



**MONITORING REPORT FORM (F-CDM-MR)**  
**Version 02.0**

**MONITORING REPORT**

<b>Title of the project activity</b>	Animal Manure Management System (AMMS) GHG Mitigation Project , Shandong Minhe Livestock Co. Ltd., Penglai, Shandong Province, P.R. of China
<b>Reference number of the project activity</b>	1891
<b>Version number of the monitoring report</b>	01
<b>Completion date of the monitoring report</b>	24/04/2012
<b>Registration date of the project activity</b>	27/04/2009
<b>Monitoring period number and duration of this monitoring period</b>	Monitoring period number : 2 <sup>nd</sup> monitoring period Duration of this monitoring period: 01/05/2010 - 31/12/2011
<b>Project participant(s)</b>	<ol style="list-style-type: none"> <li>China: Shandong Minhe Livestock Co. Ltd.</li> <li>Netherlands: Netherlands' Ministry of Infrastructure and the Environment (IenM)</li> <li>Kingdom of Belgium : Walloon Region Ministry of the Environment ; Bruxelles Environnement - IBGE</li> <li>Canada: Government of Canada - Ministry of Foreign Affairs and International Trade</li> <li>Denmark: Aalborg Portland A/S; Danish Ministry of Climate and Energy/Danish Energy Agency; Dong Naturgas A/S; Maersk Olie og Gas A/S; Nordjysk Elhandel A/S</li> <li>Luxembourg: Government of Luxembourg - Ministry of the Environment</li> <li>Spain: Endesa Generación S.A.; Hidroeléctrica del Cantábrico, S.A.; Gas Natural SDG, S.A.; Kindom of Spain - Ministry of Environment and Rural and Marine Affairs &amp; Ministry of Economy and Finance; EDP-Energias de Portugal, S.A.</li> <li>Italy: Ministry for the Environment, Land and Sea</li> </ol>



	<p>9. Japan: Daiwa Securities Capital Markets Co. Ltd.; FUJIFILM Corporation; Idemitsu Kosan Co., Ltd.; JX Nippon Oil &amp; Energy Corporation; The Okinawa Electric Power Corporation, Incorporated</p> <p>10. Germany: BASF SE; KfW</p> <p>11. Sweden: Göteborg Energi AB</p> <p>12. Finland: Ruukki Metals Oy</p> <p>13. Norway: Stratkraft Carbon Invest AS; Statoil ASA</p> <p>14. Austria: Kommunalkredit Public Consulting GmbH</p> <p>15. Switzerland: Schweizerische Rückversicherungsgesellschafts AG (Swiss RE)</p>
<b>Host Party(ies)</b>	China
<b>Sectoral scope(s) and applied methodology(ies)</b>	<p>Sectoral scopes: 13- Waste handling and disposal; 15- Agriculture 1- Renewable energy</p> <p>Applied methodology(ies): ACM0010-Version 02: Consolidated baseline methodology for GHG emission reductions from manure management systems</p>
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	120,948 tCO <sub>2</sub> e
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period</b>	118,930 tCO <sub>2</sub> e

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

#### 1. Purpose of the project activity and the measures taken to reduce greenhouse gas emissions

Animal Manure Management System (AMMS) GHG Mitigation Project is located in Penglai city. 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.

#### 2. Brief description of the installed technology and equipment

The technology employed by the project activity includes installation of new mesophilic temperature anaerobic digesters with biogas capture and power generation. The total volume of the anaerobic digesters is of 26,400 m<sup>3</sup> and three sets of 1063 KW co-generators were installed; the annual electricity generation capacity from biogas is 22.96 million kWh. The Total mixed reactor (CSTR) anaerobic reactors have sufficient capacity and hydraulic retention time to eliminate the volatile solids loading in the effluent. Processed effluent was applied to the land with aerobic condition. The electricity that was produced based on captured biogas, was supplied to the China North Grid.

#### 3. Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.).

Construction of the project started with the breaking ground of digesters in 16/12/2007; the whole system was put into operation on 15/02/2009.

#### 4. Total emission reductions achieved in this monitoring period.

This monitoring report is for the 2<sup>nd</sup> monitoring period, which is from 01/05/2010 to 31/12/2011. Total emission reductions achieved in this monitoring period are 118,930 tCO<sub>2</sub>e.

### A.2. Location of project activity

All the project activities are located in the area of Minhe, Penglai, Shandong Province, People's Republic of China, which is located within [37.416667N, 120.583333E]; [37.833333N, 120.583333E]; [37.416667N, 121.133333E]; and [37.833333N, 120.583333E]. The 16 farms are located at [37.746173N 120.709423E]. There are 2,669,299 broilers and 597,000 layers included in farms numbered No. 1 and No.15 to No.29. The biogas digesters and power station are located within the farms.



**A.3. Parties and project participant(s)**

<b>Party involved (host) indicates a host Party)</b>	<b>Private and/or public entity(ies) project participants (as applicable)</b>	<b>Indicate if the Party involved wishes to be considered as project participant (Yes/No)</b>
China (host)	Private entity: Shandong Minhe Livestock Co. Ltd.	No
Netherlands	Public entity: Netherlands' Ministry of Infrastructure and the Environment (IenM)	Yes
Belgium	Public entities: Walloon Region Ministry of the Environment; Bruxelles Environnement - IBGE	Yes
Canada	Public entity: Government of Canada - Ministry of Foreign Affairs and International Trade	Yes
Denmark	Public entity: Danish Ministry of Climate and Energy; Danish Energy Agency Private entity: Aalborg Portland A/S; Dong Naturgas A/S ; Maersk Olie og Gas A/S ; Nordjysk Elhandel A/S	Yes
Luxembourg	Public entity: Government of Luxembourg - Ministry of the Environment	Yes



Spain	Public entity: Kingdom of Spain - Ministry of Environment and Rural and Marine Affairs; Ministry of Economy and Finance Private entity: Endesa Generación S.A. ; Hidroeléctrica del Cantábrico, S.A.; Gas Natural SDG, S.A. ; EDP-Energias de Portugal, S.A.	Yes
Italy	Public entity: Ministry for the Environment, Land and Sea	Yes
Japan	Private entities: Daiwa Securities Capital Markets Co. Ltd.; FUJIFILM Corporation; Idemitsu Kosan Co., Ltd. ; JX Nippon Oil & Energy Corporation; The Okinawa Electric Power Corporation, Incorporated	No
Germany	Private entities: BASF SE; KfW	No
Sweden	Private entities: Göteborg Energi AB	No
Finland	Private entity: Ruukki Metals Oy	No
Norway	Private entities: Stratkraft Carbon Invest AS; Statoil ASA	No
Austria	Private entity: Kommunalkredit Public Consulting GmbH	No
Switzerland	Private entity : Schweizerische Rückversicherungsgesellschafts AG (Swiss RE)	No

#### **A.4. Reference of applied methodology**

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>

#### **A.5. Crediting period of project activity**

The crediting period of the project activity is from 27/04/2009 to 26/04/2019.

### **SECTION B. Implementation of project activity**

#### **B.1. Description of implemented registered project activity**

The construction of all biogas digesters was completed in October 2008. The test run period of biogas power plant was from November 2008 to February 2009. On 15/02/2009, the generated power was sent to the grid. Thus the starting date of operation and monitoring of the project activity was defined as 15/02/2009. During this monitoring period, there was no special event occurred, such as overhaul and downtimes of biogas digesters and power generators. All the equipment operates well and no equipment was under maintenance during this monitoring period.

#### **B.2. Post registration changes**

##### **B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

No temporary deviations from registered monitoring plan or applied methodology during the monitoring period.

##### **B.2.2. Corrections**

No corrections applied during the monitoring period.

##### **B.2.3. Permanent changes from registered monitoring plan or applied methodology**

No permanent changes from registered monitoring plan or applied methodology during the monitoring period

##### **B.2.4. Changes to project design of registered project activity**

During project implementation, three sets of 1,063 KW co-generators were installed at the project site, with total installed capacity being changed to 3,189 KW compared to 3,000 KW estimated in the PDD. The estimation of annual electricity generated by the project activity is updated as 22.96 million KWh, against the amount of 16.88 million KWh in the registered PDD. A reassessment was then performed as per paragraph 10(b) of EB 48 Annex 66.

It has been validated by the DOE that the change of co-generators installed has no impact on the additionality and operation of the project activity. The request for notification of changes with was submitted to the secretariat on 28/09/2010 and the change was accepted by EB on 27/02/2011, the approval change was included in registered PDD version 09 which completed on 12/07/2010.

The scale of the CDM project activity remains the same.

##### **B.2.5. Changes to start date of crediting period**

No changes to start date of crediting period.

## B.2.6. Types of changes specific to afforestation or reforestation project activity

NA.

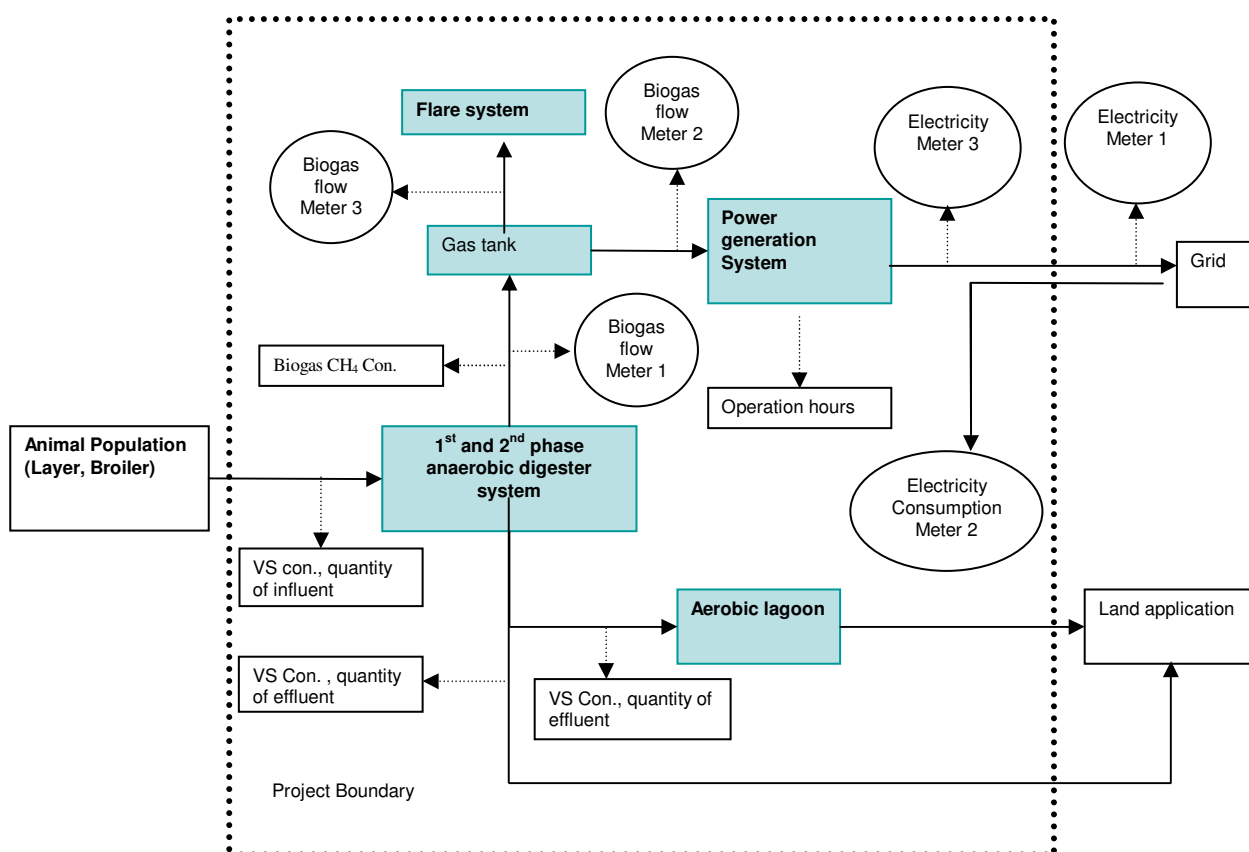
### SECTION C. Description of monitoring system

#### 1. Data collection procedure

In accordance with the Monitoring Methodology ACM0010 version 02, the location and ID numbers of the monitoring equipment for key parameters that must be monitored ex-post are described in Figure C1 and Table C1.

