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

CONTENTS

Annexes

A. SECTION A. General description of project activity:

A.1 Title of the project activity:

The title of the project activity: Animal Manure Management System (AMMS) GHG Mitigation Project , Shandong Minhe Livestock Co. Ltd.**,** Penglai, Shandong Province, P.R. of China

The current version number of the document: Version 09

The date of the document was completed: 12/07/2010

A.2 Description of the project activity:

Purpose of the project activity: The purpose of this project is to mitigate greenhouse gas (GHG) emissions from chicken manure by improving AMMS at chicken farms and utilizing a biogas co-generation system to supply electricity and displace electricity from a grid-based conventional energy source.

Description of GHG emission reduction: Animal operations are becoming progressively more intensive in order to realize economies of production and scale, and these intensive animal operations result in large amount of manure and wastewater that create profound environmental consequences, such as GHG emissions, odor nuisance, and water/land contamination from animal waste. Confined Animal Feeding Operations (CAFOs) use similar AMMS- uncovered anaerobic lagoons to treat and store animal manure, uncovered anaerobic lagoons emits large amounts of GHGs from the anaerobic decomposition processes.

This project will convert the high-GHG AMMS of uncovered anaerobic lagoons to low GHG AMMS with mesophilic temperature anaerobic digesters with biogas capture and power generation. Biogas capture and utilization reduces the GHG emissions from manure management systems and biogas-based power generation will supply electricity to the grid replacing electricity that would otherwise be generated from coal-fired power plants, reducing coal-based GHG emissions as well.

Contributions to sustainable development: The proposed project will improve living conditions in rural communities near the project site and is well in line with the developmental priorities defined by China's central government. The implementation of the project will protect human health and the environment, demonstrate a sustainable model to solve animal manure pollution problems for other livestock operations, facilitate agricultural restructuring, and increase farmers' income. It supports China's sustainable development strategy in the following ways:

1) Effectively reducing CH_4 emissions from animal wastes. The project activity consists of an advanced improvement from the common practice of manure treatment, reducing CH_4 and N_2O emissions from animal wastes through biogas digesters with methane capture and utilization;

2) Improving the local environment and human health. Properly handling of large quantities of CAFO animal waste is critical to protecting human health and the environment. The advanced animal manure management system to be employed will reduce the nuisance of odors and wastewater, benefiting both farmers' and children's health;

3) Creating job opportunities and increasing farmers' income. This project activity will increase local employment for skilled labor during production, installation, operation, and maintenance of equipment and systems;

4) Localizing energy production. The project will diversify the source of the energy supply through biogas production and biogas-based power generation. The effort will make local energy a substitute for electricity from other sources, reducing the use of coal. It will also help to ease power shortages;

5) Establishing a positive model of animal manure management practice for other animal operations. The project activity will apply new, advanced, and environmentally friendly technologies in treating animal wastes and associated utilization, which can be replicated on other CAFO livestock farms, dramatically reducing livestock-related GHG emissions and providing the potential for new sources of revenue and green power, raising the economic benefits from the livestock industry, and promoting utilization of agricultural waste, and hence building a circular economy.

A.3 Project participants:

Table A1 Project participants

Name of Party involved (*) (host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
The People's Republic of China (host)	Shandong Minhe Livestock Co. Ltd.	No
The Republic of Austria, acting through Kommunalkredit Public Consulting CmbH	The International Bank for Reconstruction and Development (IBRD) as trustee of Community Development Carbon Fund	No
State of the Netherlands, acting through the Netherlands' Ministry of Housing, Spatial Planning, and the Environment	The International Bank for Reconstruction and Development (IBRD) as trustee of Community Development Carbon Fund	Yes

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

A.4.1.2 Region/State/Province etc.:

Shandong Province

A.4.1.3 City/Town/Community etc:

Penglai, Yantai City

A.4.1.4.Detail of physical location, including information allowing the unique identification of this project activity:

All the project activities are located in the area of Minhe, Penglai, Shandong Province, People's Republic of China , which is located 120° 35' E -121° 08' E, 37° 25'N-37° 50'N. There are 16 farms located in 120° 42' 33.92435E， 37° 44'46.22138N'. There are 4,263,930 chickens included in farms numbered No.1, No.15~ No.29. The biogas digesters and power station will be located within the farms. The physical location of the project activities is shown in Figure A1, Figure A2, Figure A3 and Annex 3.

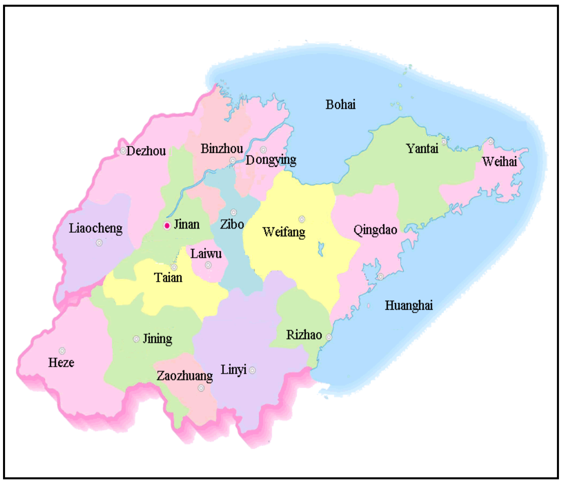

Figure A1 Map of China Figure A2 Map of Shandong Province

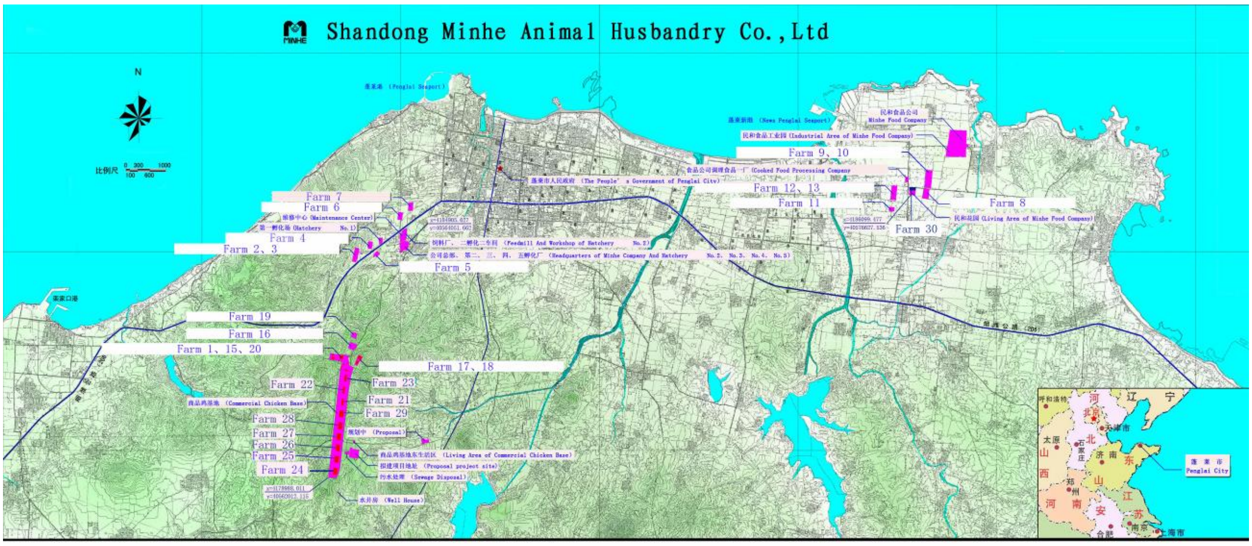

Figure A3: Project Activity Location

A.4.2 Category(ies) of project activity:

The categories of the project activity falls into sector scope 13- waste handling and disposal; and sector scope 15- agriculture, and sector scope 1- renewable energy.

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

In an effort to reduce environmental pollution and GHG emissions from animal wastes, and utilize the agricultural waste resources, the technology to be employed by the project activity in Minhe includes total replacement of uncovered anaerobic lagoons that result in high GHG emissions at the project activities sites with centralized mesophilic temperature anaerobic digesters with biogas-based power generation. Manure from 16 farms will be transported through underground pipes same as current practice to the biogas-based power generation facility. The total volume of the anaerobic digesters will be 26,400m^3, with an annual biogas output of 9.38 million m^3. Annually, it will produce 22.96 million kWh of electricity.

The project activity system will be comprised of 3 stages with sufficient capacity to eliminate the volatile solids load in the effluent and reduce GHG emissions. The first stage is mesophilic temperature anaerobic digesters with biogas capture. The second stage is biogas power generation. The third stage is aerobic treatment of biogas liquid in aerobic lagoon.

Sealed anaerobic digesters: Sealed anaerobic digesters (AD) are one of the most important processes in animal waste treatment. The anaerobic digesters receive the animal manure and maintain a steady –state population of methanogenic bacteria for degradation. Methanogenic bacteria convert organic manure into biogas in the environment without oxygen. Captured biogas then will be used to generate electricity, which will be supplied to the grid and replace electricity that would otherwise be generated from coal-fired power plants. In addition, AD could reduce offensive odors, pathogens from the manure slurry, and GHG emissions during the storage.

Total mixed reactor (CSTR) anaerobic reactors will be used in the project to treat the chicken manure and flushing water about 1150 m^3. To increase the efficiency of anaerobic digesters (AD), two

phase anaerobic digesters will be applied. For phase one, the reactor will work comfortably under an internal fermenting temperature about 38℃. Each anaerobic reactor shall have a size of Φ16.0m×16.5m, with a usable volume of 3300 m^3. In this context, the total usable volume of 6 anaerobic reactors shall be 19,800 m^3. In Phase two, there are three anaerobic digesters. Each has a size ofΦ16.0m×16.5 m, with a usable volume of 3300 m^3. The total retention time in two phases biogas digesters is about 23 days. The biogas production is estimated to be 9.38 million m^3. The methane concentration is about 60%.

To ensure the air-tightness of the anaerobic reactor, measures will be adopted to reduce possible leakages from the anaerobic fermenting process. Apart from the seal that is comprised of multi-layers of material, several reactors will be put into parallel operation, in an attempt to reduce the possible leakage from the maintenance process. In doing so, the maintenance of one reactor will not affect the operation of the others. In addition, the anaerobic digesters have been designed to enable solid residues to be removed without breaking the seal.

Biogas purification and collection: the biogas derived from the sealed anaerobic digesters is a mixed gas. In addition to its toxicity, H_2S may shorten the life of the generator. In this project, a biological stream, water vapor separator, and dry desulfurizing tower will be used for biogas purification. The purified biogas will be stored in a gas tank. The volume of gas tank is 2,000 m^3. In addition, a open flare system will be installed to convert excess methane from digesters to carbon dioxide for preventing any over pressure and explosion risk when generator does not work because of the maintenance or any other emergency situation. The gas tank will be located in the area with safe distance from generators, digesters according to requirement of related national fireproof standard.

Biogas-based power generation: The biogas can be utilized in three possible ways: combustion utility only, power generation only, or combined combustion utility and power generation. In this project, the biogas will be used entirely for power generation. Internal combustion generators using purified biogas will be installed for cogeneration. The purified biogas will be fed to the power generator from the gas holder for power generation. Electricity produced will be sold through the power grid. The heat recovered by heat recovery system from cooling waster and the exhaust gas of power generation system will be used as a thermal source of heating the anaerobic biogas digester. In this project, three sets of

1063 KW co-generators will be installed, three sets of co-generators are for daily operation. Operation days for each set are 300 days per year. The annual biogas electricity will be 22.96 million kWh.

Aerobic treatment of biogas liquid in lagoon: A storage lagoon will be used for aerobic treatment of the biogas liquid. The GHG emissions from aerobic storage of liquid will be calculated for the project activity. The treated biogas liquid will be applied to crop land of the same size croplands and with same application frequency as the baseline condition.

Technology and know how transfer:

The project developer is implementing an integrated approach to ensure the project, including technology transfer, proceeds smoothly. This approach includes careful specification and design of a complete technology solution, identification and qualification of appropriate technology/service providers, supervision of the complete project installation, farm staff training, and stringent monitoring and management plans. As part of this process, the project developer has specified a technology solution with high reliability.

By working closely on the project on a "day to day" basis, the project developer will ensure that all installed equipment is properly operated and maintained, and will carefully monitor the data collection and recording process. Moreover, by working with the farm staff over many years, the project developer will ensure that the staff acquires appropriate expertise and resources to operate the system on an ongoing/continuous basis.

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

This project applies for a fixed crediting period of 10 years. The estimated amount of emission reductions over 10 years will be 723710 tCO_2e.

TableA2 Estimated amount of emission reductions over the chosen crediting period

Year	Annual estimation of emission reductions
2009 (4-12)	54,278
2010	72,371
2011	72,371

2012	72,371
2013	72,371
2014	72,371
2015	72,371
2016	72,371
2017	72,371
2018	72,371
2019（1-3）	18,093
Total estimated reductions (tonnes of CO_2 e)	723,710
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	72,371

A.4.5. Public funding of the project activity:

No public funding from Annex 1 countries is provided to the proposed project.

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:

This project activity utilizes the Executive Board of Clean Development Mechanism (CDM) approved consolidated baseline methodology ACM0010-Version 02 titled "Consolidated baseline methodology for GHG emission reductions from manure management systems". This baseline methodology can be downloaded from the Executive Board (EB) website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

This baseline methodology, ACM0010-Version 02 is applicable to the proposed project because the proposed project can meet all the requirements of the baseline methodology.

- Minhe is a private large-scale animal operation with 16 farms where layer chickens and broiler chickens are managed under confined conditions that operate in a competitive market.
- AMMS, including baseline scenario and alternative project manure management system, is in accordance with regulatory frameworks of the host country. The chicken manure is not discharged into natural water resources (e.g. rivers or estuaries).
- The depth of anaerobic lagoon treatment systems is deeper than 3m; the minimum retention time of manure waste in the anaerobic lagoon is greater than 1 month.
- The annual average temperature at the project site is 12.7 ℃ according to the data provided by Chinese Meteorological Administration, which is higher than 5°C.
- The captured biogas will be used to produce electricity, which will reduce the GHG emissions.
- The AMMS/process in the project case will take waterproof measures, so that the project will not cause any leakage of manure waste into ground water.

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

The proposed project boundary considers the GHG emissions that come from AMMS, including the GHGs resulting from the capture of biogas, and GHG emissions from treatment and/or storage of ADR liquid by aerobic lagoon. The emission reductions from power generation are also considered. The current situation is as described in Fig. B1-1.

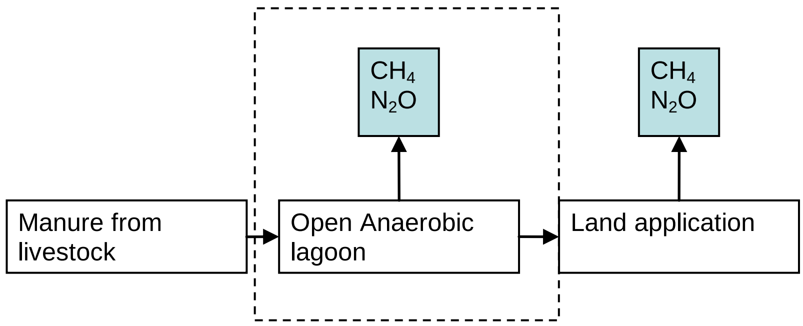

Figure B1-1 Current situation

The project boundary does not consider the effects of enteric emissions, nor does it include barn-related emissions, whether directly or indirectly associated with the animals, as these emissions are not

affected by the proposed practice changes according to ACM0010. The project activity boundary is defined in Figure B1-2.

