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

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

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

Title: Methane Recovery Project of Linqu Qinchi Biological Co., Ltd.
Version number of document: 6
Date: 30/08/2010

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

The purpose of Methane Recovery Project of Linqu Qinchi Biological Co., Ltd. (hereinafter referred to as "the Project"), is to recover the biogas generated from the wastewater treatment process, and utilizing the recovered biogas as boiler fuel. The Project site is situated in Weifang City, Shandong Province, and the Linqu Qinchi Biological Co. Ltd. (hereinafter referred to as "Linqu Qinchi") will be responsible entity to construct and operate the Project.

The Linqu Qinchi, was founded as alcohol plant in 2007. The original factory owned by another company was also producing alcohol, which started in 1970, when the lagoon was built. It now produces alcohol related products from cassava, and the yearly alcohol production is 30,000t. From the plant, 1,200m^3 of high organic content wastewater is generated daily.

Currently, the wastewater is treated through sedimentation basin, anaerobic lagoon and aeration basin, and is finally discharged after the water quality satisfies the Class III of the "Integrated Wastewater Discharge Standards" (GB8978-1996), to the pipeline to the central water treatment plant, where it will be aerobically treated before discharging to the open water. The methane generated through anaerobic decomposition is emitted to the air, and sludge from the lagoon is finally given to the nearby farmers as fertilizer.

The heat for the alcohol production is currently supplied by a coal-fired boiler.

The purpose of the project activity is to recover the biogas and utilize as a boiler fuel to supply heat. The generated steam shall be used internally for alcohol production, and will partially substitute the use of fossil fuel (coal). The Project constructs anaerobic reactor (as substitute of current lagoon), biogas recovery system and duel fuel (coal and biogas) heat generation system. For the anaerobic reactor, UASB (Upflow Anaerobic Sludge Bed) reactor is installed. The current coal-fired boiler shall be conversed so that biogas can be mixed as fuel of the boiler for the steam generation. The sludge generated from the treatment system shall be control combusted in the conversed boiler

The Project Feasibility Study Report (hereinafter called as the "FSR") was concluded on Mar 1. Based on the report, the investment decision was made by the Board of Directors on Mar 8 2008.The FSR has been approved by the Linqu Development and Reform Bureau in September, 2008. The contract for the construction had been signed on September 22, 2008, and, as of January 2009, the construction works have been finished, and already started on the new production from February. The Chinese Government has approved of the Project as a CDM project on Mar 18, 2009.

As a result of the Project, the emission reduction amount from the Methane Recovery Component shall be 58,776tCO2e and from the Heat Utilization Component shall be 13,690tCO2e, totalling to be 72,466tCO2e.

Benefits from this project besides the reduction of greenhouse gas emission are:

- Reduction of health danger from biogas diffusion, such as odour or danger of explosion.
- Reduction of air pollution from coal combustion, and reduction of coal ash waste.
- Increase of job opportunities (15people) and benefit the living standard of local residents.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Linqu Qinchi Biological Co., Ltd.	No
Japan	Energy Initiative Japan Inc.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

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

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

A.4.1.1. Host Party(ies):

People's Republic of China

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

Shandong Province

A.4.1.3. City/Town/Community etc:

Linqu County, Weifang City

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

The Project site is situated in Linqu County, Weifang City which is in the north east of Shandong Province .The physical boundary of the project are: E118°30'34" and N36°5'39". The physical location of the project area is shown on the map (Fig. A.4.1) below:

Fig. A.4.1 Location of the Project Site

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

Type and Category:
According to Appendix B to the “Simplified Modalities and Procedures for Small Scale Modalities and Procedures for Small Scale CDM Project Activities, the Project type and categories are defined as follows:

Methane Recovery Component
For the methane recovery in wastewater treatment, the following:
Type III: Other project activities
Category III.H: Methane Recovery in Wastewater Treatment
Sectoral Scope 13: Waste Handling and Disposal

Heat Utilization Component
For the utilization of methane as boiler fuel, the following:
Type I: Renewable energy projects
Category I.C: Thermal energy for the user with or without electricity
Sectoral scope 1: Energy industries (renewable/non-renewable sources)

Technology:
The Project will introduce the UASB reactor instead of anaerobic lagoon to recover biogas (**Methane Recovery Component)**. The recovered biogas, after desulfurization, will be utilized for boiler fuel, combining with coal **(Heat Utilization Component)**. The existing coal boiler shall be conversed into dual-fuel boiler. The sludge shall be control combusted in the conversed boiler, after dehydration. The characteristics of the biogas capture and utilization facility and related wastewater treatment process are shown in tableA.4.1 and A.4.2.

TableA.4.1 Main technical parameters of the Project

Parameter	Unit	Value	Source
Boiler capacity	MW_{th}	14	FSR[1]
Annual operating days	d/yr	300	FSR
Daily wastewater production	m^3	1,200	FSR
COD of waste water before treatment at the entrance of anaerobic facility	mg/L	58,000	FSR
COD after the anaerobic treatment	mg/L	2,320	FSR
COD after final treatment , discharged to the river	mg/L	200	FSR

Table A.4.2 Specification of main facility

Parameter		Value	Source
UASB reactor	Number of reactors	3	FSR
	Capacity	3,600 m^3	FSR
	Retention time	3 days	FSR
Boiler	Type	SHL20-1.57-AII	FSR

[1] Feasibility Study was published in March 2008 by Weifang Engineering Consulting Institute, and approved by the Linqu Development and Reform Bureau on Sep. 18, 2008.

Parameter		Value	Source
	Number of boiler	1	FSR
	Manufacturer	Wuxi Boiler works	FSR
	Rated steaming capacity	20t/h	FSR
	Rated steam pressure	1.57MPa	FSR
	Rated steam temperature	200^{o}C	FSR
	Feed water temperature	105^{o}C	FSR
	Boiler efficiency	100%	AMS-I.C (version16) paragraph 18, conservative value
	Expected lifetime	20 years	FSR
	Start up date of the boiler	October, 2006	FSR

To determine the remaining lifetime of the existing boiler, Option (a) of the "Tool to determine the remaining lifetime of equipment" is applied.

According to manufacture's information, the expected technical lifetime of the boiler is 20 years, and, since (i) the project participant have been operated and maintained the boiler according to the recommendations of the equipment supplier, (ii) there were no periodic replacement schedules or scheduled replacement practices specific to the alcohol plant which require any early replacement of equipment before the expiry of the technical lifetime or (iii) the equipment has no design fault or defect and did not have any industrial accident due to which the boiler cannot operate at rated performances, the boiler is expected to operate for the lifetime since its commencement, which is October 2006.

As such, whole of the crediting period shall fall during the expected lifetime.

All the technologies involved in this project are from China, it does not involve technology transfer.

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

The crediting period is 10 years, starting from January 2011 through to December 2020. The total amount of emission reduction during the crediting period is 724,660tCO2e, of which from the **Methane recovery component** the total emission reduction is 587,760tCO2e and from the **Heat utilization component** the reduction is 136,900tCO2e as shown in Table A.4.3.

Table A.4.3 Estimated amount of emission reduction during the crediting period

Year	Estimated amount of annual reduction (tCO_2e)
2011	72,466
2012	72,466
2013	72,466
2014	72,466
2015	72,466
2016	72,466
2017	72,466
2018	72,466
2019	72,466
2020	72,466
Total estimated reductions (tCO_2e)	**724,660**
Total number of crediting years（years）	**10**

Annual average of the estimated reduction over the crediting period （tCO_2e）	**72,466**

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

The Project will not receive any public funding from the Annex I Parties.

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

The project participants have not registered or are not applying to register any other small-scale CDM project activity:

• With the same project participants;
• In the same project category and technology/measure; and
• Registered within the previous 2 years; and
• Whose project boundary is within 1 km of the project boundary of the Project at the closest point.

SECTION B. Application of a baseline and monitoring methodology

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

Methane recovery component:

The methane recovery component of this project applies the approved CDM small scale baseline and monitoring methodology AMS III.H “Methane recovery in wastewater treatment” (Version 13). For more information on this methodology, please refer to link:
http://cdm.unfccc.int/UserManagement/FileStorage/K3DAOL1H7RB9CN5GMXET4F0WSU26ZY

For the calculation of the grid emission factors concerning the North China grid, “Tool to calculate the emission factor for an electricity system (version02)” shall be applied. For more information on this tool, please refer to link:
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf

For the calculation of density of methane, “Tool to determine project emissions from flaring gases containing methane”, Annex 13, Meeting report EB 28 shall be applied. For more information on this tool, please refer to link:

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf

Heat Utilization Component

The Heat Utilization component of this project applies the approved CDM small scale baseline and monitoring methodology AMS I.C “Thermal energy with or without electricity” (Version 16). For more information on this methodology, please refer to link:

http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN

For the consideration of additionality, the following guidances and attachements shall be applied:

"Attachment A of appendix B of the simplified modalities and procedures for small-scale CDM project activities"
http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf

and

"Annex: Guidelines on the Assessment of Investment Analysis (version 03)"
http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

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

Methane recovery component:

AMS-III.H (Version 13) is applicable to the **methane recovery component** of the project activities as shown in the following table.

Table B.2.1Applicability check (methane recovery component)

No.	Technology/measure	In the case of the project	Applicability
1	This methodology comprises measures that recover biogas from biogenic organic matter in wastewaters by means of one, or combination, of the following options[2]: (i) Substitution of existing aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; (ii) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to an existing wastewater treatment plant without sludge treatment; (iii) Introduction of biogas recovery and combustion to an existing sludge treatment system; (iv) Introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant[3];	The project will introduce a sequential stage of wastewater treatment including UASB reactors with methane recovery that otherwise would have been open anaerobic lagoons without methane recovery, Thus the Project falls in to option (vi). Also, the depth of the baseline lagoon is 3m (deeper than 2meters), Average monthly temperature from May to September is above 15℃,	Applicable

[2] Under this methodology anaerobic lagoons are considered ponds deeper than 2 meters, without aeration, ambient temperature above 15℃, at least during part of the year, on a monthly average basis, and with a volumetric loading rate of Chemical Oxygen Demand above 0.1kg $CODm^{-3}\cdot day^{-1}$. The minimum interval between consecutives sludge removal events shall be 30 days.

[3] Other technologies in table 6.3 of Chapter 6: Wastewater Treatment and Discharge of 2006 IPCC Guidelines for National Greenhouse Gas Inventories are included.

