CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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SECTION A. General description of project activity

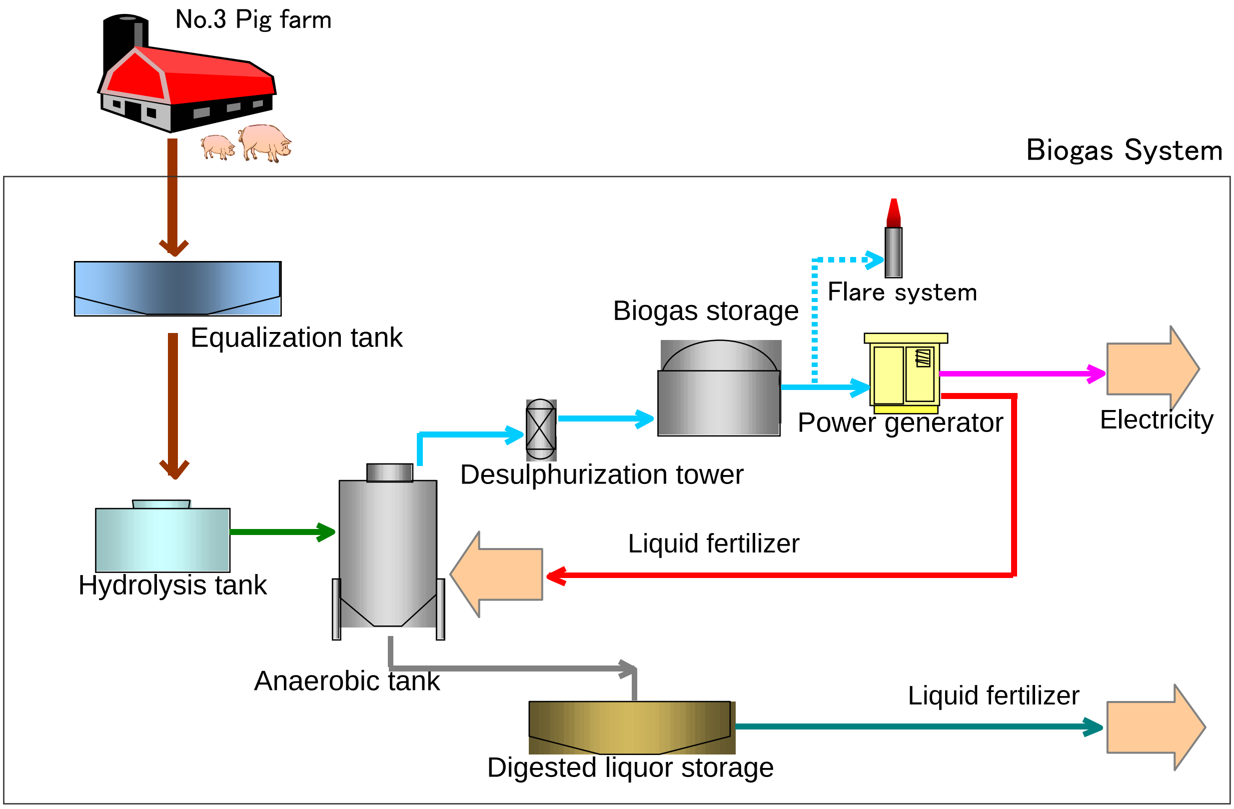
A.1 Title of the project activity:

The title of the project activity: Methane Digestion and Utilisation CDM project from Swine Manure , Foodstuffs Group Co., Laiyang City in Shandong Province
The current version number of the document: Version 01
The date of the document was completed: 03/05/2007

A.2. Description of the project activity:

The objective of this project is to generate electric power by applying methane fermentation process, and to sell extra electricity to the external grid, while by co-generation system producing heat energy to warm methane fermentation tank. The project will be implemented on the pig farm site owned by Foodstuff Group Co., Ltd., in Laiyang City, Shandong Province, People's Republic of China.

Figure A.1 : Biogas System



On the farm at present, pig manure, urine and waste water (from rinsing the farm) is separated into manure and urine (containing waste water) ; manure is used for the raw materials of organic fertilizer, while urine is treated in the anaerobic lagoon on the farm site, resulting in emission sources of GHG, including methane (CH_4) and un-oxydated Nitrogen (N_2 O). This basic scheme of this project is to curve GHG emissions such as methane and N_2O by effectively utilizing methane gas recovered from the

anaerobic fermentation tank built on the site.
In China, demand for pig meat has been substantially on the increase caused by population growth as well as by improved living standard in line with socio-economic development of the country. In recent years, pig farm or pig raising business is becoming toward more professionally managed and centralized.
At present time, there are over 15,000 large-and-medium-scaled pig farms countable across the country. According to the statistics of year 2003 issued by National Department of Agriculture, there were over 4,000 farms which were raising more than 3,000 heads of pigs respectively; and they are shipping 31.33 million pigs each year now.

In such scaled pig farms, drastically improved efficiency for pig raising enables high degree of cost reduction, although counterproductive matters come to appear to result in serious environmental problems caused by accumulated amount of manure and waste water derived from farm operation.
Statistics compiled by Shanghai Municipal Office identifies livestock manure as the 3rd largest (or over 30%) among the causes for environmental pollutions.

Energy consumption in China is being on a rapid increase because of accelerated economic development to such an extent that primary energy consumption, e.g., is successively growing every year: 3.0% in 1900 – 2001; 9.9% 2001 – 2002; 13.2% 2002 – 2003 respectively. Electric power consumption: 8.1% in 1990 – 2001; 11.6% 2001 – 2002; 14.3% 2002 – 2003 respectively. The rapid growth of energy use is fulfilled by fossil fuel resources including coal and petroleum causing GHG emissions.

Almost 100 % of electric power consumed in Laiyang City is produced by coal burning; and yet the chances will be high for the City to reduce GHG emissions by replacing conventional power generation with methane gas power system to be interfaced with the grid network in the area.

Residues from the fermentation process will be supplied to the farmers in the neighbourhood who can Use it for quality liquid fertilizer, so that environmental load may be lowered substantially.
Biogas power generation from livestock manure using methane fermentation process will be sure not only to curve serious environmental problems but to meet ever-growing energy demand without further load on the environment, thus eventually proving to make a great contribution to China's sustainable growth in the future.

A.3. Project participants:

Table A.1 : Project participants

Name of 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 participants
The People's Republic of China (host)	Foodstuffs Group Co.,	NO
Japan	Taisei Corporation	NO
	Hokkaido Electric Power Co., Inc.	
	Iwatani International Corporation	

Detailed contact information of the project participants is given in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

The People's Republic of China

Figure A.2 : Map of The People's Republic of China

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

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Shandong Province

A.4.1.3. City/Town/Community etc:

Laiyang City

Figure A.3 : Project location in the Laiyang City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

In the middle of Shandong Peninsula, Laiyang lies in middle of Lanyan railway (from Lancun to Yantai) It borders Haiyang on the east, Laixi on the west, Qixia and Zhaoyuan on the north and Jimo on the south. It is 35 kilometers from west to east and 65 kilometers from south to north. The land area of whole city totals 1731.54 square meters. The coastline is 27.5 kilometers in curve. The city zone is located in the middle by north.

Figure A.4 : The plant of the pig farm

A.4.2. Category(ies) of project activity:

The categories of the project activity are Sector Scope 13- waste handling and disposal; and Sector Scope 15- Agriculture.

A.4.3. Technology to be employed by the project activity:

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When recovering methane gas by treating manure from pig farm, there are two process systems applicable as show on Fig.8-12: Overall Methane Gas Utilization Process and Methane Gas Intensive Water Treatment Process

Proper selection among these processes may be decided according to the scale of the farm, total amount of organic resources, water-discharging standard, project investment size, and environmental capacity.

Main features of each process system are described as below:

（1） Overall Methane Gas Utilization Process

① Process Application Conditions

- require large-size user(s) in the neighbourhood to the pig farm, such as big agri-farm, fish-culture farm, and fruit farm who can consume liquid effluent or liquid fertilizer;
- need methane gas consumer(s) nearby the pig farm;
- prefer the project site(pig farm), to the circumstantial lands of which has a wide environmental capacity for waste water discharge, e.g.

