specification with will ensure optimal combustion. The biogas generator will be operated 18 hours/day.

Description of the responsible authority:

Project Management:
The day-to-day operation of the plant will be conducted by CP personnel. The responsibility for the operation and maintenance of the plant will be the responsible of the farm manager.

Registration, Monitoring, Measurement and Reporting:
CP personnel will take monthly reading of all meters and report the results in a spreadsheet to the designated Compliance officer.

Training of monitoring personnel:
The instruments manufacturers will take responsible for training of the monitoring personnel.

Procedures for calibration of monitoring equipment
The instrument manufacturers will responsible for preparing and delivering procedures for calibration of monitoring equipment

Procedures for maintenance of monitoring equipment and installations
CP sub-contract engineering team will responsible for preparing and delivering procedures for maintenance of monitoring equipment and installations

Procedures for monitoring, measurements and reporting

CP personnel will responsible for monitoring, measurements and reporting of the required factors.

Procedures for day-to-day records handling

(including what records to keep, storage area of records and how to process performance documentation)

CP personnel will responsible for preparing and delivering procedures day-to-day records handling.

Procedures for internal review of reported results/data

(Including a system for corrective actions as needed, in order to provide for more accurate future monitoring and reporting.)

CP personnel will be responsible for preparing and delivering procedures for internal review of reported results/data.