No.	Technology/measure	In the case of the project	Applicability
	(v) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream; (vi) Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an existing anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	volumetric loading rate of COD being 58kgCOD/m3.day (above 0.1kgCOD/m3.day), and the interval of consecutive sludge removal was around 2.5 months which is longer than 30 days.	
2	The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or electrical energy generation directly; or (b) Thermal or electrical energy generation after bottling of upgraded biogas; or (c) Thermal or electrical energy generation after upgrading and distribution: (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; or (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or (d) Hydrogen production.	The project is covered under paragraph 2 (a).The recovered methane is utilized directly for duel fuelled boiler.	Applicable
3	If the recovered biogas is used for project activities covered under paragraph 2 (a), that component of the project activity can use a corresponding methodology under Type I.	The approved baseline and monitoring methodology AMS I.C. is used for the heat utilization component of the project activity	Applicable
4	If the recovered biogas is utilized for production of hydrogen (project activities covered under paragraph 2 (d)), that component of project activity shall use corresponding category AMS III.O.	The project is not covered under paragraph 2 (d).	N/A

No.	Technology/measure	In the case of the project	Applicability
5	In case of project activities covered under paragraph 2 (b) if bottles with upgraded biogas are sold outside the project boundary the end-use of the biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO_2 emissions avoided by the displacement of the fuels is eligible under a corresponding Type I methodology, e.g. AMS-I.C.	The project is not covered under paragraph 2 (b).	N/A
6	In case of project activities covered under paragraph 2 (c i) emission reductions from the displacement of the use of natural gas is eligible under this methodology, provided the geographical extent of the natural gas distribution grid is within the host country boundaries.	The project is not covered under paragraph 2 (c i).	N/A
7	In case of project activities covered under paragraph 2 (c ii) emission reductions for the displacement of the use of fuels can be claimed following the provision in the corresponding type I methodology, e.g. AMS-I.C.	The project is not covered under paragraph 2 (c ii).	N/A
8	In case of project activities covered under paragraph 2 (b) and (c), this methodology is applicable if upgrade is done by one of the following technologies[4] such that the methane content of the upgraded biogas shall be in accordance with relevant national regulations (where these exist) or in absence of national regulations, a minimum of 96% (by volume). These conditions are necessary to ensure that the recovered biogas is completely destroyed through combustion in an end use. • Pressure Swing Adsorption: • Absorption with/without water circulation; • Absorption with water, with or without water recirculation (with or without recovery of methane emissions from discharge)	The project is not covered under paragraph 2 (b) and (c).	N/A
9	New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity	The Project is neither a Greenfield project nor does it involve any capacity addition of the	N/A

[4] Please refer to annex 1 of approved methodology AM0053/Version 01.1 regarding the description of these technologies.

No.	Technology/measure	In the case of the project	Applicability
	of the baseline treatment system are only eligible to apply this methodology if they comply with the requirements in the General Guidance for SSC methodologies[5] concerning these topics. In addition the requirements for demonstration of the remaining lifetime of the equipment replaced as described in the general guidance shall be followed.	wastewater treatment system.	
10	For project activities covered under paragraph 2 (b) and (c) additional guidance provided in annex 1 shall be followed for the calculations in addition to the procedures in the relevant sections below.	The project is not covered under paragraph 2 (b) and (c).	N/A
11	The location of the wastewater treatment plant shall be uniquely defined as well as the source generating the wastewater and described in the PDD.	The location of the wastewater treatment plant as well as the source generating the wastewater is uniquely defined and is described in the PDD.	Applicable
12	Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO2 equivalent annually from all Type III components of the project activity.	Annual emission reductions achieved by the methane recovery component of the project is estimated to be 58.78 ktCO2e, which is less than 60 ktCO2e.	Applicable

AMS-I.C (Version 16) is applicable to the **heat utilization component** of the project activity as shown in the following table.

Table B.2.2 Applicability check (heat utilization component)

No.	Technology/measure	In the case of the project	Applicability
1	This category comprises renewable energy technologies that supply users[6] with thermal energy that displaces fossil fuel use. These units include technologies such as solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.	The project will generate thermal energy (steam) from biogas captured through wastewater treatment process and displace steam that would have been supplied by a coal fired boiler.	Applicable
2	Biomass-based co-generating systems that produce heat and electricity are included in this category. For the purpose of this methodology “Cogeneration” shall mean the simultaneous	This project does not introduce any co-generating system.	N/A

[5] Refer to: “General guidance to Indicative simplified baseline and monitoring methodologies for elected small-scale CDM project activity categories”

[6] E.g., residential, industrial or commercial facilities.

	generation of thermal energy and electrical and/or mechanical energy in one process. Cogeneration system may supply one of the following: (a) Electricity to a grid; (b) Electricity and/or thermal energy (steam or heat) for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).		
3	The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal[7] (see paragraph 5 for the applicable limits for cogeneration project activities).	The aggregated installed capacity of the dual-fuel fired boiler is equivalent to $14MW_{th}$,which is less than $45MW_{th}$.	Applicable
4	For co-fired[8] systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel shall not exceed 45 MW thermal (see paragraph 5 for the applicable limits for cogeneration project activities).	Ditto.	Applicable
5	The following capacity limits apply for biomass cogeneration units: (a) If the project activity includes emission reductions from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to thermal energy (i.e., for renewable project activities, the maximal limit of 15 MW(e) is equivalent to 45 MW thermal output of the equipment or the plant); (b) If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e., no	This project does not introduce any cogeneration system.	N/A

[7] Thermal energy generation capacity shall be manufacturer's rated thermal energy output, or if that rating is not available the capacity shall be determined by taking the difference between enthalpy of total output (for example steam or hot air in kcal/kg or kcal/m^3) leaving the project equipment and the total enthalpy of input (for example feed water or air in kcal/kg or kcal/m^3) entering the project equipment. For boilers, condensate return (if any) must be incorporated into enthalpy of the feed.

[8] Co-fired system uses both fossil and renewable fuels

	emission reductions accrue from electricity component), the total installed thermal energy production capacity of the project equipment of the cogeneration unit shall not exceed 45 MW thermal; (c) If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e., no emission reductions accrue from thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.		
6	In case electricity and/or steam/heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.	The steam produced by the Project is utilized within the same plant.	N/A
7	Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category.	A duel-fuelled boiler is being retrofitted for renewable energy generation.	Applicable
8	The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should comply with capacity limits in paragraphs 3 to 5 and should be physically distinct[9] from the existing units.	The aggregated installed capacity of the dual-fuel fired boiler is equivalent to $14MW_{th}$,which is less than $45MW_{th}$.	Applicable
9	Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources5 provided: (a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or	The Project does not involve charcoal based biomass	N/A

[9] Physically distinct units are those that are capable of producing thermal/electrical energy without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered “physically distinct”.

	(b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology AMS-III.K. Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g., source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.		

B.3. Description of the project boundary:

The AMS III.H (version 13) stipulates that the project boundary is the physical, geographical site where the wastewater and sludge treatment takes place. The boundary covers all facilities affected by the project activity including sites where the processing, transportation and application or disposal of waste products as well as biogas takes place. Additionally, AMS I.C (version 16) states that the project boundary is the physical, geographical site of the project equipment producing renewable energy. The boundary also extends to the industrial, commercial or residential facility, or facilities, consuming energy generated by the system and the processes or equipment that is affected by the project activity..

The open stack flare is only used for emergency such as maintenance of the boiler or malfunction, and, in normal conditions, the methane recovered shall be completely isolated by a valve from the boiler system. Also, the methane recovered shall not be considered for carbon credit when the open stack flare is utilized, and the time when the flare is utilized shall be monitored.

Based on the above definition, the project boundary is shown in the figure B.3.1:

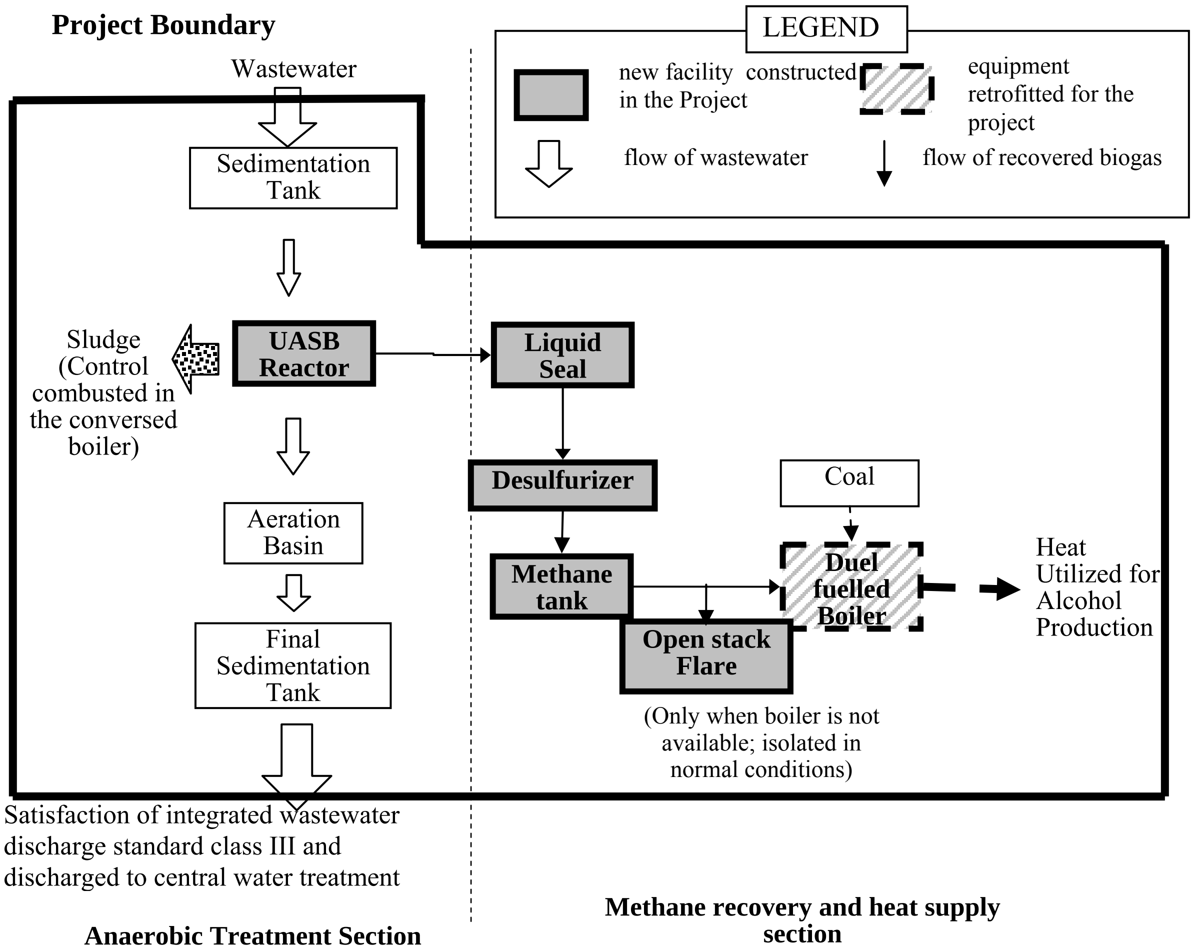

Fig. B.3.1 Project Boundary of the Proposed Project

B.4. Description of baseline and its development:

The baseline scenario of this project shall be based on the methodology AMS III.H (version 13) and AMS I.C (version 16) .