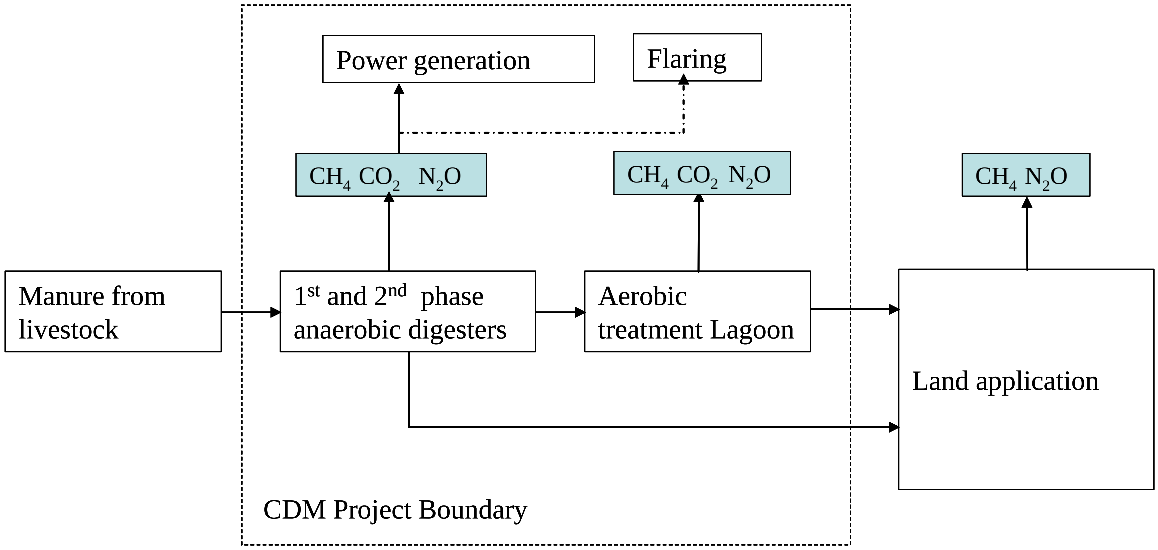

Figure B1-2 Project activity boundary

Table B1 Emission sources and gases are included in project boundary

	Source	Gas		Justification /Explanation
Baseline	Direct emissions from the waste treatment processes.	CH_4	Included	The major source of emissions in the baseline
		N_2O	Included	N_2O emission from open anaerobic lagoon
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted according to the methodology ACM0010.
	Emissions From electricity consumption/ generation	CO_2	Included	Electricity was provided by the grid.
		CH_4	Excluded	Excluded for simplification. This is conservative according to the methodology ACM0010.
		N_2O	Excluded	Excluded for simplification. This is conservative according to the methodology ACM0010.
	Emissions from thermal energy generation	CO_2	Excluded	Thermal energy generation is excluded in the baseline condition.
		CH_4	Excluded	Thermal energy generation is excluded in the baseline condition.
		N_2O	Excluded	Thermal energy generation is excluded in the baseline condition.

Project activity	Emissions from thermal energy generation	CO_2	Excluded	The heat from the biogas power generator will be used to heat the biogas digesters and is excluded for simplification. This is conservative.
		CH_4	Excluded	The heat from the biogas power generator will be used to heat the biogas digesters and is excluded for simplification. This is conservative.
		N_2O	Excluded	The heat from the biogas power generator will be used to heat the biogas digesters and is excluded for simplification. This is conservative.
	Emissions from on site electricity use	CO_2	Included	It is important source according to the methodology ACM0010.
		CH_4	Excluded	Electricity is generated from collected biogas, the emissions are not accounted for according to the methodology ACM0010.
		N_2O	Excluded	Electricity is generated from collected biogas, the emissions are not accounted for according to the methodology ACM0010.
	Direct emissions from the treatment processes	N_2O	Included	
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for according to the methodology ACM0010.
		CH_4	Included	The emissions from physical leakage, emission from slurry, and minor CH_4 emissions from aerobic treatment.

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

According to ACM 0010, the following steps are used to determine the baseline scenario:

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 proposed CDM project activity

According to ACM 0010, alternative scenarios include:

(1) Proposed project activity not being registered as a CDM project activity:

- Anaerobic Digester with Biogas-Cogeneration – Aerobic Storage Lagoon without CDM

(2) Continuation of current situation:

- Uncovered Anaerobic Lagoon

(3) All other plausible and credible alternatives:

According to the ACM0010, all other plausible and credible alternatives include the complete set of possible manure management systems listed in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006 Guidelines) and possible combination of different animal manure management systems. All other plausible and credible alternatives are listed as follows:

- Daily Spread
- Solid Storage
- Liquid/Slurry
- Composting - In-Vessel
- Composting - Static Pile
- Composting - Intensive Windrow
- Composting - Passive Windrow
- Poultry Manure with Litter
- Poultry Manure without Litter
- Aerobic Treatment
- Press (Separation) + Uncovered Anaerobic Lagoon

In IPCC 2006 Guidelines, some other manure management systems are listed, such as pasture/range/paddock, dry lot, pit storage below animal confinements, burned for fuel, and cattle and swine deep bedding. These manure management systems are not suitable for large scale chicken farms. Therefore, they are excluded in the possible baseline scenarios.

Eliminate alternatives that are not incompliance with all applicable legal and regulatory requirements. Apply Sub-step 1b “Consistency with mandatory laws and regulations” of “Tool for demonstration assessment and of additionality (version 3)”.

（1） Anaerobic Digester with Biogas-Cogeneration – Aerobic Storage Lagoon without CDM: This treatment system is considered to be one of the most advanced manure management systems in the world. Only a few countries have implemented such technology because of the high costs involved in the investment compared to other available systems. There has been no application of this system in Shandong province. The investment analysis presented in step II indicates that the anaerobic digester system is not a financial attractive project due to its high costs without the income from CDM, and the investors don't interest in it. Therefore, this system is not a realistic and credible alternative.

（2） Uncovered Anaerobic Lagoon: It is designed and operated to combine manure treatment and storage. The water from the lagoon may be recycled as flush water or used to irrigate and fertilize croplands. It is generally considered to be the most economical, efficient, and reliable AMMS, and is the most common AMMS technology in the developed and developing world with lower cost. The uncovered anaerobic lagoon represents the current practice for the project site.

（3） Daily Spread: In this system the manure is routinely removed from a confinement facility and is applied to cropland or pasture within 24 hours of excretion. For a large scale chicken farm, it is highly labor intensive to remove the manure and apply on a daily basis. Therefore, this manure management system is not in an economically attractive prospect. So the exclusion of this potential baseline scenario can be justified.

（4） Solid Storage: This involves the storage of manure, typically for a period of several months, in unconfined piles or stacks. It is suitable for small family farms. The proposed project involves large-scale chicken farms and the use of a scraping and flushing approach to remove manure which has large volumes of waster. So, this manure management system is not a potential alternative baseline scenario.

（5） Liquid/Slurry Storage: Manure is stored as excreted or with some minimal addition of water in either tanks or earthen ponds outside the animal housing. This system is just for manure storage, not for manure treatment.

（6） Composting – In Vessel: It is suitable to treat solid manure and is not applicable to the manure with large amount of water. Manure in Minhe is collected by using scraping and flushing system. Manure in Minhe is in liquid with large volume of water. Therefore, it is excluded from the possible baseline scenario.

（7） Composting – Static Pile: Composting in piles with forced aeration but no mixing will consume a great deal of electricity for forced aeration because of the large quantity of chicken manure. It is suitable

to solid treat manure, not applicable for manure with larger volume of water. Therefore it is excluded from the list of possible baseline scenarios.

（8） Composting – Intensive Windrow: Composting in windrows with regular turning for mixing and aeration emits a large quantity of odor and GHGs during turning and consumes a lot of electricity for the aeration operation. It is suitable to treat solid manure. So it is excluded from the list of possible baseline scenarios.

（9） Composting – Passive Windrow: Composting in windrows with infrequent turning for mixing and aeration takes a long time and occupies a large area of land. This kind of solid manure management system emits strong odors and GHGs during turning. For this reason, it is excluded from the list of possible baseline scenarios.

（10） Poultry Manure with Litter: It is typically used for poultry breeder flocks and for the production of meat chickens (broilers) and other fowl. This type of manure management system is suitable for poultry with litter. The caged production system is applied in proposed project farms. It can not be a possible baseline scenario.

（11） Poultry Manure without Litter: According to 2006 IPCC guideline, it is similar to open pits or so called high raised manure management system, where the solid manure is stored under the cages within the barns. Manure is stored in confinement for long period. Height of accumulated manure can be more than 1-1.5 meters. Because this system is for solid manure, and Minhe uses scraping and water flushing manure collection system and the manure is in liquid with large volume of water. If changed to this system, all chicken barns (building) and manure collection system in Minhe need to be reconstructed. Therefore, this system can not be a possible baseline scenario.

（12） Aerobic Treatment: It is suitable for treating low volatile solids (VS) content in waste water. If this management technique is applied to treat waster water with high VS content, the electricity consumed for forced aeration is very high. Due to the high electricity cost involved, it is not a plausible baseline scenario for this project.

（13） Press (Separation)- Anaerobic Lagoon: This technology separate solid and liquid manure before entering the lagoon in order to have less solid accumulation, resulting in a smaller lagoon and less land occupation making this alternative a potential baseline scenario.

According to the analysis above, the list of possible baseline scenarios as follows：

- Uncovered Anaerobic Lagoon

- Press (Separation)- Uncovered anaerobic lagoon
- Anaerobic Digester with Biogas Co-generation – Aerobic Storage Lagoon without CDM

Step II : Barrier analysis

1) Investment barriers

The technology to be used in the proposed project represents a state-of-the-art manure treatment system. Only a few developed nations are in a position to use the technology because of the high investment costs compared to other available systems. In China, the enterprise would not take the initiative to use the technology, as the investment for biogas-based power generation is very high even though a law concerning renewable energy has been formulated and subsidy for biogas power generation is considered. As a result, even commercial banks are not willing to support such projects without promises from the government or other incentives. Apart from that, manure treatment falls under the category of a public good service, beyond the production scope previously defined for the animal enterprise. Therefore, most livestock producers do not have the capacity for investment in a project activity without CDM.

Table B2 and table B3 show the investment analysis results of the project activity. Key assumptions used in the analysis as following:

- Annually output delivered to the network: 22.96 million kWh/year
- Project life time : 25 Year
- Total Investment : 78.21 million Yuan
- Maintenance: 6,12 million Yuan each year
- Electricity Tariff : 0.6 Yuan/kWh
- Tax free for the first 5 years. From the 6th year, the tax will be 33% of net income.
- Expected CERs: 54,278 t CO_2 in 2009, 72,371 t CO_2 from 2010-2018, 18,093 t CO_2 in 2019.
- Expected CERs Price: 15 $/t$CO_2$
- Annual verification, US$20,000
- CERs crediting time: 10 Year
- Exchange rate: $1=7.0 RMB
- The discount rate is 9%

Table B2 Economic analysis of project activity (Anaerobic digester + power generation from biogas + aerobic lagoon) without the revenues from the sale of CERS (Unit: RMB Yuan)

Costs and benefits	Year 0	Year 1	Year2-Year5	Year6-Year25
Digester and engineering	25,405,861			
Equipment and power generators:	40,277,273			
Maintenance and running cost		4,589,599	6,119,465	6,119,465
Other costs (consultancy, design, training)	8,918,191			
Revenues from the sale of electricity		10,332,360	13,776,480	13,776,480
Tax for construction period	3604440			
Tax from the 6th year				2,526,815
Subtotal	78,205,769	5,742,761	7,657,015	5,130,200
NPV（IC%=9%）	-18,111,686			
IRR（%）	5.44%			

From table B2, the Internal Rate of Return (IRR) without income from selling CERs is 5.44% which is lower than the benchmark IRR of 9% for the animal industry, making the proposed project financially unacceptable.

In order to further illustrate the proposed project activity without CDM is unlikely to be financial attractive, sensitivity analysis was conducted with reasonable variations in the critical assumptions.

Three factors are considered in the following sensitivity analysis: 1) total investment, 2) annual operation and maintenance cost; 3) electricity tariff.

Assuming the above three factors vary in the range of -10%-+10%, the IRR of the proposed project (without income from selling CERs) varies to some extent, as shown in Figure B2. The change of three factors will affect the financial indicator IRR, and the change of electricity tariff is the most important factor affecting the financial attractiveness of the proposed project. However, the IRR for all assumptions will be below the benchmark IRR of 9% for the animal industry. So, the sensitivity analysis further demonstrated that the proposed project without CDM is financially unacceptable.

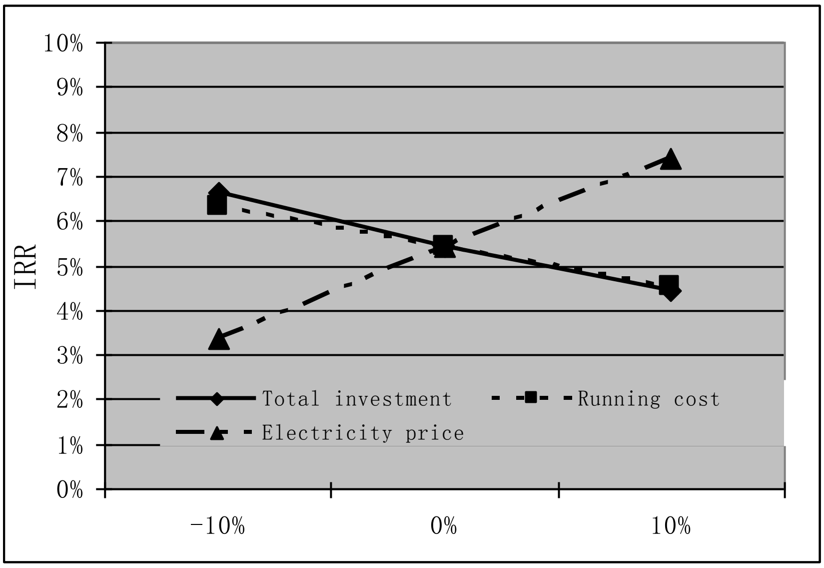

Figure B 2 Sensitivity analysis of the proposed project

The financial indicators IRR with and without income from selling CERs listed in Table B3 clearly establish the crucial impact of CDM revenue to this project's financial viability. The project's IRR can reach 13.28% with revenue from the CDM (\$15.0/t CO_2e for ten years). This will attract investors.

Table B3 Comparison of financial indicators with and without income from CERs

	IRR
Without income from CERs	5.44%
With income from CERs	13.28%

2) Technical barriers

An anaerobic digester with power generation involves great technology risk, but it also offers impressive environment benefits and new technologies. Local characteristics and circumstances must be taken into account in the design of anaerobic digesters and power generation system operations, taking into account the required scale, characteristics of the manure, and expected treatment effects. The daily operational system involved in this project needs a thoughtful monitoring plan and the monitoring parameters to maintain system performance. At present, operation and maintenance expertise is extremely limited in China. Moreover, almost animal farms are short of skilled and/or properly trained labour to operate and maintain the technology. There is no repair and parts supply system in the country to support a sustainable operation. So, it is often causes equipment disrepair and malfunctioning. Partial revenues from the CDM process can be used to support the operation and maintenance.