**Table C1: ID number of monitoring equipment for key parameters**

	Name of equipment	ID number
1	Electricity meter 1	200808251408/ 200808251072
2	Electricity meter 2	623154
3	Electricity meter 3	200808251215
4	Biogas flow meter 1	8060604
5	Biogas flow meter 2	8060602
6	Biogas flow meter 3	8060601



**Figure C1 Location of Monitoring Equipment**

#### 1) Electricity exported to grid: $EG_{d,y}$ .

The power supply of the project is measured through an electric meter (electricity meter 1) installed by the grid company at the transformer. The grid company records the readouts of electricity meter 1 on a given date, as recorded on excel file named ERs calculation spreadsheet-Minhe second monitoring period, every month. Minhe installs another electricity meter (electricity meter 3) at the outlet of biogas power generator

and records the readout of electricity meter 3 every month. Meter 3 serves as backup meter of meter 1.

The readout records of electricity meters 1 has been recorded monthly. It is 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 meter was calibrated periodically by an officially accredited entity, such as Metrological Institute of Yantai City. Collected data is archived in both electronic and printed copies. The level of accuracy was deducted from annual electricity supply while calculating the emission reduction.

### **2) The electricity used in project AMMSs: $EL_{Pr,y}$**

The local grid company reads the electricity meter, (electricity meter 2) installed in project site, once every month and issues the sales invoices based on the readings of the meter, and the electricity consumption of the biogas plant for the monitoring period is the sum of the monthly consumption. The electricity meter used was calibrated periodically by an officially accredited entity; the original collected data is archived in both electronic and printed copies. The level of accuracy was deducted from the annual electricity supply while calculating the emission reduction.

### **3) Biogas flow: $V_f$**

The Minhe responsible staff reads the biogas flow meters (biogas flow meter 1 installed at the outlet of the anaerobic digesters, biogas flow meter 3 installed at the inlet of the flare, biogas flow meter 2 installed at the inlet of the power generator) every day and copies picture of the screen of monitoring computer. The daily biogas production or biogas flow to the flare was determined by taking the reading minus the outputs of the previous reading. The weekly biogas production or biogas flow to the flare is the sum of the daily output, same principle was applied to calculate the monthly/annual biogas production or biogas flow to the flare. The biogas flow meters used were calibrated periodically by an officially accredited entity. In addition, the biogas flow meter automatically measured temperature and pressure and automatically displayed biogas volumes in normalized cubic meters, it is not necessary to separately measure the biogas temperature and pressure according to the monitoring plan of the registered PDD which was updated as version 09 and was approval on 27/02/2011. Original collected data is archived in both electronic and printed copies.

### **4) Methane fraction of biogas: $C_{CH_4}$**

$CH_4$  fraction of biogas was measured continuously through onsite gas analyser installed at the outlet of the anaerobic digesters. The Minhe staffs download hourly recordings of gas analyser once per day. Monthly  $CH_4$  concentration was calculated based on the daily average  $CH_4$  concentration. Gas analysis meter was calibrated periodically by an officially accredited entity. Original collected data is archived in both electronic and printed copies. The level of accuracy was deducted from average concentration values while calculating the emission reduction.

### **5) Influent flow rate measurement**

The Minhe staff read cumulative operational hours of influent pumps installed at the inlet of biogas digesters every day. The daily operational time of influent pumps is calculated by the hour reading as of the day minus the hours on the previous reading. The daily influent amount was calculated based on the operation hours of pump and flow rate of pumps. The weekly influent is the sum of the daily influent, same principle was applied to calculate the monthly/annual influent. Original collected data is archived in both electronic and printed copies.

### **6) Effluent flow rate measurement**

The Minhe staff read cumulative of effluent flow rate installed at the outlet of biogas digesters (same to inlet of aerobic lagoon) every day. The daily effluent quantity was the reading to date minus reading of previous day. The weekly influent is the sum of the daily effluent, same principle was applied to calculate the monthly/annual effluent. Original collected data is archived in both electronic and printed copies.



## 7) VS concentration measurement

Samples were taken from sample points located before the inlet of biogas digesters and inlet of aerobic lagoon for 5 consecutive days quarterly. VS concentration of collected samples was analysed in Penglai inspection testing center, the average of VS concentration for 5 consecutive days was applied to calculate the fraction of Volatile solids directed to the stages of anaerobic digesters and aerobic treatment respectively. Original collected data is archived in both electronic and printed copies.

## 8) Average chicken population used in both baseline and project case emission estimation: $N_{LT}$

The populations of the chicken are recorded daily by the technicians in farms. The data on the start date and hand-in chicken numbers, end date and hand-out chicken number of each flock were also recorded. The relevant monthly/flock data of chicken is checked by the operators in the farm and delivered to the CDM monitor division, a report for every flock of chicken is generated by the CDM monitor staff in the form of Excel tables, and the original collected data is archived in both electronic and printed copies.

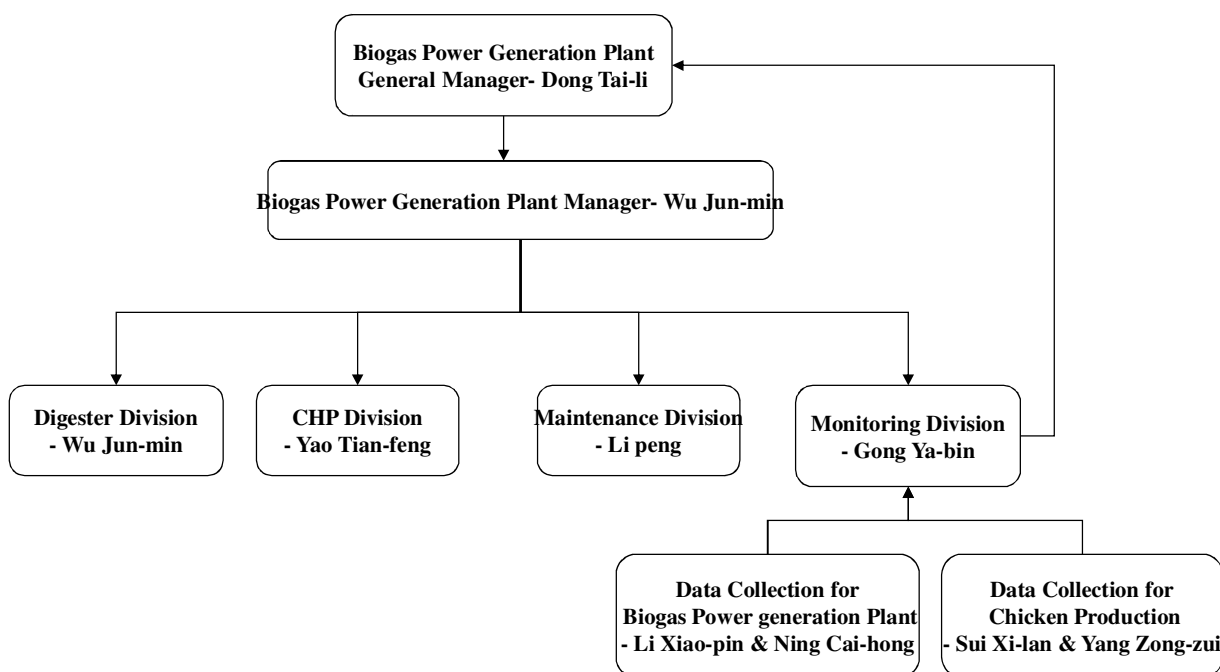
## 9) Weight of chicken: $W_{site}$

0.2% of broiler and layers for each flock was sampled and weighted weekly by the technicians in each farm, Site weight of each flock was estimated based on average weight of sampled chicken in each flock. After every month or when every flock of broiler is finished, the weighing result is checked by the CDM broiler farm operators and delivered to the CDM monitor division. A report on chicken weight for every month or every flock of broiler is generated by the CDM monitor staff in the form of Excel tables, and the original collected data is archived in both electronic and printed copies.

## 2. *Organizational structure*

Figure C2 outlines the Project's operational and management structure. General Manager of Biogas power generation plant is responsible for implementation and supervision of the CDM monitoring activity and is the liaison of the CDM project. Since March 2009, Ms. DONG Tai-li has been serving as General Manager. Digester division is responsible for daily operation of the digesters, power generation division (here refers to CHP) is responsible for the daily operation of the power generators; maintenance division is responsible for daily check and maintenance of the CDM project activity, above three division ensure the sustainable operating of project system.

Monitoring division is responsible for monitoring the CDM data: the data collection personnel are responsible for collecting, processing and submitting data. Internal verification personnel are responsible for meter calibration and data review and archiving in order to ensure data accuracy and completeness. Monitored data was reviewed and approved by General Manager before it is accepted and stored.



**Figure C2: Project's operational and management structure**

### 3. Emergency procedure:

If abnormal operation occurs, the responsible staff should immediately report to Project General Manager. When erroneous measurement is detected by operators involved in implementation of the monitoring plan, the erroneous measurement should be reported to the Project General Manager instantly. The Project Manager takes the responsibility to handle the erroneous measurement as follows: If the reason for erroneous measurement is the malfunction of the meter(s), recalibrate or replace the meter as appropriate. At the same time, training courses will be re-arranged for relevant employees to ensure the correct implementation of the monitoring plan, so as to prevent error.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante or at renewal of crediting period

<b>ID Number:</b>	1
<b>Data/Parameter</b>	$EF_{N_2O, D, i}$ , $EF_{N_2O, ID, j}$
<b>Unit</b>	kg N <sub>2</sub> O-N/ kg N and kg N <sub>2</sub> O-N/ kg NH <sub>3</sub> -N and NO <sub>x</sub> -N
<b>Description</b>	N <sub>2</sub> O emission factors (direct and indirect emissions)
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) applied</b>	$EF_{N_2O, D}=0$ for anaerobic lagoon and digester; $EF_{N_2O, D}=0.01$ for aerobic lagoon; $EF_{N_2O, ID, j}=0.01$ for indirect N <sub>2</sub> O emission
<b>Purpose of data</b>	Data on $EF_{N_2O, D}=0$ for anaerobic lagoon and $EF_{N_2O, ID, j}=0.01$ are used for baseline emission Data on $F_{N_2O, D}=0$ for a digester, $EF_{N_2O, D}=0.01$ for aerobic lagoon, as well as $EF_{N_2O, ID, j}=0.01$ are used for project emission
<b>Additional comment</b>	Default values in IPCC 2006 Guidelines were used because country specific or region specific data are not available.



<b>ID Number:</b>	2
<b>Data/Parameter</b>	$F_{\text{gas}}$
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of N lost due to volatilization
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) applied</b>	40% for lagoon, 20% for land application
<b>Purpose of data</b>	Data on 40% for lagoon and 20% for land application are used for Baseline, Project and Leakage emission calculations.
<b>Additional comment</b>	Default values in IPCC 2006 Guidelines were used because country specific or region specific data are not available.

<b>ID Number:</b>	3
<b>Data/Parameter</b>	$EF_1, EF_4, EF_5$
<b>Unit</b>	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 $EF_4$
<b>Description</b>	$EF_1$ is emission factor for direct $N_2O$ from soils; $EF_4$ is emission factor for direct $N_2O$ emissions from atmospheric deposition of N on soils and water surfaces; $EF_5$ is emission factor for indirect $N_2O$ emission of from runoff.
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) applied</b>	$EF_1=0.01, EF_4=0.01, EF_5=0.0075$
<b>Purpose of data</b>	Data on $EF_1=0.01, EF_4=0.01, EF_5=0.0075$ were used for baseline, project and leakage emission calculations.
<b>Additional comment</b>	Default values in IPCC 2006 Guidelines may be used because country specific or region specific data are not available.

<b>ID Number:</b>	4
<b>Data/Parameter</b>	$F_{\text{leach}}$
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of N leached
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) applied</b>	0
<b>Purpose of data</b>	Data were used for leakage emission calculations.
<b>Additional comment</b>	Default values in IPCC 2006 Guidelines were used because country specific or region specific data are not available.