Figure A.5 : Process of integrated utilization type

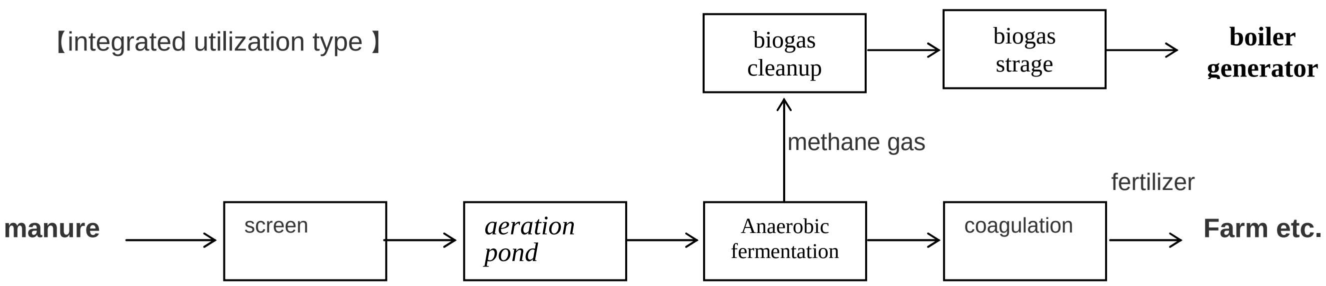
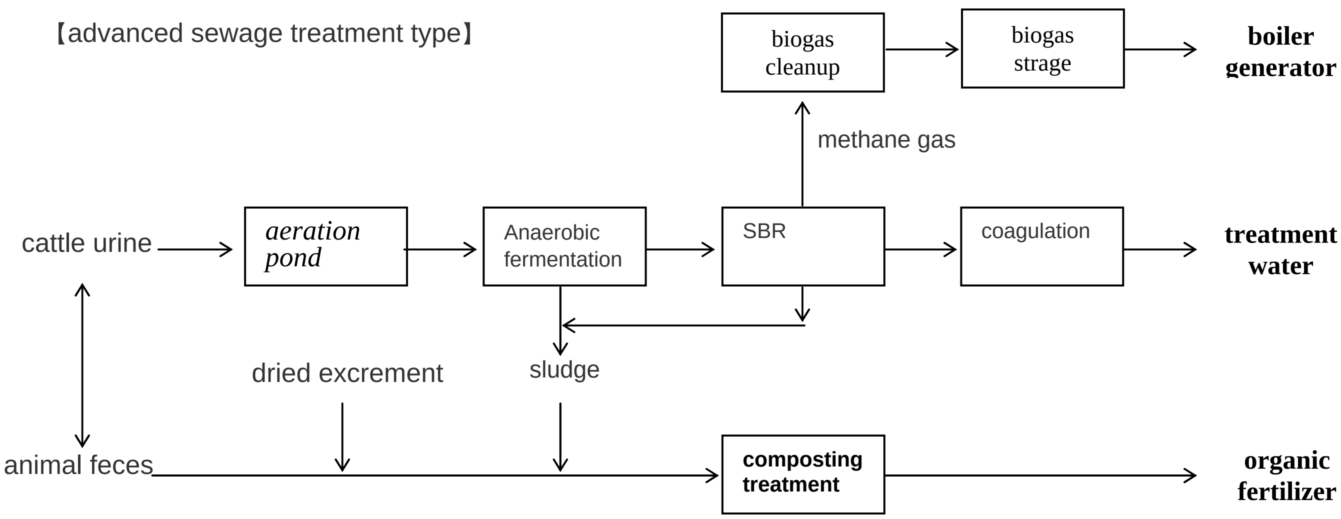


Figure A.6: Process of advanced sewage treatment type



② Features of the Process

- Almost all of the manure and waste water from pig farm can be treated by automatically-operated system
- For the anaerobic treatment process, total anaerobic mixing tank or anaerobic contact reactor can be employed; efficient in treating high SS density effluent; HRT8-10 days; COD removal ratio 75-85%; Gasification ratio/volume 0.6-1.0m^3/m^3.d; Anaerobic treated effluent COD 1,500-3,000mg/l
- Digested effluent can be totally used; therefore, enabling to structure a recycle system based on methane gas recovery process resulting in favorable economics

③ Benefits of the Process

- Total configuration of the process is simple and easy to operate and control。
- High rate of methane gas production can be obtained
- Equipment Investment and operational expenses are low, and payback time on investment will be shorter

④ Drawbacks of the Process

- Efficiency of the process is not so high
- high density of the treated effluent may pollute periphery environment
- Pollution materials are digested on the plant site, and therefore wider range and amount of physical resources are required to achieve total utilization scheme of the process

（2） Methane Gas Intensive Water Treatment Process

① Process Application Conditions

- Applicable to such large-size pig firms that ship over 5,000 heads per year
- Suitable for the plant site controlled by strict discharging rules

② Features of the Process

- Pig farm never fails to practice hygiene breeding by segregating dry matters from wet materials, so that dried manure is used to produce organic fertilizer
- Waste water is always pretreated before discharging, and separating solid from liquid matters is reinforced by sedimentation thus to control SS density quite strictly
- For anaerobic process configuration, UASB anaerobic reactor can be employed with HRT= 3 days; COD Removal ratio 80%-85%; Gasification ratio per Volume 率 1.0-1.2m^3/m^3.d; Anaerobic-treated effluent 700-1,000mg/l。
- For aerobic process configuration, SBR system can be adopted to obtain removal effects of COD, Nitrogen, Phosphorous, with HRT=2-3 days; COD Removal ratio 90-95%; NH_3-N95 ratio < 95%
- After aerobic treatment, further intensive treatment can be attained by condensation and

sedimentation process

- Sludge treated by anaerobic—aerobic processes makes good organic fertilizer after dehydrated; continuous aerobic bio-composting process is employed to make organic fertilizer

③ Benefits of the Process

- Not only able to recover methane gas, but to meet water-discharge regulations through intensive waste water treatment; therefore thus so widely applicable
- Process efficiency is so high as to attain great level of operational control management
- Removal ratio of COD and NH_3-N is high

④ Drawbacks of the Process

- Equipments investment is expensive and so as operational expenses
- Highly-skilled operator(s) is required for smooth operational control
- Off-take use of dried manure for organic fertilizer lowers methane gas production volume

（3） Process Selection

Careful reviewing and comparing the above 2 processes' benefits as well as their drawbacks has made us decide to adopt "Overall Methane Gas Utilization Process" as a new manure-treatment system for the following reasons:

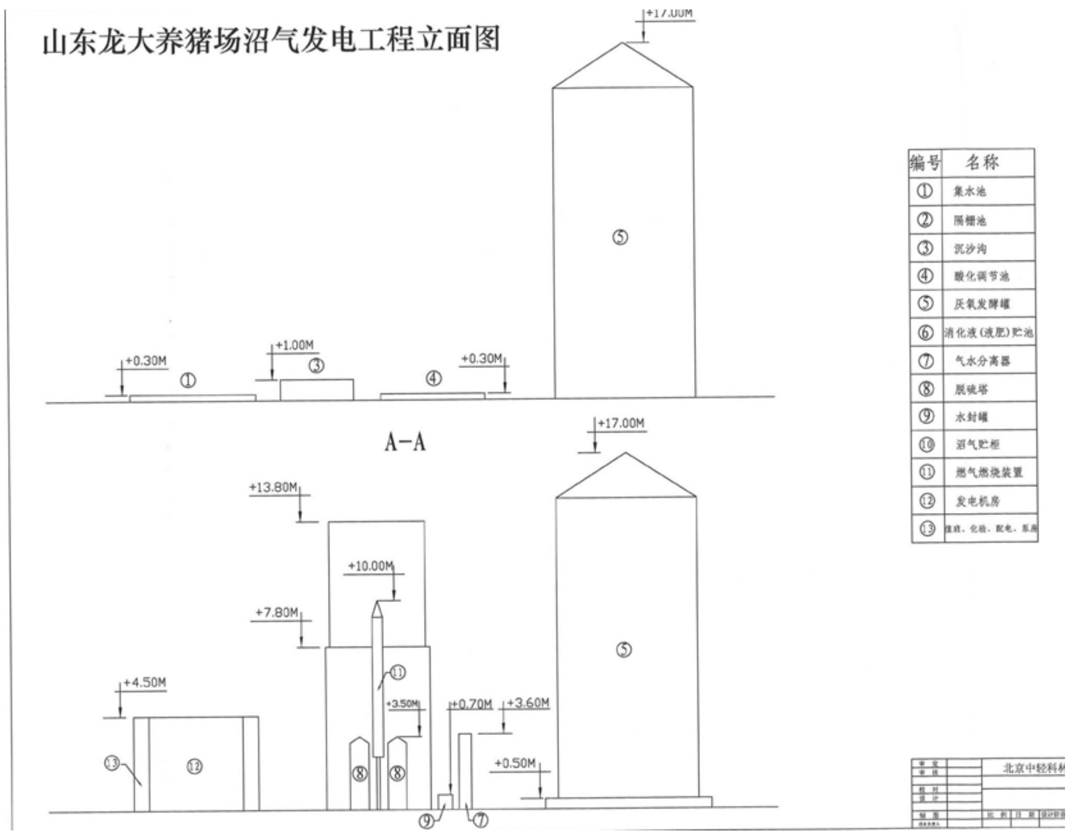
- Around Pig Farm site, wide areas of agricultural land、fish culture farms and fruit plantation farms are located, which can provide large degree of environmental capacity allowing for overall utilization of digested effluent
- The process will be more economically competitive because of higher income expectable from electric power disposal to the grid which is generated by more methane gas recoverable compared with the other process
- The process is 50% less expensive in operational costs and equipment investment is about 40% less than the other process

Liquid waste emitted from is retained in collecting pond, and then sand will be separated during the water going through the sand screen ditch while large foreign matters and impurities being removed by the filter screen , then transported into the oxidation adjustment pond.

From the pond, the pre-treated liquid water will be pumped into anaerobic fermentation tank for anaerobic fermentation processing. The methane gas produced around the internal top of the tank will be st6red into the gas storage tank after treatment by way of dehydration and de-sulphurication (or gas purification process). The purified methane gas then will be sent to the CHP (combined heat and power generator) for power generation; and when the CHP is out of service for maintenance, methane gas will be transferred to the Flare stuck for burning in the air. The digested effluent from the anaerobic fermentation tank will be stored in the digested effluent storage pond for further treatment by diluting with water for irrigation water used by nearby agricultural farmers.

Figure A.7 : The bird's eye view of the plant site;

Figure.A.8 : The plant configuration.