3) Barriers due to prevailing practice

There has been no similar project in operation in Shandong Province, China.

Based on the analysis above, the uncovered anaerobic lagoon and press (separation) –uncovered anaerobic lagoon are not prevented from being implemented by these barriers.

Step III: Investment analysis

According to ACM 0010, for each alternative that does not face any barriers, as identified in Step II, investment analysis was undertaken. Table B4 and table B5 show the investment analysis results of the uncovered anaerobic lagoon and press (separation)–uncovered anaerobic lagoon, respectively.

Table B4 Economic analysis of the uncovered anaerobic lagoon（Unit: RMB Yuan）

Costs and benefits	Year 0	Year 1	Year 2-24	Year 25
Equipment cost (pulp, pile)	0	0	0	0
Installation cost	0	0	0	0
Maintenance cost	16,603	16,603	16,603	16,603
Other cost (consultancy, design)	0	0	0	0
Revenues from the sale of electricity or other project-related products, when applicable	0	0	0	0

SUBTOTAL	16,603	16,603	16,603	16,603
NPV(Yuan)（IC=9%）	−164,851			
IRR（%）	Undefined			

Because the uncovered anaerobic lagoon is the current practice of treating animal waste, there is no investment cost to construct the uncovered anaerobic lagoon, only maintenance cost will occur during the lifetime of the proposed project.

Table B5 Economic analysis of the Press (separation) + anaerobic lagoon (Unit: RMB Yuan)

Costs and benefits	Year 0	Year 1	Year2-24	Year 25
Equipment cost (pulp, pile, equipment for separation)	1,429,000	0	0	0
Installation cost	523,000	0	0	0
Maintenance cost	0	125,703	125,703	125,703
Other cost (consultancy, design)	0	0	0	0
Revenues from the sale of electricity or other project related products, when applicable	0	0	0	0
SUBTOTAL	-1,952,00	125,703	125,703	125,703
NPV(Yuan)（IC=9%）	-1,234,728			
IRR（%）	Undefined			

There are no potential revenues involved in the baseline scenarios. There are only negative flows in the baseline scenarios, so the IRR can not be calculated and the economic comparison should be based on the Net Present Value (NPV) indicator. Table B6 summaries the results of financial analysis for each scenario.

Table B6 NPV comparison for plausible baseline scenarios (Unit: RMB Yuan)

	Anaerobic lagoon	Press (separation) + anaerobic lagoon	Anaerobic digester + power generation + Aerobic lagoon without CDM
NPV（IC=9%）	-164,851	-1,234,728	-18,111,686

It can be seen from the above table B6 that the open anaerobic lagoon is economically the most

competitive, with the lowest cost. In this context, the open anaerobic lagoon is selected as the baseline scenario.

Based on analysis above, following matrix is used to indicate the barriers for possible alternatives.

Table B7 Matrix on barriers for possible alternatives

	Investment	Technology	Prevailing practice
Uncovered anaerobic lagoon			
Press (separation) + uncovered anaerobic lagoon	✓		
Anaerobic digester + power generation from biogas + aerobic lagoon without CDM	✓	✓	✓

Conclusion: An open anaerobic lagoon shall be the baseline scenario for the project. The proposed project activity scenario cannot be a baseline scenario.

Step IV: Baseline revision

Ten year fixed crediting period is selected, so the baseline revision is not related to this project.

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 in section B4 has demonstrated that the baseline is different from the proposed project activity not undertaken as a CDM project activity. According to ACM0010, it is concluded that the project is additional.

B.6. Emission reduction:

B.6.1. Explanation of methodological choices:

The equations from approved methodology ACM0010-Version 02 were used to determine the GHG emissions from each scenario.

Step I: Baseline emission

Baseline emissions are:

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

where:

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 year y, in tCO_2e/year.

(i) Methane emissions

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

where:

$BE_{CH4,y}$	The annual baseline methane emissions in t CO_2 e/y
GWP_{CH4}	Global Warming Potential (GWP) of CH_4.
D_{CH4}	CH_4 density (0.00067 t/m^3 at room temperature (20ºC) and 1 atm pressure).
MCF_j	Annual methane conversion factor (MCF) for the baseline $AMMS_j$ (anaerobic lagoon) from IPCC 2006 Guidelines Table 10.17, chapter 10, volume 4.
$B_{O,LT}$	Maximum methane producing potential of the volatile solid generated, in m^3CH_4/kg_dm, by broiler and layer chicken.
N_{LT}	Number of broiler and layer for the year y, expressed in numbers.
$VS_{LT,y}$	Annual volatile solid for broiler and layer chickens on a dry matter weight basis (kg dm/year).
$MS\%_{Bl,j}$	Fraction of manure handled in system j, here, In this proposed project, the baseline manure management system is an anaerobic lagoon only. The amount of manure handled by the anaerobic lagoon is 100%. $MS\%_{Bl,j}$ =100%

Estimation of various variables and parameters for above equations:

(A) Determination of volatile solids ($VS_{LT,y}$)

ACM0010-Version 2 provides four options for the determination of volatile solids (VS) excretion rate: (1) Using published country specific data; (2) Estimation of VS based on dietary intake of livestock; (3)Scaling default IPCC values to adjust for a site-specific average animal weight; (4) Utilizing published IPCC defaults.

According to scientific publication database (www.cnki.org.cn), there are no published country-specific data on VS data available, there are no energy intake of chicken available. Scaling default IPCC values $VS_{default}$ to adjust for a site-specific average animal weight as shown in equation (3):

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

Where

$W_{site,LT}$	Average animal weight of a defined livestock population at the project site for LT type of chicken，0.9 Kg/head for broiler and 2.4 Kg/head for layers.
$W_{default}$	IPCC Default weight, 2006 IPCC Guidelines (kg) for developed countries，for broilers (0.9 Kg /head) and for layers (1.8 Kg /head)
$VS_{default}$	The IPCC default $VS_{LT,y}$ values, The IPCC default $VS_{LT,y}$ values for broilers (0.01 kg dm/day) and for layers (0.02 kg dm/day) are selected for the project activity sites. Because the genetic source of chicken is from the developed country, the FFR was used as chicken feed, and animal weight are similar to developed country IPCC default value.
Ndy	Number of days in year “y” where the treatment plant was operational.

(B) ***Maximum Methane Production Potential ($B_{O,LT}$):***

According to the scientific publication database (www.cnki.org.cn), there are no published country specific data on Bo. Developed countries $B_{O,LT}$ values will be used. Because the genetic source of chicken is from the developed country, the FFR was used as chicken feed, and animal weight are similar to developed country IPCC default value.

(C) Methane conversion factor (MCF_j):

IPCC 2006 Guidelines MCF values given in table 10.17 (chapter 10, volume 4) will be used. MCF values depend on the annual average temperature where the anaerobic manure treatment facility in the baseline existed. For this project, the annual average temperature is 12.7℃ and the value of 70% is applied. A conservative factor should be applied by multiplying MCF values with a value of 0.94, to account for the 20% uncertainty in the MCF values as recommended by ACM0010.

（ii）***N_2O emissions from manure management***

Equation 4 will be applied to calculate N_2O emissions from the baseline according to ACM0010.

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

where:

GWP_{N2O}	Global Warming Potential 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.

Direct N_2O emission will be estimated according to equation 5.

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

where:

$EF_{N2O,D,j}$ The direct N_2O emission factor for the treatment system j of the manure management system in kg N_2O-N/kg N. According to scientific the publication database (www.cnki.org.cn), there are no published country specific data on EF_{N2O}. Default EF_3 from table 10.21, chapter 10, volume 4, in the IPCC 2006 Guidelines was applied.

$NEX_{LT,y}$ The annual average nitrogen excretion per head of a defined livestock population in kg N/animal/day. Even there are data on crude percent of protein, there are no gross energy intake data available, because lack of daily weight gain data which is important to calculate the gross energy intake. So, there is no data on protein intake. According to scientific publication database (www.cnki.org.cn) ,there are also no published country-specific data on NEX data available. According to the Annex 2 of ACM 0010 version 2, scaling default IPCC values NEX to adjust for a site-specific average animal weight as shown in equation (6).

$MS\%_{BL,j}$ Fraction of manure handled in system j, in %. In this proposed project, j = anaerobic lagoon. $MS\%_{BL,j}$ =100%.

N_{LT} Number of broilers and layers for the year y, expressed in numbers.

$$NEX_{LT,y} = \left[\frac{W_{site,LT}}{W_{default}}\right] \times NEX_{IPCC,default} \quad (6)$$

Where

$NEX_{IPCC,default}$ 2006 IPCC Guidelines default NEX. the default value (1.1 kg /1000 kg animal mass/day for broilers ,0.83 kg /1000 kg animal mass/day for layers) n volume 4, chapter 10, table 10.19 in IPCC 2006 Guidelines for developed countries will be applied. Because the genetic source of chicken is from the developed country, the FFR was used as chicken feed, and animal weight are similar to developed country IPCC default value

The indirect N_2O emissions will be estimated according to equation 7.

$$E_{N2O,ID,y} = \sum_{j,LT}(EF_{N2O,ID,j} * F_{gasm} * NEX_{LT,y} * N_{LT} * MS\%_{Bl,j}) \quad (7)$$

Where:

$EF_{N2O,ID,j}$ The indirect N_2O emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N_2O-N/kg NH_3-N and NOx-N emitted. According to scientific publication database (www.cnki.org.cn), there are no published country specific data on $EF_{N2O,ID,j}$. Default values for EF_4 from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines was applied.

F_{gasm} Percent of managed manure nitrogen for livestock category that volatilizes as NH_3 and NOx in the manure management system. According to scientific publication database (www.cnki.org.cn), there are no published country specific data on F_{gasm}. Default value, 0.4, was applied (Table 10.22, Volume 4 of IPCC 2006 Guidelines).

(iii) CO_2 emission from electricity and heat within the project boundary

$BE_{elec/heat,y} = EG_{Bl,y} * CEF_{Bl,elec,,y} + EG_{d,y} * CEF_{grid} + HG_{BL,y} * CEF_{Bl,\ therm,y}$ (8)

where:

$EG_{Bl,y}$ 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 AMMS.

$CEF_{Bl, elec,y}$	The carbon emissions factor for electricity consumed at the project site in the absence of the project activity (tCO_2/MWh). 182 MWh was consumed according to the Minhe electricity payment.
$EG_{d,y}$	The amount of electricity generated utilizing the biogas collected during project activity and exported to the grid during the year y (MWh)
CEF_{grid}	The carbon emissions factor for the grid in the project scenario (tCO_2/MWh)
$HG_{BL,y}$	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 AMMS
$CEF_{Bl, therm}$	The CO_2 emissions intensity for thermal energy generation (tCO_2 e/MJ)

Determination of $CEF_{Bl,elec}$: Electricity consumed at the project site, in the absence of the project activity, purchased from the grid. According to ACM0010-version 2, the emission factor $CEF_{Bl,elec}$ should be calculated according to approved methodology ACM0002 (Consolidated baseline methodology for grid-connected electricity generation from renewable sources).

Determination of CEF_{grid}: According to the requirements of ACM0010-Version 02, CEF_{grid} should be calculated according to methodology ACM0002.

Determination of $CEF_{Bl,therm}$: *Thermal energy generation is not related*

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 CO_2 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 for the 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 (ACM0002.) as described in detail by the following steps.

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

Calculation of the 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 material, 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 normal 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 2002 to 2004, hydropower in the North China Power Grid accounted for about 7%-10%, and wind power or other 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 ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted 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:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad (9)$$

where:

$F_{i,j,y}$ — 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 must-run power plants, and including imports to the grid.

$COEF_{i,j,y}$ — 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.

$GEN_{j,y}$ — electricity (MWh) delivered to the grid by sources j.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i \quad (10)$$

where:

NCV_i — net calorific value (energy content) per mass or volume unit of a fuel i, (TJ/ mass or volume unit）.

$OXID_i$ — oxidation factor of the fuel i.

$EF_{CO_2,i}$ — CO_2 emission factor per unit of energy of the fuel i (tCO_2e/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 4,515 GWh in 2004, 4,244 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 in line 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 tCO_2/MWh announced by Office of National Coordination Committee on Climate Change, National Development and Reform Committee, December 15, 2006 (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215911355 75.pdf).

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

According to the ACM0002, the baseline Build Margin emission factor was calculated using the following formula 11.

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \quad (11)$$

where:

$F_{i,m,y}$	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.
$COEF_{i,m,y}$	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*
$GEN_{m,y}$	electricity (MWh) delivered to the grid by *m* power plants

According to the baseline methodology ACM0002, 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 plant's 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, $EF_{BM,y}$, for the North China Power Grid is 0.9066 tCO_2/MWh, and was announced by the Office of National Coordination Committee on Climate Change, National Development and Reform Committee in December 15, 2006. (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/2006121591135575.pdf)**.**

Step3: Calculation the baseline emission factor (EF_y)

According to the baseline methodology ACM0002, 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 ($EF_{BM,y}$):

$$EF_y = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \quad (12)$$

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:

$$EF_y = 0.50 \times EF_{OM,y} + 0.50 \times EF_{BM,y} = 0.9826 tCO_2/\mathbf{MWh.} \quad \mathbf{(13)}$$

Step II: Project emissions

Two stages are involved in the manure treatment for the project activity: (1) anaerobic digester; (2) aerobic treatment of biogas liquid in lagoon.
Project emissions are estimated as follows:

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N2O,y} + PE_{PL,y} + PE_{flared,y} + PE_{elec/heat} \quad (14)$$

$PE_{AD,y}$ Leakage from AMMS systems that capture methane in tCO_2e/yr

$PE_{Aer,y}$ Methane emissions from AMMS that aerobically treats the manure in tCO_2e/y

$PE_{N2O,y}$ Nitrous oxide emission from project manure waste management system in tCO_2e/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 tCO_2e/yr

$PE_{flared,y}$ Project emissions from flaring of the residual gas stream in tCO_2e/yr

$PE_{elec/heat,y}$ Project emissions from use of heat and/or electricity in the project case in tCO_2e/yr

(i) Methane emissions from anaerobic digester where gas is captured ($PE_{AD,y}$):

ACM0010 specify physical leakage from anaerobic digesters as being 15% of total biogas production. Because two stage manure management is involved in the manure treatment for the project activity, the equation 15 will be applied to the estimate methane emissions from the project activity.

$$PE_{AD,y} = GWP_{CH4} * D_{CH4} * LF_{AD} * F_{AD} * \left[\prod_{n=1}^{N} \left(1 - R_{VS,n}\right) \right] * \sum_{j,LT} (B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (15)$$

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 treated in anaerobic digester, 100% was applied, because all the

manure was feed into anaerobic digester.

$R_{VS,n}$ Fraction of volatile solid degraded in AMMS stage n. 70% of VS will be consumed in anaerobic digesters (in Annex 2 of ACM0010-Version 2).