<b>ID Number:</b>	5
<b>Data/Parameter</b>	$EG_{\text{Bl},y}$
<b>Unit</b>	MWh
<b>Description</b>	Electricity consumption by baseline AMMS
<b>Source of data</b>	Project proponents
<b>Value(s) applied</b>	$182 \times 610 / 365 = 304$
<b>Purpose of data</b>	data are used for baseline emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	6
-------------------	---



<b>Data/Parameter</b>	$N_{dy}$
<b>Unit</b>	Number
<b>Description</b>	Number of days treatment plant was operational.
<b>Source of data</b>	Project proponents
<b>Value(s) applied</b>	610
<b>Purpose of data</b>	Data are used for baseline, project and leakage emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	7
<b>Data/Parameter</b>	$MS\%_{Bl,j}$
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of manure handled in open lagoon system in the baseline
<b>Source of data</b>	Project proponents
<b>Value(s) applied</b>	100%
<b>Purpose of data</b>	Data are used for baseline emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	8
<b>Data/Parameter</b>	$GWP_{CH_4}$
<b>Unit</b>	$tCO_2\ e/tCH_4$
<b>Description</b>	Global warming potential for $CH_4$
<b>Source of data</b>	IPCC
<b>Value(s) applied</b>	21
<b>Purpose of data</b>	Data are used for baseline, project and leakage emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	9
<b>Data/Parameter</b>	$GWP_{N_2O}$
<b>Unit</b>	$tCO_2e/tN_2O$
<b>Description</b>	Global warming potential for $N_2O$
<b>Source of data</b>	IPCC
<b>Value(s) applied</b>	310
<b>Purpose of data</b>	Data are used for baseline, project and leakage emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	10
<b>Data/Parameter</b>	$D_{CH_4}$
<b>Unit</b>	$t/m^3$
<b>Description</b>	Density of methane
<b>Source of data</b>	ACM0010
<b>Value(s) applied</b>	0.00067
<b>Purpose of data</b>	Data are used for baseline, project and leakage emission calculations.



<b>Additional comment</b>	0.00067 t/m <sup>3</sup> is density of methane at room temperature 20°C and 1 atm pressure
---------------------------	--

<b>ID Number:</b>	11
<b>Data/Parameter</b>	MCF <sub>d</sub>
<b>Unit</b>	t/m <sup>3</sup>
<b>Description</b>	Methane conversion factor for leakage calculation.
<b>Source of data</b>	ACM0010
<b>Value(s) applied</b>	1
<b>Purpose of data</b>	Data are used for leakage emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	12
<b>Data/Parameter</b>	CF <sub>N2O-N,N</sub>
<b>Unit</b>	
<b>Description</b>	Conversion factor N to N <sub>2</sub> O
<b>Source of data</b>	ACM0010
<b>Value(s) applied</b>	44/28
<b>Purpose of data</b>	Data are used for baseline, project and leakage emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	13
<b>Data/Parameter</b>	EF <sub>OM, y</sub>
<b>Unit</b>	tCO <sub>2</sub> /MW•h
<b>Description</b>	Operating Margin Emission Factor
<b>Source of data</b>	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 ( <a href="http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/2006121591135575.pdf">http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/2006121591135575.pdf</a> ).
<b>Value(s) applied</b>	1.0585
<b>Purpose of data</b>	Data are used for baseline and project emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	14
<b>Data/Parameter</b>	EF <sub>BM, y</sub>
<b>Unit</b>	tCO <sub>2</sub> /MW•h
<b>Description</b>	Build Margin Emission Factor
<b>Source of data</b>	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 ( <a href="http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/2006121591135575.pdf">http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/2006121591135575.pdf</a> ).
<b>Value(s) applied</b>	0.9066



<b>Purpose of data</b>	Data are used for baseline and project emission calculations.
<b>Additional comment</b>	

<b>ID Number:</b>	15
<b>Data/Parameter</b>	$\eta_{flare,h}$
<b>Unit</b>	percent
<b>Description</b>	Flare efficiency in hour h
<b>Source of data</b>	Tool to determine project emissions from flaring gases containing methane
<b>Value(s) applied</b>	0 %
<b>Purpose of data</b>	Data are used for project emission calculations.
<b>Additional comment</b>	It is conservative to set flare efficiency as zero.

<b>ID Number:</b>	16
<b>Data/Parameter</b>	$NCV_{CH_4}$
<b>Unit</b>	GJ/t
<b>Description</b>	Net calorific value of methane
<b>Source of data</b>	Rose and Cooper, 7 <sup>th</sup> edition 1977 “Technical Data on Fuel” WEC British National Committee, Edinburgh
<b>Value(s) applied</b>	50.04
<b>Purpose of data</b>	Data are used for project emission calculations.
<b>Additional comment</b>	

## D.2. Data and parameters monitored

<b>ID Number:</b>	1
<b>Data/Parameter</b>	MCF
<b>Unit</b>	Fraction
<b>Description</b>	Methane conversion factor
<b>Measured/Calculated/Default</b>	Calculated as per IPCC Guidelines
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) of monitored parameter</b>	73%
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	Annual average temperature during the monitoring period was 14.1 °C according to the record Penglai Meteorological Station. According to IPCC 2006 Guideline, when annual average temperature=14 °C, the MCF for lagoon is 73%
<b>QA/QC procedures</b>	IPCC default factor was applied resulting in no error due to measurement.
<b>Purpose of data</b>	The data was used for baseline emission calculations
<b>Additional comment</b>	-



<b>ID Number:</b>	2
<b>Data/Parameter</b>	B <sub>O,LT</sub>
<b>Unit</b>	m <sup>3</sup> CH <sub>4</sub> /kg-VS
<b>Description</b>	Maximum methane production
<b>Measured/Calculated/Default</b>	Default
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) of monitored parameter</b>	0.36 for broiler; 0.39 for layer
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually, according to published information such as IPCC
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	Developed country values were applied because following conditions are satisfied: 1) Genetic source -Arbor Acres(AA) of the production operations livestock originate from US which is Annex I Party; 2) Formulated feed rations (FFR) used by farms are optimized for various chicken, stage and productivities. 3) Farms keep the recording of FFR use which have been used at the project site 4) The project animal weight is similar to developed country IPCC default values.
<b>Purpose of data</b>	The data was used for baseline, project, and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	3
<b>Data/Parameter</b>	VS <sub>LT,y</sub>
<b>Unit</b>	kg dry matter/animal/year
<b>Description</b>	Volatile solid excretion per animal per year
<b>Measured/Calculated/Default</b>	Calculated based on default
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) of monitored parameter</b>	5.073 for broiler 12.368 for layer
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually, estimated or based on published information such as IPCC
<b>Calculation method (if applicable)</b>	According to equation (4) in ACM0010, site-specific average VS was calculated based on default VS value provided by IPCC 2006, default weight, and measured site average weight of chicken. Please refer to the calculation in section E. $VS_{LT,y} = \left[ \frac{W_{site,LT}}{W_{default}} \right] \times VS_{default} \times nd_y$



<b>QA/QC procedures</b>	Values for developed countries were applied because genetic source of the production operations livestock originate from an Annex I Party; formulated feed rations (FFR) have been used at the project site.
<b>Purpose of data</b>	The data was used for baseline, project, and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	4
<b>Data/Parameter</b>	CEFB <sub>elec,y</sub>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Emission factor of baseline electricity use
<b>Measured/Calculated/Default</b>	Default
<b>Source of data</b>	ACM0010 version 02.
<b>Value(s) of monitored parameter</b>	0.8
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	At start of project
<b>Calculation method (if applicable)</b>	
<b>QA/QC procedures</b>	In cases where electricity would, in the absence of the project activity, be purchased from the grid, and project electricity consumption of 184Mwh is less than small scale threshold (15 GWh/yr), according to ACM0010 version 2. Default emission factor of 0.8 tCO <sub>2</sub> /MWh was applied.
<b>Purpose of data</b>	The data was used for baseline emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	5
<b>Data/Parameter</b>	CEF <sub>grid</sub>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Emission factor of exported electricity
<b>Measured/Calculated/Default</b>	Calculated
<b>Source of data</b>	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. For 2010, data issued by China NDRC on December 20, 2010 ( <a href="http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf">http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf</a> ); for 2011, data issued by China NDRC on October 20, 2011, <a href="http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf">http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf</a> . Respectively.
<b>Value(s) of monitored parameter</b>	0.87045 as per the data issued by China NDRC on December 20, 2010 0.81145 as per the data issued by China NDRC on October 20, 2011As a conservative approach, lower value of 0.81145 tCO <sub>2</sub> /MWh was adopted for baseline emissions calculation in this monitoring period.





<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	According to NDRC publication of Emission factors for grids
<b>QA/QC procedures</b>	
<b>Purpose of data</b>	The data was used for baseline emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	6
<b>Data/Parameter</b>	CEF <sub>d</sub>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Emissions factor for project activity consumption electricity
<b>Measured/Calculated/Default</b>	Calculated
<b>Source of data</b>	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. for 2010, data issued by China NDRC on December 20, 2010 ( <a href="http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf">http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf</a> ); for 2010, data issued by China NDRC on October 20, 2011, <a href="http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf">http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf</a> .
<b>Value(s) of monitored parameter</b>	0.87045 as per the data issued by China NDRC on December 20, 2010 0.81145 as per the data issued by China NDRC on October 20, 2011, As a conservative approach, higher value of 0.87045 tCO <sub>2</sub> /MWh was adopted for project emissions calculation in this monitoring period.
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	According to NDRC publication of Emission factors for grids
<b>QA/QC procedures</b>	
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	7
<b>Data/Parameter</b>	LF <sub>AD</sub>
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of methane leakage from anaerobic digester
<b>Measured/Calculated/Default</b>	Default
<b>Source of data</b>	ACM0010 version 02
<b>Value(s) of monitored parameter</b>	0.09
<b>Monitoring equipment</b>	NA



<b>Measuring/Reading/Recording frequency</b>	NA
<b>Calculation method (if applicable)</b>	$0.15 \times 61.3\% = 0.09$ which was calculated according to ACM0010 version 02
<b>QA/QC procedures</b>	
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	8
<b>Data/Parameter</b>	$R_{N,n}$
<b>Unit</b>	fraction
<b>Description</b>	Nitrogen degradation factor
<b>Measured/Calculated/Default</b>	Default
<b>Source of data</b>	Refer to IPCC default value
<b>Value(s) of monitored parameter</b>	0.0 for heated digesters 0.4 for aerobic treatment
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	According to IPCC default value
<b>QA/QC procedures</b>	
<b>Purpose of data</b>	The data was used for leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	9
<b>Data/Parameter</b>	Type
<b>Unit</b>	Type of barn and AMMS
<b>Description</b>	Project proponents
<b>Measured/Calculated/Default</b>	NA
<b>Source of data</b>	Barn and AMMS layout and configuration
<b>Value(s) of monitored parameter</b>	keep same with the baseline
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	NA
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	
<b>Purpose of data</b>	NA
<b>Additional comment</b>	

<b>ID Number:</b>	10
-------------------	----



<b>Data/Parameter</b>	T
<b>Unit</b>	°C
<b>Description</b>	Annual average ambient temperature at weather station nearby project site
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Penglai Meteorological Station
<b>Value(s) of monitored parameter</b>	14.1
<b>Monitoring equipment</b>	The data source is from meteorological station directly, no equipment is required on the project site.
<b>Measuring/Reading/Recording frequency</b>	Monthly
<b>Calculation method (if applicable)</b>	Average of monthly temperature
<b>QA/QC procedures</b>	NA
<b>Purpose of data</b>	The data was used for baseline emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	11
<b>Data/Parameter</b>	Rainfall
<b>Unit</b>	mm
<b>Description</b>	Annual average rainfall at weather station nearby project site
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Penglai Meteorological Station
<b>Value(s) of monitored parameter</b>	839.7
<b>Monitoring equipment</b>	The data source is from meteorological station directly, no equipment is required on the project site.
<b>Measuring/Reading/Recording frequency</b>	Monthly
<b>Calculation method (if applicable)</b>	Average of monthly rainfall
<b>QA/QC procedures</b>	NA
<b>Purpose of data</b>	The data was used for both baseline and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	12
<b>Data/Parameter</b>	Evaporation
<b>Unit</b>	mm
<b>Description</b>	Annual average evaporation at weather station nearby project site
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Penglai Meteorological Station



<b>Value(s) of monitored parameter</b>	1899.2
<b>Monitoring equipment</b>	The data source is from meteorological station directly, no equipment is required on the project site.
<b>Measuring/Reading/Recording frequency</b>	Monthly
<b>Calculation method (if applicable)</b>	Average of monthly evaporation
<b>QA/QC procedures</b>	NA
<b>Purpose of data</b>	The data was used for baseline and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	13
<b>Data/Parameter</b>	EG <sub>d,y</sub>
<b>Unit</b>	MWh
<b>Description</b>	Electricity exported to grid
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	33,035 for electricity meter 1