1. Methane Recovery component (AMS III.H(version13))

This project fits in the type (vi) of the AMS III.H (version13) For this project, the baseline shall be the existing wastewater treatment process, which is the anaerobic lagoon system. The outline of the existing anaerobic lagoon is as follows:

- Number of lagoons : 2
- Capacity : 29,970m^3 (A capacity of one lagoon)
- Depth : 3m (With this depth the lagoon has enough anaerobic conditions to generate large amount of methane)

Also, the sludge generated in the baseline system is distributed to the nearby farmers for soil application. The sludge had been removed from the lagoon around every 2.5 months.

2. Heat utilization component (AMS I.C(version 16))

Methodology AMS I.C (version 16) is applied for the heat utilization. The baseline scenario in this methodology, in paragraph 11, states "For renewable energy that displaces technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission factor for the fossil fuel displaced". Thus, for this project, the baseline shall be the amount of coal that would have been used in the absence of the project activity based on the amount of steam generated in the boiler.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Prior and Serious consideration of CDM

The purpose of the project activity is to recover methane emitted from the wastewater treatment facility and supply heat from the recovered methane from a renewable energy source. CDM was considered in the decision making process by the Linqu Qinchi in the meeting of the Board of Directors. From the economical analysis in the FSR, it was found that only cash flow financed by CDM would be financially attractive for the Project. The timeline of the Project is summarized in Table B.5.1.

Table B.5.1. Timeline of the proposed project

Date	Event	Evidence
Mar 2008	Completion of Feasibility Study Report (FSR)	FSR was prepared by Weifang Engineering Consulting Institute.
8 Mar 2008	Investment Decision	Minutes of the Meeting of the Board of Directors
12 Mar 2008	Agreement with CDM consultant	Agreement between Linqu Qinchi Biological and UNIUFA Energy Technology Co., Ltd.
21 Aug 2008	Conclusion of ERPA	ERPA concluded between Linqu Qinchi Biological and Energy Initiative Japan Inc.
18 Sep 2008	FSR approved	Approval Letter by Linqu Development and Reform Bureau
18 Sep 2008	Application for CDM to NDRC	Application form prepared and applied.
21 Sep 2008	EIA Report Approved	Approval letter of Linqu Environmental Protection Bureau
22 Sep 2008	Signing of Construction contract (= starting date of the Project Activity)	Construction contract with Weifang Second Construction Company Foundation Construction Branch Company
1 Oct 2008	Disclosure of PDD to global stakeholder consultation (GSC) on UNFCCC web-site	PDD version 1.0 was uploaded at the UNFCCC website
15 Oct 2008	Signing of Purchase contract of major equipment	Purchase contract with Shandong Mengyin Huanyu Installation Engineering CO., Ltd
30 Jan 2009	Start of production	
18 Mar 2008	CDM project approval by the	LOA of China

Date	Event	Evidence
	Government of China	
27 Feb 2009	Project approval by the government of Japan	LOA of Japan
January 2011 (or registered date)	Expected time of project start up (Starting date of crediting period)	

In accordance to Attachment A of Appendix B of the simplified modalities and procedures for small-scale CDM project activities, additionality is demonstrated by showing that the project activity would not have occurred anyway due to one of the barriers: i.e., Investment barrier, technological barrier, barrier due to prevailing practice or other barriers. For the Project, existence of an investment barrier prevents the Project from occurring, which is substantiated by the following benchmark analysis.

Whether or not the Project shall be implemented will be determined by comparing the IRR after tax of the Project without CDM financing to a suitable benchmark.

As methane recovery is not the main business of the Linqu Qinchi, the benchmark IRR after tax of the alcohol production industry in China applies to this project. In the "Economic evaluation measurements and parameters of constructive projects", issued by NDRC & Ministry of Construction of the People's Republic of China in 2006 the benchmarks of projects for all industries are categorized into 24 sectors and 94 detailed sectors. Among these sectors, the sector which specifically points out as alcohol industry is not found in the said document. However, various authoritative Chinese literatures[10] cite that edible alcohol is included in the organic chemistry industry. Therefore, benchmark of 12% for manufacturer of "Organic chemical feedstock and intermediates production", which is widely used in many feasibility study reports for alcohol manufacturing industry in China[11], is applied for this case.

Table B.5.2 shows the financial parameter used in the analysis.

Table B.5.2 Financial Parameter for this Project

Parameter	Value	Source
Amount of coal displaced	8,630t	Feasibility Study Report
Coal price	500Yuan RMB/t	Feasibility Study Report
Total investment cost	7,175 thousand Yuan RMB	Feasibility Study Report
Total annual running cost	4,014 thousand Yuan RMB	Feasibility Study Report
Value Added Tax	17%	Feasibility Study Report
City Construction Tax	5%	Feasibility Study Report
Education Additional Tax	3%	Feasibility Study Report
Cooperate Income Tax	25%	Feasibility Study Report

[10] Literatures such as: "Handbook of Chemical Products", Chemical Industry Press; "Library of Organic Chemistry Material", Chemical Industry Press, or "Organic Chemical Process", Chemical Industry Press (all in Chinese)

[11] Examples of feasibility studies for edible alcohol industries which used 12% as benchmark are:
Jilin Tuopai Agricultural Development Co., Ltd; a FS for edible alcohol plant, published in 2005 (http://chinaneast.xinhuanet.com/2005-04/19/content_4091817.htm)
Gansu Mogao Industrial Development Co., Ltd , a FS for winery project published in 2007 (http://www.guosen.com.cn/webd/public/infoDetail.jsp?infoid=2735700)
Baishan Municipal People's Government a FS for beer production project, published in 2007 (http://bs.jl.gov.cn/BsWebCms/site/bscms/touzibaishan/news/n2820451087.html)

Parameter	Value	Source
Depreciation method	Straight line method	Feasibility Study Report
Depreciation period	15 years	Feasibility Study Report
Residual book price	5%	Feasibility Study Report

The IRR for the project with and without CDM revenue is shown in Table B.5.3

Table B.5.3 IRR after tax of the Project

	IRR
Without CDM	4.0%
With CDM	79.8%

As above, the IRR after tax without CDM revenue is 4.0% which is below the benchmark IRR after tax for alcohol industry of 12%, which indicates that the Project is not financially attractive without CDM. On the contrary, the IRR after tax including CDM revenue is 79.8%, showing that the Project become financially be attractive if the project is registered as CDM project.

In order to assess whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions, sensitivity analysis is undertaken for the proposed project activity.

According to the Paragraph 17 of "Annex: Guidelines on the Assessment of Investment Analysis (Version 03)" only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. For the project activity, coal price and biogas treatment cost in addition to the electricity cost are selected for variables subject to the sensitivity analysis based on their quantitative materiality following the guidance. Also, initial investment cost was selected for comparison.

The table and figure below shows variation of equity IRR after tax when the selected three critical variables are changed range of -10% and +10% (the range is equivalent to the least cover range stipulated in Section 18 of "Annex: Guidelines on the Assessment of Investment Analysis (Version 03)").

Table B.5.4 Sensitive Analysis

Parameters	-10%	-5%	0%	5%	10%
Fuel cost saving (coal price)	-4.8%	0.5%	4.0%	7.2%	10.1%
Biogas treatment cost	5.6%	4.8%	4.0%	3.2%	2.3%
Electricity cost	6.1%	5.1%	4.0%	3.0%	1.8%
Initial investment cost	5.5%	4.7%	4.0%	3.4%	2.8%

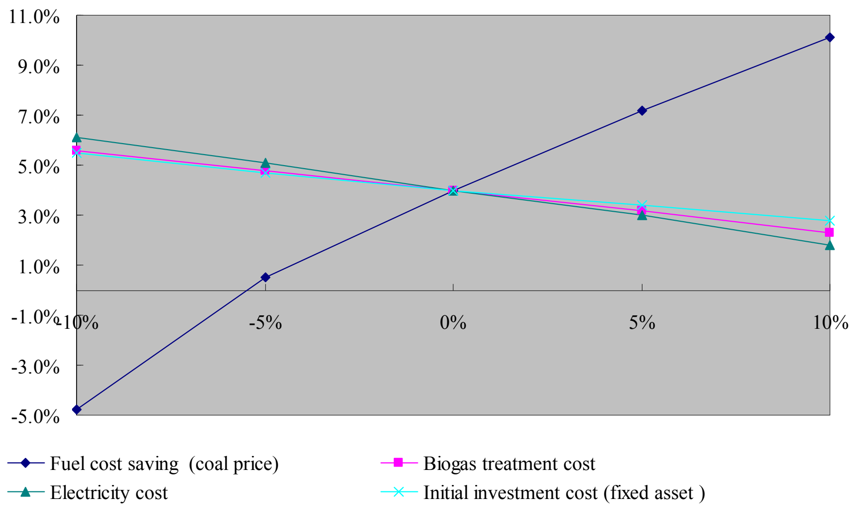

Fig. B.5.1 Sensitive Analysis

Coal price, biogas treatment cost, electricity cost and initial investment cost hit the benchmark IRR after tax of 12% when they changed by +14%, -54%,-42% and -44% respectively (see separate Excel spreadsheet for detail). These magnitudes of the change are very unlikely to occur because;

- Coal price: Past 7 year's statistical data published by the Shandong Statistical Bureau indicated that annual fluctuation of coal price is +8.1% in average and +12.9% at the maximum (see Table B.5.5). This means 14% increase of the coal price, which is necessary to hit the benchmark IRR, is unrealistic.
- Biogas treatment cost: As there is no data for the past statistics on the annual fluctuation of the biogas treatment cost, the data for the price fluctuation of the raw material, fuel and power purchasing is compared (See Table B.5.5). According to the Shandong Statistical Bureau, it is indicated that the average annual fluctuation of the "raw material, fuel and power purchasing" in the past 7 years is +4.6%, and the minimum decrease of the price is -1.3% (in 2001-2002). This means 54% decrease of the biogas treatment cost, which is necessary to hit the benchmark IRR, is unrealistic.
- Electricity cost: As there is no data for the past statistics on the annual fluctuation of the electricity cost, the data for the price fluctuation of the raw material, fuel and power purchasing is compared. According to the Shandong Statistical Bureau, it is indicated that the average annual fluctuation of the "raw material, fuel and power purchasing" in the past 7 years is +4.6%, and the minimum decrease of the price is -1.3% (in 2001-2002). This means 42% decrease of the electricity cost, which is necessary to hit the benchmark IRR, is unrealistic.
- Investment cost: For the evaluation of the investment cost, the data for the price fluctuation of the raw material, fuel and power purchasing is also compared as these make up most of the investment cost. According to the Shandong Statistical Bureau, it is indicated that the average annual fluctuation of the "raw material, fuel and power purchasing" in the past 7 years is +4.6%, and the minimum decrease of the price is -1.3% (in 2001-2002). This means 44% decrease of the initial investment cost, which is necessary to hit the benchmark IRR, is unrealistic.

Table B.5.5 Past annual fluctuation of prices (preceding year =100)

Item	2001	2002	2003	2004	2005	2006	2007	Average
Coal price	105	103.1	108.7	112.9	113	110	104.1	**8.11%**
Raw material, fuel and power purchasing	99.4	98.7	105.7	113.4	105.9	104.3	104.8	**4.60%**

Source: Statistical yearbook of Shandong

From the sensitivity analysis, it is concluded that the proposed project activity is unlikely to be financially/economically attractive.