LT Index for livestock type

$B_{O,LT}$ CH_4 production capacity from manure for chickens, in m^3 CH_4/kg-VS.

$VS_{LT,y}$ Annual volatile solid excretion of chickens on a dry matter basis in kg/animal/day.

N_{LT} Population of livestock type LT for the year y, expressed in numbers.

$MS\%_j$ Fraction of manure handled in system j.

(ii) Methane emissions from aerobic AMMS treatment ($PE_{Aer,y}$):

IPCC 2006 Guidelines specify emissions from aerobic lagoons as 0.1% of total methane generating potential of the waste processed, which can be used as a default for all types of aerobic AMMS treatment.

$$PE_{Aer,y} = GWP_{CH4} \cdot D_{CH4} * 0.001 * F_{Aer} * \left[\prod_{n=1}^{N} (1 - R_{VS,n}) \right] * \sum_{j.LT} (B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) + PE_{Sl,y} \quad (16)$$

F_{Aer} The fraction of volatile solid directed to aerobic system.

$PE_{Sl,y}$ CH_4 emissions from sludge disposed of in storage pit prior to disposal during the year in tCO_2e/yr.

The methodology used to estimate methane emissions from sludge is in equation 17.

$$PE_{SL,y} = GWP_{CH4} * D_{CH4} * MCF_{sl} * F_{Aer} * \left[\prod_{n=1}^{N} (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (17)$$

MCF_{sl} Methane conversion factor (MCF) for the sludge stored in sludge pits estimated as in the baseline emissions section.

The slurry storage ponds are not within the project boundary. The CH_4, direct N_2O and indirect N_2O emissions from methane emissions from sludge are considered as leakage of the project activity.

(iii) N_2O emissions from manure management

$$PE_{N2O,y} = GWP_{N2O} \cdot CF_{N2O-N,N} \cdot \frac{1}{1000} * (E_{N2O,D,Y} + E_{N2O,ID,y}) \quad (18)$$

where:

$PE_{N2O,y}$	Annual project N_2O emissions in t CO_2e / yr
GWP_{N2O}	Global Warming Potential (GWP) for N_2O.
$CF_{N2O\text{-}N,N}$	Conversion factor N_2O-N to N_2O (44/28).
$PE_{N2O,D,,y}$	Direct N_2O emission in kg N_2O-N/year.
$PE_{N2O,ID,,y}$	Indirect N_2O emission in kg N_2O-N/year.

The same method used to estimate the emissions in the baseline should be used to estimate the project emissions of nitrous oxide.

$$E_{N2O,D,y} = \sum_{j,LT}(EF_{N2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_j) \quad (19)$$

where:

$EF_{N2O,D,j}$	The direct N_2O emission factor for the treatment system j of the manure management system in kg N_2O-N/kg N. According to scientific publication database (www.cnki.org.cn), there are no published country specific data on $EF_{N2O,D,j}$. Default EF_3 in volume 4, chapter 10, table 10.21 in IPCC 2006 Guidelines was applied.
$NEX_{LT,y}$	The annual average nitrogen excretion per head of a defined livestock population in kg N/animal/year. IPCC default value (0.83 kgN/1000kg weight/day) was applied.

$$E_{N2O,ID,y} = \sum_{j,LT} EF_{N2O,ID,j} * F_{gasm} * NEX_{LT,y} * N_{LT} * MS\%_j \quad (20)$$

where:

$EF_{N2O,ID,j}$	The indirect N_2O emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N_2O-N/kg $_{NH3}$-N and NOx-N emitted, estimated with site-specific, regional or national data if such data is available. Otherwise, default values for EF_4 from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines can be used.
F_{gasm}	Percent of managed manure nitrogen for livestock category that volatilizes as NH_3 and NOx in the manure management system.

(iv) 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. In this proposed project, $P_{EPL,Y}$ is assumed to be zero because biogas is a very dangerous gas and gas delivery is on site

delivery only). During the construction of the pipelines, the project sponsor will be very careful to avoid gas leakage from pipelines.

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

In case, there is residual gas stream which will be flared by open flaring. Project emissions from open flaring of the residual gas stream can be determined according to the "Tool to determine project emissions from flaring gases containing Methane". According to "Tool to determine project emissions from flaring gases containing Methane", in case open flare system will be installed and the flare efficiency cannot be measured in a reliable manner, default value of 50% can be used when the flare is operational. If the flare is not operational the default value to be adopted for flare efficiency is 0%. In this project, Fixed value of 0% for the flare efficiency will be applied, and this is for conservative.

(vi) Project emissions from heat and electricity use ($PE_{elec/heat}$):

$$PE_{elec/heat} = EL_{Pr,y} * CEF_d + HG_{Pr,y} * CEF_{Pr,therm,y} \qquad (21)$$

where:

$EL_{Pr,y}$	The amount of electricity in the year y that is consumed at the project site for the project activity (MWh).
CEF_d	The carbon emissions factor for electricity consumed at the project site during the project activity (tCO_2/MWh).
$HG_{Pr,y}$	The quantity of thermal energy consumed in year y at the project site due to the project activity (MJ).
$CEF_{Pr,therm,y}$	The CO_2 emissions intensity for thermal energy generation (tCO_2e/MJ). The factor is zero if biogas is used for generating thermal energy.

Determination of CEFd: the determination of CEFd is the same as the method of CEFgrid

STEP III: 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 the project activity and those released in the baseline scenario. Net leakage of N_2O and CH_4 are only considered if they are positive.

$$LE_y = (LE_{P,N2O} - LE_{B,N2O}) + (LE_{P,CH4} - LE_{B,CH4}) \quad (22)$$

Where,

$LE_{P,N2O}$	The N_2O emissions released during the project activity from land application of the treated manure, in tCO_2e/year.
$LE_{B,N2O}$	The N_2O emissions released during the baseline scenario from land application of the treated manure, in tCO_2e/year.
$LE_{P,CH4}$	The CH_4 emissions released during the project activity from land application of the treated manure, in tCO_2e/year.
$LE_{B,CH4}$	The CH_4 emissions released during the baseline scenario from land application of the treated manure, in tCO_2e/year.

(i) Estimation of N_2O emissions outside the project boundary in baseline:

$$LE_{B,N2O} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (LE_{N2O,land} + LE_{N2O,runoff} + LE_{N2O,vol}) \quad (23)$$

$$LE_{N2O,land} = EF_1 * \prod_{n=1}^{N} (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (24)$$

$$LE_{N2O,runoff} = EF_5 * F_{Leach} * \prod_{n=1}^{N} (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (25)$$

$$LE_{N2O,vol} = EF_4 * F_{gasm} * \prod_{n=1}^{N} (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (26)$$

where:

$LE_{N2O,land}$	Direct nitrous oxide emission from application of manure waste, in Kg N_2O-N/year.
$LE_{N2O,runoff}$	Nitrous oxide emission due to leaching and run-off, in Kg N_2O-N/year.
F_{gasm}	Fraction of animal manure N that volatizes as NH_3 and NOX in kg NH_3-N and NOx-N per kg of N. There is no site-specific, regional, or national data available. According to ACM0010, default values from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines was used.
EF_1	Emission factor for direct emission of N_2O from soils in Kg N_2O-N/kg N. There is no

	site-specific, regional, or national data available. According to ACM0010, default values from table 11.1, chapter 11, volume 4 of IPCC 2006 Guidelines was used.
EF_4	Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces, in kg N- N_2O / (kg NH_3-N + NOx-N volatilized. There is no site-specific, regional, or national data available. According to ACM0010, default values from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines was used.
EF_5	Emission factor for indirect emission of N_2O from runoff in Kg N_2O-N/kg N. There is no site-specific, regional, or national data available. According to ACM0010, default values from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines was used.
F_{leach}	Fraction of *all* N added to mineralized in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff. There is no site-specific, regional, or national data available. According to ACM0010, default values from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines was used.
$R_{N,n}$	Fraction of NEX in manure waste that is reduced in the Baseline AMMS. The relative reduction of nitrogen depends on the treatment technology and should be estimated in a conservative manner. Default values for different treatment technologies can be found in Annex 1 of methodology ACM 0010.

(ii) N_2O emissions out the project boundary in project case

$$LE_{P,N2O} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (LE_{N2O,land} + LE_{N2O,runoff} + LE_{N2O,vol}) \quad \textbf{(27)}$$

$$LE_{N2O,land} = EF_1 * \prod_{n=1}^{N} (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (28)$$

$$LE_{N2O,runoff} = EF_5 * F_{Leach} * \prod_{n=1}^{N} (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (29)$$

$$LE_{N2O,vol} = EF_4 * F_{gasm} * \prod_{n=1}^{N} (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (30)$$

(iii) Methane emissions from disposal of treated manure in baseline condition

$$LE_{B,CH4} = GWP_{CH4} \cdot D_{CH4} * MCF_d * \left[\prod_{n=1}^{N} \left(1 - R_{VS,n}\right) \right] * \sum_{j,LT} (B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (31)$$

Where:

$LE_{B,CH4}$ Methane leakage emissions in the baseline (tCO_2e / yr)

MCF_d Methane conversion factor (MCF) assumed to be equal to 1.

(iv) Methane emissions from disposal of treated manure in project case

$$LE_{P,CH4} = GWP_{CH4} * D_{CH4} * MCF_d * \left[\prod_{n=1}^{N}\left(1 - R_{VS,n}\right)\right] * \sum_{j,LT} B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (32)$$

Where:

$LE_{P,CH4}$ Methane leakage emissions in the project case (tCO_2e / yr)

STEP IV: EMISSION REDUCTION （ ER_y ）

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:

$$ER_y = BE_y - PE_y - LE_y \quad (33)$$

Further, in estimating emissions reductions for claiming certified emissions reductions (CERs), if the actual methane captured from anaerobic digesters in project activity is lower than ($BE_{CH4,y}$ - $PE_{AD,y}$), then ($BE_{CH4,y}$ - $PE_{AD,y}$) (which is a component of BE_y -PE_y) in equation 33 is replaced by actual methane captured.

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

The data and parameters that are not monitored throughout the crediting period, but are determined only once and remain fixed throughout the crediting period are listed in Table B7.

Table B7 Data and parameters not monitored

ID Number:	1
Parameter:	$RV_{S,n}$
Data unit:	Fraction
Description:	VS degradation factor
Source of data:	Refer to Annex 1 of ACM0010-version 2
Value applied:	Uncovered anaerobic lagoon: 70%; Biogas digester: 70%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Estimated from Table provided in Annex 1 of ACM0010. The most conservative value for the given technology must be used. Archive electronically during project plus 5 years

Any comment:	

ID Number:	2
Parameter:	$EF_{N2O, D,j}$, $EF_{N2O,ID,j}$
Data unit:	kg N_2O-N/ kg N and kg N_2O-N/ kg NH_3-N and NO_X-N
Description:	N_2O emission factors (direct and indirect emissions)
Source of data:	IPCC 2006 Guidelines
Value applied:	$EF_{N2O, D}$=0 for anaerobic lagoon and digester, $EF_{N2O, D}$=0.01 for arobic lagoon, $EF_{N2O,ID,j}$=0.01
Justification of the choice of data or description of measurement methods and procedures actually applied:	Archive electronically during project plus 5 years.
Any comment:	Default values in IPCC 2006 Guidelines may be used because country specific or region specific data are not available.

ID Number:	3
Parameter:	F_{gasm}
Data unit:	Fraction
Description:	Fraction of N lost due to volatilization
Source of data:	IPCC 2006 Guidelines
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	40% from lagoon, 20% from land application Archive electronically during project plus 5 years
Any comment:	Default values in IPCC 2006 Guidelines may be used because country specific or region specific data are not available.

ID Number:	4
Parameter:	EF_1, EF_4, EF_5
Data unit:	kg N_2O-N/ kg N for EF_1, EF_5 and kg N_2O-N/ kg NH_3-N and NO_X-N for EF_4
Description:	N_2O emission factor from soil and runoff water.
Source of data:	IPCC 2006 Guidelines
Value applied:	EF_1=0.01, EF_4=0.01, EF_5=0.0075
Justification of the choice of data or description of measurement methods and procedures actually applied:	Archive electronically during project plus 5 years
Any comment:	Default values in IPCC 2006 Guidelines may be used because country specific or region specific data are not available.

ID Number:	5
Parameter:	F_{leach}
Data unit:	Fraction
Description:	Fraction of N leached
Source of data:	IPCC 2006 Guidelines
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	Precipitation is less than evaporation. The annual average precipitation is 715mm. The average evaporation for the project area is 2100mm. Archive electronically during project plus 5 years
Any comment:	Default values in IPCC 2006 Guidelines may be used because country specific or region specific data are not available.

ID Number:	6
Parameter:	$CEF_{Bl, therm,y}$
Data unit:	tCO_2/MJ
Description:	Emission factor of baseline heat use
Source of data:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	Thermal energy generation is excluded in the baseline condition. So, this parameter is not relevant.

ID Number:	7
Parameter:	$EG_{Bl,y}$
Data unit:	MWh
Description:	Electricity consumption by baseline AMMS
Source of data:	Project proponents
Value applied:	182
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	There was no receipt for electricity consumption in baseline condition. The pump power capacity was used to estimate the electricity consumption under baseline.

ID Number:	8
Parameter:	N_{dy}

Data unit:	Number
Description:	Number of days treatment plant was operational in year y.
Source of data:	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:	

ID Number:	9
Parameter:	HGBL,y
Data unit:	MJ
Description:	Heat used by baseline AMMS
Source of data:	Project proponents
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	Thermal energy generation is excluded in the baseline condition. So, this parameter is not relevant.

ID Number:	10
Parameter:	$MS\%_{Bl,j}$
Data unit:	Fraction
Description:	Fraction of manure handled in open lagoon system in the baseline
Source of data:	Project proponents
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied:	All manure collected from the farms was applied to lagoon
Any comment:	

ID Number:	11
Parameter:	GWP_{CH4}
Data unit:	tCO_2 e/tCH_4
Description:	Global warming potential for CH_4
Source of data:	IPCC
Value applied:	21
Justification of the choice of data or description of	

measurement methods and procedures actually applied:	
Any comment:	

ID Number:	12
Parameter:	GWP_{N2O}
Data unit:	tCO_2e/tN_2O
Description:	Global warming potential for N_2O
Source of data:	IPCC
Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

ID Number:	13
Parameter:	D_{CH4}
Data unit:	t/m^3
Description:	Density of methane
Source of data:	ACM0010
Value applied:	0.00067
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	Any comment: 0.00067 t/m^3 at room temperature 20℃ and 1 atm pressure.