<b>Monitoring equipment</b>	<p>Name : Electricity meter 1  Type: DSSD876  Accuracy class: 0.5S  Series number: 200808251408  Calibration frequency: every 5 years  Date of calibration: 13/10/2008  Validity: 12/10/2013  Calibration standard: JJG596-1999  Calibration agency: Metrological center of Yantai Electricity Company  Other: This meter with series number of 200808251408 was replaced by meter with series number of 200808251072 on 18/09/2009</p> <p>Name : Electricity meter 1  Type: DSSD876  Accuracy class: 0.5S  Series number: 200808251072  Calibration frequency: every 5 years  Date of calibration: 23/07/2009  Validity: 22/07/2014  Calibration standard: JJG596-1999  Calibration agency: Metrological center of Yantai Electricity Company  Other: This meter started work on 18/09/2009</p> <p>Name : Electricity meter 3  Type: DSSD876  Accuracy class: 0.5S  Series number: 200808251215  Calibration frequency: every 5 years  Date of calibration: 23/12/2008  Validity: 22/12/2013  Calibration standard: JJG596-1999  Calibration agency: Metrological center of Yantai Electricity Company  Other: this is backup meter installed in the project site</p>
<b>Measuring/Reading/Recording frequency</b>	Monthly
<b>Calculation method (if applicable)</b>	Accumulative electricity exported to the grid
<b>QA/QC procedures</b>	Electricity meters undergo maintenance/calibration subject to appropriate industry standards (JJG596-1999). The accuracy of the meter readings was verified by receipts issued by the purchasing power company. Uncertainty (0.5%) of the meters obtained from the manufacturers and verified by Calibration agency. This uncertainty was included in a conservative manner while calculating CERs
<b>Purpose of data</b>	The data was used for baseline emission calculations
<b>Additional comment</b>	
<b>ID Number:</b>	14
<b>Data/Parameter</b>	N <sub>LT</sub>
<b>Unit</b>	Number



<b>Description</b>	Average chicken population used in both baseline and project case emissions estimations.
<b>Measured/Calculated/Default</b>	Calculated
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	Broiler: 2,669,299 Layers: 597,000
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Each flock, broiler lived around 42-43 days, the frequency for the broiler is 42-43 days, for conservative, the number of handout broilers was applied. The layer lived more than 365 days, layers number in stock was monitored every day.
<b>Calculation method (if applicable)</b>	The method for monitoring the number of livestock population was described in B7.2 of this PDD.
<b>QA/QC procedures</b>	Feed purchase is recorded to verify the chicken population
<b>Purpose of data</b>	The data was used for baseline, project and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	15
<b>Data/Parameter</b>	W <sub>site</sub>
<b>Unit</b>	kg
<b>Description</b>	Weight of chicken
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	Broiler: 1.251 Layers: 3.050
<b>Monitoring equipment</b>	Name: Scale Type: ACS-30 Accuracy class: III Series number: 08105295, 08106701, 08074223, 08071582, 08090309, 08061195, 08091093, 08021852. Calibration frequency: once a year Date of calibration: 18/02/2009, 11/02/2010, 09/02/2011 Validity: 08/02/2012 Calibration standard: JJG539-97 Calibration agency: Metrological center of Penglai City
<b>Measuring/Reading/Recording frequency</b>	Weekly
<b>Calculation method (if applicable)</b>	0.2% of broiler and layers are weighed weekly to obtain average site weight.
<b>QA/QC procedures</b>	
<b>Purpose of data</b>	The data was used for baseline, project, and leakage emission calculations
<b>Additional comment</b>	



<b>ID Number:</b>	16
<b>Data/Parameter</b>	$F_{AD}$
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of volatile solids directed to anaerobic digesters
<b>Measured/Calculated/Default</b>	Measured and calculated
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	100%
<b>Monitoring equipment</b>	<p>Name: Nemo Pump  Type: NM090SY01L06V  Accuracy class: NA  Series number: 19456 and 19457 (one main and one backup)  Calibration frequency: no such national standard addressing the calibration requirement; to make sure the accuracy of data, once per one or two years as per manufacturer's recommendation is adopted  Date of calibration: 30/04/2008, 29/04/2009, 29/04/2010, 28/04/2011  Calibration standard: NS0003 company standard of NETZSCH (Lanzhou) Pumps Co. Ltd  Calibration agency: NETZSCH (Lanzhou) Pumps Co. Ltd.</p>
<b>Measuring/Reading/Recording frequency</b>	Four times a year in different seasons.
<b>Calculation method (if applicable)</b>	Fraction of volatile solids directed to anaerobic digesters was calculated based on the VS concentration and quantity of influent of biogas digesters with the same location of point 1 in monitored parameters. No volatile solids were sent to the land. VS concentration was measured by taking sample of influent. Quantity of influent was measured by the operation hours of pumps.
<b>QA/QC procedures</b>	Pumps was in compliance with relevant standards in China, there is no national or local standard on test NETZSCH pump, the pumps were tested according to company standard by NETZSCH (Lanzhou) Pumps Co. Ltd.. VS concentration of collected samples was sent for analysis Metrological center of Penglai City which is qualified testing centers at the city level.
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	17
<b>Data/Parameter</b>	$F_{Aer}$
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of volatile solids directed to aerobic treatment
<b>Measured/Calculated/Default</b>	Calculated
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	15.6%



<b>Monitoring equipment</b>	<p>Name: Flow meter installed in front of aerobic lagoon  Type: LMZ-100  Accuracy class: 1.0  Series number: 800930105  Calibration frequency: once per year  Date of calibration: 18/03/2009; 16/03/2010  Validity: 15/03/2011  Calibration standard: JJG771-1990  Calibration agency: Metrological Institute of Yantai City  Other: This meter with series number of 800930105 was replaced by meter with series number of H08090108108-W1 on 06/03/2011.</p> <p>Name: Flow meter installed in front of aerobic lagoon  Type: XSJ/A-H21B1AVO  Accuracy class: 1.0  Series number: H08090108108-W1  Calibration frequency: once per year  Date of calibration: 4/03/2011  Validity: 3/03/2012  Calibration standard: JJG771-1990  Calibration agency: Metrological Institute of Yantai City</p> <p>Name: Nemo Pump  Type: NM090SY01L06V  Accuracy class: NA  Series number: 19456 and 19457 (one main and one backup)  Calibration frequency: no such national standard addressing the calibration requirement; to make sure the accuracy of data, once per one or two years as per manufacturer's recommendation is adopted  Date of calibration: 30/04/2008, 29/04/2009, 29/04/2010, 28/04/2011  Calibration standard: NS0003 company standard of NETZSCH (Lanzhou) Pumps Co. Ltd  Calibration agency: NETZSCH (Lanzhou) Pumps Co. Ltd.</p> <p>VS concentration of collected samples was sent for analysis at Metrological center of Penglai City which is qualified testing centers at the city level.</p>
<b>Measuring/Reading/Recording frequency</b>	<p>VS concentration was measured by taking sample of influent four times a year in each season. Quantity of influent was continuously measured by flow meter.</p>
<b>Calculation method (if applicable)</b>	<p>Fraction of volatile solids directed to aerobic lagoons was calculated based on the VS concentration and quantity of influent of biogas digesters. VS concentration was measured by taking sample of influent. Samples were taken from three points four times a year. Point 1 is at the inlet of biogas digester, Point 2 is before transportation to land and Point 3 is at the inlet of aerobic lagoon. To calculate the <math>F_{Aer}</math>, only data for point 1 and point 3 were applied, because <math>F_{Aer}</math> is the fraction into aerobic lagoon while data for point 2 is the concentration directed to land, and effluent for direct land application did not happen during this monitoring period. The influent of biogas digesters was monitored by pumps working hours. Quantity of volatile solids directly to aerobic treatment was measured by flow meter.</p>





<b>QA/QC procedures</b>	Flow meter was in compliance with relevant standards in China, calibration of flow meter occurred according to technical specification (JJG771-1990) by an officially accredited entity. The pumps were tested according to their company standard by NETZSCH (Lanzhou) Pumps Co. Ltd since there is no national or local standard on pump test. Samples were taken for 5 consecutive days quarterly, and VS concentration of collected samples was sent for analysis Metrological center of Penglai City which is qualified testing centers at the city level.
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	18
<b>Data/Parameter</b>	EL <sub>Pr,y</sub>
<b>Unit</b>	MWh
<b>Description</b>	Electricity used in project AMMSs
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	2902
<b>Monitoring equipment</b>	Name : Electricity meter 2 Type: DTSD71 Accuracy class: 2.0 S Series number: 623154 Calibration frequency: 5 years Date of last calibration: 18/09/2008 Validity: 17/09/2013 Calibration standard: JJG596-1999 Calibration agency: Metrological Center of Penglai Electricity Company
<b>Measuring/Reading/Recording frequency</b>	Monthly
<b>Calculation method (if applicable)</b>	Accumulative electricity consumption
<b>QA/QC procedures</b>	Electricity meter undergoes maintenance/calibration subject to appropriate industry standards. The accuracy of the meter readings is verified by receipts issued by the purchasing power company. Uncertainty of the meter (2.0%) was obtained from the manufacturers. This uncertainty was included in a conservative manner while calculating CERs
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	19
<b>Data/Parameter</b>	V <sub>f</sub>
<b>Unit</b>	m <sup>3</sup>
<b>Description</b>	Biogas flow
<b>Measured/Calculated/Default</b>	Measured



<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	17.82 million m <sup>3</sup> for biogas flow meter 1; 17.67 million m <sup>3</sup> for biogas flow meter 2 ; 0.12 million m <sup>3</sup> for biogas flow meter 3
<b>Monitoring equipment</b>	<p>Name: biogas flow meter 1 Type: KVS08IIKF23FSN Accuracy class: 0.5S Series number: 8060604 Calibration frequency: 2 years for first calibration, 1 year after second calibration Calibration date: 30/06/2008, 22/06/2010, 20/06/2011 Validity: 19/06/2012 Calibration standard: JJG640-1994 Calibration agency: Shanghai Equipment Test Center for first calibration / Metrological Institute of Yantai City for second and third calibration Other: biogas meter 1 installed in outlet of digesters</p> <p>Name: biogas flow meter 2 Type: KVS08IIKF23FSN Accuracy class: 0.5S Series number: 8060602 Calibration frequency: 2 years for first calibration, 1 year after second calibration Calibration date: 30/06/2008; 22/03/2010, 20/03/2011 Validity: 19/03/2012 Calibration standard: JJG640-1994 Calibration agency: Shanghai Equipment Test Center for first calibration / Metrological Institute of Yantai City for second and third calibration Other: biogas meter 2 installed in inlet of power generator</p> <p>Name: biogas flow meter 3 Type: KVS08IIKF23FSN Accuracy class: 0.5S Series number: 8060601 Calibration frequency: 2 years for first calibration, 1 year after second calibration Calibration date: 30/06/2008; 22/03/2010, 20/03/2011 Validity: 19/03/2012 Calibration standard: JJG640-1994 Calibration agency: Shanghai Equipment Test Center for first calibration / Metrological Institute of Yantai City for second and third calibration Other: biogas meter 3 installed in inlet of flare</p>
<b>Measuring/Reading/Recording frequency</b>	Continuously measured by flow meters and report the accumulative data on weekly basis
<b>Calculation method (if applicable)</b>	Accumulative total biogas production
<b>QA/QC procedures</b>	Biogas flow meters undergo maintenance/calibration subject to appropriate national standards or manufacture's recommendations. The reading is expressed as biogas volumes in normalized cubic meters. No separate biogas temperature and pressure monitoring is required