From the above reason, it is demonstrated that the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The small scale methodologies AMS-III.H (Version 13) and AMS-I.C (version 16) are applied to calculate the emission as following steps:

1. Calculate Baseline Emissions
2. Calculate Project Emissions
3. Calculate Leakage
4. Calculate Emission Reductions

Step 1 Baseline Emissions

In accordance with the methodologies AMSIII.H (version 13) and AMS I.C (version 16), the baseline emissions for this project can be refined as:

$$\mathbf{BE_y = BE_{component1,y} + BE_{compononent2,y}}$$

where:

$BE_{component1,y}$: The baseline emissions from the Methane recovery component
$BE_{component2,y}$: The baseline emissions from the Heat utilization component

Step 1.1 Methane recovery component

According to AMS III.H (version 13) paragraph 16, the baseline emissions are calculated as follows:

$$\mathbf{BE}_{component1,y} = \mathbf{BE}_{power,y} + \mathbf{BE}_{ww,treatment,y} + \mathbf{BE}_{s,treatment,y} + \mathbf{BE}_{ww,discharge,y} + \mathbf{BE}_{s,final,y} \text{ [AMSIII.H eq.(1)]}$$

Where:

$\mathbf{BE}_{power,y}$	Baseline emissions from electricity or fuel consumption in year *y* (tCO_2e)
$\mathbf{BE}_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems affected by the project activity in year *y* (tCO_2e) .
$\mathbf{BE}_{s,treatment,y}$	Baseline emissions of the sludge treatment systems affected by the project activity in year *y* (tCO_2e) As sludge is used for soil application in the baseline scenario, this term is

	neglected.
$\mathbf{BE}_{ww,discharge,y}$	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year *y* (tCO_2e). The value of this term is zero for the case 1 (ii)
$\mathbf{BE}_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected

For this project, $\mathbf{BE}_{power,y}$ is not applied, as the existing water treatment system, which is the anaerobic lagoon, does not use any electricity. Therefore, the baseline equation shall become:

$$\mathbf{BE}_{component1,y} = \mathbf{BE}_{ww,treatment,y} + \mathbf{BE}_{ww,discharge,y}$$

According to AMS III.H (version 13) Paragraph 20, Methane emissions from the baseline wastewater treatment systems affected by the project are determined using the following formula:

$$\mathbf{BE}_{ww,\ treatment,\ y} = \sum_j \mathbf{Q}_{ww,i,y} * \mathbf{COD}_{removed,i,,y} * \mathbf{MCF}_{ww,treatment,BL,i} * \mathbf{B}_{o,ww} * \mathbf{UF}_{BL} * \mathbf{GWP}_{CH4}$$

[AMS III.H eq(2)]

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3)
$COD_{removed,i,y}$	Chemical oxygen demand removed by baseline treatment system *i* in year *y*(tonnes/m^3), measured as the difference between inflow COD and the outflow COD in system *i*
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i* (MCF values as per table III.H.1, a value of 0.8, Anaerobic deep lagoon(depth more than 2 meters) is used)
Bo,ww	Methane producing capacity of the wastewater (IPCC lower value of 0.21 $kgCH_4$/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

For ex-post calculation, since the baseline treatment system (anaerobic lagoon) is different from the project scenario (UASB reactor), the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions *ex post*. Accoding to paragraph 20 of the AMS-III.H (version 13), the outflow COD of the baseline system will be estimated using the removal efficiency of the baseline treatment systems. The removal efficiency of the baseline systems will be measured *ex ante* through representative measurement campaign, or using historical records of COD removal efficiency of at least one year prior to the project implementation as per AMS III.H (version 13) paragraph 17 or 18. The COD removal efficiency for this Project is calculated as 98.53%, based on the yearly measured records.

According to AMS III.H (version 13) Paragraph 24, Methane emissions from degradable organic carbon treated wastewater discharged to the central wastewater treatment plant where it is aerobically treated in the baseline situation are determined using the following formula:

$$\mathbf{BE}_{ww,discharge,y} = \mathbf{Q}_{ww,y} * \mathbf{GWP}_{CH4} * \mathbf{B}_{o,ww} * \mathbf{UF}_{BL} * \mathbf{COD}_{ww,discharge,BL,y} * \mathbf{MCF}_{ww,BL,discharge}$$

[AMS III.H eq(6)]

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in the year y (m^3)
GWP_{CH4}	Global Warming Potential for methane (IPCC default value of 21 is used)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value of 0.21 kg CH_4/kgCOD)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the final treated wastewater discharged into river in the year y (tonnes/m^3) (Taken from the historical recorded data)
$MCF_{ww,BL,discharge}$	Methane correction factor based on discharge pathway in the baseline situation (central wastewater treatment plant, aerobically treated) of the wastewater (fraction) (MCF in table III.H.1 aerobic treatment, well managed i.e. 0.0)

Step 1.2 Heat Utilization Component

Ex-ante calculation

In this project, the current coal-fired boiler will be conversed to the co-fired boiler of which the generated biogas from UASB system will be mixed with coal as fuel of the co-fired boiler for the steam generation. Sludge from the UASB system will also be combusted in the co-fired boiler, so the parameters for the sludge shall also be considered.

According to AMS I.C. (version 16) paragraph 36, it stipulates that for the cases of co-fired systems, baseline emissions calculated as per paragraph 21 and as per paragraph 35 shall be compared and the lower of the two values shall be used to calculate emission reductions. However, as paragraph 21 applies for project activity producing both heat and electricity, this does not apply to this Project, as it produces heat only. Thus, only paragraph 35 applies for this Project.

According to AMS I.C. (version 16) paragraph 35, the baseline emission for the case of co-fired plants, shall be calculated as follows:

$$BE_{component2,y} = BE_{cofire,y} = \frac{\sum_{j,}(FC_{biomass,k,y} * NCV_{biomass,k,y})}{SEC_{PJ,J,ymonitered} \times \eta_{BL}} \times EF_{BL}$$

[AMS I.C eq.(15)]

$BE_{cofire,y,}$	: Baseline emissions during the year y in tCO2
$FC_{biomass,k,y,}$	: Quantity of biomass type k (methane and sludge)combusted during the year y in volume or mass unit
$NCV_{biomass,k,y}$	: Average net calorific value of biomass type k (methane and sludge) combusted during the year y in TJ per unit volume or mass unit
EF_{BL}	: CO2 emission factor of the fossil fuel that would have been used in the baseline co-fired plant established using three years average historical data (t-CO2/MWh)
η_{BL}	: Energy efficiency of the equipment that would have been used in the baseline

According to paragraph 34, $SEC_{j,PJ,y\ measured}$ is calculated by the following equation:

$$SEC_{j,Pj,y\ measured} = \frac{\sum_{j}(FC_{j,PJ,y} * NCV_{j,y})}{EG_{PJ,y}}$$

[AMS I.C eq.(14)]

Where;

$SEC_{j,PJ,y,measured}$: Specific energy consumption of fuel type j of the project activity in year y in TJ/MWh

$EG_{PJ,y}$: Energy generation in MWh in y (=EG $_{thermal,\ y}$)

$FC_{j,PJ,y}$: Quantity of fuel type j (coal, methane and sludge)combusted in the project activity during the year y in volume or mass unit (m3 for methane, t for coal)

$NCV_{j,y}$: Average net calorific value of fuel type j combusted during the year y in TJ per unit volume or mass unit

For ex-ante calculations, $FC_{biomass,metane,,y}$, which is the quantity of methane combusted in the co-fired boiler, can be obtained using the equation (11) and (12) of AMS III.H (version 13)

$$\mathbf{FC_{biomass,methane,y} = CFE_{ww} * Q_{ww,y} * B_{o,ww} * UF_{BL} * \sum_{k} COD_{removed,PJ,k,y} * MCF_{ww,treatment,,PJ,,k}}$$

where:

CFE_{ww} Capture efficiency of the biogas recovery equipment in the wastewater treatment (a default value of 0.9 shall be used)

$Q_{ww,y}$ Volume of wastewater treated in the year y (m_3)

$B_{o,ww}$ Methane producing capacity of the wastewater (IPCC lower value of 0.21 kg CH_4/kg.COD)

UF_{BL} Model correction factor to account for model uncertainties (0.94)

$COD_{removed,PJ,k,y}$ The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y (tonnes/m_3)

$MCF_{ww,treatment,PJ,k}$ Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment (MCF value in table III.H.1: 0.8 for anaerobic reactor without methane recovery)

$FC_{coal,PJy}$ is obtained from the following formula:

$$\mathbf{FC_{coal,PJ,y} = (EG_{PJ,y} - FC_{biomass,methane,y} * NCV_{methane}) / NCV_{coal}}$$

thus,

$$\mathbf{FC_{coal,PJ,y} * NCV_{coal} = EG_{PJ,y} - (FC_{biomass,methane,y} * NCV_{methane})}$$

For sludge, $\mathbf{FC_{biomass,sludge,y}}$ is assumed to be zero (0) since no historical records can be obtained before the Project.

Ex-post calculation

For ex-post calculation, $SEC_{j,PJ,y,measured}$ will be calculated as per AMS I.C paragraph 34 and the consumption of each type of fuel (i.e., methane, sludge and coal), which will be combusted by the co-fired boiler, will be monitored.

Step 2. Project Emissions

In accordance with the methodologies AMSIII.H (version 13) and AMS I.C (version 16), the project emissions for this project can be refined as:

$$\mathbf{PE_y = PE_{component1,y} + PE_{compononent2,y}}$$

where:

$PE_{component1,y}$: The project emissions from the Methane recovery component
$PE_{component2,y}$: The project emissions from the Heat utilization component

Step 2.1 Methane Recovery Component

According to the methodology AMS III.H (Version 13) paragraph 26, the project activity emissions are calculated as follows:

$$\mathbf{PE_{component1,y} = PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s\ final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}}$$

[AMSIII.H eq.(8)]

Where:

$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y,.
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e). As the treatment system is equipped with biogas recovery, this term is neglected.
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e). As the sludge treatment is control combusted, this term can be neglected.
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in the year y. The sludge from the Project is controlled combusted in the conversed boiler, thus this term can be neglected.
$PE_{ww,\ discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year y(tCO_2e).
$PE_{fugitive,y}$	Methane emissions from biogas release in capture system in the year y
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year y. Since the recovered methane is combusted in the conversed boiler, and not in an enclosed or open flare, this term is neglected. Also, because the methane capture through combustion in the emergency flare is not to be claimed for conservativeness, this term is not considered.
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. The recovered methane from the Project is not stored thus this term can be neglected.