ID Number:	14
Parameter:	MCF_d
Data unit:	t/m^3
Description:	Methane conversion factor for leakage calculation assumed to be equal to 1.
Source of data:	ACM0010
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

ID Number:	15
Parameter:	$CF_{N2O-N,N}$

Data unit:	
Description:	Conversion factor=44/28
Source of data:	ACM0010
Value applied:	44/28
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

ID Number:	16
Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/MW•h
Description:	Operating Margin Emission Factor
Source of data used:	The Affiche about determining the emission factors of China regional power grid, released by Office of National Coordination Committee on Climate Change, National Development and Reform Committee, December 15, 2006 (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/200612159113557 5.pdf).
Value applied:	1.0585
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released by government. Archive electronically during project plus 5 years
Any comment:	

ID Number:	17
Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MW•h
Description:	Build Margin Emission Factor
Source of data:	The affiche about determining the emission factor of China Regional Power Grid, released by Office of National Coordination Committee on Climate Change, National Development and Reform Committee, December 15, 2006 (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/200612159113557 5.pdf).
Value applied:	0.9066
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released by government. Archive electronically during project plus 5 years
Any comment:	

ID Number:	18
Data / Parameter:	$\eta_{flare,h}$
Data unit:	percent
Description:	Flare efficiency in hour h
Source of data used:	Tool to determine project emissions from flaring gases containing methane
Value applied:	0 %
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

ID Number:	19
Data / Parameter:	NCV_{CH4}
Data unit:	GJ/tonne
Description:	Net calorific value of methane
Source of data used:	Rose and Cooper, 7th edition 1977 "Technical Data on Fuel" WEC British National Committee, Edinburgh
Value applied:	50.04
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Step 1: Estimate of baseline emissions

Methane (CH_4) emissions for the baseline were calculated using ACM0010 equation 2. Nitrous oxide (N_2O) emissions for the baseline were calculated using equations 4, 5, and 7. Carbon dioxide (CO_2) emissions from baseline electricity consumption and CO_2 emission reduction by power generation were calculated using equations 8, 9, 10, 11, 12, and 13. Equation 1 was applied to calculate GHG emissions from baseline. Table B8 is annual baseline GHG emissions in CO_2 equivalents.

Table B8 Baseline GHG emissions by source in CO_2 equivalents

Baseline GHG emissions（t CO_2e）			
CH_4	N_2O	CO_2	Total
60,921	3,457	22,740	87,118

Step 2: Estimate of project emissions:

Methane (CH_4) emissions for the project activity were calculated using equations 15, 16, and 17. Nitrous oxide (N_2O) emissions for the project activity were calculated using equations 18, 19, and 20. Carbon dioxide (CO_2) equivalent emissions (the extra power required for project equipment) for the project activity were calculated using equation 21. Equation 14 was applied to calculate GHG emissions from project activity. Table B9 presents annual project activity GHG emissions in CO_2 equivalents:

Table B9 Project activity emissions

GHG emission from project activities（t CO_2e）			
CH_4	N_2O	CO_2	Total
5,841	3,630	1,041	10,512

Step 3: Estimate of leakage:

The methane (CH_4) leakage emissions from disposal of treated manure were calculated using equations 31 and 32. The nitrous oxide (N_2O) leakage emissions from manure land application were calculated using equations 23~30. All the parameters used are default values for developed countries in the IPCC 2006 Guidelines. No negative leakage is included in the calculation of emission reduction. Equation 20 was applied to calculate leakage emissions. Table B10 presents the annual GHG leakage emissions in CO_2 equivalents.

Table B10 Leakage emissions

Leakage（t CO_2e）								
Baseline			Project Activity			Change		
CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2
27,775	5,185	0	**27,767**	9,420	0	0	4,235	0

Step 4: Estimate of emissions reductions

Equation 33 was applied to calculate project emission reductions. The total project emissions are presented in Table B11.

Table B11 Total project activity emission reductions

Sources GHG emission （t CO_2e）			
Baseline emissions	Project activity emissions	Estimate of leakage	Emission reduction
87,118	10,512	4,235	**72,371**

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

Table B12 Summary of the ex-ante estimation of emission reductions

Year	Estimation of Project Activity Emissions (tCO_2e)	Estimate of Baseline Emissions (tCO_2e)	Estimate of Leakage (tCO_2e)	Estimation of Project Activity Emissions Reductions (tCO_2e)
2009 (4-12)	7,884	65,339	3,176	54,278
2010	10,512	87,118	4,235	**72,371**
2011	10,512	87,118	4,235	**72,371**
2012	10,512	87,118	4,235	**72,371**
2013	10,512	87,118	4,235	**72,371**
2014	10,512	87,118	4,235	**72,371**
2015	10,512	87,118	4,235	**72,371**
2016	10,512	87,118	4,235	**72,371**
2017	10,512	87,118	4,235	**72,371**

2018	10,512	87,118	4,235	**72,371**
2019(1-3)	2,628	21,779	1,059	18093
Total （tCO_2e）	105,120	871,180	42,350	**723,710**

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

B.7.1 Data and parameters monitored:

According to the ACM0010, the data and parameters involved in the monitoring plan are presented in the Table B13.

Table B13 Data and parameters monitored

Data / Parameter:	MCF
Data unit:	Fraction
Description:	Methane correction factor
Source of data:	IPCC 2006 Guidelines
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	IPCC default factor will be applied resulting in no error due to measurement.
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 that MCF=0 at the annual average temperature of 5℃. MCF for Minhe will be based on the annual average temperature from Penglai Meteorological Station.

Data / Parameter:	MCF_{sl}
Data unit:	Fraction
Description:	Methane correction factor
Source of data:	IPCC 2006 Guidelines
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	IPCC default factor will be applied resulting in no error due to measurement.
Any comment:	The factor MCFsl 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 that MCF=0 at the annual average temperature of 5℃. MCFsl for Minhe will be based on the annual

	average temperature from Penglai Meteorological Station.

Data / Parameter:	$B_{O,LT}$
Data unit:	m^3CH_4/kg-VS
Description:	Maximum methane production
Source of data:	IPCC 2006 Guidelines
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually, estimated or based on published information such as IPCC
QA/QC procedures:	Default factor from technical literature will be applied resulting in no error due to measurement.
Any comment:	IPCC 2006 Guidelines for developed country Bo values were applied because genetic source of the production operations livestock originate from an Annex I Party; and the formulated feed rations (FFR) is applied.

Data / Parameter:	$VS_{LT,y}$
Data unit:	kg dry matter/animal/year
Description:	Volatile solid excretion per animal per day
Source of data:	IPCC 2006 Guidelines
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually, estimated or based on published information such as IPCC
QA/QC procedures:	IPCC default factor will be applied resulting in no error due to measurement.
Any comment:	VS for developed country values were applied because the genetic source of the operation's livestock originate from an Annex I Party; and the formulated feed ration (FFR) is applied.

Data / Parameter:	$CEF_{Bl,elec,y}$
Data unit:	tCO_2/MWh
Description:	Emission factor of baseline electricity use
Source of data:	The affiche about determining the emission factor of China Regional Power Grid, released by Office of National Coordination Committee on Climate Change, National Development and Reform Committee.
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	At start of project
QA/QC procedures:	---
Any comment:	Calculated as per procedure described in the baseline methodology.

Data / Parameter:	CEF_{grid}
Data unit:	tCO_2/MWh

Description:	Emission factor of exported electricity
Source of data:	The affiche about determining the emission factor of China Regional Power Grid, released by Office of National Coordination Committee on Climate Change, National Development and Reform Committee.
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	---
Any comment:	Calculated as per procedure described in the baseline methodology.

Data / Parameter:	CEF_d
Data unit:	tCO_2/MWh
Description:	Emission factor for project activity consumption electricity
Source of data:	The affiche about determining the emission factor of China Regional Power Grid, released by Office of National Coordination Committee on Climate Change, National Development and Reform Committee.
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	---
Any comment:	Calculated as per procedure described in the baseline methodology.

Data / Parameter:	$CEF_{Pr,therm,y}$
Data unit:	tCO_2/MJ
Description:	Emission factor for thermal energy
Source of data:	Refer to baseline methodology
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	At the start of the project activity
QA/QC procedures:	---
Any comment:	Not relevant

Data / Parameter:	LF_{AD}
Data unit:	Fraction
Description:	Fraction of methane leakage from anaerobic digester
Source of data:	IPCC 2006 Guidelines
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	IPCC default factor will be applied resulting in no error due to measurement.
Any comment:	IPCC default of 0.15 or less if documented evidence can be provided.

Data / Parameter:	$R_{N,n}$
Data unit:	fraction
Description:	Nitrogen degradation factor
Source of data:	Refer to Annex 1 of ACM0010
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	IPCC default factor will be applied resulting in no error due to measurement.
Any comment:	Estimated from Table provided in Annex 1 of ACM0010

Data / Parameter:	Type
Data unit:	---
Description:	Type of barn and AMMS
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Barn and AMMS layout and configuration.

Data / Parameter:	CP
Data unit:	%
Description:	Crude protein percent
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation (1a) in Annex 2 of ACM0010 was not applied. Therefore, this parameter is not relevant.

Data / Parameter:	GE
Data unit:	MJ/d
Description:	Gross energy intake of the animal
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation (3) of ACM0010 was not applied. Therefore, this parameter is not relevant.

Data / Parameter:	T

Data unit:	℃
Description:	Annual Average ambient temperature at weather station nearby project site
Source of data:	Penglai Meteorological Station
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Monthly
QA/QC procedures:	---
Any comment:	Used to select the annual MCF from IPCC 2006 Guidelines

Data / Parameter:	Rainfall
Data unit:	Mm
Description:	Annual Average rainfall at weather station nearby project site
Source of data:	Penglai Meteorological Station
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Monthly
QA/QC procedures:	---
Any comment:	Used to select the EF_{leach} from IPCC 2006 Guidelines

Data / Parameter:	Evaporation
Data unit:	Mm
Description:	Annual Average evaporation at weather station nearby project site
Source of data:	Penglai Meteorological Station
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Monthly
QA/QC procedures:	---
Any comment:	Used to select the EF_{leach} from IPCC 2006 Guidelines

Data / Parameter:	EGd,y
Data unit:	MWh
Description:	Electricity exported to grid
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annual
QA/QC procedures:	Electricity meters will undergo maintenance/calibration subject to appropriate industry standards. The accuracy of the meter readings will be verified by receipts issued by the purchasing power company. Uncertainty of the meters to be obtained from the manufacturers. This uncertainty to be included in a conservative manner while calculating CERs and procedure for doing so was described in B7.2 of this CDM-PDD.
Any comment:	---

Data / Parameter:	Regulations
Data unit:	---
Description:	Existence and enforcement of relevant regulations
Source of data:	Project proponents
Measurement procedures (if any):	See SEPA www.sepa.gov.cn
Monitoring frequency:	At start of crediting period
QA/QC procedures:	Quality control for the existence and enforcement of relevant regulations and 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 chicken population used in both baseline and project case emissions estimations.
Source of data:	Project proponents
Measurement procedures (if any):	Average chicken population will be calculated based on the numbers of chicken grown annual and chicken growing days for each flock and growing cycles Archive electronically during project plus 5 years
Monitoring frequency:	Each flock
QA/QC procedures:	Feed purchase will be recorded to verify the chicken population
Any comment:	The method for monitoring the number of livestock population was described in B7.2 of this PDD.

Data / Parameter:	W_{site}
Data unit:	kg
Description:	Weight of chicken
Source of data:	Project proponents
Measurement procedures (if any):	0.2% of broiler and layers (about 10,000) will be weighed weekly to obtain average site weight. Archive electronically during project plus 5 years
Monitoring frequency:	weekly
QA/QC procedures:	---
Any comment:	---

Data / Parameter:	F_{AD}
Data unit:	Fraction
Description:	Fraction of volatile solids directed to anaerobic digesters
Source of data:	Project proponents

Measurement procedures (if any):	Archive electronically during project plus 5 years Fraction of volatile solids directed to anaerobic digesters will be calculated based on the VS concentration and quantity of influent of biogas digesters. VS concentration will be measured by taking sample of influent. quantity of influent will measured by the operation hours of pumps.
Monitoring frequency:	Four times a year in different seasons.
QA/QC procedures:	Pumps will be in compliance with relevant standards in China, calibration of pumps will occur according to technical specification by an officially accredited entity. VS concentration of collected samples will be sent for analysis at qualified labs or testing centers at the city level.
Any comment:	---

Data / Parameter:	F_{Aer}
Data unit:	Fraction
Description:	Fraction of volatile solids directed to aerobic treatment
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years Fraction of volatile solids directed to aerobic digesters will be calculated based on the VS concentration and quantity of influent of biogas digesters. VS concentration will be measured by taking sample of influent. Quantity of influent will be measured by flow meter.
Monitoring frequency:	Four times per year in different seasons.
QA/QC procedures:	Pumps will be in compliance with relevant standards in China, calibration of pumps and flow meter will occur according to technical specification by an officially accredited entity. VS concentration of collected samples will be sent for analysis at qualified labs or testing centers at the city level.
Any comment:	---

Data / Parameter:	$EL_{Pr,y}$
Data unit:	MWh
Description:	Electricity used in project AMMSs
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Annually
QA/QC procedures:	Electricity meters will undergo maintenance/calibration subject to appropriate industry standards. The accuracy of the meter readings will be verified by receipts issued by the purchasing power company. Uncertainty of the meters to be obtained from the manufacturers. This uncertainty to be included in a conservative manner while calculating CERs and procedure for doing so was described in B7.2 of this CDM-PDD.
Any comment:	---

Data / Parameter:	$HG_{Pr,y}$
Data unit:	MJ
Description:	Heat used by project AMMS
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	---
QA/QC procedures:	Fuel purchase records to be cross checked with estimates.
Any comment:	Not relevant

Data / Parameter:	V_f
Data unit:	m^3
Description:	Biogas flow
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Continuously by flow meter and reported cumulatively on weekly basis
QA/QC procedures:	Flow meters will undergo maintenance/calibration subject to appropriate industry standards. The frequency of calibration and control procedures would be different for each application. This maintenance/calibration practice was stated in B7.2 of this CDM-PDD.
Any comment:	The biogas flow will be measured at 3 points: (1)Outlet of digester; (2) Inlet to flare; (3) Inlet to power generator, as shown in monitoring plan, Figure B3.

Data / Parameter:	T_{Biogas}
Data unit:	℃
Description:	Biogas temperature
Source of data:	Project proponents
Measurement procedures (if any):	Measured to determine the density of methane D_{CH4} No separate monitoring of temperature is necessary when using flow meters that automatically measure the temperature and pressure of biogas, and expressing biogas volumes in normalized cubic meters. Archive electronically during project plus 5 years
Monitoring frequency:	Continuous
QA/QC procedures:	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards.
Any comment:	

Data / Parameter:	P_{Biogas}
Data unit:	Pa
Description:	Biogas pressure

Source of data:	Project proponents
Measurement procedures (if any):	Measured to determine the density of methane D_{CH4} No separate monitoring of pressure is necessary when using flow meters that automatically measure the temperature and pressure of biogas, and expressing biogas volumes in normalized cubic meters. Archive electronically during project plus 5 years
Monitoring frequency:	Continuous
QA/QC procedures:	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards.
Any comment:	

Data / Parameter:	C_{CH4}
Data unit:	Fraction
Description:	Methane fraction of biogas
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 years
Monitoring frequency:	Continuous metering and reported monthly.
QA/QC procedures:	The project proponents shall define the viability of the concentration. They shall also define the error in estimating for different level of measurement frequency. The level of accuracy will be deducted from average concentration measurement.
Any comment:	---

Data / Parameter:	$PE_{flare,y}$
Data unit:	TCO_{2-}
Description:	Project emission from flaring of the residual gas stream in year y
Source of data:	Measurements by project participants
Measurement procedures (if any):	
Monitoring frequency:	--------
QA/QC procedures:	
Any comment:	The parameter is calculated. The fixed vales of 0% of flare efficiency will be applied.