<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	20
<b>Data/Parameter</b>	$C_{CH_4}$
<b>Unit</b>	Fraction
<b>Description</b>	Methane fraction of biogas
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	61.3%
<b>Monitoring equipment</b>	Name : Methane concentration meter Type: 97460 Accuracy class: $<\pm 2\%$ of full scale Series number: 27112 Calibration frequency: once per year Date of last calibration: 03/04/2009; 01/04/2010, 30/03/2011 Validity: 29/03/2012 Calibration standard: JJG693-2004 Calibration agency: Metrological Institute of Yantai City Other: Installed at the outlet of the anaerobic digesters
<b>Measuring/Reading/Recording frequency</b>	Continuous measurement and monthly recorded
<b>Calculation method (if applicable)</b>	Monthly average
<b>QA/QC procedures</b>	The measuring instrument has been calibrated in accordance to appropriate national/international standards The level of accuracy was deducted from average concentration measurement.
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	21
<b>Data/Parameter</b>	$PE_{flare,y}$
<b>Unit</b>	tCO <sub>2</sub> e
<b>Description</b>	Project emission from flaring of the residual gas stream in year y
<b>Measured/Calculated/Default</b>	Calculated based on measurements for gas flared
<b>Source of data</b>	Project participant
<b>Value(s) of monitored parameter</b>	1011



<b>Monitoring equipment</b>	Name : biogas flow meter 3 Type: KVS08IIKF23FSN Accuracy class: 0.5S Series number: 8060601 Calibration frequency: 2 years for first calibration, 1 year after second calibration Calibration date: 30/06/2008; 22/03/2010, 20/03/2011 Validity: 19/03/2012 Calibration standard: JJG640-1994 Calibration agency: Shanghai Equipment Test Center for first calibration / Metrological Institute of Yantai City for second the third calibration Other: biogas flow meter 3 installed at the inlet of flare.
<b>Measuring/Reading/Recording frequency</b>	Continuously by flow meter and reported cumulatively on weekly basis
<b>Calculation method (if applicable)</b>	Accumulative total biogas flared
<b>QA/QC procedures</b>	Biogas flow meter has been undergone maintenance/calibration subject to appropriate national standards or manufacture's recommendations.
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	22
<b>Data/Parameter</b>	MS% <sub>i</sub>
<b>Unit</b>	Fraction
<b>Description</b>	Fraction of manure handled in anaerobic digesters under project activity
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Project proponents
<b>Value(s) of monitored parameter</b>	100%
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually recorded
<b>Calculation method (if applicable)</b>	The manure flew into digesters by pipes. Fraction of manure handled in anaerobic digesters under project activity was 100%. Percentage of manure which did not flow into system is recorded as zero.
<b>QA/QC procedures</b>	The manure flew into digesters by pipes.
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	23
<b>Data/Parameter</b>	NEX <sub>LT,y</sub>
<b>Unit</b>	kg N/1000 kg animal mass/year
<b>Description</b>	Annual average nitrogen excretion per 1000 kg animal mass, estimated as described in Annex 2 of ACM0010.



<b>Measured/Calculated/Default</b>	Calculated
<b>Source of data</b>	2006 IPCC Guideline, Project proponents
<b>Value(s) of monitored parameter</b>	0.502 for broiler, 0.924 for layer
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	According to Annex 2 of ACM0010, default NEX from IPCC 2006 Guidelines, default weight, and measured site average weight to scale site-specific average $NEX_{LT,y}$
<b>QA/QC procedures</b>	NA
<b>Purpose of data</b>	The data was used for baseline, project, and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	24
<b>Data/Parameter</b>	Genetic source
<b>Unit</b>	
<b>Description</b>	Genetic source of broilers and layers
<b>Measured/Calculated/Default</b>	Default
<b>Source of data</b>	Project proponent, recorded certificate of genetic source
<b>Value(s) of monitored parameter</b>	Arbor Acres (AA)
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	Genetic source of the livestock production operations was confirmed to originate from an Annex I Party.
<b>Purpose of data</b>	The data was used for baseline, project, and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	25
<b>Data/Parameter</b>	FFR
<b>Unit</b>	
<b>Description</b>	Formulated feed ratio
<b>Measured/Calculated/Default</b>	Measured
<b>Source of data</b>	Project proponent, recorded amounts of FFR for farm and the ingredient of FFR



<b>Value(s) of monitored parameter</b>	100%
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Annually
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	NA
<b>Purpose of data</b>	The data was used for baseline, project, and leakage emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	26
<b>Data/Parameter</b>	MCF <sub>sl</sub>
<b>Unit</b>	Fraction
<b>Description</b>	Methane conversion factor
<b>Measured/Calculated/Default</b>	Default
<b>Source of data</b>	IPCC 2006 Guidelines
<b>Value(s) of monitored parameter</b>	0.1%
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	NA
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	IPCC default value is applied.
<b>Purpose of data</b>	The data was used for project emission calculations
<b>Additional comment</b>	

<b>ID Number:</b>	27
<b>Data/Parameter</b>	Regulations
<b>Unit</b>	--
<b>Description</b>	Existence and enforcement of relevant regulations
<b>Measured/Calculated/Default</b>	NA
<b>Source of data</b>	Project proponents, check the website of China ministry of environmental protection ( <a href="http://www.sepa.gov.cn">www.sepa.gov.cn</a> )
<b>Value(s) of monitored parameter</b>	No regulation.
<b>Monitoring equipment</b>	NA
<b>Measuring/Reading/Recording frequency</b>	Monthly
<b>Calculation method (if applicable)</b>	NA

QA/QC procedures	NA
Purpose of data	The data was used for baseline, project, and leakage emission calculations
Additional comment	

### D.3. Implementation of sampling plan

NA.

## SECTION E. Calculation of emission reductions or GHG removals by sinks

### E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

The calculation of baseline emission is included in excel file named as ERs calculation spreadsheet-Minhe second monitoring period.

Baseline emissions are estimated as follows:

$$BE_y = BE_{CH_4,y} + BE_{N_2O,y} + BE_{elec/heat,y} \quad (1)$$

where:

$BE_y$	Baseline emissions in year y, in tCO <sub>2</sub> e/year.
$BE_{CH_4,y}$	Baseline methane emissions in year y, in tCO <sub>2</sub> e/year.
$BE_{N_2O,y}$	Baseline N <sub>2</sub> O emissions in year y, in tCO <sub>2</sub> e/year.
$BE_{elec/heat,y}$	Baseline CO <sub>2</sub> emissions from electricity and/or heat used in the baseline in year y, in tCO <sub>2</sub> e/year.

#### (i) Methane emissions

$$BE_{CH_4,y} = GWP_{CH_4} * D_{CH_4} * \sum_{j,LT} (MCF_j * B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_{Bl,j}) \quad (2)$$

where:

$BE_{CH_4,y}$	The annual baseline methane emissions in t CO <sub>2</sub> e/y
$GWP_{CH_4}$	Global Warming Potential (GWP) of CH <sub>4</sub> .
$D_{CH_4}$	CH <sub>4</sub> density (0.00067 t/m <sup>3</sup> at room temperature (20°C) and 1 atm pressure).
$MCF_j$	Annual methane conversion factor (MCF) for the baseline AMMS <sub>j</sub> (anaerobic lagoon) from IPCC 2006 Guidelines Table 10.17, chapter 10, volume 4. $MCF_j = 0.73$ was applied. A conservativeness factor was applied by multiplying MCF values with a value of 0.94, to account for the 20% uncertainty in the MCF values as reported by IPCC 2006.
$B_{O,LT}$	Maximum methane producing potential of the volatile solid generated, in m <sup>3</sup> CH <sub>4</sub> /kg dm, by broiler and layer chicken. $B_{O,LT} = 0.36$ for broiler and 0.39 for layers respectively
$N_{LT}$	Number of broiler and layer for the year y, expressed in numbers. $N_{LT} = 2,669,299$ for broiler and 597,000 for layers respectively.
$VS_{LT,y}$	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%.

Annual baseline CH<sub>4</sub> emission and values of related parameters were listed in table E1. Total baseline CH<sub>4</sub> emission during the monitoring period was listed in table E2.

Table E1: Estimated annual baseline methane emissions

Parameters	Unit	Broiler	Layers
$GWP_{CH_4}$	-	21	21
$D_{CH_4}$	t/m <sup>3</sup>	0.00067	0.00067
$MCF_j$	fraction	0.73	0.73
Conservativeness factor of MCF	fraction	0.94	0.94
$B_{o,LT}$	m <sup>3</sup> CH <sub>4</sub> /kg dm	0.36	0.39
$N_{LT}$	head	2,669,299	597,000
$VS_{LT,y}^*$	kg dm/year	5.073	12.368
$MS\%_{BL,j}$	%	100	100

\*: Calculated using equation (3), the results were listed in table E3.

Table E2: Total baseline methane emissions during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
Baseline CH <sub>4</sub> emission for different chicken	t CO <sub>2</sub> e	78,660	46,464
Total baseline CH <sub>4</sub> emission during the monitoring period	t CO <sub>2</sub> e	125,124	

### 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, 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):

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

Where

$W_{site,LT}$	Average animal weight of a defined livestock population at the project site for LT type of chicken.
---------------	---



$W_{default}$	IPCC Default weight, 2006 IPCC Guidelines (kg) for developed countries.
$VS_{default}$	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.
$nd_y$	Number of days in year “y” where the treatment plant was operational. $Ndy = 365$ days

Estimation of annual volatile solid for broiler and layer chickens was listed in table E3.

Table E3: Annual volatile solid for broiler and layer chickens

Parameters	$VS_{default}$ (kg dm/day/head)	$W_{default}$ (kg)	$W_{site,LT}$ (kg)	$nd_y$ (day)	$VS_{LT,y}$ (kg dm/year/head)
Broiler	0.01	0.9	1.251	365	5.073
Layer	0.02	1.8	3.050	365	12.368

(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 are 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) is 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 14.1°C and the value of 73% is applied. A conservative factor is 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.

$$BE_{N_2O,y} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (E_{N_2O,D,y} + E_{N_2O,ID,y}) \quad (4)$$

where:

$GWP_{N_2O}$	Global Warming Potential for $N_2O$ .
$CF_{N_2O-N,N}$	Conversion factor $N_2O-N$ to $N_2O$ (44/28).
$E_{N_2O,D,y}$	Direct $N_2O$ emission in kg $N_2O-N$ /year.
$E_{N_2O,ID,y}$	Indirect $N_2O$ emission in kg $N_2O-N$ /year.

Direct  $N_2O$  emission estimated according to equation 5.

$$E_{N_2O,D,y} = \sum_{j,LT} (EF_{N_2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_{BL,j}) \quad (5)$$

where:

$EF_{N_2O,D,j}$	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 $EF_{N_2O}$ . 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/year. Even there are data on crude per cent 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 ACM0010 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. $N_{LT} = 2,669,299$ for broiler and 597,000 for layers respectively.

(1) Calculation of  $NEX_{LT,y}$

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

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) in volume 4, chapter 10, table 10.19 in IPCC 2006 Guidelines for developed countries was 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.
----------------------	---

Estimation of nitrogen excretion per head of chicken was listed in table E4.

Table E4: Annual nitrogen excretion per head of chicken (kgN/head/year)

Parameters	$NEX_{IPCC,default}$ (kgN/1000kganimal mass/day)	$W_{site,LT}$ (kg)	$W_{default}$ (kg)	$nd_y$ (day)	$NEX_{LT,y}$ (kg N/head/year)
Broiler	1.1	1.251	0.9	365	0.502
Layer	0.83	3.050	1.8	365	0.924

Because the  $N_2O$  emission factor for anaerobic lagoon is 0, therefore, the annual direct baseline  $N_2O$  emission is zero.

The indirect N<sub>2</sub>O emissions estimated according to equation 7.

$$E_{N_2O,ID,y} = \sum_{j,LT} (EF_{N_2O,ID,j} * F_{gasm} * NEX_{LT,y} * N_{LT} * MS\%_{Bl,j}) \quad (7)$$

Where:

$EF_{N_2O,ID,j}$	The indirect N <sub>2</sub> O emission factor for N <sub>2</sub> O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N <sub>2</sub> O-N/kg NH <sub>3</sub> -N and NO <sub>x</sub> -N emitted. According to scientific publication database (www.cnki.org.cn), there are no published country specific data on $EF_{N_2O,ID,j}$ . Default values for EF <sub>4</sub> 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 <sub>3</sub> and NO <sub>x</sub> 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 (Table 10.22, Volume 4 of IPCC 2006 Guidelines).