Taking the above into consideration, the formula used to calculate project emissions is simplified to be:

$$\mathbf{PE_{component1,y} = PE_{power,y} + PE_{ww,discharg,y} + PE_{fugitive,y}}$$

According to AMS III. H (version 13) paragraph 19, the $PE_{y,power}$ is determined as per procedures described in AMS I.D, which can be calculated as follows:

$$\mathbf{PE_{power,y}=EC_y*EF_{gird,CM,y}}$$

Where:

EC_y	The power consumption in the year "y" (MWh)
$EF_{gird,CM,y}$	The Grid emission factor, in the year "y" (tCO_2e/MWh). The factor is calculated based on the "Tool to calculate the emission factor for an electricity system(version02)" and "2008 Baseline Emission Factors for Regional Power Grids in China" issued by China DNA on 18th July, 2008. The detail calculation and the basis are shown in Annex3.

According to AMS III.H (version 13) paragraph 26 the $PE_{yww,discharge,y}$ can be calculated as follows:

$$\mathbf{PE_{ww,discharge,y}=Q_{ww,y}*\ GWP_{CH4}*\ B_{o,ww}\ *UF_{PJ}*COD_{ww,discharge,PJ,y}\ *\ MCF_{ww,PJ,discharge}}$$

[AMSIII.H eq.(6)]

Where:

$Q_{ww,y}$	Volume of wastewater treated in the year y (m^3)
GWP_{CH4}	Global Warming Potential for methane (IPCC default value of 21 is used)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value of of 0.21 kg CH_4/kg.COD)2
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the Project activity in the year " (tonnes/m^3)2
$MCF_{ww,PJ,discharge}$	Methane correction factor based on discharge pathway(central wastewater treatment plant, aerobically treated) of the wastewater (fraction) (MCF in table III.H.1 aerobic treatment, well managed i.e. 0.0)

According to AMSIII.H (version 13) paragraph 27, the $PE_{fugitive,y}$ can be calculated as follows:

$$\mathbf{PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}}$$

[AMSIII.H eq.(9)]

Where:

$PE_{fugitive,ww,y}$	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment in the year y (tCO_2e)
$PE_{fugitive,s,y}$	Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment in the year y (tCO_2e). In this Project, the sludge shall be control combusted, therefore the value is zero.

Thus,

$$\mathbf{PE_{fugitive,y} = PE_{fugitive,ww,y}}$$

$$\mathbf{PE_{fugitive,ww,y} = (1-CFE_{ww})*MEP_{ww,treatment,y}*GWP\_CH_4}$$

[AMSIII.H eq.(10)]

Where:

CFE_{ww} Capture efficiency of the biogas recovery equipment in the wastewater treatment (a default value of 0.9 shall be used)

$MEP_{ww,treatment,y}$ Methane emission potential of wastewater treatment system equipped with biogas recovery in the year "y" (tonnes)

and

$$\mathbf{MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_{k} COD_{removed,PJ,,k,y} * MCF_{ww,treatment,PJ,k}}$$

[AMSIII.H eq.(11)]

Where:

$Q_{ww,y}$ Volume of wastewater treated in the year y (m_3)

$B_{o,ww}$ Methane producing capacity of the wastewater (IPCC lower value for wastewater of 0.21 kg CH_4/kg.COD)

UF_{PJ} Model correction factor to account for model uncertainties (1.06)

$COD_{removed,PJ,k,y}$ The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y (tonnes/m_3)

$MCF_{ww,treatment,PJ,k}$ Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment (MCF value in table III.H.1: 0.8 for anaerobic reactor without methane recovery)

Step 2.2 Heat Utilization Component

According to AMS I.C (version 16), anthropogenic emissions due to the Heat Utilization Component of the project activity are zero (as this project is utilizing biogas with biogenic origins); therefore, project emissions for this component are not applicable. Thus, $\mathbf{PE_{component2,\ y}=0}$

Step 3. Leakage

The equipment for the Project is not transferred from another facility and the existing equipment will not be transferred to another activity, thus leakage effects are not considered as per AMS-III.H and AMS-I.C. Thus, $\mathbf{LE_y=0}$

Step 4. Emission Reduction

The total emission reduction in the year y is calculated in the below formula:

$$\mathbf{ER_y=BE_y-PE_y-LE_y=BE_y-PE_y}$$

Where:

ER_y the emission reduction in the year y

BE_y the baseline emission in the year y

PE_y the Project emission in the year

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

Data / Parameter:	$Q_{ww,y}$
Data unit:	m3/yr
Description:	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y*
Source of data to be used:	Historical record data

Value applied	362,965
Justification of the choice of data or description of measurement methods and procedures actually applied :	Accumulation of daily average data taken from record of historical measurement of the baseline facility
Any comment:	This data is needed only for ex-ante calculation.

Data / Parameter:	$RE_{COD\ removal,\ BL}$
Data unit:	%
Description:	Removal efficiency of the baseline treatment systems
Source of data to be used:	Historical record data
Value applied	98.53%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taken from record of historical measurement of the baseline facility
Any comment:	

Data / Parameter:	$COD_{removed,BL,j,,y}$
Data unit:	t/m^3
Description:	Chemical oxygen demand removed by baseline treatment system *j* in year *y*(tonnes/m_3), measured as the difference between inflow COD and the outflow COD in system *j*
Source of data to be used:	Historical record data
Value applied	0.057
Justification of the choice of data or description of measurement methods and procedures actually applied :	Annual average of data taken from record of historical measurement of the baseline facility
Any comment:	This data is needed only for ex-ante calculation.

Data / Parameter:	$MCF_{ww,treatment,BL,j}$
Data unit:	-
Description:	Methane correction factor for baseline wastewater treatment systems *j*
Source of data used:	AMS III.H (version 13) Table III.H.I
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS-III.H (Version 09)Table III.H.1 Value of “Anaerobic reactor without methane recovery”
Any comment:	-

Data / Parameter:	$B_{o,ww}$
Data unit:	$kgCH_4/kg$
Description:	Methane producing capacity of the wastewater
Source of data used:	2006 IPCC Guidelines for National Greenhouse Inventories
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value suggested by AMS III.H

Any comment:	-

Data / Parameter:	$COD_{ww,discharge,BL,y}$
Data unit:	t/m^3
Description:	Chemical oxygen demand of the final treated wastewater discharged into river in the year y
Source of data to be used:	Historical record data
Value applied	0.000354
Justification of the choice of data or description of measurement methods and procedures actually applied :	Annual average of data taken from record of historical measurement of the baseline facility
Any comment:	-

Data / Parameter:	$MCF_{ww,BL,discharge}$
Data unit:	-
Description:	Methane correction factor based on discharge pathway in the baseline situation of the wastewater
Source of data used:	AMS III.H (version 13) Table III.H.I
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS-III.H (Version 09)Table III.H.1 Value of "aerobic treatment, well managed"
Any comment:	-

Data / Parameter:	$EF_{coal,CO2}$
Data unit:	tCO_2 / TJ
Description:	CO_2 emission factor per unit of energy of fossil fuel (coal) that would have been used in the baseline unit
Source of data used:	2006 IPCC Guidelines for National Greenhouse Inventories
Value applied:	94.6 (Other Bituminous Coal)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value of the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories.
Any comment:	-

Data / Parameter:	η_{BL}
Data unit:	%
Description:	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity
Source of data used:	Paragraph 18 (c), AMS I.C (version 16)
Value applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to AMS I.C., efficiency of the baseline units shall be determined by adopting one of the following criteria: (a) Highest measured efficiency of a unit with similar specifications; (b) Highest of the efficiency values provided by two or more

	manufacturers for units with similar specifications; (c) Default efficiency of 100%.
Any comment:	Used for ex-post calculation of $BE_{thermal,y}$

Data / Parameter:	$NCV_{CH4,y}$ (= $NCV_{biomass, CH4, y}$=$NCV_{CH4,PJ,y}$)
Data unit:	GJ/ m^3
Description:	Average net calorific value of biomass type j (methane) for SEC calculation, and type k (methane) for $BE_{cofire,y}$ calculation, combusted during the year y in GJ per unit volume or mass unit
Source of data used:	The fundamentals and technology of furnace", Chemical Industry Press.
Value applied:	0.035865
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Used for ex-post calculation of $BE_{thermal,y}$

Data / Parameter:	$COD_{removed,PJ,k.y}$
Data unit:	t/m3
Description:	The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y
Source of data to be used:	Historical record data and FSR
Value applied	0.056
Justification of the choice of data or description of measurement methods and procedures actually applied :	Difference between inflow of UASB reactor (average of historical data) and outflow (Design COD taken from FSR)
Any comment:	This data is needed only for ex-ante calculation.

Data / Parameter:	$MCF_{ww,treatment,PJ,k}$
Data unit:	-
Description:	Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment
Source of data used:	AMS III.H (version 13) Table III.H.I
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS-III.H (Version 13)Table III.H.1 Value of "anaerobic reactor without methane recovery"
Any comment:	-

Data / Parameter:	D_{CH4}
Data unit:	t/Nm^3
Description:	Density of methane
Source of data used:	Methodological "Tool to determine project emissions from flaring gases containing methane", Annex 13, Meeting report EB28

Value applied:	0.000716 tCH_4/Nm^3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value suggested by the Methodological Tool
Any comment:	-

Data / Parameter:	$NCV_{sludge,\ y}$ (=$NCV_{biomass,\ sludge,y}$)
Data unit:	GJ/ t
Description:	Average net calorific value of biomass type j (sludge) for SEC calculation and type k (sludge) for $BE_{cofire,y}$ calculation combusted during the year y in GJ per unit volume or mass unit
Source of data used:	Research for sluge combustion process of fluid bed, Beijing University
Value applied:	- 0.79345
Justification of the choice of data or description of measurement methods and procedures actually applied :	Obtained from the Higher Heating Value for sludge (7,500kJ/kg) and the average water content of sludge (85%) and heat of vaporization of water (2,257kJ/kg)
Any comment:	

Data / Parameter:	$NCV_{coal,y}$
Data unit:	GJ/ t
Description:	Average net calorific value of co-fired coal for $BE_{cofire,y}$ calculation, combusted during the year y in GJ per unit volume or mass unit
Source of data used:	China Energy Statistics Yearbook 2005
Value applied:	20,908
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Used for ex-post calculation of $BE_{thermal,y}$

Data / Parameter:	EC_y
Data unit:	MWh/yr
Description:	The power consumption in the year “y”
Source of data to be used:	Plant data
Value applied:	2,250
Justification of the choice of data or description of measurement methods and procedures actually applied :	FSR
Any comment:	This data is needed only for ex-ante calculation.

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2e/MWh
Description:	The Grid emission factor, in the year “y”
Source of data used:	“2008 Baseline Emission Factors for Regional Power Grids in China” issued by China DNA on 18th July, 2008.

Value applied:	0.9928
Justification of the choice of data or description of measurement methods and procedures actually applied :	The detail calculation and the basis are shown in Annex3.
Any comment:	-

Data / Parameter:	$COD_{ww,discharge,PJ,y}$
Data unit:	t/m^3
Description:	Chemical oxygen demand of the final treated wastewater discharged into river in the year "y"
Source of data to be used:	Plant data
Value applied	0.0002
Justification of the choice of data or description of measurement methods and procedures actually applied :	Feasibility Study
Any comment:	This data is needed only for ex-ante calculation.