Data / Parameter:	N_{DM}
Data unit:	kg N_2O-N/kg effluent
Description:	N concentration in disposed manure
Source of data:	-----
Measurement procedures (if any):	

Monitoring frequency:	-----
QA/QC procedures:	---
Any comment:	Due to the choice of Equation (24) (25)(26)of ACM0010, N_{DM} was not applied. Therefore, this parameter is not relevant

Data / Parameter:	Q_{DM}
Data unit:	Kg
Description:	Mass of manure disposed outside project boundary
Source of data:	--------
Monitoring frequency:	-----
QA/QC procedures:	---
Any comment:	Due to the choice of Equation (24) (25)(26)of ACM0010, N_{DM} was not applied. Therefore, this parameter is not relevant

Data / Parameter:	MS%j
Data unit:	Fraction
Description:	Fraction of manure handled in system j in project activity
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 yrs
Monitoring frequency:	Annually
QA/QC procedures:	The manure will flow into system by pipes.
Any comment:	

Data / Parameter:	$NEX_{LT,y}$
Data unit:	kg N/animal/year
Description:	Annual average nitrogen excretion per chicken, in kg N/animal/year estimated as described in Annex 2 of ACM0010.
Source of data:	IPCC
Measurement procedures (if any):	Archive electronically during project plus 5 yrs
Monitoring frequency:	Annual review to the IPCC data.
QA/QC procedures:	---
Any comment:	Default value provided by IPCC 2006 Guidelines will be applied before new IPCC GHG guidelines published.

Data / Parameter:	GE_{LT}
Data unit:	MJ/day
Description:	Daily average gross energy intake in MJ/day.
Source of data:	Project proponents
Measurement procedures (if any):	Archive electronically during project plus 5 yrs

Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation 3 of ACM0010 was not applied. Therefore, this parameter is not relevant

Data / Parameter:	DE_{LT}
Data unit:	%
Description:	Digestible energy of the feed in percent (defaults available in IPCC 2006 Guidelines).
Source of data:	---
Measurement procedures (if any):	---
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation 3 of ACM0010 was not applied. Therefore, this parameter is not relevant

Data / Parameter:	UE
Data unit:	fraction of GE
Description:	Urinary energy expressed as fraction of GE
Source of data:	---
Measurement procedures (if any):	---
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation 3 of ACM0010 was not applied. Therefore, this parameter is not relevant

Data / Parameter:	ASH
Data unit:	fraction of the dry matter feed intake
Description:	Ash content of the manure calculated as a fraction of the dry matter feed intake.
Source of data:	---
Measurement procedures (if any):	---
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation 3 of ACM0010 was not applied. Therefore, this parameter is not relevant

Data / Parameter:	ED_{LT}
Data unit:	MJ/kg
Description:	Energy density of the feed in MJ/kg fed to livestock type LT.
Source of data:	---

Measurement procedures (if any):	---
Monitoring frequency:	---
QA/QC procedures:	---
Any comment:	Equation 3 of ACM0010 was not applied. Therefore, this parameter is not relevant

Data / Parameter:	Genetic source
Data unit:	
Description:	Genetic source of broilers and layers
Source of data:	Project proponent
Measurement procedures (if any):	Recorded certificate of genetic source
Monitoring frequency:	Annually
QA/QC procedures:	---
Any comment:	

Data / Parameter:	FFR
Data unit:	
Description:	Formulated feed ratio
Source of data:	Project proponent
Measurement procedures (if any):	Record the use amount of FFR for farm and the ingredient of FFR
Monitoring frequency:	Annually
QA/QC procedures:	---
Any comment:	---

B.7.2 Description of the monitoring plan:

Monitoring plan is a division and schedule of a series of monitoring tasks. Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term GHG emissions reductions for the proposed project are monitored and reported.

1. What is required by the monitoring plan?

Managers of the proposed project must maintain credible, transparent, and adequate data estimation, as well as measurement, collection, and tracking systems to maintain the information required for an audit of an emissions reduction project. These records and monitoring systems are needed to allow the selected DOE to verify project performance as part of the verification and certification process. This process also

reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs).

Emission reductions will be achieved through improving AMMS at chicken farms; and utilize biogas co- generation systems to supply electricity to/and or displace electricity from a grid-based conventional energy. The amount of animal population, amount the electricity generated from biogas and electricity consumption by proposed project is therefore defined as the key activities to monitor.

2. Who uses the monitoring plan?

Minhe, the proposed project owner, will use this document as guidelines in monitoring of the project's emissions reduction performance. This plan should be modified according to actual conditions and requirements of the DOE in order to ensure that the monitoring is credible, transparent and conservative.

3. Key definitions

The monitoring plan will use the following definitions of monitoring and verification.

- Monitoring: the systematic surveillance of the project's performance by measuring and recording performance-related indicators relevant in the context of GHG emission reductions.

- Verification: the periodic ex-post auditing of monitoring results, the assessment of achieved emission reductions and of the project's continued conformance with all relevant project criteria by a selected DOE.

4. Calibration of meters and metering

The on-site and lab instruments including biogas flow meters, electricity meters, pumps need to be calibrated periodically by an officially accredited entity according to appropriate national or international standard and technical specifications of manufacturer of the metering devices. Biogas temperature and pressure meter will also need to be calibrated if they are applied in the monitoring of project activity. All collected samples will be sent for analysis at qualified labs or testing centers at the city level. Their equipments will be periodically calibrated according to appropriate standards.

5. Monitoring

According to ACM0010, the monitored parameters, the location of meters installed on-site, and the sampling points are described in Figure B3.

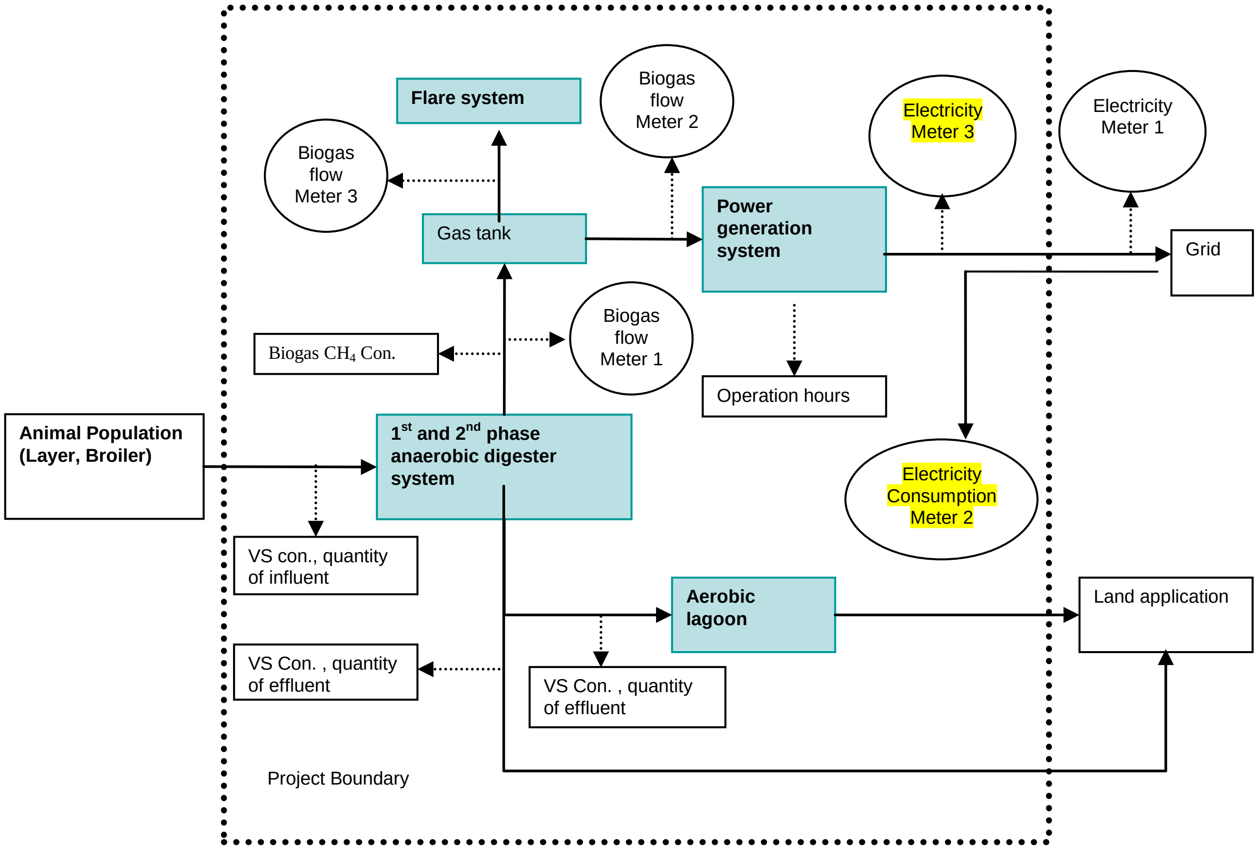

Figure B3 Monitoring plan

5.1 Power supply measurement

The power supply of the project will be measured through an electric meter (electricity meter 1) installed by the grid company at the transformer. The grid company will record the readouts of electricity meter 1 on a given date every month. Minhe will install another electricity meter (electricity meter 3) at the outlet of biogas power generator and record the readout of electricity meter 3 on a given date every month. The meter 3 serves two purposes in case of failure of electricity meter 1, 1) it can be used to verify that the biogas is actually destroyed in the power generator. 2) the electricity generation as recorded in the meter 3 minus transmission loss can be used as the conservative proxy for net electricity supply to the grid, a parameter that the electricity 1 should provide under normal operating condition. The transmission loss is conservatively set as 3% while the normally transmission loss should be normally 0.5%.

Minhe will provide to the DOE the readout records of electricity meters 1. It will be cross-checked by the utility invoices produced by the utility company that specifically is based on the readout of the electric meter 1. The electricity meters will be in compliance with relevant standards in China, The electricity meters used will be calibrated periodically by an officially accredited entity. The level of accuracy will be deducted from average measurement.

5.2 Power consumption measurement

The power consumption of the project will be measured through an on-site electricity meter (electricity meter 2) installed at a place where the biogas power generator sits. Minhe, the project participant, will record the readouts of electricity meter 2 on a given date every month. The electricity meters will be in compliance with relevant standards in China, the electricity meters used will be calibrated periodically by an officially accredited entity. The level of accuracy will be deducted from average measurement.

Minhe will provide to the DOE the readout records of electricity meter 2.

5.3. Chicken characteristics and

calculation

Pursuant to the formula defined by IPCC 2006 Guidelines, annual average number of chicken can be calculated as following:

$$N_{LT} = N_{da}\left\{\frac{N_P}{365}\right\}$$

Where:

N_{LT}: Annual average chicken population of type LT for the year y, expressed in numbers.

N_{da}: Number of days chicken is alive/growing in the farm in the year y, expressed in numbers

Np: Number of chicken produced annually of type LT for the year y, expressed in numbers

Minhe will collect the data of chicken numbers and chicken growing/alive days for each flocks during growing cycle before slaughter or sale.

Minhe will record the genetic sources for each population and use of FFR as well as the ingredient of FFR.

0.2% of broiler and layers (about 10,000) will be weighed weekly to obtain average site weight by Minhe Company.

Minhe will provide to the DOE the records of chicken population, , generic sources and use of FFR.

5.4 Biogas output measurement

Biogas output of the project will be measured through a biogas flow meter (biogas flow meter 1) installed at the outlet of the anaerobic digesters. In the meantime, two other biogas flow meters (biogas flow meter 2, and 3) will be installed at the inlet of the generator as well as the inlet of flare. Minhe will record the readouts of biogas flow meters 1, 2 and 3 on a weekly basis. Biogas flow meters will be in compliance with relevant standards in China, calibration of all meters will occur according to technical specification by an officially accredited entity. To make sure the readout of flowmeter is appropriate, Minhe company makes sure working conditions which is required by the flow meters. Biogas temperature and pressure need to be measured using temperature meter and pressure meter located before flow meter if the flow meter could not automatically measure the temperature and pressure of biogas, and expressing biogas volumes in normalized cubic meters. Measuring instruments should be subject to a regular maintenance and testing regime in according to appropriate national/international standards.

Minhe will provide to the DOE the records from Biogas flow meters and calibration certificate.

5.5 CH_4 concentration measurement

CH_4 concentration will be measured continuously through onsite gas analyzer installed at the outlet of the anaerobic digesters. Minhe will be record the readout of gas analyzer on monthly basis. Gas analysis will be in compliance with relevant standards in China, and meter used will be calibrated periodically by an officially accredited entity. The level of accuracy will be deducted from average concentration measurement.

Minhe will provide to the DOE the records of CH_4 concentrations.

5.6 Climatic parameters measurement

Monthly average data on temperature, pressure, rainfall and evaporation will be monitored by the Penglai Meteorological Station according to the national standard.

Minhe will buy the climatic parameters and provide to the DOE.

5.7 VS concentration measurement

Samples will be taken from three points four times a year. Point 1 is located before the inlet of biogas digesters. Point 2 is located in the sludge before transported to land. Point 3 is located before the inlet of aerobic lagoon. All collected samples will be sent for analysis at qualified labs or testing centers at the city level.

Minhe will provide to the DOE the records of VS concentrations.

5.8 Influent and Effluent flow rate measurement

The influent and effluent flow rate will be measured at three points same as VS concentration sampling point as described above through recording the working hours of pumps and flow meter. Pumps and flow meter will be in compliance with relevant standards in China, calibration of pumps and flow meter will occur according to technical specification by an officially accredited entity.

Minhe will provide to the DOE the records of pump working hours and the calibration certificate.

6. Data Management System

Records are the most important exercise in relation to the monitoring process. Without accurate and efficient record keeping, project emission reductions cannot be verified. The following is an outline of how project related records will be managed.

Overall responsibility for the monitoring of GHG emission reductions will rest with the CDM-responsible person at the proposed project site. The CDM manual sets out the procedures for tracking information from the primary source to the end-data calculations, in paper document format. If data and information are available via the internet, the website must be provided. It is the responsibility of the proposed project owner to provide necessary data and information for verification and certification requirements to the respective DOE.

Physical documentation such as paper-based maps, diagrams, and environmental impact assessments will be collated in a central place, together with this monitoring plan. All paper-based information will be stored by the proposed project owner who will keep at least one copy.

7. Verification Procedure

The verification procedure for the monitoring results of the project is a mandatory process required for all CDM projects. The main objective of the verification is to independently verify that the proposed project has achieved the emission reductions as reported and projected in the PDD. It is expected that the verification can be done annually.

Main verification activities include:

- The proposed project owner should sign a verification service agreement with the specific DOE and comply with the time framework set by the CDM EB and the buyer's schedule to carry out verification activities. The proposed project owner should prepare for and conduct verification activities with high efficiency and high quality.
- The proposed project owner should provide completed necessary information for verification to the DOE before and during verification activities.
- The proposed project owner should cooperate with the DOE and, instruct its staff and manager to be available for interviews and respond honestly to all questions relevant to verification from the DOE.
- If the proposed project owner deems that requirements of the DOE are beyond the scope of verification activities authorized by the CDM EB, he should contact the CDM developer of the proposed project, or other qualified entities to determine whether the requirements of the DOE are reasonable. If the requirements are considered unreasonable, a rejection letter in a written format should be provided to the DOE with justifiable reasons. If the project owner and the DOE cannot reach an agreement on these requirements, the matter should be submitted to the CDM EB or UNFCCC for arbitration.