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

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Years	**Annual estimation of emission reductions in tons of CO_{2e}**
2009	27,774
2010	27,774
2011	27,774
2012	27,774
2013	27,774
2014	27,774
2015	27,774
2016	27,774
2017	27,774
2018	27,774
Total estimated reductions (tons of CO_{2e})	**277,740**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tons of CO_{2e})	**27,774**

A.4.5. Public funding of the project activity:

There is no public funding involved in this project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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ACM0010 (Version 02) "Consolidated methodology for GHG emission reductions from manure management systems"

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

This approved methodology ACM0010 is applicable to manure management system with the following conditions:

- Farms where livestock populations, comprising of cattle, buffalo, swine, sheep, goats, and/or poultry, is managed under confined conditions;
- Farms where manure is not discharged into natural water resources (e.g. rivers or estuaries);
- In case of anaerobic lagoons treatments systems, the depth of the lagoons used for manure management under the baseline scenario should be at least 1m[1].
- The annual average temperature in the site where the anaerobic manure treatment facility in the baseline existed is higher than 5°C.
- In the baseline case, the minimum retention time of manure waste in the anaerobic treatment system is greater than 1 month.
- The AWMS/process in the project case should ensure that no leakage of manure waste into ground water takes place, e.g., the lagoon should have a non-permeable layer at the lagoon bottom.

The proposed project can meet all the above requirements of the baseline methodology with the following conditions. So this methodology is applicable to the proposed project.

- The farm of the proposed project where livestock populations comprising of swine is managed under confined conditions;
- AWMS system, including baseline scenario and alternative project manure management system, is in accordance with regulatory frameworks of the host country. The swine manure is not discharged into natural water resources (e.g. rivers or estuaries).
- The depth of anaerobic lagoon treatment systems of the baseline scenario is deeper than 2.5m.
- The annual average temperature at the project site is 8.75℃.
- The minimum retention time of manure waste in the anaerobic lagoon is greater than 40 days.
- The AWMS/process in the project case will not cause any leakage of manure waste into ground water.

The baseline methodology, ASM-I.D.-Version 09, was chosen because it offers a GHG emissions model that can be used to characterize baseline emissions for project activities that use renewable energy technologies that supply electricity. Specifically, the methodology is applicable because:

- The project activity includes renewable energy generation from, biogas cogeneration to offset the use of electricity supplied by coal-fired generating units.
- The added new renewable component is less that 15MW, which qualifies as a small scale CDM project activity.

B.3. Description of the sources and gases included in the project boundary

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Figure B.1 : Project Boundary

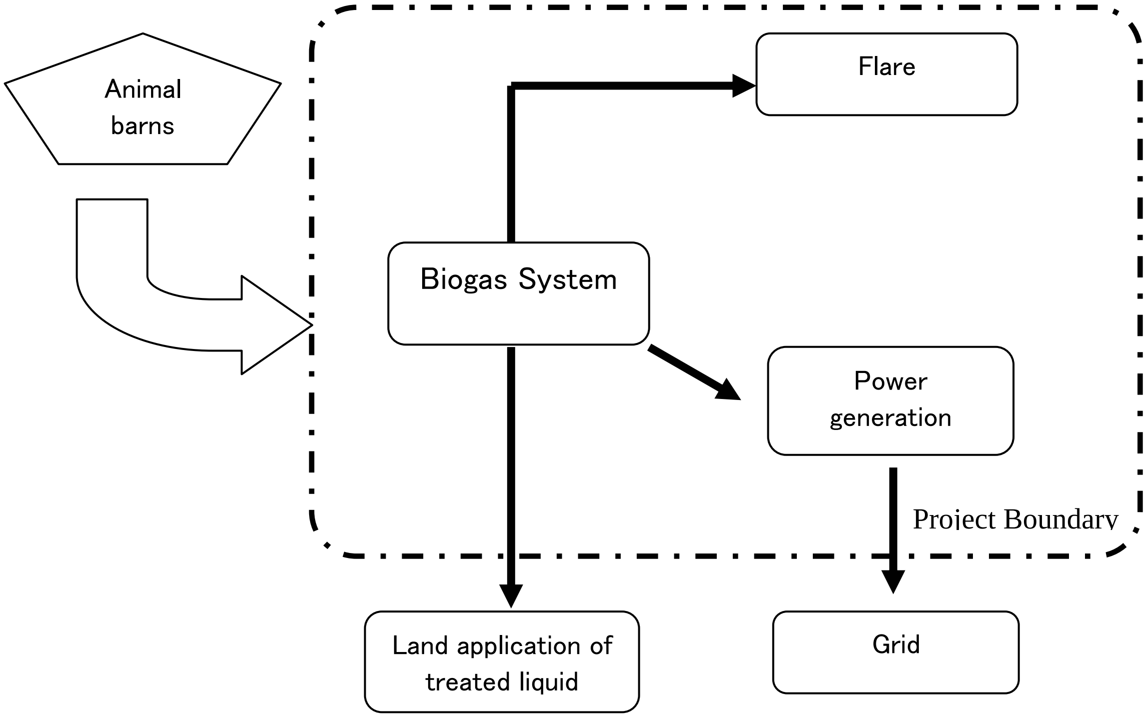

Table B.1 : Sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Direct emissions from the uncovered anaerobic lagoon	CH_4	Included	
		N_2O	Included	
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted.
	Emissions from electricity consumption	CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
		CO_2	Excluded	Electricity is consumed from the grid in the baseline scenario
	Emission from thermal energy generation	CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
		CO_2	Excluded	Thermal energy generation is not included in the project activity
Project Activity	Emission from thermal energy generation	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.

		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		CO_2	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emission from onsite electricity use	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		CO_2	Excluded	Electricity is generated from collected biogas. Therefore these emissions are not accounted.
	Direct emissions from the treatment process	CH_4	Included	
		N_2O	Excluded	
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The methodology ACM0010 determines the baseline scenario through the following steps:
Step I: Define alternative scenarios to the proposed CDM project activity;
Step II: Barriers analysis;
Step III: Investment analysis;
Step IV: Baseline revision at renewal of crediting period.

Step I*: *Define alternative scenarios to the proposed CDM project activity

Identify realistic and credible alternative scenarios that are available either to the project participants or to other potential project developers for managing the manure.

The following list of scenario alternatives is derived from different AWMS presented in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories:

- Solid Storage
- Liquid/Slurry
- Pit Storage
- Deep Bedding
- Uncovered Anaerobic Lagoon

According to the ACM0010, in drawing up a list of possible scenarios, combination of different AWMS should be taken into account. Possible combinations of AWMS are as follows:

1.Anaerobic treatment - Flare

2.Intensive Treatment by mixing manure and urine with water for discharging in the river
3.Urine is treated in anaerobic lagoon, while dried manure is utilized as organic fertilizer
4. This project non-applicable for registration as CDM

Apply Sub-step 1b of "Tool for demonstration assessment and of additionality (Version 02)". Eliminate alternatives that are not in compliance with all applicable legal and regulatory requirements.

Solid Storage: This involves the storage of manure, typically for a period of several months, in unconfined piles or stacks. It is suitable for household farms. The proposed project is large-scale swine farms. So, this manure management system is not a potential alternative baseline scenario.

Liquid/Slurry: Since the amount of discharged manure is very large even on a daily bases, storing the liquid manure in the tank to distribute them to the farmland requires a lot of labor work. Therefore it is unrealistic to implement such a task for this project under the competition of the market. Therefore this option faces significant barrier and is excluded from the baseline scenario.

Pit Storage: This project site is a large-scale livestock farm and the manure quantity produced is too large to implement pit storage structure under the barns, so this scenario is excluded.

Deep Bedding: The deep bedding is laborious and this is counter to achieving economies of scale associated with large animal counts. The concentration of nocuous gas in the bedding is high enough to poison pigs if it is disposed inappropriately, and it is favourable for the survival and breeding of vermin and microorganisms due to its high temperature and humidity. So, the deep bedding practice is excluded from consideration. This system is more applicable to small scale farms.

Uncovered Anaerobic Lagoon: This system is the most common system in China, but in China, for enforcing anti-pollution regulations aimed at livestock industry, National Environment Protection Agency institutes "Control and Management Methods on Pollutants derived from Livestock Farms", "Standards on Pollutants Emissions derived from Livestock Farms and Industry", and "Technical Standards on Pollution Protection for Livestock Farms"
On 4.3 of "Technical Standards on Pollution Protection for Livestock Farms", newly-built, re-modeled , and enlarged pig farms are prohibited to emit manure mixed with urine ; therefore, this particular system will not construe Baseline scenario.

All Possible combinations of AWMS meet regulations good enough to move on to Step Ⅱ.

Step II: Barriers analysis;

After analysing possible technical barriers as well as and customary and institutional barriers, there are no barriers and constraints detected in the Baseline scenarios of combinations of AWMS.

Step III: Investment analysis;

According to ACM0010 in the Step Ⅲ, undertake investment analysis of all the alternatives that don't face any barriers, as identified in Step II. For each alternative, all costs and economic benefits attributable to the waste management scenario should be illustrated in a transparent and complete manner, as in the following tables.