Data / Parameter:	$MCF_{ww,PJ,discharge}$
Data unit:	-
Description:	Methane correction factor based on discharge pathway (e.g. into sea, river or lake) of the wastewater
Source of data used:	AMS III.H (version 13) Table III.H.I
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS-III.H (Version 13)Table III.H.1 Value of"Discharge of wastewater to sea, river or lake"
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

As stated in section B.6.1, the emission reduction can be calculated as follows:

1. Baseline emissions:

The baseline emission can be obtained from the following:

$$\mathbf{BE_y = BE_{component1,y} + BE_{component2,y}}$$

1.1 Methane recovery component

The baseline emissions from the methane recovery component are calculated as follows:

$$BE_{component1,y} = BE_{ww,treatment,y} + BE_{ww,discharge,y}$$

$$BE_{ww,\ treatment,\ y} = \sum_i Q_{ww,i,y} * COD_{removed,i,y} * MCF_{ww,treatment,BL,i} * B_{o,ww}\ UF_{BL} * GWP_{CH4}$$

$$BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,BL,discharge}$$

$$Q_{ww,y} = V_h * 24hours * Op_D$$

$$COD_{removed,j,y} = COD_{untreated} * RE_{COD,BL}$$

Table B.6.1 Parameters for calculating Baseline emissions from Methane Recovery

Parameter	Description	Value	Unit
V_h	Volume of treated wastewater in the hour "h"	47.70	m^3/h
Op_D	Number of Operational days in the year "y"	317	days/yr
$Q_{ww,i,y}$	Volume of wastewater treated in the year "y"	362,965	m^3/ yr
$COD_{untreatedj,y}$	COD at the entrance of anaerobic lagoon	0.058	t/m^3
$RE_{COD,BL}$	Removal efficiency ofthe baseline lagoon	98.53	%
$COD_{removed,i,y}$	Chemical oxygen demand removed by the anaerobic wastewater treatment systems "i" in the baseline situation in the year "y" to which the sequential anaerobic treatment step is being introduced	0.057	t/m^3
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the final treated wastewater discharged into river in the year "y"	0.000354	t/m^3
$MCF_{ww,treatment,BL,i}$	Methane correction factor for the existing anaerobic wastewater treatment systems "i" to which the sequential anaerobic treatment step is being introduced	0.8	-
$MCF_{ww,BL,discharge}$	Methane correction factor based on type of treatment and discharge pathway of the wastewater	0.0	
$B_{o,\ ww}$	Methane producing capacity of the wastewater	0.21	$kgCH_4$/ kg
UF_{BL}	Model correction factor to account for model uncertainties	0.94	
GWP_{CH4}	Global warming potential of methane	21	tCO_2e/tCH_4
	$BE_{ww,\ treatment,\ y}$	**68,611**	t CO_2 e/yr
	$BE_{ww,discharge,y}$	**0**	t CO_2 e/yr

$BE_{component1,y}$= $BE_{ww,treatment,y}$ + $BE_{ww,\ discharge,y}$= 68,611 +0 =68,611

1.2 Heat Utilization Component

$$\mathbf{BE_{component2,y}} = BE_{cofire,y} = \frac{\sum_{j,}(FC_{biomass,k,y} * NCV_{biomass,k,y})}{SEC_{PJ,J,ymonitered} \times \eta_{BL}} \times EF_{BL}$$

$$SEC_{j,PJ,y\ measured} = \frac{\sum_{j,}(FC_{j.PJ.y} * NCV_{j,y})}{EG_{PJ,y}}$$

where:

$$EG_{PJ,y} = BC * OpD * OpH * ECF \text{ (ex-ante only)}$$

$$FC_{CH4,y} = FC_{CH4,PJ,y} = FC_{biomass,CH4,y}$$
$$= CFE_{ww} * Q_{ww,y} * B_{o,ww} * UF_{BL} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$$

Table B.6.2 Parameters of calculating Baseline emission of $BE_{component2,\ y}$

Parameters	Description	Value	Unit
CFE_{ww}	Capture and utilization efficiency of methane recovery	0.9	
$Q_{ww,y}$	Volume of treated wastewater per year	362,965	m3
$B_{o,ww}$	Methane producing capacity of the wastewater	0.21	tCH4/tCOD
UF_{BL}	Model Correction factor	0.94	
$COD_{removed,\ PJ,k,y}$	COD removed from the UASB reactor	0.056	t/m3
$MCF_{ww,\ treatment}$	Methane correction factor for the existing anaerobic treatment systems	0.8	
$FC_{CH4,y}$ (mass)	Quantity of methane combusted in mass unit	2,889	t
D_{CH4}	Density of methane at normal conditions	0.000716	tCH4/Nm3
$FC_{CH4,y}$ (volume)	Volume of combusted methane	4,034,916	m3CH4
NCV_{CH4}(=$NCV_{biomass,CH4,y}$ =$NCV_{CH4,PJ,y}$)	Net Calorific Value of Methane	0.035865	GJ/m3
$FC_{sludge,y}$(=$FC_{biomass,sludge,y}$ =$FC_{sludge,PJ,y}$)	Amount of sludge to be combusted in the boiler	*0*	t/y
NCV_{sludge}($NCV_{biomass,sludge,y}$ =$NCV_{sludge,PJ,y}$)	Net Calorific Value of sludge to be combusted in the boiler	-0.79345	GJ/t
BC	Boiler rated capacity	14	MWth
OpD	Number of Operational Days	317	days
OpH	Daily operational hours	24	hours/day
(EG (MWh))	Net quantity of heat in MWh	106,512	MWh
ECF	Energy Conversion Factor	3.6E-03	TJ/MWh
$EG_{PJ,y}$		383.4432	TJ/y
$FC_{coal,PJ,y}$*NCV_{coal}	Quantity of heat from the of coal combusted	238,731	GJ
$SEC_{\_PJ}$		**1.000**	
$EF_{coal,CO2}$	Carbon Emission factor of coal	94600	kgCO2/TJ
η_{BL}	Boiler efficiency	100%	
BE_{cofire}		**13,690**	**tCO2**

From the above, the baseline emission **BE_y=68,611+13,690=82,301 tCO_2e/yr**

2. Project emission

The project emission is calculated as follows：

$$PE_{component1,y} = PE_{power,y} + PE_{ww,discharg,y} + PE_{fugitive,y}$$

$$PE_{power,y}=EC_y*EF_{gird,CM,y}$$

Table B.6.3 Parameters for calculating project emission of $PE_{,power,y}$

Parameters	Description	Value	Unit
EC_y	The power consumption in the year "y"	2,250	MWh/yr
$EF_{grid,CM,y}$	The grid emission factor, in the year "y"	0.9928	tCO_2e/MWh
Emissions from electricity consumption $PE_{,power,y}$		**2,234**	tCO_2e/yr

$$PE_{ww,discharge,y}=Q_{ww,y}*GWP_{CH4}*B_{o,ww}*UF_{PJ}*COD_{ww,discharge,PJ,y}*MCF_{ww,PJ,discharge}$$

$$PE_{fugitive,ww,y}=(1-CFE_{ww})*MEP_{ww,treatment,y}*GWP\_CH_4$$

$$MEP_{ww,treatment,y}=Q_{ww,y}*B_{o,ww}*UF_{PJ}*\sum_j COD_{removed,PJ,j,y}*MCF_{ww,treatment,PJ,j}$$

Table B.6.4 Parameters for calculating project emission of $PE_{y,ww,treated}$、 $PE_{y,fugitive,ww}$

Parameters	Description	Value	Unit
$Q_{ww,y}$	Volume of wastewater treated in the year "y"	362,965	m^3/ yr
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the final treated wastewater discharged into river in the year "y"	0.0002	t/m^3
GWP_{CH4}	Global Warming Potential for methane	21	tCO_2e/tCH_4
$B_{o,\ ww}$	Methane producing capacity of the wastewater	0.21	$kgCH_4$/ kg
UF_{PJ}	Model correction factor to account for model uncertainties	1.06	
$MCF_{ww,PJ,discharge}$	Methane correction factor based on type of treatment and discharge pathway of the wastewater	0.0	-
CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment	0.9	t/m^3
$COD_{removed,PJ,j,y}$	The chemical oxygen demand removed by the treatment system "j" of the project activity equipped with methane recovery in the year "y	0.056	t/m^3
$MCF_{ww,treatment,\ PJ,\ j}$	Methane correction factor for the wastewater treatment system "j" equipped with biogas recovery equipment	0.8	-
Emissions from degradable organic carbon in treated wastewater $PE_{ww,discharge,y}$		**0**	$t\ CO_2e/yr$
Emissions from methane release in capture and utilization/combustion/flare systems $PE_{fugitive,ww,y}$		**7,601**	tCO_2e/yr

From the above, the project emission is $\mathbf{PE_{component1,y}=2,234+0+7,601=9,835tCO_2e/yr}$

<u>3. Emission reduction</u>

From the discussion in B.6.1, the total emission reduction from the project can thus be calculated as：

ER_y=BE_y-PE_y=82,301-9,835=72,466tCO_2e

As such, the yearly total emission reduction from this project is **72,485**CO_2e。

Table B.6.5 Yearly emission reduction calculation

	Baseline emission (tCO2e)	Project Emission (tCO2e)	Emission Reduction (tCO2e)
Methane recovery component	68,611	9,835	58,776
Heat supply component	13,690	0	13,690
Total	**82,301**	**9,835**	**72,466**

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

The total emission reduction (ex-ante estimation) for the whole project period is 724,660CO_2e。

Table B.6.5 Summary of the ex-ante estimation of emission reduction

Year	Baseline emission (tCO_2e)	Project emission (tCO_2e)	Leakage (tCO_2e)	Emission reduction (tCO_2e)
2011	82,301	9,835	0	72,466
2012	82,301	9,835	0	72,466
2013	82,301	9,835	0	72,466
2014	82,301	9,835	0	72,466
2015	82,301	9,835	0	72,466
2016	82,301	9,835	0	72,466
2017	82,301	9,835	0	72,466
2018	82,301	9,835	0	72,466
2019	82,301	9,835	0	72,466
2020	82,301	9,835	0	72,466
Total(tCO_2e)	**823,010**	**98,350**	**0**	**724,660**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{ww,y}$
Data unit:	m3/yr
Description:	Volume of wastewater treated in the year "y"
Source of data to be used:	Measurement by electromagnetic flow meter
Value applied	361,063 (ex-ante calculation)
Description of measurement methods and procedures to be applied:	Continuously measured and recorded monthly

QA/QC procedures to be applied:	The meter will be calibrated every second year
Any comment:	for ex-post calculation

Data / Parameter:	$COD_{ww,untreated,y}$
Data unit:	t/m^3
Description:	Chemical oxygen demand of the untreated wastewater in the year "y"
Source of data to be used:	Measurement by COD meter
Value applied	0.058 (ex-ante calculation)
Description of measurement methods and procedures to be applied:	Periodically measured and recorded monthly
QA/QC procedures to be applied:	The meter will be calibrated according to relevant standards.
Any comment:	for ex-post calculation.