Annual indirect baseline N<sub>2</sub>O emission was estimated and listed in table E5. Total indirect baseline N<sub>2</sub>O emission during the monitoring period was listed in table E6

Table E5: Estimated annual indirect baseline N<sub>2</sub>O emission

	$EF_{N_2O,ID,j}$ (fraction)	$F_{gasm}$ (fraction)	$NEX_{LT,y}$ (kg N/animal/ year)	$N_{LT}$ (head)	$MS\%_{Bl,j}$ (fraction)	$E_{N_2O,ID,y}$ kg N <sub>2</sub> O-N
Broiler	0.01	0.4	0.502	2,669,299	100	5,362
Layer	0.01	0.4	0.924	597,000	100	2,206
Total						7,568

Table E6: Total indirect baseline N<sub>2</sub>O emission during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
Baseline indirect N <sub>2</sub> O emission during the monitoring period	kg N <sub>2</sub> O-N	8,961	3,687
Total indirect N <sub>2</sub> O baseline emission during the monitoring period	kg N <sub>2</sub> O-N	12,648	

N<sub>2</sub>O emissions from manure management under baseline is listed in table E7.

Table E7: N<sub>2</sub>O emission under baseline

Parameters	Unit	Value
$GWP_{N_2O}$	-	310
$CF_{N_2O-N,N}$	-	44/28
$E_{N_2O,y}$ in one year	t CO <sub>2</sub> e	3,687
$E_{N_2O,y}$ during the monitoring period	t CO <sub>2</sub> e	6,161

**(iii) CO<sub>2</sub> emission from electricity and heat within the project boundary**

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

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 <sub>2</sub> /MWh).
$EG_{d,y}$	The amount of electricity generated utilizing the biogas collected under 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 <sub>2</sub> /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, there is no thermal energy consumption in the baseline.
$CEF_{Bl,therm}$	The CO <sub>2</sub> emissions intensity for thermal energy generation (tCO <sub>2</sub> e/MJ), it is not related.

Annual baseline CO<sub>2</sub> emissions were estimated and listed in table E8. Baseline CO<sub>2</sub> emissions during the monitoring period were estimated and listed in table E9.

Table E8: Estimated annual baseline CO<sub>2</sub> emission

Parameters	$EG_{Bl,y}$ (Mwh)	$CEF_{Bl,elec,y}$ (tCO <sub>2</sub> /MWh)	$EG_{d,y}$ (Mwh)	$CEF_{grid}^*$ (tCO <sub>2</sub> /MWh)	$HG_{Bl,y}$ (MJ)	$CEF_{Bl,therm}$ (tCO <sub>2</sub> e/MJ)	$BE_{elec/heat,y}$ (t CO <sub>2</sub> e)
Value	182	0.8	19,821	0.81145	0	-	16,283

\*:calculated using equation (9) and listed in table E10.

Table E9: Baseline CO<sub>2</sub> emission during the monitoring period

Parameters	$EG_{Bl,y}$ (Mwh)	$CEF_{Bl,elec,y}$ (tCO <sub>2</sub> /MWh)	$EG_{d,y}$ (Mwh)	$CEF_{grid}^*$ (tCO <sub>2</sub> /MWh)	$HG_{Bl,y}$ (MJ)	$CEF_{Bl,therm}$ (tCO <sub>2</sub> e/MJ)	$BE_{elec/heat,y}$ (t CO <sub>2</sub> e)
Value	304	0.8	33,035	0.81145	0	-	27,213

\*: calculated using equation (9) and listed in table E10.

The carbon emission factor for the grid  $CEF_{grid}$  is calculated as the weighted average of the Operating Margin emission factor ( $EF_{OM,y}$ ) and the Build Margin emission factor ( $EF_{BM,y}$ ):

$$CEF_{grid} = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \quad (9)$$

where the weights  $\omega_{OM}$  and  $\omega_{BM}$  are 50% and 50% respectively by default.

Where the default weights are adopted for the proposed project, the baseline emission factor is:

$$CEF_{grid} = 0.50 \times EF_{OM,y} + 0.50 \times EF_{BM,y} \quad (10)$$

The carbon emissions factor for the grid was calculated using equation (9) and listed in table E10.

Table E10: Carbon emissions factor for the grid

Parameters	$\omega_{OM}$	$EF_{OM,y}$ (tCO <sub>2</sub> /MWh)	$\omega_{BM}$	$EF_{BM,y}$ (tCO <sub>2</sub> /MWh)	$CEF_{grid}$ (tCO <sub>2</sub> /MWh)
$CEF_{grid}$ in 2010	0.5	0.9914	0.5	0.7495	0.87045
$CEF_{grid}$ in 2011	0.5	0.9803	0.5	0.6426	0.81145

As a conservative approach, the lower value of 0.81145 tCO<sub>2</sub>/MWh was adopted for baseline emission calculation in this monitoring period.

Table E11 is the summary of the baseline emissions during the monitoring period:

Table E11: Summary of the baseline emissions during the monitoring period (t CO<sub>2</sub>e)

BE <sub>CH<sub>4</sub>,y</sub>	125,124
BE <sub>N<sub>2</sub>O,y</sub>	6,161
BE <sub>elec,y</sub>	27,213
BE <sub>y</sub>	158,498

## E.2. Calculation of project emissions or actual net GHG removals by sinks

The calculation of project emissions is included in excel file named as ERs calculation spreadsheet-Minhe second monitoring period.

Project emissions are calculated as follows:

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N_2O,y} + PE_{PL,y} + PE_{flared,y} + PE_{elec/heat} \quad (11)$$

$PE_{AD,y}$	Leakage from AMMS systems that capture methane in tCO <sub>2</sub> e/yr
$PE_{Aer,y}$	Methane emissions from AMMS that aerobically treats the manure in tCO <sub>2</sub> e/y
$PE_{N_2O,y}$	Nitrous oxide emission from project manure waste management system in tCO <sub>2</sub> e/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 <sub>2</sub> e/yr
$PE_{flared,y}$	Project emissions from flaring of the residual gas stream in tCO <sub>2</sub> e/yr
$PE_{elec/heat,y}$	Project emissions from use of heat and/or electricity in the project case in tCO <sub>2</sub> e/yr

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

ACM0010 specifies 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 12 is applied to the estimate methane emissions from the project activity.

$$PE_{AD,y} = GWP_{CH_4} * D_{CH_4} * LF_{AD} * F_{AD} * \left[ \prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (12)$$

$D_{CH_4}$	CH <sub>4</sub> density (0.00067 t/m <sup>3</sup> at room temperature (20 °C) and 1 atm pressure).
$LF_{AD}$	Methane leakage from Anaerobic digesters, default of 0.15 multiplied by methane content of biogas. $LF_{AD} = 0.15 * 61.3\% = 0.09$
$F_{AD}$	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. $R_{VS,n} = 84.4\%$
LT	Index for livestock type
$B_{O,LT}$	CH <sub>4</sub> production capacity from manure for chickens, in m <sup>3</sup> CH <sub>4</sub> /kg-VS. $B_{O,LT} = 0.36$ for broiler and 0.39 for layers respectively
$VS_{LT,y}$	Annual volatile solid excretion of chickens on a dry matter basis in kg/animal/year. $VS_{LT,y} = 5.073$ for broiler and 12.368 for layers respectively
$N_{LT}$	Population of livestock type LT for the year y, expressed in numbers. $N_{LT} = 2,669,299$ for broiler and 597,000 for layers respectively.
MS% <sub>j</sub>	Fraction of manure handled in system j. MS% <sub>j</sub> =100%

Annual project CH<sub>4</sub> emissions from anaerobic digester and values of related parameters were listed in table E12. Total project methane emissions from anaerobic digester during the monitoring period were listed in table E13.

Table E12: Estimated annual project CH<sub>4</sub> emissions from anaerobic digester where gas is captured

Parameters	Unit	Broiler	Layers
$GWP_{CH_4}$	-	21	21
$D_{CH_4}$	t/m <sup>3</sup>	0.00067	0.00067
$LF_{AD}$	fraction	0.09	0.09
$F_{AD}$	%	100	100
$R_{VS,n}$	%	84.4	84.4
$B_{O,LT}$	m <sup>3</sup> CH <sub>4</sub> /kg_dm	0.36	0.39
$N_{LT}$	head	2,669,299	597,000
$VS_{LT,y}^*$	kg dm/year	5.073	12.368
$MS\%_{Bl,j}$	%	100	100
$PE_{AD,y}$	t CO <sub>2</sub> e	5,324	3,145
Total	t CO <sub>2</sub> e	8,469	

Table E13: Project CH<sub>4</sub> emissions from anaerobic digester during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610

Project CH <sub>4</sub> emission from anaerobic digesters	t CO <sub>2</sub> e	8,898	5,256
Total project CH <sub>4</sub> emission from anaerobic digesters during the monitoring period	t CO <sub>2</sub> e	14,154	

**(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.

$$PE_{Aer,y} = GWP_{CH_4} \cdot D_{CH_4} \cdot 0.001 \cdot F_{Aer} \cdot \left[ \prod_{n=1}^N (1 - R_{VS,n}) \right] \cdot \sum_{j,LT} (B_{O,LT} \cdot N_{LT} \cdot VS_{LT,y} \cdot MS\%_j) + PE_{Sl,y} \quad (13)$$

$F_{Aer}$	The fraction of volatile solid directed to aerobic system. $F_{Aer} = 15.6\%$
$PE_{Sl,y}$	CH <sub>4</sub> emissions from sludge disposed in storage pit prior to disposal during the year in tCO <sub>2</sub> e/yr.

The equation used to estimate methane emissions from sludge is in equation 14.

$$PE_{Sl,y} = GWP_{CH_4} \cdot D_{CH_4} \cdot MCF_{sl} \cdot F_{Aer} \cdot \left[ \prod_{n=1}^N (1 - R_{VS,n}) \right] \cdot \sum_{j,LT} (B_{O,LT} \cdot N_{LT} \cdot VS_{LT,y} \cdot MS\%_j) \quad (14)$$

$MCF_{sl}$	Methane conversion factor (MCF) for the sludge stored in sludge pits estimated as in the baseline emissions section. $MCF_{sl} = 0.1\%$
------------	---

The slurry storage ponds are not within the project boundary. The CH<sub>4</sub>, direct N<sub>2</sub>O and indirect N<sub>2</sub>O emissions from methane emissions from sludge are considered as leakage of the project activity.

Annual project CH<sub>4</sub> emissions from aerobic lagoon and related parameters were listed in table E14. Total project CH<sub>4</sub> emissions from aerobic lagoon during the monitoring period were listed in table E15.

Table E14. Estimated annual CH<sub>4</sub> emissions from aerobic lagoon under project activity

Parameters	Unit	Broiler	Layers
$GWP_{CH_4}$	-	21	21
$D_{CH_4}$	t/m <sup>3</sup>	0.00067	0.00067
$F_{Aer}$ to aerobic lagoon	%	100%	100%
$MCF_{sl}$	fraction	0.001	0.001
$R_{VS,n}$	%	84.4	84.4
$B_{O,LT}$	m <sup>3</sup> CH <sub>4</sub> /kg <sub>dm</sub>	0.36	0.39
$N_{LT}$	head	2,669,299	597,000
$VS_{LT,y} \cdot$	kg dm/year	5.073	12.368
$MS\%_{Bl,j}$	%	100	100

$PE_{Aer,y}$	t CO <sub>2</sub> e	11	6
Total	t CO <sub>2</sub> e	17	

Table E15: Total project CH<sub>4</sub> emissions from aerobic lagoon during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
Project CH <sub>4</sub> emissions from aerobic lagoon during the monitoring period	t CO <sub>2</sub> e	18	10
Total project CH <sub>4</sub> emissions from aerobic lagoon during the monitoring period	t CO <sub>2</sub> e	28	

(iii) N<sub>2</sub>O emissions from manure management

$$PE_{N_2O,y} = GWP_{N_2O} \cdot CF_{N_2O-N,N} \cdot \frac{1}{1000} * (E_{N_2O,D,y} + E_{N_2O,ID,y}) \quad (15)$$

where:

$PE_{N_2O,y}$	Annual project N <sub>2</sub> O emissions in t CO <sub>2</sub> e / yr
$GWP_{N_2O}$	Global Warming Potential (GWP) for N <sub>2</sub> O.
$CF_{N_2O-N,N}$	Conversion factor N <sub>2</sub> O-N to N <sub>2</sub> O (44/28).
$E_{N_2O,D,y}$	Direct N <sub>2</sub> O emission in kg N <sub>2</sub> O-N/year.
$E_{N_2O,ID,y}$	Indirect N <sub>2</sub> O emission in kg N <sub>2</sub> O-N/year.