Table B.2 : Calculation of NPV and IRR – Baseline Ⅰ

COSTS AND BEBEFITS(RMB) **BASELINE Ⅰ:** Anaerobic treatment - Flare	**Year 0**	**Year 1**	**Year n**	**Year 10**
Equipment costs	-3,240,000			
Installation costs	-1,085,000			
Maintenance costs		-513,000	-513,000	-513,000
Other costs	-1,445,000			
Revenues from the sale of electricity or other project related products, when applicable				
TOTAL	-5770,000	-513,000	-513,000	513,000
NPV(RMB)(discount rate = 10%)	-8,922,163			
IRR(%)	Undefined			

Table B.3 : Calculation of NPV and IRR – Baseline Ⅱ

COSTS AND BEBEFITS(RMB) **BASELINE Ⅱ:** Intensive Treatment by mixing manure and urine with water for discharging in the river	**Year 0**	**Year 1**	**Year n**	**Year 10**
Equipment costs	-7,080,000			
Installation costs				
Maintenance costs		-200,000	-200,000	-200,000
Other costs				
Revenues from the sale of electricity or other project related products, when applicable				
TOTAL	-7,080,000	-200,000	-200,000	-200,000
NPV(RMB)(discount rate = 10%)	-8,308,913			
IRR(%)	Undefined			

Table B.4 : Calculation of NPV and IRR – BaselineⅢ

COSTS AND BEBEFITS(RMB) **BASELINE Ⅲ:** Urine is treated in anaerobic lagoon, while dried manure is utilized as organic fertilizer	**Year 0**	**Year 1**	**Year n**	**Year 10**
Equipment costs	-192,000			
Installation costs				
Maintenance costs		-50,000	-50,000	-50,000
Other costs				
Revenues from the sale of organic fertilizer		100,000	100,000	100,000
TOTAL	-192,000	50,000	50,000	50,000
NPV(RMB)(discount rate = 10%)	115,228			
IRR(%)	Undefined			

Table B.5 : Calculation of NPV and IRR – BaselineⅣ

COSTS AND BEBEFITS(RMB) **BASELINE Ⅳ:** This project non-applicable	**Year 0**	**Year 1**	**Year n**	**Year 10**

for registration as CDM				
Equipment costs	-7,854,000			
Installation costs	-1,085,000			
Maintenance costs		513,000	513,000	513,000
Other costs	-1,445,000			
Revenues from the sale of electricity or other project related products, when applicable		1,012,800	1,012,800	1,012,800
TOTAL	-10,384,000	499,800	499,800	499,800
NPV(RMB)(discount rate = 10%)	-7,656,589			
IRR(%)	Undefined			

The IRR cannot be calculated due to the existence of only negative flows in the financial analysis; so the economic analysis compares Net Present Value (NTV) parameters between the different scenarios.
The following table shows the NPV of each scenario analyzed.

Table B.6 : NPV comparison

	BASELINE Ⅰ: Anaerobic treatment - Flare	**BASELINE Ⅱ:** Intensive Treatment by mixing manure and urine with water for discharging in the river	**BASELINE Ⅲ:** Urine is treated in anaerobic lagoon, while dried manure is utilized as organic fertilizer	**BASELINE Ⅳ:** This project non-applicable for registration as CDM
NPV(RMB) (discount rate = 10%)	-8,922,163	-8,308,913	115,228	-7,656589

As shown in Table B. 6,it can be seen that BASELINEⅢ is the most attractive course of action and so the prevailing practice. The cost of BASELINEⅣ(This project non-applicable for registration as CDM) is much higher than the cost of BASELINEⅢ, so it is quantifiable that the project is additional from an economic standpoint.
Therefore the most likely alternative scenario is the baseline scenario.

Step IV: Baseline revision at renewal of crediting period.
The crediting period adopted in the project activity is fixed crediting period, so this step is not applicable.

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 CDM project activity (assessment and demonstration of additionality): >>

The baseline determination process has demonstrated that the baseline is different from the proposed project activity not undertaken as a CDM project activity, it is concluded that the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>The emission reductions of the project activity are calculated according to the following equations

Baseline emissions

$$BE_y = BE_{CH4,y} + BE_{N2O,y} + BE_{elec/heat,y} \qquad (1)$$

BE_y : Baseline emissions in year y, in tCO_2e/year.
$BE_{CH4,y}$: Baseline methane emissions in year y, in tCO_2e/year.
$BE_{N2O,y}$: Baseline N_2O emissions in year y, in tCO_2e/year.
$BE_{elec/heat,y}$: Baseline CO_2 emissions from electricity and/or heat used in the baseline, in tCO_2e/year.

Methane emissions

$$BE_{CH4,j,y} = GWP_{CH4} * D_{CH4} * \sum_{j,LT} MCFj * B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_{Bl,j} \qquad (2)$$

$BE_{CH4,y}$: the annual baseline methane emissions in t CO2e/y
GWP_{CH4} : Global Warming Potential (GWP) of CH_4.
D_{CH4} : CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
MCF_j : Annual methane conversion factor (MCF) for the baseline $AWMS_j$ from IPCC 2006 table 10.17, chapter 10, volume 4.
$B_{0,LT}$: Maximum methane producing potential of the volatile solid generated, in m^3CH_4/kg_dm, by animal type LT.
N_{LT} : Number of animals of type LT for the year y, expressed in numbers.
$VS_{LT,y}$: Annual volatile solid for livestock LT entering all AWMS [on a dry matter weight basis (kg-dm/animal/year), as estimated below.
$MS\%_{Bl,j}$: Fraction of manure handled in system j

Scaling default IPCC value Vsdefault to adjust for a site-specific average animal weight as shown in equation below :

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y \qquad (3)$$

$VS_{LT,y}$: Adjusted volatile solid excretion per year on a dry-matter basis for a defined livestock population at the project site in kg-dm/animal/yr.
W_{site} : Average animal weight of a defined population at the project site in kg.
$W_{default}$: Default average animal weight of a defined population in kg from where the data on $VS_{default}$ is sourced (IPCC 2006 or US-EPA, which ever is lower).
$VS_{default}$: Default value (IPCC 2006 or US-EPA, which ever is lower) for the volatile solid excretion per day on a dry-matter basis for a defined livestock population in kg-dm/animal/day.
nd_y : Number of days in year y where the treatment plant was operational.

Detailed information is given in Annex 2.

N20 emissions from manure management

$$BE_{N2O,y} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (E_{N2O,D,Y} + E_{N2O,ID,y}) \qquad (4)$$

$BE_{N2O,y}$: Annual baseline N_2O emissions in t CO2e / yr
GWP_{N2O} : Global Warming Potential (GWP) for N_2O.
$CF_{N2O-N,N}$: Conversion factor N_2O-N to N_2O (44/28).
$E_{N2O,D,y}$: Direct N_2O emission in kg N_2O-N/year.
$E_{N2O,ID,y}$: Indirect N_2O emission in kg N_2O-N/year.

$$E_{N2O,D,y} = \sum_{j,LT} (EF_{N2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_{Bl,j}) \quad (5)$$

$E_{N2O,D,y}$: Are the direct nitrous oxide emissions in kg of N_2O per year.
$EF_{N2O,D,j}$: Is the direct N_2O emission factor for the treatment system j of the manure management system in kg N_2O-N/kg N (estimated with site-specific, regional or national data if such data is available, otherwise use default EF_3 from table 10.21, chapter 10, volume 4, in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories).
$NEX_{LT,y}$: Is the annual average nitrogen excretion per head of a defined livestock population in kgN/animal/year estimated as described in Annex 2.
$MS\%_{Bl,j}$: Fraction of manure handled in system j, in %
N_{LT} Number of animals of type LT for the year y, expressed in numbers.

$$NEX_{LT,y} = \frac{W_{site}}{W_{default}} * NEX_{IPCCdefault} \quad (6)$$

Detailed information is given in Annex 2.

CO2 emission from electricity and heat within the project boundary

$$BE_{elec/heat,y} = EG_{Bl,y} * CEF_{Bl,elec,y} + EG_{d,y} * CEF_{grid} + HG_{BL,y} * CEF_{Bl,therm,y} \quad (7)$$

$EG_{BL,y}$: is the amount of electricity in the year y that would be consumed at the project site in the absence of the project activity (MWh) for operating AWMS.
$CEF_{Bl,elec,y}$: is the carbon emissions factor for electricity consumed at the project site in the absence of the project activity (tCO_2/MWh)
$EG_{d,y}$: is the amount of electricity generated utilizing the biogas collected during project activity and exported to the grid during the year y (MWh)
CEF_{grid} : is the carbon emissions factor for the grid in the project scenario (tCO_2/MWh)
$HG_{BL,y}$: is the quantity of thermal energy that would be consumed in year y at the project site in the absence of the project activity (MJ) using fossil fuel for operating AWMS.
$CEF_{Bl,therm}$: is the CO_2 emissions intensity for thermal energy generation (tCO_2 e/MJ)

Determination of CEF_{grid}*: According to the requirements of ACM0010/Version 01,* CEF_{grid} *should be calculated according to methodology ASM-I.D.-Version 09* ("*Indicative simplified baseline and monitoring Methodologies for Grid-Connected Renewable Electricity Generation*").*Although the generation capacity is less than the small-scale project activity (15 MW), AMS 1.D simplified baseline methodology for small-scale CDM project activity could be used.*

The Electricity generated utilizing the biogas collected during the project activity is exported to the grid. By replacing electricity generated by fossil fuel-fired power plants connected to the North China Power Grid, the proposed project will achieve CO2 emission reductions. In the baseline scenario, the electricity would be otherwise generated by the operation of grid-connected power plants or by the addition of new generation sources.
The spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system to which the CDM project power plant will be connected. The electricity system of the proposed project is defined as the North China Power Grid, and the connected

electricity system is defined as the Northeast China Power Grid.
To determine baseline scenario emissions, the emission factors of Operating Margin ($EF_{OM,y}$) and Build Margin ($EF_{BM,y}$) were calculated based on historical data from the North China Power Grid, which include the installed capacity, electricity generation and different types of fuel consumption of all the power plants connected into the North China Power Grid. Then, the baseline emission factor (EF_y) was calculated as a combined margin(CM) of the Operating Margin (OM) and Build Margin (BM) emission factors as described in following three steps. All the calculations are in compliance with the requirements of the baseline methodology (ASM-I.D.) as described in detail by the following steps.