Data / Parameter:	$COD_{ww,discharge,PJ,y}$
Data unit:	t/m^3
Description:	Chemical oxygen demand of the final treated wastewater discharged into river in the year "y"
Source of data to be used:	Measurement by COD meter (on-line)
Value applied	0.0002 (ex-ante calculation)
Description of measurement methods and procedures to be applied:	Continuously measured and recorded monthly
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	for ex-post calculation.

Data / Parameter:	$BG_{burnt,\ y}$
Data unit:	Nm^3/yr
Description:	The flow rate of biogas recovered and flared or fuelled to a boiler
Source of data to be used:	Measurement data by a thermal type mass flow meter
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuously measured and recorded monthly.
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	w_{CH4}
Data unit:	%
Description:	Methane fraction of the recovered biogas
Source of data to be used:	Measurement data by infrared gas analyzer
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuous measurement or periodical measurement at 95% confidential level
QA/QC procedures to be applied:	The analyzer will be calibrated annually according to relevant

	standards.
Any comment:	ex-post only

Data / Parameter:	$Q_{y,st}$
Data unit:	Nm^3/yr
Description:	Total quantity of steam generated by the conversed boiler during the year y
Source of data to be used:	Measured by a orfice plate flow meter
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuously measured, recorded monthly
QA/QC procedures to be applied:	The meter will be calibrated according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$T_{y,st}$
Data unit:	^oC
Description:	Temperature of steam generated
Source of data to be used:	Measurement data by a thermometer
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuous measurement
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$P_{y,st}$
Data unit:	Pa
Description:	Pressure of steam generated
Source of data to be used:	Measurement data by a pressure gauge
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuous measurement
QA/QC procedures to be applied:	The pressure gauge will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$T_{y,fw}$
Data unit:	^oC
Description:	Temperature of feed water
Source of data to be used:	Measurement data by a thermometer
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuous measurement
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$P_{y,fw}$
Data unit:	Pa
Description:	Pressure of feed water generated
Source of data to be used:	Measurement data by a pressure gauge
Value of data	N/A
Description of measurement methods and procedures to be applied:	Continuous measurement
QA/QC procedures to be applied:	The pressure gauge will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$FC_{coal,PJ,y}$
Data unit:	Tonnes/yr
Description:	Quantity of co-fired coal consumed by the boiler modified by the CDM project activity during the year y
Source of data to be used:	Measured by a truck scale
Value of data	N/A
Description of measurement methods and procedures to be applied:	Measured periodically by a truck scale
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	EC_y
Data unit:	MWh/yr
Description:	The power consumption in the year "y"
Source of data to be used:	Measurement by wattmeter
Value applied:	2,250 (ex-ante calculation)
Description of measurement methods and procedures to be applied:	Continuously measured and recorded monthly
QA/QC procedures to be applied:	The meter will be calibrated according to relevant standards.
Any comment:	for ex-post calculation

Data / Parameter:	$COD_{after\ treatment,y}$
Data unit:	t/m^3
Description:	The chemical oxygen demand after being removed by anaerobic treatment system "j" of the project activity equipped with methane recovery in the year "y"
Source of data to be used:	Measurement by COD meter
Value applied	0.00232(ex-ante calculation)
Description of measurement methods and procedures to be applied:	Periodically measured and recorded monthly
QA/QC procedures to be applied:	The meter will be calibrated according to relevant standards.
Any comment:	for ex-post calculation.

Data / Parameter:	$HHV_{sludge,y}$

Data unit:	kJ/kg
Description:	Higher heating value of sludge
Source of data to be used:	Measured by a calorimeter
Value of data	N/A
Description of measurement methods and procedures to be applied:	Measured 4 times a year by sampling the sludge
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$WC_{sludge,y}$
Data unit:	%
Description:	water content of sludge to be combusted in the boiler
Source of data to be used:	Measured by analytical balance
Value of data	N/A
Description of measurement methods and procedures to be applied:	Measured 4 times a year at the time of sampling. by calculating the difference between the weight of the wet sludge and the dried sludge.
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	$FC_{sludge,y}$
Data unit:	t/y
Description:	Amount of sludge to be combusted in the boiler
Source of data to be used:	Measured by a truck scale
Value of data	N/A
Description of measurement methods and procedures to be applied:	Measured periodically by a truck scale
QA/QC procedures to be applied:	The meter will be calibrated annually according to relevant standards.
Any comment:	ex-post only

Data / Parameter:	Time of the open stack flaring
Data unit:	-
Description:	Time of open stack flaring at abnormal conditions
Source of data to be used:	Monitored by the monitoring team
Value of data	-
Description of measurement methods and procedures to be applied:	The flare is utilized when boiler is not used. This process shall be recorded by the monitoring plan implementation team
QA/QC procedures to be applied:	-
Any comment:	ex-post monitoring

Ex-post calculations

1. Baseline Emissions

$\mathbf{BE_y= BE_{component1,y,ex\text{-}post} + BE_{compononent2,y,ex\text{-}post}}$

1.1 Methane recovery component

$\mathbf{BE}_{component1,y,ex\text{-}post} = \mathbf{BE}_{ww,treatment,y} + \mathbf{BE}_{ww,discharge,}$

Where:

$\mathbf{BE}_{ww,\ treatment,\ y}$ $\mathbf{= Q_{ww,j,y} * COD_{untreated,y} * RE_{COD\ removal,BL} * MCF_{ww,treatment,BL,j} * B_{o,ww} * UF_{BL} * GWP_{CH4}}$

$\mathbf{BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,BL,discharge}}$

$\mathbf{RE_{CODremoval,\ BL}}$**:** COD Removal Efficiency of baseline lagoon required as per paragraph 20 of AMS-III.H (version13), which is calculated from the historical records

1.2 Heat Utilization Component

$\mathbf{BE_{component2,y,ex\text{-}post}}$ $=BE_{cofire,y} = \dfrac{\sum_{1k}(FC_{biomass,k,y} * NCV_{biomass,k,y})}{SEC_{PJ,J,ymonitered} \times \eta_{BL}} \times EF_{BL}$

Where:

$$SEC_{j,PJ,y\ measured} = \frac{\sum_{j,}(FC_{j.PJ.y} * NCV_{j,y})}{EG_{PJ,y}}$$

Where:

j = methane, sludge and coal

$FC_{CH4,y,}(=FC_{CH4,\ PJ,y}) = BG_{burnt,\ y} * w_{CH4}$

$NCV_{sludge,y}(= NCV_{sludge,PJ,y}) = HHV_{sludge,y} * (1-WC_{sludge}) - 2257 * WC_{sludge}$

2. Project Emissions

$\mathbf{PE_y=PE_{component1,y,ex\text{-}post} + PE_{compononent2,y,ex\text{-}post}}$

2.1 Methane recovery component

$\mathbf{PE_{component1,y,ex\text{-}post} = PE_{power,y} + PE_{ww,discharge,y} + PE_{fugitive,y}}$

Where:

$\mathbf{PE_{power,y} = EC_y * EF_{gird,CM,y}}$

$\mathbf{PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,discharge}}$

and

$\mathbf{PE_{fugitive,ww,y} = (1-CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}}$

Where:

$\mathbf{MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * COD_{removed,PJ,j,y} * MCF_{ww,treatment,PJ,j}}$

Where:

$\mathbf{COD_{removed,PJ,j,y} = COD_{untreated,y} - COD_{after\ treatment,y}}$

2.2 Heat Utilization Component

$PE_{component2,y,ex\text{-}post}=0$

3. Emisssion Reduction
$ER_y=BE_y-PE_y-LE_y=BE_y-PE_y$

for methane recovery component, the following formula applies:
$ER_{y,\ expost} = \min((BE_{y,ex\ post} - PE_{y,\ ex\ post} - LE_{y,\ ex\ post}), (MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,\ expost}))$
where:
$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$

Where :
FE = 1 (as methane is combusted in a boiler)

$LE_{y,ex\text{-}post} = 0$

B.7.2 Description of the monitoring plan:

The project participant (Linqu Qinchi Biological) shall be fully responsible for the implementation of the monitoring plan to ensure the completeness and accuracy of the calculation and monitoring of the project emission reduction during the crediting period.

1. Monitoring Organization

A team exclusively in charge for CDM monitoring shall be established. The President of the company will appoint 1 (one) CDM monitoring manager, along with few persons responsible for the monitoring. The CDM team shall be in charge of the following:

- Supervision of the whole monitoring for the CDM project
- Measurement
- Recording
- Data collection
- Calculation of emission reductions
- Monitoring report preparation

The CDM monitoring manager or a third party expert will conduct training on CDM to the monitoring staff to warrant that they understand the accurate data measurement and data collection and the importance of emission reduction calculation. The framework of the monitoring sector is as follows:

President of the Linqu Qinchi Biological
Selection and appointment of CDM monitoring manager

↓

CDM Monitoring Manager (1 person; factory director)
Responsible for comprehensive management and data collection, including instruction and training of staff, check for validity, correctness and completeness of data, report to the board and relevant department about CDM monitoring activities, authoring a monitoring report for verification, support of DOE when verification, etc.

↓

CDM Monitoring Chief (1 person; head of relevant department)
Responsible for daily monitoring activities and instruction of monitoring staff

↓

CDM Monitoring Staff (2 persons; staff of relevant department)
Implement daily check and maintenance of monitoring equipment, data reading and entry to data sheet, calculation of emissions reductions, preparation of internal monitoring report archiving of data, calibration of meters according to relevant standards, report of abnormal event to the CDM monitoring chief, etc.

Figure B.7.1 Managing structure of the CDM monitoring

2. Education and training for CDM monitoring

The Uniufa Energy Technology Co., Ltd. will perform a consultant role for CDM monitoring implemented by the Linqu Qinchi Biologocal. It will offer annual training course and daily practical assistance for the CDM monitoring manager. The CDM monitoring manager is responsible for education and training of CDM monitoring chief/staff. The education and training include how to use, maintain and calibrate monitoring equipment (including on-site training), procedure for error detection and correction, data processing for calculation of emissions reductions, data archiving system (storage media, frequency of recording and backup, etc.), preparation of internal monitoring report and data entry method. The CDM monitoring manager will make the CDM monitoring chief/staff understand the importance of monitoring for the CDM project activity.

For effective education and training, the CDM monitoring manager will provide several training courses to the CDM monitoring staff/chief while receiving necessary support form third party technical experts. Necessary hours of education/training will be determined according to the experience and technical background of each person. In order to check level of understanding and skill, the CDM monitoring manager will give paper tests and/or skill tests when they finished training courses and when the need arisen.

3. Monitoring equipment and installation

Meters are installed in order to monitor data and parameters defined in section B.7.1. Conceptual diagram of monitoring location and details of meters are shown in Figure B.7-2 and Table B.7-1, respectively.