The proposed project owner should designate a person in charge of the overall responsibility for the monitoring and verification procedure and to act as the focal point for the DOE.

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 detailed baseline information is attached in Annex 3.

Date of completion of baseline study: 10/05/2007

Name of persons/entity determining the baseline：

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- Li Yue,

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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 starting date of the project activity is 17 July 2007.

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

The expected operational lifetime of the project activity is 25 years.

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

C.2.1. Renewable crediting period

N/A

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

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

1 April 2009 or the date of registration whichever comes later

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The Environmental Impact Assessment of the proposed project was completed by the Environmental Science Research Institute of the Shandong, and approved by the Environment Protection Bureau of Shandong Province on Nov.24, 2006 (Document No. [2006] 245). Main conclusions of the Environmental Impact Assessment are summarized as follows:

The proposed project activity has no any negative environmental impacts.

In addition to reducing GHG emissions, the proposed project has the following environmental benefits:

（1）NMVOC emissions into the atmosphere and the odor caused by the animal manure will be reduced;

（2）The fly population will be reduced. Therefore, the potential for the spread of disease will be reduced;

（3）Contamination of ground water will be reduced by applying biogas residue with no harmful bacterial;

（4）Application of biogas residue will increase soil organic carbon content;

（5）The electricity generated by the project can be provided to local farmers for their cooking, heating, and lighting. Since the farmers can use clean energy, both their living standards and environmental conditions will be improved.

In summary, the implementation of the proposed project will improve the local environment.

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:

The proposed project will reduce environmental pollution and GHG emissions by generating electricity using biogas which will reduce the consumption of fossil fuels. The implementation of the project will protect the local environment and human health and there are no negative impacts on the local environment.

E. SECTION E. Stakeholders' comments

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

According to "Measures for Operation and Management of Clean Development Mechanism Projects in China" and the requirements of the PDD, in August 2006, staff from the Minhe carried out a survey of the local residents in the area where the project will be sited. Eleven institutions including EPA, Animal Husbandry Bureau, and Agricultural Bureau issued a support letter, respectively. The support letters can revalidate by the DOE. Fifty individuals from nearby villages, schools, hospitals, government officials, and workers from Minhe were invited for their comments on this project.

E.2. Summary of the comments received:

In August 2006, staff from the Minhe carried out a survey of the local villagers in the area where the project will be sited. The survey was conducted through the distribution of a questionnaire and collection of responses.

The one page questionnaire contains the following sections:

1) Project introduction

2) Respondent's basic information and education level

3) Questions on:

- How do they feel about their surrounding environment? (1) very good; (2)not very good; (3) bad; (4) very bad.

- How much familiarity do they have with biogas digester, animal manure compost treatment, biogas power generation projects? (1) very familiar; (2) know some; (3) not familiar.
- Is the pollution caused by intensive animal farms serious? (1) very serious; (2) serious; (3) not serious; (4) no pollution.
- What is the position on controlling the pollution caused by animal waste? (1) support; (2) not support.
- Do you know this CDM project? (1) yes; (2) no.
- If yes, where do you obtain this project information? (1)TV; (2) Newspaper; (3) Radio; (4) friends or relatives; (5) other
- What are the positive impacts of the project will have on their livelihood? (1) Reduce water pollution; (2) Reduce air pollution; (3) Reduce soil pollution; (4) Reduce contamination of agricultural products; (5) Reduce electricity consumption; (6) increase organic fertilizer; (7) Increase family income; (8) increase job opportunity; (9) other.
- What are the negative impacts of the project will have on their livelihood? (1) Noises; (2) Land occupation; (3) Increase the discharge of sludge amount during project development; (4)other.
- Among the perceived negative impacts, what are considered the most important, somewhat important and the least important?
- What are the measures that can be taken to mitigate the negative impacts?
- Will the overall impact of the project on their livelihood be positive, negative or negligible?
- What other comments and suggestions do they have regarding the project?
- Whether support the project activity or not?

4) Signature and date

The survey had a 100% response rate (50 questionnaires returned out of 50). The stakeholders' comments are summarized as follows:

- Education level of the respondents: primary level (24%), middle level (16%), high level (46%);
- 54% of the respondents are satisfied with their life condition and surrounding environment, 46% are not too satisfied;

- Most respondents (74%) have some understanding of biogas digesters and biogas-powered generation projects, while 8% have thorough understanding of this kind of project. Nine people have never heard of this kind of these types of projects.
- 100% of the respondents support the biogas digester and biogas-powered generation projects in the area;
- Among the positive impacts the project will have on the respondents' livelihoods, "improvement of standard of living" accounts for the highest percentage (100%), followed by "improvement of air quality" (90%), "decrease of tariff" (86.7%), "increase of income" (76.6%) and "increase of job opportunities"(63.3%).
- The positive impacts the project will have on their livelihoods: (1) reduce water, air and soil pollution (92%); (2) increase family income (52%); (3) increased job opportunities (46%); (5)reduced electricity consumption (26%);
- The negative impacts of the project are: (1) noise (48%); (2) land occupation (26%); (3) Increased discharge of sludge during project development (20%). 100% of respondents said that the project may have minor negative impacts on their livelihoods.
- 100% of the respondents said that the project will have overall positive impacts on their livelihoods.
- 100% of the respondents support the construction of the project.

Conclusion

The survey indicates that the project has very strong support from local people. This is closely linked to the fact that the majority of local villagers have had some familiarity with biogas digesters and biogas-power generation projects. The respondents generally find that the project will improve their environment and bring them multiple benefits. Negative impacts included the increase in noise and an increase in the amount of wastewater discharge in the construction phase of the project. However, as the environmental impact assessment demonstrates, both impacts occur only during the construction phase of the project. Thus, these impacts will be minimized after construction is completed. The project will use land possessed by the project sponsor, and the project will not occupy other land.

In summary, all comments received were positive and supported the implementation of this CDM project.

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

The residents and local government are all very supportive of the project, therefore there has been no need to modify the project due to the comments received.

The local government and residents supported this project very much. It is unnecessary to revise the PDD or change the schedule of construction.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

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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

Part I: Animal related baseline information

Animal data*

Baseline data			
Population		Climate	
Layer (head)	Broiler (head)	Annual average temperature ℃	Precipitation（cm）
637638	3626292	12.7	63

*** Animal population in 2005**

Data categorization

Farm system	AWPS			AMMS			Other
	Animal Category	**Genetics**	**Population**	**Baseline**	**Project**	**Detailed data**	**Climate**
Farm 1 Farm15~23	Layer	Annex I Country	See annex 3	Open anaerobic lagoon	Anaerobic digester + biogas co-generation + Aerobic treatment of biogas liquid	See annex 3	Temperate
Farm 24~29	broiler	Annex I Country	See annex 3	Open anaerobic lagoon	Anaerobic digester + biogas co-generation + Aerobic treatment of biogas liquid	See annex 3	Temperate

Data of manure management system

Farm	Manure management	Length (m)	Width (m)	Depth (m)	Volume (m^3)	Population (h)	Usage percentage (%)	Retention time (d)	Total manure (m^3/d)
Farm 1, 15	Open anaerobic lagoon	26	13	4.5	1521	101268	100	35	43
Farm 16	Open anaerobic lagoon	30	17	4.5	2295	44016	100	92	25
Farm17, 18	Open anaerobic lagoon	30	20	10	6000	93516	100	182	33
Farm 19	Open anaerobic lagoon	31.7	20.7	4.5	2953	44016	100	118	25
Farm 20	Open anaerobic lagoon	26	20	6.3	3276	44016	100	131	25
Farm21 — 29	Open anaerobic lagoon	100	67	7.5	50250	3937098	100	50	997

Chicken Stock

Farms	Chick category	Production system	Genetics	Weight (g)	Number of house	Length of house(m)	Width of house(m)	Layers	Population /house	Total population/farm	Manure removal method
Farm 1	Layer	Caged	Arbor Acres （AA）	40～550	3	68	6.6	4	15006	51768	Scraper
				40～930	1	37	6.6	4	6750		
Farm 15	Layer	Caged	Arbor Acres （AA）	550～2700	7	76	8	3	6300	49500	Scraper
				930～3600	1	76	9	2	5400		
Farm 16	Layer	Caged	Arbor Acres （AA）	2800～4700	14	88	6	2	3144	44016	Remove manually
Farm 17	Layer	Caged	Arbor Acres （AA）	550～2700	7	54	11	3	6300	49500	Scraper
				930～3600	1	54	14	2	5400		
Farm 18	Layer	Caged	Arbor Acres （AA）	2800～4700	14	88	6	2	3144	44016	Remove manually
Farm 19	Layer	Caged	Arbor Acres （AA）	2800～4700	14	88	6	2	3144	44016	Remove manually
Farm 20	Layer	Caged	Arbor Acres （AA）	2800～4700	14	88	6	2	3144	44016	Remove manually
Farm 21	Layer	Caged	Arbor Acres	40-2700	28.5	54	6.6	3	4140	131814	Remove

			（AA）	40～3600	4.5	54	6.6	3	3072		manually
Farm 22	Layer	Caged	Arbor Acres （AA）	2800～4700	33	54	6.6	2	1808	59664	Scraper
Farm 23	Layer	Caged	Arbor Acres （AA）	2800～4700	33	102	6.6	2	3616	119328	Scraper
Farm 24	Broiler	Caged	Arbor Acres （AA）	40～2550	33	102	7.8	3	16060	529980	Scraper
Farm 25	Broiler	Caged	Arbor Acres （AA）	40～2550	33	102	7.8	3	16060	529980	Scraper
Farm 26	Broiler	Caged	Arbor Acres （AA）	40～2550	33	102	7.8	3	16060	529980	Scraper
Farm 27	Broiler	Caged	Arbor Acres （AA）	40～1000	33	102	7.8	4	21212	699996	Scraper
Farm 28	Broiler	Caged	Arbor Acres （AA）	40～1000	33	102	7.8	4	21212	699996	Scraper
Farm 29	Broiler	Caged	Arbor Acres （AA）	40～1000	30	102	7.8	4	21212	636360	Scraper

Part II: North China Grid related baseline information

Table1. Calculation of Thermal Power supplied to the North China Grid in 2002 and Imported Power

Province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Thermal power Generation (MWh)	17886000	27263000	100970000	82256000	51382000	124162000
Rate of Electricity Consumption of Power Plant (%)	7.95	7.08	6.72	7.98	7.93	6.79
Thermal power Supplied (MWh)	16464063	25332780	94184816	75691971	47307407	115731400.2
Total Thermal Power of the North China Supplied to Grid (MWh)	374,712,437.40					
Net import power from the Northeast Grid (MWh)	2,905,200.00					
The total Power for the North China Grid (MWh)	377,617,637.40					

Data source: 2003 China Electric Power Yearbook.

Table2. Calculation of Thermal Power supplied to the North China Grid in 2003 and Imported Power

Province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Thermal power Generation (MWh)	18608000	32191000	108261000	93962000	65106000	139547000
Rate of Electricity Consumption of Power Plant (%)	7.52	6.79	6.5	7.69	7.66	6.79
Thermal power Supplied (MWh)	17208678	30005231.1	101224035	86736322.2	60118880.4	130071758.7
Total Thermal Power of the North China Supplied to Grid (MWh)	425,364,905.80					
Net import power from the Northeast Grid (MWh)	4,244,380.00					
The total Power for the North China Grid (MWh)	429,609,285.80					

Data source: 2004 China Electric Power Yearbook

Table3. Calculation of Thermal Power supplied to the North China Grid in 2004 and Imported Power

Province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Thermal power Generation (MWh)	18579000	33952000	124970000	104926000	80427000	163918000
Rate of Electricity Consumption of Power Plant (%)	7.94	6.35	6.5	7.7	7.17	7.32
Thermal power Supplied (MWh)	17103827.4	31796048	116846950	96846698	74660384.1	151919202.4
Total Thermal Power of the North China Supplied to Grid (MWh)	489,173,109.90					
Net import power from the Northeast Grid (MWh)	4,514,550.00					
The total Power for the North China Grid (MWh)	493,687,659.90					

Data Source: 2005 China Electric Power Yearbook.

Table 4 Calculation of average emission factor for the Northeast China Grid in 2002 to 2004

Year	Total CO_2 emission of the Northeast Grid(tCO_2e)	The total power supplied to the Northeast Grid (MWh)	Emission for the North China Grid due to power import form Northeast Grid
2002	154,209,494.94	138,139,812.60	1.11633
2003	170,716,049.72	153,809,752.10	1.10992
2004	195,958,648.61	170,132,885.10	1.1518

Table 5. Energy Consumption Statistics of Power Generation of the North China Grid in 2002

Fuel	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
		A	B	C	D	E	F
Raw coal	Ten thousand Tons	691.84	1052.74	4988.01	4037.4	3218	5162.86
Clean coal	Ten thousand Tons						80.71
Other washed coal	Ten thousand Tons	3.43		65.2	135.56		106.32
Coke	Ten thousand Tons						
Coke kven gas	10^8 Cubic meter	0.17	1.71		0.75	0.16	0.04
Other gas	10^8 Cubic meter	15.82		7.34		10.35	
Crude oil	Ten thousand Tons						14.98
Gasoline	Ten thousand Tons						0.65
Diesel oil	Ten thousand Tons	0.26	2.35	4.12		1.6	10.02
Fuel oil	Ten thousand Tons	13.94	0.04	1.22		0.42	20.33
LPG	Ten thousand Tons						
Refinery gas	Ten thousand Tons			0.27			
Natural Gas	10^8 Cubic meter		0.55			0.02	
Other petroleum products	Ten thousand Tons						
Other coking products	Ten thousand Tons						
Other energy	Ten thousand Tce					1.1	15.92

Data Source: China Energy Statistical Yearbook 2003.

Table 6. The Operation Margin Emission Factor Calculation of the North China Grid in 2002

		Fuel Consumption of the North China Grid in 2002 G	Emission factor H	Oxidation Rate I	Average NCV J	CO_2 Emission（tCO_2e）K
Fuel	Unit	G=A+B+C+D+E+F	（tc/TJ）	（%）	（MJ/t,km^3）	K=G*H*I*J*44/12/10000 (For quality unit) K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 Tons	0	25.8	98	20908	0
Clean coal	10^4 Tons	371229180.5	25.8	98	26344	9066528612305
Other washed coal	10^4 Tons	1997621.968	25.8	98	8363	15487902797
Coke	10^4 Tons	2415897.829	29.5	98	28435	72820107926
Coke oven gas	10^8 m^3	28533	13	99.5	16726	2263483809
Other gas	10^8 m^3	241325.5238	13	99.5	5227	5982650343
Crude oil	10^4 Tons	836065.8673	20	99	41816	25381635403
Gasoline	10^4 Tons	496684.0717	18.9	99	43070	14676534968
Diesel oil	10^4 Tons	62375.87269	20.2	99	42652	1950805763
Fuel oil	10^4 Tons	616647.3513	21.1	99	41816	19750060841
LPG	10^4 Tons	1193326.233	17.2	99.5	50179	37575446353
Refinery gas	10^4 Tons	50278.5	18.2	99.5	46055	1537534956
Natural Gas	10^8 m^3	54411.19895	15.3	99.5	38931	11824146366
Other petroleum products	10^4 Tons	162897.7104	20	99	38369	4537661354
Other coking products	10^4 Tons	38468	25.8	98	28435	1014074944
Other energy	10^4 Tce	28533	0	0	0	0
CO_2 emission of power import from the Northeast Grid		1.11633×2,905,200.00=3,243,159.35tCO_2e				
Total Emission (Q)		382,216,597.48tCO2e				

Thermal Power supplied to the North China Grid (P)		377,617,637.40MWh
OM Emission Factor in 2002 [= Q/P]		1.01218tCO_2e/MWh

Data sources: China Energy Statistical Yearbook 2005: p.365; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook: p. 1.8;,p. 1.6.