1) Calculation the Operating Margin emission factor ($EF_{OM,y}$)

Calculation of OM emission factor should be based on one of the following four methods:
(a) Simple OM, or
(b) Simple Adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.
The justifications of the choice of method to calculate OM emission factor are as follows.
Method (b): Method (b) requires the annual load duration curve of the power grid and the load data of hourly data during the whole year on the basis of the time order. As mentioned above, the dispatch data and detailed load curve data were not available publicly. Therefore, method (b) is not applicable for the proposed project.
Method (c): If the dispatch data is available, method (c) should be the first methodological choice. This method requires the dispatch order of each power plant and the dispatched electricity generation of all the power plants in the power grid during every operation hour period. The dispatch data and power plant operation data are considered confidential materials, available for internal usage only and not available publicly. Thus, method (c) is not applicable for the proposed project.
Method (d): Method (d) will only be used when (1) low-cost/must-run resources constitute more than 50% of total grid generation and detailed data to apply method (b) is not available, and (2) where detailed data to apply option (c) above is unavailable. From 2002 to 2004, hydropower in the North China Power Grid accounted for about 7%-10% and tended to decrease, and wind power or other low-cost/ must-run resources constituted less than 4%, the sum of which is much less than 50%. Hence method (d) is not applicable for the proposed project.
Method (a): Method (a) can only be used where low-cost/must-run resources constitute less than 50% of total grid generation in: (1) average of the five most recent years, or (2) based on long-term normals for hydroelectric production. Low operating cost and must-run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is used as must-run, it should also be included in this list, i.e. excluded from the set of plants. From 2002to 2004, hydropower in the North China Power Grid accounted for about 7%-10%, and wind power or other sources low-cost/ must- run resources constituted less than 4%, the sum of which is much less than 50%. Therefore, method (a) is applicable for the proposed project.
In conclusion, method (a) is the only reasonable and feasible method among the four methods for calculating
the Operating Margin emission factor ($EF_{OM,y}$) of the North China Power Grid.
According to the ASM-I.D., the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generationweighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants.The detailed formulas are as follows:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad (8)$$

F is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y ,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and mustrun
power plants, and including imports to the grid1,
$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y , and $GEN_{j,y}$ is the electricity (MWh) delivered to the grid by sources j .
The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO2,i} \times OXID_i \quad (9)$$

where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i , (TJ/ mass or volume unit),
$OXID_i$ is the oxidation factor of the fuel i (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO_2,i}$ is the CO_2 emission factor per unit of energy of the fuel i (tCO2e/TJ).
The Northeast China Power Grid is defined as the connected electricity system of the proposed project. For the past three years NCPG has continuously imported small amounts of electricity from the Northeast China Power Grid. According to the China Electric Power Yearbook, the imported electricity from the Northeast China Power Grid to the North China Power Grid was 4515GWh in 2004, 4244 GWh in 2003 and 2905GWh in 2002 (http://www.sp.com.cn/zgdl/spw/12y/wsdljh1.htm). These imports account for less than 1% of total generation in NCPG for each respective year. In addition, the Northeast China Power Grid is also a coal-fired generation dominated grid (coal-fired power accounting for 94.1% in 2004). Therefore, these imports are not included in calculations of the OM emission factor, which is inline with conservation principles.
Based on the calculation results, the Operation Margin emission factor ($EF_{OM,y}$) of the North China Power Grid is: ***1.0585 tCO2/MWh*** announced by Office of National Coordination Committee on Climate Change, National Development and Reform Committee, October 16 2006 **.**

2) Calculation of the Build Margin emission factor ($EF_{OM,y}$ ***)***

According to the ASM-I.D., the baseline Build Margin emission factor was calculated using the following

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \quad (10)$$

$F_{i,m,y}$ is the amount of fuel i (in a mass or volume unit) consumed by m power plants in year(s) y,
m refers to the power plants included in the sample group determined by the following steps.
$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by m power plants and the percent oxidation of the fuel in

year(s) *y*,
$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by *m* power plants.
According to the baseline methodology (ASM-I.D.-Version 09), one of the following two options shall be selected to identify the sample group for calculating the Build Margin emission factor.
Option 1. Calculate the Build Margin emission factor $EF_{BM,y}$ *ex-ante* based on the most recent information available on plants already built for sample *m* at the time of PDD submission. The sample group *m* consists of either

- The five power plants that have been built most recently, or
- The power plants' capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should choose the option whose sample group comprises the larger annual generation.
Option 2. For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually
ex-post for the year in which actual project generation and associated emission reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated *ex-ante*, as described in Option 1 above. The sample group m consists of either

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants chose the options whose sample group comprised the larger annual generation.
Power plant capacity additions registered as CDM project activities should be excluded from the sample group m.
For the proposed project, Option 1 was adopted for calculating the Build Margin emission factor. The Build Margin emission factor $EF_{BM,y}$ of the North China Power Grid is **0.8642 tCO2/MWh which was** announced by Office of National Coordination Committee on Climate Change, National Development and Reform Committee in October 16 2006**.**

Step3: Calculation the baseline emission factor (EF_y)

According to the baseline methodology (ASM-I.D.-Version 09), the baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$),:

$$EF_y = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \qquad (11)$$

where the weights ω_{OM} and ω_{BM} are 50% and 50% respectively by default.
Where the default weights are adopted for the proposed project, the baseline emission factor is:
EF_y=0.50*$EF_{OM,y}$+0.50*$EF_{BM,y}$=0.9826tCO_2/**MWh.**

Project emission

Project emissions are estimated as follows:

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N2O,y} + PE_{PL,y} + PE_{flare,y} + PE_{elec/heat} \qquad (12)$$

$PE_{AD,y}$: Leakage from AWMS systems that capture's methane in t CO2e/yr
$PE_{Aer,y}$: Methane emissions from AWMS that aerobically treats the manure in t CO2e/yr
$PE_{N2O,y}$: Nitrous oxide emission from project manure waste management system in t CO2e/yr
$PE_{PL,y}$: Physical leakage of emissions from biogas network to flare the captured methane or

supply to the facility where it is used for heat and/or electricity generation in t CO2e/yr
$PE_{flare,y}$: Project emissions from flareing of the residual gas stream in tCO2e/yr
$PE_{elec/heat}$: Project emissions from use of heat and/or electricity in the project case in t CO2e/yr

Methane emissions from AWMS where gas is captured ($PE_{AD,y}$)

$$PE_{AD,y} = GWP_{CH4} * D_{CH4} * LF_{AD} * F_{AD} * \sum_{LT}(B_{0,LT} * N_{LT} * VS_{LT,y}) \quad (13)$$

D_{CH4} : CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure).
LF_{AD} : Methane leakage from Anaerobic digesters, default of 0.15 multiplied by methane content of biogas.
F_{AD} : Fraction of volatile solid directed to anaerobic digester.
LT : Index for livestock type
$B_{0,LT}$: CH_4 production capacity from manure for livestock type LT, in m^3 CH_4/kg-VS, to be chosen based on procedure provided for in the baseline methodology section.
N_{LT} : Population of livestock type LT for the year y, expressed in numbers.
$VS_{LT,y}$: Annual volatile solid excretion of livestock type LT on a dry-matter basis in kg/animal/year

Scaling default IPCC value Vsdefault to adjust for a site-specific average animal weight as shown in equation below :

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y \quad (3)$$

$VS_{LT,y}$: Adjusted volatile solid excretion per year on a dry-matter basis for a defined livestock population at the project site in kg-dm/animal/yr.
W_{site} : Average animal weight of a defined population at the project site in kg.
$W_{default}$: Default average animal weight of a defined population in kg from where the data on $VS_{default}$ is sourced (IPCC 2006 or US-EPA, which ever is lower).
$VS_{default}$: Default value (IPCC 2006 or US-EPA, which ever is lower) for the volatile solid excretion per day on a dry-matter basis for a defined livestock population in kg-dm/animal/day.
nd_y : Number of days in year y where the treatment plant was operational.

Detailed information is given in Annex 2.

Methane emissions from aerobic AWMS treatment ($PE_{Ave,y}$)
This project activity will not include aerobic AWMS treatment. In this project, $PE_{Ave,y}$=0

N2O emission from manure management

$$PE_{N2O,y} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (E_{N2O,D,Y} + E_{N2O,ID,y}) \quad (14)$$

$BE_{N2O,y}$: Annual baseline N_2O emissions in t CO2e / yr
GWP_{N2O} : Global Warming Potential (GWP) for N_2O.
$CF_{N2O-N,N}$: Conversion factor N_2O-N to N_2O (44/28).

$E_{N2O,D,y}$: Direct N_2O emission in kg N_2O-N/year.
$E_{N2O,ID,y}$: Indirect N_2O emission in kg N_2O-N/year.

$$E_{N2O,D,y} = \sum_{j,LT} EF_{N2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_j \qquad (15)$$

$E_{N2O,D,y}$: Are the direct nitrous oxide emissions in kg of N_2O per year.
$EF_{N2O,D,j}$: Is the direct N_2O emission factor for the treatment system j of the manure management system in kg N_2O-N/kg N (estimated with site-specific, regional or national data if such data is available, otherwise use default EF_3 from table 10.21, chapter 10, volume 4, in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories).
$NEX_{LT,y}$: Is the annual average nitrogen excretion per head of a defined livestock population in kgN/animal/year estimated as described in Annex 2.
$MS\%_j$: Fraction of manure handled in system j, in %
N_{LT} : Number of animals of type LT for the year y, expressed in numbers.