The same method applied in estimating N<sub>2</sub>O emissions in the baseline is used to estimate the project emissions of nitrous oxide.

$$E_{N_2O,D,y} = \sum_{j,LT} (EF_{N_2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_j) \quad (16)$$

where:

$EF_{N_2O,D,j}$	The direct N <sub>2</sub> O emission factor for the treatment system j of the manure management system in kg N <sub>2</sub> O-N/kg N. According to scientific publication database (www.cnki.org.cn), there are no published country specific data on $EF_{N_2O,D,j}$ . Default EF3 in volume 4, chapter 10, table 10.21 in IPCC 2006 Guidelines was applied. $EF_{N_2O,D,j} = 0.01$ for aerobic lagoon.
$NEX_{LT,y}$	The annual average nitrogen excretion per head of a defined livestock population in kg N/animal/year. IPCC default value with site weight adjustment was applied.

Annual direct N<sub>2</sub>O emission from aerobic lagoon under project activity was estimated and listed in table E16. Total direct N<sub>2</sub>O emission from aerobic lagoon under project activity during the monitoring period was estimated and listed in table E17.

Table E16: Estimated annual direct N<sub>2</sub>O emission from aerobic lagoon under project activity

	$EF_{N_2O,D,j}$ (fraction)	$NEX_{LT,y}$ * (kg N/animal/year)	$MS\%_{BL,j}$ (%)	$N_{LT}$ (head)	$E_{N_2O,D,y}$ kg N <sub>2</sub> O-N
Broiler	0.01	0.502	100	2,669,299	13,406



Layer	0.01	0.924	100	597,000	5,516
Total					18,922

\*: calculated using equation (6), results listed in table E4.

Table E17: Total direct N<sub>2</sub>O emission under project activity during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
Baseline direct N <sub>2</sub> O emission during the monitoring period	kg N <sub>2</sub> O-N	22,405	9,219
Total direct N <sub>2</sub> O baseline emission during the monitoring period	kg N <sub>2</sub> O-N	31,624	

$$E_{N_2O,ID,y} = \sum_{j,LT} EF_{N_2O,ID,j} * F_{gasm} * NEX_{LT,y} * N_{LT} * MS\%_j$$

(17)

where:

$EF_{N_2O,ID,j}$	The indirect N <sub>2</sub> O emission factor for N <sub>2</sub> O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N <sub>2</sub> O -N/kg NH <sub>3</sub> -N and NO <sub>x</sub> -N emitted, estimated with site-specific, regional or national data if such data is available. Otherwise, default values for EF <sub>4</sub> from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines can be used. $EF_{N_2O,ID,j}=0.01$ for indirect N <sub>2</sub> O emission
$F_{gasm}$	Percent of managed manure nitrogen for livestock category that volatilizes as NH <sub>3</sub> and NO <sub>x</sub> in the manure management system. $F_{gasm}=40\%$ were applied.

Annual indirect N<sub>2</sub>O emission under project activity was estimated and listed in table E18. Total indirect N<sub>2</sub>O emission from project activity during the monitoring period was listed in table E19. The duration of the monitoring period is 610 days.

Table E18: Annual indirect N<sub>2</sub>O emission from project activity

	$EF_{N_2O,ID,j}$ (fraction)	$NEX_{LT,y}$ (kg N/animal/year)	$MS\%_{BL,j}$ (%)	$N_{LT}$ (head)	$F_{gasm}$ (%)	$E_{N_2O,ID,y}$ kg N <sub>2</sub> O-N
Broiler	0.01	0.502	100	2,669,299	40	5,362
Layer	0.01	0.924	100	597,000	40	2,206
Total						7,568

Table E19: Total indirect N<sub>2</sub>O emission from project activity during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
Indirect N <sub>2</sub> O emission from project activity	kg N <sub>2</sub> O-N	8,961	3,687
Indirect N <sub>2</sub> O emission under project activity during the monitoring period	kg N <sub>2</sub> O-N	12,648	

Total N<sub>2</sub>O emissions from manure management under project activity are listed in table E20.

Table E20: N<sub>2</sub>O emission under project activity

Parameters	Unit	Value
$GWP_{N_2O}$	-	310
$CF_{N_2O-N,N}$	-	44/28
$PE_{N_2O,y}$ in one year	t CO <sub>2</sub> e	12,904
$E_{N_2O,y}$ during the monitoring period	t CO <sub>2</sub> e	21,566

**(iv) Physical leakage from distribution network of the captured methane (PE<sub>PL,Y</sub>)**

This refers to leaks in the biogas system from the biogas pipeline delivery system. In this monitoring period, the pipeline leakage of biogas was 32,868 m<sup>3</sup>. The PE<sub>PL,Y</sub> is calculated using equation (18):

$$PE_{PL,y} = V_L * C_{CH_4} * GWP_{CH_4} * D_{CH_4} \quad (18)$$

where:

$V_L$	Pipeline leakage of biogas, m <sup>3</sup>
$C_{CH_4}$	Methane concentration in the biogas, %
$GWP_{CH_4}$	Global Warming Potential (GWP) of CH <sub>4</sub> .
$D_{CH_4}$	CH <sub>4</sub> density (0.00067 t/m <sup>3</sup> at room temperature (20°C) and 1 atm pressure).

Annual project CH<sub>4</sub> emissions from physical leakage and related parameters were listed in table E21.

Table E21. Estimated annual CH<sub>4</sub> emissions from physical leakage

Parameters	Unit	Value
$V_L$	m <sup>3</sup>	32,868
$C_{CH_4}$	%	61.3
$GWP_{CH_4}$	-	21
$D_{CH_4}$	t/m <sup>3</sup>	0.00067

Table E22: Total project CH<sub>4</sub> emissions from aerobic lagoon during the monitoring period

Parameters	Unit	Layers
Annual project CH <sub>4</sub> emissions from pipeline leakage	t CO <sub>2</sub> e	170
Monitoring period	day	610
Project CH <sub>4</sub> emissions from pipeline leakage during the monitoring period	t CO <sub>2</sub> e	283

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

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000} \quad (19)$$

where

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y, tCO <sub>2</sub> e
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h
$\eta_{flare,h}$	Flare efficiency in hour h. According to registered PDD, in this project, fixed value of 0% for the flare efficiency was applied, and this is for conservative.

Total project CO<sub>2</sub> emissions from flare during the monitoring period were estimated and listed in table E23.

Table E23: Project CO<sub>2</sub> emissions from flare during the monitoring period

Parameters	$\sum_{h=1}^{8856} TM_{RG,h} \text{ (kg)}$	$\eta_{flare,h} \text{ (%)}$	$PE_{flare,y} \text{ (t CO}_2\text{e)}$
Value	117,282	0	1011

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

$$PE_{elec/heat} = EL_{Pr,y} * CEF_d + HG_{Pr,y} * CEF_{Pr,therm,y} \quad (20)$$

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 <sub>2</sub> /MWh).
$HG_{Pr,y}$	The quantity of thermal energy consumed in year y at the project site due to the project activity (MJ). there is no thermal energy consumption in the project activity
$CEF_{Pr,therm,y}$	The CO <sub>2</sub> emissions intensity for thermal energy generation (tCO <sub>2</sub> e/MJ). The factor is zero if biogas is used for generating thermal energy. It is not related

In this project, there is no thermal energy consumed, Determination of  $CEF_d$ : the determination of  $CEF_d$  is the same as the method of  $CEF_{grid}$ .

Total project CO<sub>2</sub> emissions from heat and electricity use during the monitoring period were estimated and listed in table E24.

Table E24: Project CO<sub>2</sub> emissions from heat and electricity use during the monitoring period

Parameters	$EL_{Pr,y}$	$CEF_d$	$HG_{Pr,y}$	$CEF_{Pr,therm,y}$	$PE_{elec/heat,y}$
------------	-------------	---------	-------------	--------------------	--------------------

	(Mwh)	(tCO <sub>2</sub> /MWh)	(MJ)	(tCO <sub>2</sub> e/MJ)	(t CO <sub>2</sub> e)
Value	2,902	0.87045	0	-	2526

$CEF_d$  is calculated as the weighted average of the Operating Margin emission factor ( $EF_{OM,y}$ ) and the Build Margin emission factor ( $EF_{BM,y}$ ):

$$CEF_d = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \quad (21)$$

where the weights  $\omega_{OM}$  and  $\omega_{BM}$  are 50% and 50% respectively by default.

Where the default weights are adopted for the proposed project, the baseline emission factor is:

$$CEF_d = 0.50 \times EF_{OM,y} + 0.50 \times EF_{BM,y} \quad (22)$$

The carbon emissions factor for the grid was calculated using equation (21) and listed in table E25.

Table E25: Carbon emissions factor for the grid  $CEF_d$

Parameters	$\omega_{OM}$	$EF_{OM,y}$ (tCO <sub>2</sub> /MWh)	$\omega_{BM}$	$EF_{BM,y}$ (tCO <sub>2</sub> /MWh)	$CEF_{grid}$ (tCO <sub>2</sub> /MWh)
$CEF_d$ in 2009	0.5	0.9914	0.5	0.7495	0.87045
$CEF_d$ in 2010	0.5	0.9803	0.5	0.6426	0.81145

As a conservative approach, the higher value of 0.87045 tCO<sub>2</sub>/MWh was adopted for project emission calculation in this monitoring period.

Therefore for this monitoring period the following is the summary of the Project Emissions:

Summary of Project Emissions for this monitored Period (tCO <sub>2</sub> e)	
PE <sub>AD,y</sub>	14,154
PE <sub>Aer,y</sub>	28
PE <sub>N<sub>2</sub>O,y</sub>	21,566
PE <sub>PL,y</sub>	283
PE <sub>flare,y</sub>	1011
PE <sub>elec/heat</sub>	2526
PE <sub>y</sub>	39,568

### E.3. Calculation of leakage

The calculation of leakage is included in excel file named as ERs calculation spreadsheet-Minhe second monitoring period.

Leakage emissions are calculated as follows:

$$LE_y = (LE_{P,N_2O} - LE_{B,N_2O}) + (LE_{P,CH_4} - LE_{B,CH_4}) \quad (23)$$

Where,

$LE_{P,N_2O}$	The N <sub>2</sub> O emissions released during the project activity from land application of the treated manure, in tCO <sub>2</sub> e/year.
$LE_{B,N_2O}$	The N <sub>2</sub> O emissions released during the baseline scenario from land application of the treated manure, in tCO <sub>2</sub> e/year.

$LE_{P,CH_4}$	The CH <sub>4</sub> emissions released during the project activity from land application of the treated manure, in tCO <sub>2</sub> e/year.
$LE_{B,CH_4}$	The CH <sub>4</sub> emissions released during the baseline scenario from land application of the treated manure, in tCO <sub>2</sub> e/year.

(i) Estimation of N<sub>2</sub>O emissions outside the project boundary in baseline:

$$LE_{B,N_2O} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (LE_{N_2O,land} + LE_{N_2O,runoff} + LE_{N_2O,vol}) \quad (24)$$

$$LE_{N_2O,land} = EF_1 * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (25)$$

$$LE_{N_2O,runoff} = EF_5 * F_{leach} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (26)$$

$$LE_{N_2O,vol} = EF_4 * F_{gasm} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (27)$$

where:

$LE_{N_2O,land}$	Direct nitrous oxide emission from application of manure waste, in Kg N <sub>2</sub> O-N/year.
$LE_{N_2O,runoff}$	Nitrous oxide emission due to leaching and run-off, in Kg N <sub>2</sub> O-N/year.
$F_{gasm}$	Fraction of animal manure N that volatilizes as NH <sub>3</sub> and NO <sub>x</sub> in kg NH <sub>3</sub> -N and NO <sub>x</sub> -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. $F_{gasm} = 20\%$ for land application were applied
$EF_1$	Emission factor for direct emission of N <sub>2</sub> O from soils in Kg N <sub>2</sub> O-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. $EF_1=0.01$
$EF_4$	Emission factor for N <sub>2</sub> O emissions from atmospheric deposition of N on soils and water surfaces, in kg N- N <sub>2</sub> O / (kg NH <sub>3</sub> -N + NO <sub>x</sub> -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. $EF_4=0.01$
$EF_5$	Emission factor for indirect emission of N <sub>2</sub> O from runoff in Kg N <sub>2</sub> O-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. $EF_5=0.0075$
$F_{leach}$	Fraction of <i>all</i> 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. $F_{leach}=0$
$R_{N,n}$	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. However, there is no value for aerobic lagoon in ACM0010 Annex I or national data, so the default value of 2006 IPCC guideline was applied.