Table 7. Energy Consumption Statistics of Power Generation of the North China Grid in 2003

Fuel	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
		A	B	C	D	E	F
Raw coal	10^4 Tons	714.73	1052.74	5482.64	4528.5	3949.3	6808
Clean coal	10^4 Tons						9.41
Other washed coal	10^4 Tons	6.31		67.28	208.21		450.9
Coke	10^4 Tons					2.8	
Coke kven gas	10^8 m^3	0.24	1.71		0.9	0.21	0.02
Other gas	10^8 m^3	16.92		10.63		10.32	1.56
Crude oil	10^4 Tons						29.68
Gasoline	10^4 Tons						0.01
Diesel oil	10^4 Tons	0.29	1.35	4		2.91	5.4
Fuel oil	10^4 Tons	13.95	0.02	1.11		0.65	10.07
LPG	10^4 Tons						
Refinery gas	10^4 Tons			0.27			0.83
Natural Gas	10^8 m^3		0.5				1.08
Other petroleum products	10^4 Tons						
Other coking products	10^4 Tons						
Other energy	10^4 Tce	9.83					39.21

Data Source: China Energy Statistical Yearbook 2004.

Table 8. The Operation Margin Emission Factor Calculation of the North China Grid in 2003

Fuel	Unit	Fuel Consumption of the North China Grid in 2003 G	Emission factor H	Oxidation Rate I	Average NCV J	CO_2 Emission（tCO_2e） K
		G=A+B+C+D+E+F	（tc/TJ）	（%）	（MJ/t,km3）	K=G*H*I*J*44/12/10000(For quality unit） K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 Tons	22535.94	25.8	98	20908	436822883.4
Clean coal	10^4 Tons	9.41	25.8	98	26344	229820.3878
Other washed coal	10^4 Tons	732.7	25.8	98	8363	5680747.688
Coke	10^4 Tons	2.8	29.5	98	28435	84397.73393
Coke kven gas	10^8 m^3	3.08	13	99.5	16726	244332.1814
Other gas	10^8 m^3	39.43	13	99.5	5227	977500.8431
Crude oil	10^4 Tons	29.68	20	99	41816	901037.7869
Gasoline	10^4 Tons	0.01	18.9	99	43070	295.490349
Diesel oil	10^4 Tons	13.95	20.2	99	42652	436286.327
Fuel oil	10^4 Tons	25.8	21.1	99	41816	826325.7251
LPG	10^4 Tons	0	17.2	99.5	50179	0
Refinery gas	10^4 Tons	1.1	18.2	99.5	46055	33638.40313
Natural Gas	10^8 m^3	1.58	15.3	99.5	38931	343351.2148
Other petroleum products	10^4 Tons	0	20	99	38369	0
Other coking products	10^4 Tons	0	25.8	98	28435	0
Other energy	10^4 Tce	49.04	0	0	0	0
CO_2 emission of power import from the Northeast Grid		1.10992×4,244,380.00=4,710,909.27tCO_2e				
Total Emission (Q)		451,291,526.44tCO_2e				
Thermal Power supplied to the North China Grid (P)		429,609,285.80MWh				
OM Emission Factor in 2002 [= Q/P]		1.05047tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2005: p.365; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook: p. 1.8;,p. 1.6.

Table 9. Energy Consumption Statistics of Power Generation of the North China Grid in 2004

		Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Fuel	Unit	A	B	C	D	E	F
Raw coal	10^4 Tons	823.09	1410	6299.8	5213.2	4932.2	8550
Clean coal	10^4 Tons						40
Other washed coal	10^4 Tons	6.48		101.04	354.17		284.22
Coke	10^4 Tons					0.22	
Coke kven gas	10^8 m^3	0.55		0.54	5.32	0.4	8.73
Other gas	10^8 m^3	17.74		24.25	8.2	16.47	1.41
Crude oil	10^4 Tons						
Gasoline	10^4 Tons						
Diesel oil	10^4 Tons	0.39	0.84	4.66			
Fuel oil	10^4 Tons	14.66		0.16			
LPG	10^4 Tons						
Refinery gas	10^4 Tons		0.55	1.42			
Natural Gas	10^8 m^3		0.37		0.19		
Other petroleum products	10^4 Tons						
Other coking products	10^4 Tons						
Other energy	10^4 Tce	9.41		34.64	109.73	4.48	

Data sources: China Energy Statistical Yearbook 2005.

Table 10. The Operation Margin Emission Factor Calculation of the North China Grid in 2004

Fuel	Unit	Fuel Consumption of the North China Grid in 2004 G	Emission factor H	Oxidation Rate I	Average NCV J	CO_2 Emission（tCO_2e） K
		G=A+B+C+D+E+F	（tc/TJ）	（%）	（MJ/t,km^3）	K=G*H*I*J*44/12/10000（For quality unit） K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 Tons	27228.29	25.8	98	20908	527776527.1
Clean coal	10^4 Tons	40	25.8	98	26344	976919.8208
Other washed coal	10^4 Tons	745.91	25.8	98	8363	5783167.065
Coke	10^4 Tons	0.22	29.5	98	28435	6631.250523
Coke kven gas	10^8 m^3	15.54	13	99.5	16726	1232766.915
Other gas	10^8 m^3	68.07	13	99.5	5227	1687509.064
Crude oil	10^4 Tons	0	20	99	41816	0
Gasoline	10^4 Tons					
Diesel oil	10^4 Tons	5.89	20.2	99	42652	184209.7825
Fuel oil	10^4 Tons	14.82	21.1	99	41816	474656.87
LPG	10^4 Tons	0	17.2	99.5	50179	0
Refinery gas	10^4 Tons	1.97	18.2	99.5	46055	60243.32197
Natural Gas	10^8 m^3	0.56	15.3	99.5	38931	121694.1015
Other petroleum products	10^4 Tons	0	20	99	38369	0
Other coking products	10^4 Tons	0	25.8	98	28435	0
Other energy	10^4 Tce	158.26	0	0	0	0
CO_2 emission of power import from the Northeast Grid		1.15180×4,514,550.00 =5,199,847.85tCO_2e				
Total Emission (Q)		543,504,173.12tCO_2e				
Thermal Power supplied to the North China Grid (P)		493,687,659.90MWh				
OM Emission Factor in 2002 [= Q/P]		1.10091tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2005: p.365; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook: p. 1.8; p. 1.6.

Table 11 Full-weighted Average OM three years of the North China Grid

Year	2002	2003	2004
Total CO_2 Emission (TCO_2e)	382,216,597.48	451,291,526.44	543504173.1
Total Supply (MWh)	377,617,637.40	429,609,285.80	493687659.9
Full-weighted average OM	= (382,216,597.48 +451,291,526.44+543,504,173.12) /(377,617,637.40+429,609,285.80 +493,687,659.90)= 1.0585tCO_2e/MWh		

Table 12. Calculation of CO_2 Emission of Solid, Liquid and Gas Fuel for Power Generation in 2004

Fuel	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Fuel Consumption of the North China Grid in 2004 G G=A+B+C+D+E+F	Emission factor H （tc/TJ）	Oxidation Rate I （%）	Average NCV J （MJ/t,km^3）	CO_2 Emission（tCO_2e） K=G*H*I*J*44/12/10000 （For quality unit） K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 Tons	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	25.8	98	20908	527776527
Clean coal	10^4 Tons						40	40	25.8	98	26344	976920
Other washed coal	10^4 Tons	6.48		101.04	354.17		284.22	745.91	25.8	98	8363	5783167
Coke	10^4 Tons					0.22		0.22	29.5	98	28435	6631
Coal Fuel Subtotal												534,543,245
Crude oil	10^4 Tons							0	20	99	41816	0
Gasoline	10^4 Tons											0
Coal oil	10^4 Tons											0
Diesel oil	10^4 Tons	0.39	0.84	4.66				5.89	20.2	99	42652	184210
Fuel oil	10^4 Tons	14.66		0.16				14.82	21.1	99	41816	474657
Other petroleum products	10^4 Tons							0	20	99	38369	0
Oil Fuel Subtotal												658867
Natural Gas	10^8 m^3		0.37		0.19			0.56	15.3	99.5	38931	12169
Coke oven gas	10^8 m^3	0.55		0.54	5.32	0.4	8.73	15.54	13	99.5	16726	123277
Other gas	10^8 m^3	17.74		24.25	8.2	16.47	1.41	68.07	13	99.5	5227	168751
LPG	10^4 Tons							0	17.2	99.5	50179	0
Refinery gas	10^4 Tons		0.55	1.42				1.97	18.2	99.5	46055	60243
Gas Fuel Subtotal												364440
Total												535,566,552

Table13. Calculating of Emission Factor for Various Power Plant

	Variable	Power Supply Efficiency L	Emission Factor for Fuels (tc/TJ) I	Oxidation Rate J	Emission Factor (tCO_2e/MWh) O=3.6/L/1000*I*J*44/12
Coal-fired Power Plant	$EF_{Coal,Adv}$	36.53%	25.8	0.980	0.9136
Gas-fired Power Plant	$EF_{Oil,Adv}$	45.87%	15.3	0.995	0.4381
Oil-fired Power Plant	$EF_{Gas,Adv}$	45.87%	21.1	0.990	0.6011

Therefore, the emission factor of thermal power is:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9104tCO_2e / MWh$$

Table14. Installed Capacity of the North China Grid in 2004

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal Power	MW	3,458.5	6,008.5	19,932.7	17,693.3	13,641.5	32,860.4	93,594.9
Hydro Power	MW	1,055.9	5.0	783.8	787.3	567.9	50.8	3,250.7
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and others	MW	0.0	0.0	13.5	0.0	111.8	12.4	137.7
Total	MW	4,514.4	6,013.5	20,730.0	18,480.5	14,312.2	32,923.6	96,983.2

Data Source: 2005 China Electric Power Yearbook.

Table15. Installed Capacity of the North China Grid in 2002

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal Power	MW	3,407.5	6,245.5	16,745.7	14,327.8	9,778.7	25,102.4	75,607.6
Hydro Power	MW	1,038.5	5.0	775.9	795.3	592.1	50.8	3,257.6
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and others	MW	0.0	0.0	13.5	0.0	76.6	0	90.1
Total	MW	4,446	6,250.5	17,535.1	15,123.1	10,447.4	25,153.1	78,955.2

Data Source: 2003 China Electric Power Yearbook.

Table16. Installed Capacity of the North China Grid in 2001

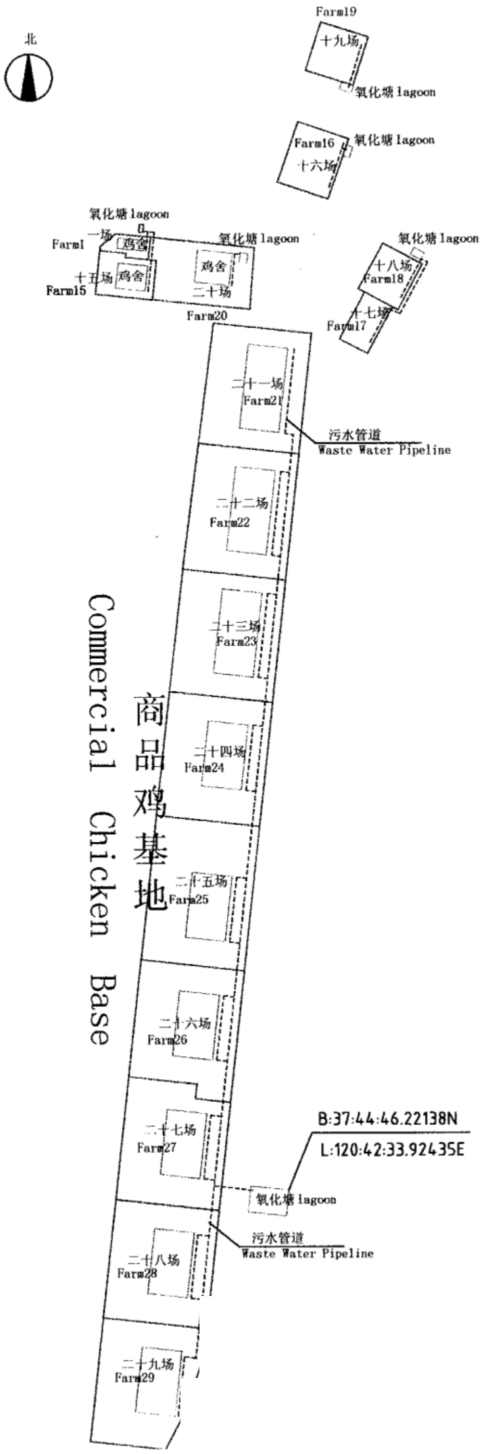
Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal Power	MW	3,412.5	5,632	16,474.9	13,415.8	8,898.3	20,957.7	68,791.3
Hydro Power	MW	1,058.1	5.0	742.6	795.9	566.2	56.2	3,224
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and others	MW	0.0	0.0	9.9	0.0	46.7	0.0	56.6
Total	MW	4,470.6	5,637	17,227.4	14,211.8	9,511.2	21,013.9	72,071.9

Data Source: 2002 China Electric Power Yearbook.

Table17. The BM Calculation of the North China Grid

	Installed Capacity in 2001	Installed Capacity in 2002	Installed Capacity in 2004	Capacity Addition Of 2001-2004	Ratio of Capacity Addition
Thermal Power (MW)	68,791.3	75,607.6	93,594.9	24803.6	99.58%
Hydro Power (MW)	3,224	3,257.6	3,250.7	26.7	0.10%
Nuclear Power (MW)	0.0	0.0	0.0	0.0	0.00%
Wind Power and others (MW)	56.6	90.1	137.7	81.1	0.32%
Total（ MW）	72,071.9	78,955.2	96,983.2	24911.3	100.00%
Percent of Installed Capacity in 2004	74.31%	81.41%	100.00%	-	-

Therefore, the BM was calculated as $EF_{BM,y} = 0.9104 \times 99.85\% = 0.9066 tCO_2e / MWh.$ The baseline emission factor was calculated as the weighted average of the OM Emission Factor (1.0585tCO_2e/MWh) and the BM Emission Factor (0.9066tCO_2e/MWh). The defaults weights of OM Emission Factor and the BM Emission Factor for wind power projects are used as 0.5 and 0.5 respectively. We obtain a baseline emission factor of 0.9826 tCO_2e/MWh.



Farm location in Shandong Minhe Livestock Co. Ltd. (Scale 1:13000)

Annex 4

MONITORING PLAN

Monitoring plan is provided in Section B7.2.