There are no Indirect N_2O emissions in this project. $E_{N2O,ID,y} = 0$

Physical Leakage from distribution network of the captured methane in ($PE_{PL,y}$)

This refers to leaks in the biogas system from the biogas pipeline delivery system. The sum of the quantities of captured methane fed to the flare, to the power plant and to the boiler (measured as per the monitoring plan) must be compared annually with the total methane generated as measured by meter at the outlet of the methane generating digester. The difference between the monitored value of methane generated and that consumed in flare/electricity generation/heat shall be accounted as leakage from the pipelines.
In the case where biogas is just flared and the pipeline from collection point to flare is short (i.e., less than 1 km, and for on site delivery only), one flow meter can be used. In such cases the physical leakage may be considered as zero.

The leakage from the pipeline is the difference between the monitored value of methane generated and that consumed in flare/electricity generation/heat which should be calculated based on monitored data, therefore the pipeline leakage would not be estimated ex-ante in the CDM-PDD.

Project emissions from flaring of the regidual gas stream($PE_{flare,y}$)

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} * \left(1 - \eta_{flare,h}\right) * \frac{GWP_{CH4}}{1000} \qquad (16)$$

$TM_{RG,h}$: Mass flow rate of methane in the residual gas in the hour *h*
$\eta_{flare,h}$: Flare efficincy in hour *h*
GWP_{CH4} : Global Warming Potential of methane valid for the commitment period

Project emission from heat use and electricity use ($PE_{elec/heat}$)

$$PE_{elec/heat,y} = EL_{Pr,y} * CEF_d + HG_{Pr,y} * CEF_{Pr,therm,y} \qquad (17)$$

$EL_{Pr,y}$ is the amount of electricity in the year y that is consumed at the project site in the project case (MWh).
CEF_d is the carbon emissions factor for electricity consumed at the project site during the project activity (tCO_2/MWh), estimated as described below. Factor is zero if biogas is used to produce electricity.
$HG_{Pr,y}$ is the quantity of thermal energy consumed in year y at the project site in the project case (MJ).
$CEF_{Pr,therm,y}$ is the CO2 emissions intensity for thermal energy generation (tCO_2e/MJ),. Factor is zero if biogas is used for generating thermal energy.

Because the biogas collected are used in the project generation in the project activity, the electricity generated are much more than the electricity consumed by the manure management facilities used by the project activity, these emissions are not accounted for.

Leakage

Leakage covers the emissions from land application of treated manure, outside the project boundary. These emissions are estimated as net of those released under project activity and those released in the baseline scenario. In this project net leakage of N_2O and CH_4 are not considered because they are negative.

Emission reduction

The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions (BE_y) and the sum of project emissions (PE_y) and leakage, as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad (18)$$

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

Data / Parameter:	$R_{VS,n}$
Data unit:	%
Description:	Volatile solid degradation factor
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years
Any comment:	

Data / Parameter:	$EF_{N2O,D,y}$
Data unit:	Kg N2O-N/kg N
Description:	Direct N2O emission factors
Source of data used:	Table 10.21,chapter 10,volume4, IPCC2006 Guidelines
Value applied:	Uncovered anaerobic lagoon:0

Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years
Any comment:	

Data / Parameter:	nd_y
Data unit:	Number
Description:	Number of days treatment plant was operationl in year y
Source of data used:	Project proponents
Value applied:	365
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years
Any comment:	

Data / Parameter:	$MS\%_{Bl,j}$
Data unit:	Fraction
Description:	Fraction of manure handled in system j in the baseline
Source of data used:	Project proponents
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years
Any comment:	

Data / Parameter:	GWP_{CH4l}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH4
Source of data used:	IPCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	

Data / Parameter:	GWP_{N2O}
Data unit:	tCO_2e/tN_2O
Description:	Global warming potential for N2O
Source of data used:	IPCC
Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied :	310 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	

Data / Parameter:	D_{CH4}
Data unit:	t/m^3
Description:	Density of methane
Source of data used:	Technical literature
Value applied:	0.00067(at room temperature 20℃ and 1 atm pressure)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years
Any comment:	

Data / Parameter:	$CF_{N2O-N,N2o}$
Data unit:	
Description:	Conversion factor from N_2O-N to N_2O
Source of data used:	Technical literature
Value applied:	44/28
Justification of the choice of data or description of measurement methods and procedures actually applied :	Archive electronically during project plus 5 years
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline emission

$$BE_{CH4,j,y} = GWP_{CH4} * D_{CH4} * \sum_{j,LT} MCFj * B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_{Bl,j} \quad (2)$$

= 21 * 0.00067 *
(0.665 * 0.29 * 18,000 * 156.4 * 1 + 0.665 * 0.29 * 2,000 * 711.7 * 1)
= 11,501 t-CO2e/y

$$BE_{N2O,y} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (E_{N2O,D,Y} + E_{N2O,ID,y}) \quad (4)$$

= 310 * 44/28 * 1/1000 * (36,355.7 kg-N2O/year + 0)
= 17,710.4 tCO2e/y

$$BE_{elec/heat,y} = EG_{Bl,y} * CEF_{Bl,elec,y} + EG_{d,y} * CEF_{grid} + HG_{Bl,y} * CEF_{Bl,therm,y} \quad (7)$$

= 0+1,739 MWh/y * 0.9826 t-CO2/MWh+0
= 1,708 t-CO2e/y

$$BE_{y} = BE_{CH4,y} + BE_{N2O,y} + BE_{elec/heat,y} \quad (1)$$

=11,501 t-CO2e/y + 17,710.4 t-CO2e/y + 1,708 t-CO2e/y
= 30,919.4 t-CO2e/y

Project emission

$$PE_{AD,y} = GWP_{CH4} * D_{CH4} * LF_{AD} * F_{AD} * \sum_{LT} (B_{0,LT} * N_{LT} * VS_{LT,y}) \quad (13)$$

= 21 * 0.00067 * 0.15 * 1*(0.29*18,000*156.4 + 0.29*2,000*711.7)
= 2,594.2 t-CO2e/y

$$PE_{N2O,y} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (E_{N2O,D,Y} + E_{N2O,ID,y}) \quad (14)$$

=310 * 44/28 *1/1000 * (0 + 0)
= 0

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} * \left(1 - \eta_{flare,h}\right) * \frac{GWP_{CH4}}{1000} \quad \mathbf{(16)}$$

= 52516*(1-0.5)*21/1000
= 551.4 t-CO2e/y

$$PE_{y} = PE_{AD,y} + PE_{Aer,y} + PE_{N2O,y} + PE_{PL,y} + PE_{CH4\_IC,y} + PE_{elec/heat} \quad (12)$$

= 2,594.2 t-CO2e/y + 0 + 0 + 0 + 551.4 t-CO2e/y + 0
= 3,145.6 t-CO2e/y

Emission reduction

$$ER_y = BE_y - PE_y - LE_y \qquad (18)$$

= 30,919.4t-CO2e/y –3,145.6 t-CO2e/y – 0
= 27,773.8 t-CO2e/y

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

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Year	Estimation of baseline emissions (t-CO2e/y)	Estimation of project activity emissions (t-CO2e/y)	Estimation of leakage (t-CO2e/y)	Estimation of emission reductions (t-CO2e/y)
2009	30,919	3,145	0	27,774
2010	30,919	3,145	0	27,774
2011	30,919	3,145	0	27,774
2012	30,919	3,145	0	27,774
2013	30,919	3,145	0	27,774
2014	30,919	3,145	0	27,774
2015	30,919	3,145	0	27,774
2016	30,919	3,145	0	27,774
2017	30,919	3,145	0	27,774
2018	30,919	3,145	0	27,774
Total	**309,190**	**31,450**	**0**	**277,740**

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

In deciding monitoring methodology, ACM0010 Consolidated baseline methodology for GHG emission reduction from manure management system – Version 02" will be applied.

In ACM0010 methodology, the following items below are mandated to be monitored with regards to Baseline Emissions as well as Project Emissions:

Baseline Emissions

- Diagrammatic representation of animal waste management system existing on the project site prior to project implementation.
- Parameters MCF, B_o, and R_{vs} for estimating methane emissions from AWMS in the baseline.
- EF_{N2O} and R_N for estimating nitrogen emission from AWMS in the baseline;
- Ambient temperature at the AWMS site;
- Amount of electricity used for the operation of the AWMS in the baseline;
- Amount of fossil fuel used for the operation of the AWMS in the baseline;
- Biogas based electricity exported to the grid, needs to be monitored only if emissions reduction for electricity generation from biogas are claimed;
- Data and parameters for estimating heat and electricity emission factors.

Project Emissions

- The livestock populations by different livestock types. This includes the number of heads of each population and the average animal weight in each population;
- Parameters MCF, B_o, and R_{VS} for estimating methane emissions from AWMSs in the project case.
- EF_{N2O} and R_N for estimating nitrogen emission from AWMS in the baseline.
- The default volatile solid excretion values or other parameters required for estimating the volatile solids.
- Leakage from anaerobic digester, if used. The default value is 15%, but in case project participants use a lower value, the appropriate measurement to support the lower value shall be monitored and reported.
- The default nitrogen excretion per animal or parameters required to estimate nitrogen excretion. If N intake method is used the amount of dry matter intake by livestock shall be monitored;
- Amount of electricity used in the project case;
- Amount of heat used in the project case;
- Flow of biogas to the flare, heat generation, and electricity generation. In the case where biogas is just flared, one flow meter can be used provided that the meter used is calibrated periodically by an officially accredited entity.
- Concentration of methane in biogas at outlet of anaerobic digester, this shall be measured on wet basis;

Biogas leakage in project: through leaks in the pipeline during transportation of biogas.

B.7.1 Data and parameters monitored:

The detail of monitoring items in this project is shown below.