Annual baseline N<sub>2</sub>O leakage emission for land application was estimated as table E26. Baseline N<sub>2</sub>O leakage emission for land application during the monitoring period was estimated as table E27.

Table E26: Estimated annual baseline N<sub>2</sub>O leakage emission from land application

	$EF_1$ (fraction)	$NEX_{LT,y}^*$ (kg N/head/year)	$R_{N,n}$ (fraction)	$N_{LT}$ (head)	$F_{gasm}$ (%)	$LE_{N_2O,land}$ (kg N <sub>2</sub> O-N)
Broiler	0.01	0.502	0.4	2,669,299	20	6,435
Layer	0.01	0.924	0.4	597,000	20	2,647
Total						9,082

Table E27: Baseline N<sub>2</sub>O leakage emission from land application during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
Annual baseline N <sub>2</sub> O leakage emission for land application	kg N <sub>2</sub> O-N	10,754	4,424
Total baseline N <sub>2</sub> O leakage emission for land application during the monitoring period	kg N <sub>2</sub> O-N	15,178	

Because the precipitation is less than the expiration, according to version 02 of ACM0010, the  $LE_{N_2O,runoff}$  is zero.

Annual baseline N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces was estimated as table E28. Baseline N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces during the monitoring period was estimated as table E29.

Table E28: Estimated annual baseline N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces

	$EF_1$ (fraction)	$NEX_{LT,y}^*$ (kg N/head/year)	$R_{N,n}$ (fraction)	$N_{LT}$ (head)	$F_{gasm'}$ (%)	$LE_{N_2O,vol}$ (kg N <sub>2</sub> O-N)
Broiler	0.01	0.502	0.4	2,669,299	20	1,609
Layer	0.01	0.924	0.4	597,000	20	662
Total						2,271

Table E29 Baseline N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610

Baseline N <sub>2</sub> O leakage emission from atmospheric deposition of N on soils and water surfaces during the monitoring period	kg N <sub>2</sub> O-N	2,689	1,106
Total baseline N <sub>2</sub> O leakage emission from atmospheric deposition of N on soils and water surfaces during the monitoring period	kg N <sub>2</sub> O-N	3,795	

Total baseline leakage N<sub>2</sub>O emissions from land application is listed in table E30.

Table E30: N<sub>2</sub>O emission under project activity

Parameters	Unit	Value
$GWP_{N_2O}$	-	310
$CF_{N_2O-N,N}$	-	44/28
$LE_{B,N_2O}$ in one year	t CO <sub>2</sub> e	5,531
$LE_{B,N_2O}$ during the monitoring period	t CO <sub>2</sub> e	9,243

(ii) N<sub>2</sub>O emissions out the project boundary in project case

$$LE_{P,N_2O} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (LE_{N_2O,land} + LE_{N_2O,runoff} + LE_{N_2O,vol}) \quad (28)$$

$$LE_{N_2O,land} = EF_1 * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (29)$$

$$LE_{N_2O,runoff} = EF_5 * F_{Leach} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (30)$$

$$LE_{N_2O,vol} = EF_4 * F_{gasm} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (31)$$

Annual N<sub>2</sub>O leakage emission from land application under project activity was estimated as table E31. Total N<sub>2</sub>O leakage emission from land application under project activity during the monitoring period was estimated as table E32.

Table E31: Estimated annual N<sub>2</sub>O leakage emission from land application under project activity

	$EF_1$ (fraction)	$NEX_{LT,y}$ (kg N/head/year)	% of NEX in Aerobic Lagoon for land application	$N_{LT}$ (head)	$F_{gasm}$ (%)for aerobic lagoon	$F_{gasm}$ (%)for land application	$LE_{N_2O,land}$ (kg N <sub>2</sub> O-N)
Broiler	0.01	0.502	99	2,669,299	40	20	6,371

Layer	0.01	0.924	99	597,000	40	20	2,621
Total							8,992

Table E32: N<sub>2</sub>O leakage emission from land application under project activity during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
N <sub>2</sub> O leakage emission for land application under project activity during the monitoring period	kg N <sub>2</sub> O-N	10,647	4,380
Total N <sub>2</sub> O leakage emission for land application under project activity during the monitoring period	kg N <sub>2</sub> O-N	15,027	

Because the precipitation is less than the expiration, according to ACM0010, version 02, the  $LE_{N_2O, runoff}$  is zero.

Annual N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces under project activity was estimated as table E33. Total N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces under project activity during the monitoring period was estimated as table E34.

Table E33: Estimated annual N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces under project activity

	$EF_1$ (fraction)	$NEX_{LT,y}^*$ (kg N/head/year)	% of NEX in Aerobic Lagoon for land application	$N_{LT}$ (head)	$F_{gasm}$ (%) for aerobic lagoon	$F_{gasm}$ (%) for land application	$LE_{N_2O, vol}$ (kg N <sub>2</sub> O-N)
Broiler	0.01	0.502	99	2,669,299	40	20	1,593
Layer	0.01	0.924	99	597,000	40	20	655
Total							2,248

Table E34: Total N<sub>2</sub>O leakage emission from atmospheric deposition of N on soils and water surfaces under project activity during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
N <sub>2</sub> O leakage emission from atmospheric deposition of N on soils and water surfaces under project activity during the monitoring period	kg N <sub>2</sub> O-N	2,662	1,095



Total N <sub>2</sub> O leakage emission from atmospheric deposition of N on soils and water surfaces under project activity during the monitoring period	kg N <sub>2</sub> O-N	3,757
--	-----------------------	-------

Total leakage N<sub>2</sub>O emissions under project activity from land application is listed in table E35.

Table E35: Leakage N<sub>2</sub>O emission under project activity

Parameters	Unit	Value
$GWP_{N_2O}$	-	310
$CF_{N_2O-N,N}$	-	44/28
$LE_{B,N_2O}$ in one year	t CO <sub>2</sub> e	5,476
$LE_{B,N_2O}$ during the monitoring period	t CO <sub>2</sub> e	9,150

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

$$LE_{B,CH_4} = GWP_{CH_4} \cdot D_{CH_4} * MCF_d * \left[ \prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{O,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (32)$$

Where:

$LE_{B,CH_4}$  Methane leakage emissions in the baseline (tCO<sub>2</sub>e / yr)

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

Annual CH<sub>4</sub> leakage emission in baseline was estimated as table E36. CH<sub>4</sub> leakage emission under baseline during the monitoring period was listed in table E37.

Table E36: Estimated annual methane leakage emission in baseline

Parameters	Unit	Broiler	Layers
$GWP_{CH_4}$	-	21	21
$D_{CH_4}$	t/m <sup>3</sup>	0.00067	0.00067
$MCF_d$	fraction	1	1
$R_{VS,n}$	fraction	0.7	0.7
$B_{O,LT}$	m <sup>3</sup> CH <sub>4</sub> /kg_dm	0.36	0.39
$N_{LT}$	head	2,669,299	597,000
$VS_{LT,y} *$	kg dm/year	5.073	12.368
$MS\%_{Bl,j}$	%	100	100

$LE_{B,CH_4}$	t CO <sub>2</sub> e	20,577	12,155
Total	t CO <sub>2</sub> e	32,732	

Table E37: Methane leakage emission under baseline during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
CH <sub>4</sub> leakage emission under baseline during the monitoring period	t CO <sub>2</sub> e	34,389	20,314
Total CH <sub>4</sub> leakage emission under baseline during the monitoring period	t CO <sub>2</sub> e	54,703	

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

$$LE_{P,CH_4} = GWP_{CH_4} * D_{CH_4} * MCF_d * \left[ \prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} B_{O,LT} * N_{LT} * VS_{LT,y} * MS \%_j \quad (33)$$

Where:

$LE_{P,CH_4}$  Methane leakage emissions in the project case (tCO<sub>2</sub>e / yr)

Annual CH<sub>4</sub> leakage emission under project activity includes sludge land application and of aerobic treated effluent land application. Because there is no sludge applied to soil during 1st monitoring period, the CH<sub>4</sub> emission from sludge land application is zero. The annual CH<sub>4</sub> leakage emission from aerobic lagoon effluent land application under project activity is estimated as table E38. Methane leakage emission under project activity during the monitoring period was listed in table E39.

Table E38: Estimated annual methane leakage emission from aerobic lagoon effluent land application under project activity

Parameters	Unit	Broiler	Layers
$GWP_{CH_4}$	-	21	21
$D_{CH_4}$	t/m <sup>3</sup>	0.00067	0.00067
$MCF_d$	fraction	1	1
$R_{VS,1}$	%	84.4	84.4
$R_{VS,2}$	%	0.1	0.1
$B_{O,LT}$	m <sup>3</sup> CH <sub>4</sub> /kg_dm	0.36	0.39
$N_{LT}$	head	2,669,299	597,000

$VS_{LT,y}^*$	kg dm/year	5.073	12.368
$MS\%_j$	%	100	100
$LE_{P,CH4}$	t CO <sub>2</sub> e	10,675	6,306
Total	t CO <sub>2</sub> e	16,981	

Table E39: Methane leakage emission from aerobic lagoon effluent land application under project activity during the monitoring period

Parameters	Unit	Broiler	Layers
Monitoring period	day	610	610
<u>Methane leakage emission from aerobic lagoon land application</u> under project activity during the monitoring period	t CO <sub>2</sub> e	17,840	10,539
Total <u>methane leakage emission from aerobic lagoon land application</u> under project activity during the monitoring period	t CO <sub>2</sub> e	28,379	

Therefore leakage emissions for the current monitored period are summarized as follows:

Summary of Leakage Emissions for this monitored Period		
Parameters	Unit	Value
$LE_{B,CH4}$	t CO <sub>2</sub> e	54,703
$LE_{P,CH4}$	t CO <sub>2</sub> e	28,379
$LE_{B,N2O}$	t CO <sub>2</sub> e	9,243
$LE_{P,N2O}$	t CO <sub>2</sub> e	9,150
$LE_Y$	t CO <sub>2</sub> e	0

For further details please see ERs calculation spreadsheet-Minhe second monitoring period.

#### E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (tCO <sub>2</sub> e)	Leakage (tCO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO <sub>2</sub> e)
<b>Total</b>	158,498	39,568	0	118,930

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:

$$ER_y = BE_y - PE_y - LE_y$$

Further, if the actual methane captured from anaerobic digesters in project activity is lower than  $(BE_{CH_4,y} - PE_{AD,y} - PE_{PL,y})$ , then  $(BE_{CH_4,y} - PE_{AD,y} - PE_{PL,y})$  (which is a component of  $BE_y - PE_y$ ) in equation 32 is replaced by actual methane captured.

During the monitoring period, biogas captured during monitoring period was 17,824,039 m<sup>3</sup>, which equals to 153,713 tCO<sub>2</sub>e. Baseline methane emission ( $BE_{CH_4,y}$ ) was 125,124 tCO<sub>2</sub>e. Methane emissions from anaerobic digester where gas is captured ( $PE_{AD,y}$ ) was 14,154 tCO<sub>2</sub>e. Methane emissions from Physical leakage of distribution network were 283 tCO<sub>2</sub>e. Actual methane captured from anaerobic digesters is higher than the difference of  $BE_{CH_4,y} - PE_{AD,y}$  and  $PE_{PL,y}$ . Therefore, the equation 34 can be used to calculate emission reduction.

Emission reduction generated in the monitoring period (01/05/2010-31/12/2011): 118,930 tCO<sub>2</sub>e.

#### E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

According to the registered PDD, the expected emission reduction of the project was estimated to be 72,371 tCO<sub>2</sub>e per year. During the monitoring period (01/05/2010-31/12/2011), the measured annual emission reduction was 118,930 tCO<sub>2</sub>e which is 2% lower than the ex-ante calculated result of 121,550 tCO<sub>2</sub>e.

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO <sub>2</sub> e)	120,948 (=72,371/365*610)	118,930

#### E.6. Remarks on difference from estimated value in registered PDD

There was no increase from actual values compared with estimated values.

-----

#### History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Form <b>Business Function:</b> Issuance		