Data / Parameter:	**MCF**
Data unit:	Fraction
Description:	Methane correction factor
Source of data to be used:	Table 10.17 , Chapter10 , volume 4 , IPCC2006 Guidelines
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Uncovered anaerobic lagoon = 66% Composting – Intensive windrow = 0.5%
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	The factor MCF is taken from IPCC 2006 guidelines. If annual average temperature is lower than 10℃ and higher than 5, Annual MCF should be estimated using linear interpolation assuming MCF=0 at annual average

	temperature of 5.

Data / Parameter:	$B_{0,LT}$
Data unit:	Fraction
Description:	Maximum methane production
Source of data to be used:	Table 10A-7 , Table 10A-8 , Chapter10 , volume 4 , IPCC2006 Guidelines
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Market swine = 0.29 m3CH4/kgVS Breeding swine = 0.29 m3CH4/kgVS
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	This value should be updated on latest revisions of IPCC Guidelines

Data / Parameter:	$VS_{LT,y}$
Data unit:	Kg-dm / animal / year
Description:	Volatile solid excretion per animal per year
Source of data to be used:	Equation 4 of ACM0010 "Consolidated baseline methodology for GHG emission reduction from manure management system – Version 02"
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y$
Description of measurement methods and procedures to be applied:	-----
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	$VS_{default}$
Data unit:	Kg-dm / animal / day

Description:	Default value for the volatile solid excretion per animal per day
Source of data to be used:	Table 10A-7 , Table 10A-8 , Chapter10 , volume 4 , IPCC2006 Guidelines
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Market swine = 0.3kg-dm/animal/day Breeding swine = 0.3kg-dm/animal/day
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	This value should be updated on latest revisions of IPCC Guidelines

Data / Parameter:	W_{site}
Data unit:	Kg
Description:	Weight of swine
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Market swine = 40kg Breeding swine = 182kg
Description of measurement methods and procedures to be applied:	Monitoring frequency : average weight of each age categories. Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	Based on the pig farming standards of FOODSTUFFS GROUP CO.,LTD.
Any comment:	-----

Data / Parameter:	$W_{dehault}$
Data unit:	Kg
Description:	Default average weight of swine
Source of data to be used:	Table 10A-7 , Table 10A-8 , Chapter10 , volume 4 , IPCC2006 Guidelines
Value of data applied	Market swine = 28kg

for the purpose of calculating expected emission reductions in section B.5	Breeding swine = 28kg
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	This value should be updated on latest revisions of IPCC Guidelines

Data / Parameter:	CEF_{grid}
Data unit:	tCO2/MWh
Description:	Emission factor of exported electricity
Source of data to be used:	Official data on Dec.15,2006 issued by CHINA DNA “Clean Development Mechanism in China”
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.9826 tCO2/MWh
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	LF_{AD}
Data unit:	Fraction
Description:	Fraction of methane leakage from anaerobic digester
Source of data to be used:	IPCC2006 Guidelines
Value of data applied for the purpose of calculating expected	0.15

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	*Type*
Data unit:	-----
Description:	Type of barn and AWMS
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-----
Description of measurement methods and procedures to be applied:	Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	*T*
Data unit:	℃
Description:	Annual average ambient temperature at project site
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8.5
Description of measurement methods	Monitoring frequency : monthly Measurement procedures : Archive electronically during project plus 5 years.

and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	Used to select the annual MCF from IPCC 2006 guidelines

Data / Parameter:	$EG_{d,y}$
Data unit:	MWh
Description:	Electricity exported to grid
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,739 MWh/y
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	Electricity meters will undergo maintenance/calibration subject to appropriate industry standards. The accuracy of meter readings will be verified by receipts issued by the purchasing power company.
Any comment:	-----

Data / Parameter:	$\mathrm{Re}\,gulations$
Data unit:	-----
Description:	Existence and enforcement of relevant regulation
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-----
Description of measurement methods and procedures to be applied:	Monitoring frequency : at start of crediting period
QA/QC procedures to	Quality control for the existence and enforcement of relevant regulations and

be applied:	incentives is beyond the bounds of the project activity. Instead,the DOE will verify the evidence collected.
Any comment:	-----

Data / Parameter:	N_{LT}
Data unit:	Number
Description:	Average swine population used in both baseline and project case emissions estimation
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Market swine = 18,000 Breeding swine = 2,000
Description of measurement methods and procedures to be applied:	Monitoring frequency : monthly Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	Based on the pig farming standards of FOODSTUFFS GROUP CO.,LTD.
Any comment:	-----

Data / Parameter:	F_{AD}
Data unit:	Fraction
Description:	Fraction of volatile solids directed to anaerobic digesters
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	V_f
Data unit:	m3
Description:	Biogas flow
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-----
Description of measurement methods and procedures to be applied:	Installation : 1) outlet of the anaerobic digester 2) inlet of the power generation system 3) inlet of the flare system Monitoring frequency : Continuously by flow meter and reported cumulatively on weekly basis Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	Flow meters will undergo maintenance/calibration subject to appropriate industry standards.
Any comment:	

Data / Parameter:	C_{CH4}
Data unit:	Fraction
Description:	Methane fraction of biogas
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	60%
Description of measurement methods and procedures to be applied:	Monitoring frequency : daily Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	CH4 analyzer will undergo maintenance/calibration subject to appropriate industry standards.
Any comment:	-----

Data / Parameter:	$MS\%$
Data unit:	Fraction
Description:	Fraction of manure handled in system j in project activity
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	$NEX_{LT,y}$
Data unit:	Kg N / animal / year
Description:	Annual average nitrogen excretion per head of a defined swine population
Source of data to be used:	Annex 2 of ACM0010 "Consolidated baseline methodology for GHG emission reduction from manure management system – Version 02"
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y$
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

Data / Parameter:	$NEX_{IPCCdefault}$
Data unit:	kg N /t/ day
Description:	Daily average nitrogen excretion per 1000kg of a defined swine population
Source of data to be	Table 10.19 , Chapter10 , volume 4 , IPCC2006 Guidelines

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Market swine = 0.42 kg N /t/ day Breeding swine = 0.24 kg N /t/ day
Description of measurement methods and procedures to be applied:	Monitoring frequency : Annually Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

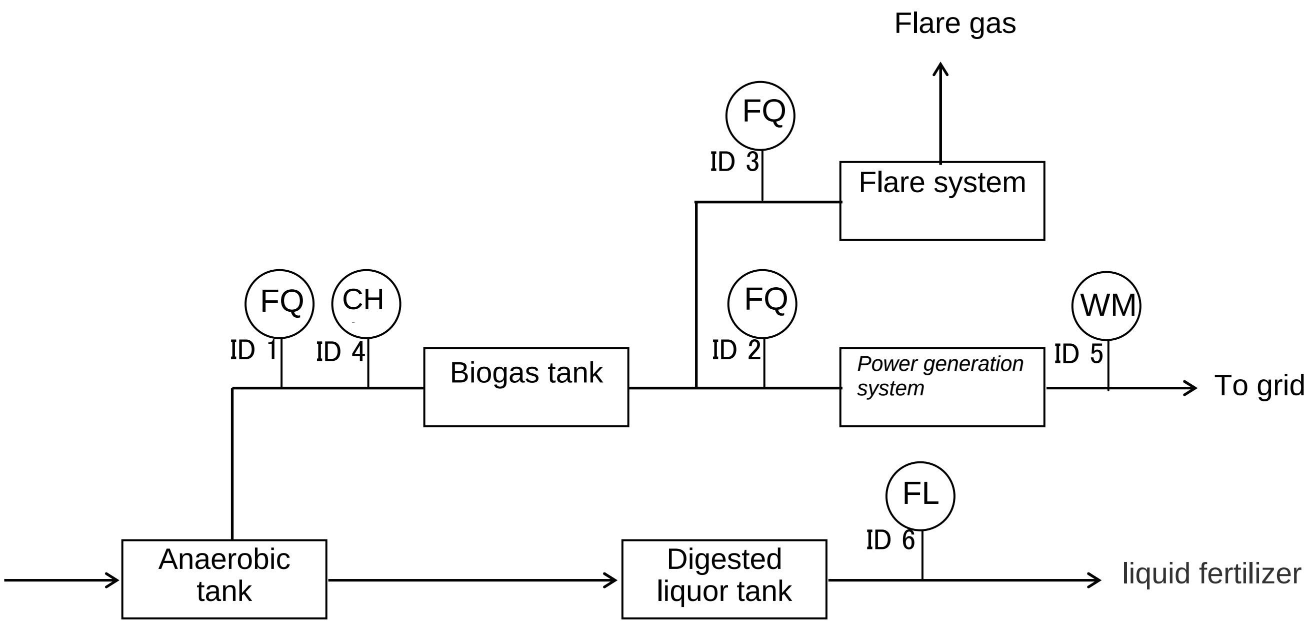
Data / Parameter:	FDT_y
Data unit:	minute/year
Description:	Flame detection time
Source of data to be used:	Project proponents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50,400 minutes = 840 hours
Description of measurement methods and procedures to be applied:	Monitoring frequency : continuously Measurement procedures : Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	-----
Any comment:	-----

B.7.2 Description of the monitoring plan:

>>■Monitoring points

Figure B.2 : The monitoring points in this project process

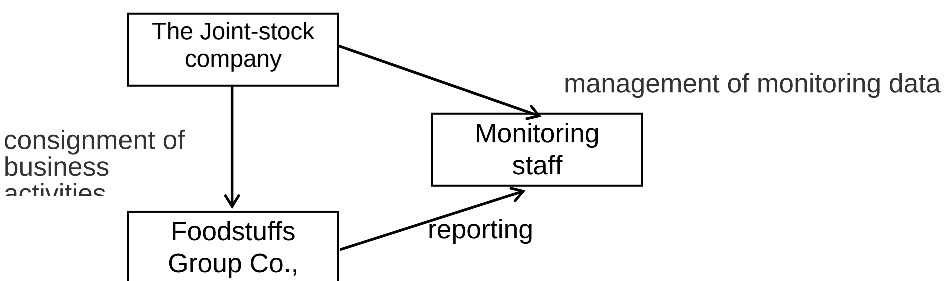
Monitoring instrument	
FQ	Biogas flow meter
FL	Digested liquor flow meter
CH4	Methane concentration analyzer
WM	Electricity meter



ID No.	Data	parameter	unit	remarks
ID 1	$V_{f,OD}$	Amount of biogas	m3	outlet of the anaerobic digester
ID 2	$V_{f,IG}$	Consumption of biogas	m3	inlet of the power generation system
ID 3	$V_{f,IF}$	Consumption of biogas	m3	inlet of the flare system
ID 4	C_{CH4}	Methane concentration	mg/l	regular time sampling
ID 5	$EG_{d,y}$	Power generation	MWh	electricity meter
ID 6	Q_{DV}	Amount of liquid fertilizer	m3	Outlet of digested liquor tank

■Management and operational structure

Figure B.3 : The organization chart of monitoring



The Joint-stock (or SPC) company will consign to Foodstuff Group Co., Ltd. Plant operation and monitoring implementations. Foodstuff Group Co., Ltd. will be assigned to control and manage daily works of monitoring done by its technical staff, the monthly report of which shall be submitted to the company. The company will compile the collected data which should back up verification of the project.

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

>>

The baseline and monitoring study was completed on 31/01/2007

Name of persons/entity determining the baseline and monitoring methodology:

Taisei Corporation
1-25-1 Nishi Shinjuku, Shinjuku-ku, Tkyo, Japan
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E-mail: nobuyuki@eng.taisei.co.jp

Taisei Corporation
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E-mail: kzmkzy00@pub.taisei.co.jp

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:

The construction of the plant will start on 01/02/2008

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

>>
15 years

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

C.2.1. Renewable crediting period

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

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:

>>
01/01/2009

C.2.2.2. Length:

>>
10years

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
This project must make an extensive contribution to the betterment and improvement of the periphery neighbourhood to the project site in terms of reducing GHG emissions, odour and ground water contamination, all of the effects which can be achieved by closed process technology to treat pig manure causing serious environmental impact upon the neighbourhood .
It may be pointed out that there will be a quite limited impact on the periphery environment around the project site, due to the fact that no human residence nor social buildings are situated nearby the project site. The Table11-1 shows projected environmental impacts to be caused in executing this project.

Table 11-1. Projected Environmental Impacts

Impacts	During Construction Period	During Operation Period	Remarks

Air Pollution	Exhaust gas emission from Heavy construction machinery	Gas emission from power generating equipments	
Noise	Noise from heavy construction machinery	Noise from power generating equipments	
Vibration	Vibration from heavy construction machinery	Vibration from power generating equipments	
Odor	Gaseous odor from heavy construction machinery	Odor caused by emissions from biogas equipments	

As stated above, there could be no major impact on the periphery environment due to no residence located in the project site, but when executing the project designing, the China's Environment Standards shall be given the first priority in all respects.

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:

>>

According to the EIA report table, the impacts of this project activity are very small. The project activity can mitigate the environmental pollutions caused by the manure from swine farms

SECTION E. Stakeholders' comments

>>

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

>>

	Stakeholders	Relation	Date of meeting	Remarks
1	Laiyang Municipal Bureau of Foreign Trade & Economic Cooperation	Municipal office in the project area jurisdiction	19.Sep.2006	
2	Laiyang Municipal Bureau of Power Supply	Grid company	20.Dec.2006	
3	Farmers in the project neighbourhood	Users of manure fertilizer	19.Dec.2006	
4	Lognda Foodstuff Group Co., Ltd.	Supplier of pig manure and assigned plant operator	20.Sep.2006 19.Dec.2006 17.Jan.2007	

E.2. Summary of the comments received:

>>

Laiyang Municipal Office（Bureau of Joint Economic Policy; Bureau of Investment Promotion）

- is not familiar with CDM project at all, and yet welcomes any investment by foreign company;
- is anticipating good environmental effects to be brought out by the project, including improvement of periphery environment to the pig farm and preventive effect to ground water contamination;
- is ready to talk about favorable treatment measures for the new project company.

Laiyang Municipal Bureau of Power Supply

- is not experienced at all with grid-interface power supply generated by biogas generation;
- will be able to apply for the favorable treatment measures granted to effective power generation business with use of industrial wastes and water;
- is not in a good position to fix purchasing price of the proposed power because no such previous cases have been seen by them.

Farmers in the project neighbourhood

- like very much to use liquid fertilizer produced in the project because it it is easy to use and good as fertilizer;
- use manure by mixing with soil, and apply urine diluted by water for irrigation, but found them quite a poor fertilizer.
- can use all of the liquid fertilizer to spread as much as 500m^3/day（to apply on their own 600 ha fields）

Foodstuff Group Co., Ltd.

The company is our project partner and, therefore, is quite enthusiastic about CDM project activities, although good amount of hearing research has been executed by us in consideration of possible impact upon their manure supplies as well as upon their pig farming business to be caused by the project:

- Foodstuff Group is an environment-conscious company, and therefore welcomes any projects that must contribute to protect its periphery environment and to be earth-friendly as a whole.
- For account of quarantine reason, they want to avoid as much as possible moving pig manure derived from its each farm.
- Pig manure is now disposed to external users as fertilizer, and they intend to reserve a part of manure as well as residues from methane fermentation for organic fertilizer outlet.

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

There were no negative comments on the project. The stakeholders, including local government and local residents, support the project very much. Therefore, the adjustment for the project is not needed.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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URL:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex Ⅰ Parties for the project.

Annex 3

BASELINE INFORMATION

Adjusting the default value of $VS_{LT,y}$ in terms of weight is done by formula (3) below:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y \qquad (3)$$

W_{site} : Weights of Merchandise pig and Mother pig are set out as under:

Raising Merchandise Pig is done as below:

	Breeding days	Weight	Change of Heads	Remarks
Baby Pig	0 day～21days	1.35kg～6.2kg	110 Heads /day In-take	
Pig under Nursery	21days～70days	6.2kg～25kg		
Grownup Pig	70days～160days	25kg～100kg	110 Heads/day Shipped Out	

This may construe to set out an average weight of Merchandise pig as 40kg/head

Raising Mother Pig is done as below:

	Breeding Period	Weight	Change of Heads	
When delivered	100 days after birth	50kg～60kg	600Heads/year In-take	30％ Replaced
Grownup Period	240 days	200kg		
Breeding Period	1000 days	200kg	600 Heads/year Shipped Out	Change in weight in pregnancy disregarded

This may construe to set out an average weight of Mother pig as 182kg/head

$W_{default}$: Default value applicable to Merchandise pig and Mother pig raised in Asian countries is referred as 28kg/head
（Source: IPCC2006 table 10A.7,10A.8,chapter 10,volume4）

$VS_{default}$: Emission of VS(Volatile Solids) from Merchandise pig and Mother pig raised in Asian countries is 0.3 kg/hd/day

nd_y : System's total operation days per year is 365days

■ Merchandise Pig's $VS_{LT,m,y}$ Adjustment

$$VS_{LT,m,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y \quad (3.a)$$

= (40kg/28kg)*0.3 kg/hd/day *365
= 156.4kg/hd/y

■ Mother pig's $VS_{LT,b,y}$ adjustment

$$VS_{LT,b,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y \quad (3.b)$$

= (182kg/28kg)*0.3 kg/hd/day *365
= 711.7kg/hd/y

Annex 4

MONITORING INFORMATION

■ Method to monitor the numbers of pigs
The numbers of pigs by species will be monitored based on the data now available in Foodstuffs Group Co., to manage the total heads of the pigs fed. Usable data can be obtained from Pig Breeding Division of Foodstuffs Group Co., accordingly.

■ Method to scale pig's weight
Scaling pig's weight by species will be monitored based on the data also available in Logda to manage weight-control system. Usable data can be obtained from the same Division of the company.

■ Calibration of Measuring Instruments
Calibration works of measuring tools and instruments shall be based on the standards specified by individual manufacturers of them. The following instruments are required to be aligned :

ID No.	Monitoring instrument	frequency	calibration
ID 1	Biogas flow meter	annually	Based on the manufacturer standard
ID 2	Biogas flow meter	annually	Based on the manufacturer standard
ID 3	Biogas flow meter	annually	Based on the manufacturer standard
ID 4	Methane concentration analyzer	annually	Based on the manufacturer standard
ID 5	Electricity meter	annually	Based on the

			manufacturer standard
ID 6	Digested liquor flow meter	annually	Based on the manufacturer standard

■ Measuring Mandates

Flow Meter :
3 Flow Meters for measuring biogas flows will be installed in such places as: the outlet of the anaerobic fermentation tank; the inlet of the power generator; the inlet of the flare system. Each flow meter shows its accumulated data of figures which should be checked and recorded at regular time every day by the staff.
A digested effluent flow meter will be installed in the exit of digested effluent tank to show Accumulated data of figures which should be checked and recorded by the staff at regular time every day.

Methane concentration analyzer:

The analyzer will be installed in the outlet of the anaerobic fermentation tank. Biogas should be sampled at regular time to measure biogas density which can be checked and recorded at regular time every day by the operator.

Electric Power Meter:
The meter will be installed at the interface with the external grid for measuring supplied quantity of electric power to the external grid. The accumulated data of supplied figures should be checked and recorded regularly by the staff every day.