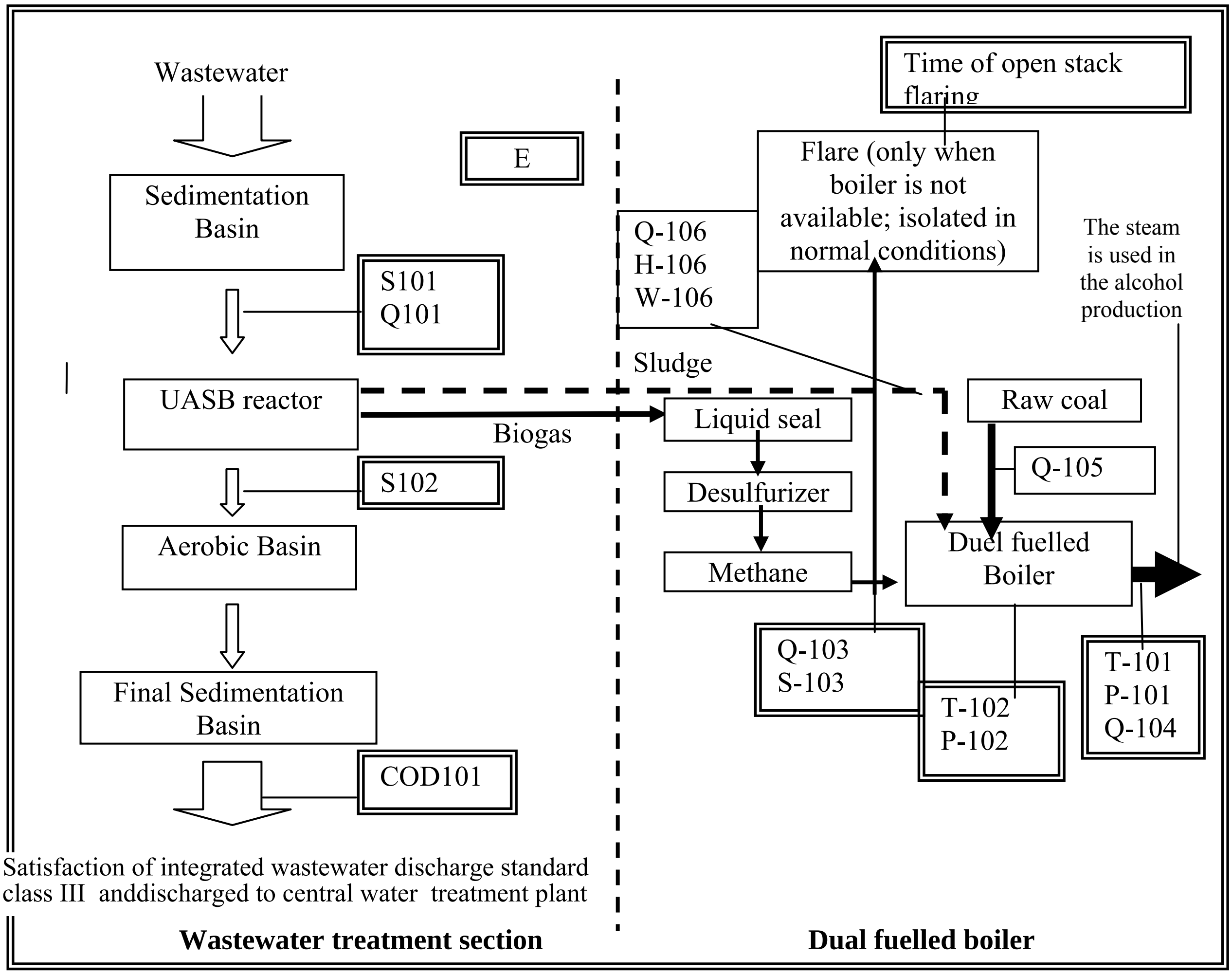

Figure B.7.2 Location of CDM monitoring

Table B.7-1 Details of monitoring equipment

No.	Parameter	Location	Measuring equipment	Relevant national standards	Accuracy level	Frequency of calibration
Q-101	Wastewater flow rate ($Q_{ww,y}$)	Inlet of UASB reactor	Electromagnetic flow meter	JJG1033-2007	0.5	Every second year
Q-103	Biogas flow rate ($BG_{burnt,y}$)	Inlet of boiler	Thermal type mass flow meter	JJG897-1995	1.5	Annually
Q-104	Steam flow rate ($Q_{y,st}$)	Final discharge	Orfice plate flowmeter	JJG640-94	1.5	Annually

No.	Parameter	Location	Measuring equipment	Relevant national standards	Accuracy level	Frequency of calibration
Q-105	Amount of coal fuelled ($FC_{coal,PJ,y}$)	Inlet of Boiler	Truck scale (SCS-100)	JJG539-1997	III	Annually
Q-106	Amount of sludge to be combusted in the boiler ($FC_{sludge,y}$)	Inlet of boiler	Truck scale (SCS-100)	JJG539-1997	III	
H-106	Higher heating value of sludge to be combusted ($HHV_{sludge,y}$)	Inlet of boiler	Caloriemeter			
W-106	Water content of sludge to be combusted ($WC_{sludge,y}$)	Inlet of boiler	Analytical balance, heating oven			
S-101	$COD_{untreated,y}$	Inlet of UASB reactor	Periodically measured and analysed indoor			
S-102	$COD_{after\ treatment,y}$	Outlet of UASB reactor	Periodically measured and analysed indoor			
COD-101	$COD_{ww,dicharge,PJ,y}$	Final discharge point	Online monitoring		10	Annually
S-103	Methane content in the biogas (w_{CH4})	Inlet pipe of biogas into the boiler	Infrared gas analyser	JJG689-1990	2	Annually
T-101	Steam temperature ($T_{y,st}$)	Outlet of boiler	Thermometer (WZP)	JJG229-1998	B (0.3℃)	Annually
T-102	Feed water temperature ($T_{y,fw}$)	Inlet of boiler	Thermometer (WZP)	JJG229-1998	1	Annually
P-101	Steam pressure ($P_{y,st}$)	Outlet of boiler	Pressure meter (1151)	JJG882-2004	1	Annually
P-102	Feed water pressure ($P_{y,fw}$)	Inlet of boiler	Pressure meter (1151)	JJG882-2004	1	Annually
E	Electricity consumption (EC_y)	Panel board of the water treatment system	Wattmeter	JJG307-1988	1.0	Annually
Time of flaring	Time of open stack flaring	Monitored and recorded by the monitoring team				

4. Data Collection and Archiving

Data collection and archiving is carried out in conformity with the method stated in section B.7.1. and monitoring manual. Dedicated data entry sheets as well as calculation spreadsheets are prepared. If the data is temporarily not available because of breakdown and/or failure of equipment, conservatively estimated value should be used alternatively in transparent and reasonable manner. At the same time, the CDM monitoring manager take actions for prompt recovery from abnormal conditions and minimization of negative impact on production according to the procedures stipulated in the CDM manual. For example, when biogas cannot be combusted at the boiler due to malfunction, the CDM monitoring chief will soon direct a CDM monitoring staff to take measures for recovery as well as to record the time when the boiler stopped and restarted, and at the same time, will inform it to relevant department to adjust plant operation.

Data monitored for CDM purposes will be aggregated, summarized, calculated and recorded as an electronic and a paper form at the end of every month. The paper form record must have at least one copy of backup. The electronic data should be saved in a digital recording media like CD for backup. All relevant written documentation such as monitoring manual, regulatory standards, maps, drawings, etc. are systematically stored in order to use for checking appropriateness of data and data management. The collected data and relevant documents will be made available to the verifier so that the reliability of the information can be checked. All the data shall be kept until two years after the end of crediting period.

5. Quality Assurance and Quality Control (QA and AC)
All monitoring equipment will be maintained and calibrated in line with manufacturers' instruction and/or national standards. Calibration will be implemented at least once a year. The amount of coal consumption is also managed through the same method, by weighing the amount of coal put in the boiler by the truck scale, which, is calibrated once a year. These activities will assure that the equipment operates at the stated level of accuracy. Data collected by CDM monitoring staff will be cross-checked by the CDM monitoring chief and the CDM monitoring manager to detect and correct errors in accordance with the predetermined procedure. In order to check if daily monitoring activities are implemented in compliance with the CDM monitoring manual, and to continuously improve monitoring practice, internal audit will also be implemented on at least once a year. In the internal audit, document survey concerning procedures of data collection, management and archiving, status of calibration, education and training, etc. and onsite audit are made. Corrective action will be taken on any deviations from the manual identified though the internal audit.

6. Monitoring Report
At the end of the year, CDM monitoring manager of the Linqu Qinchi Biological will compile a monitoring report for verification by DOE. The monitoring report includes monitoring data such as wastewater flow rate, COD concentration in wastewater, biogas flow rate, fraction of methane in biogas and end use of the final sludge, record of calibration of meters, calculations of emissions reductions, etc. The Uniufa Energy Technology Co., Ltd. will instruct how to prepare the monitoring report to the CDM monitoring manager to adjust and enhance it according to the latest requirements by the CDM EB.

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

Date of completion: 15/05/2009

Uniufa Energy Technology Co., Ltd.
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E&E Solutions Inc.

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The above persons are not the Project Participants.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

22/09/2008 (Signing of the construction contract)

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

15 years

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

C.2.1. Renewable crediting period

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2011 or date of registration, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The Linqu Qinchi Biological consigned preparation of environmental impact assessment (EIA) form to the Weifang Environmental Science Research Institute. The EIA form was completed in 27 Mar. 2008 and was approved by the Environmental Protection Agency of the Linqu County on 21 Sep, 2008. Major contents of EIA form and its approval are summarized below.

1. Air Quality

The main air pollutant generated from the Project is SO_2, which occurs through combustion of H_2S contained in biogas. The SO_2 emission will be prevented by the desulfurization process (using desulfurization agent (Fe2O3)) to remove H_2S in the biogas before combustion. Through this process, majority of H_2S will be removed, and as a result, the SO2 concentration emitted from the plant shall be reduced to 625mg/m3, which is below the standard of 900mg/m3.

The standard applied is "Boiler emission standards for air pollutants "(GB13271-2001[12]), since it is applied for coal-burning boilers which have output of less than 45.5MW (65t/h).

Therefore, it is concluded that the Project will result in no increase of air pollution.

2. Noise

The main source of noise by the proposed project activity is the operation of pumps. Although the noise level at one meter from the plant is estimated as high as 90dB(A), noise level at the boundary will comply with the applicable standards because appropriate soundproof measures will be taken to reduce the noise level going outside.

The standard applied for the noise level is he standard of Area II in "Standard of noise at boundary of industrial enterprises" (GB12348-90)[13], since the plant is built within the industrial area. The limit level of noise in this standard is 60dB(A) for daytime, and 50dB(A) for night time.

Therefore, it is concluded that the Project will result in no impact of noise pollution.

3. Water Quality

Anaerobic lagoon will be modified to anaerobic reactor, where the methane will be recovered. Thus there will be no change as far as impact on water quality through the water treatment process is concerned.

The standard applied is "Integrated wastewater discharge standard class III" (GB8978-1996)[14]. The COD limit of third class discharge of alcohol industries, applied in this area, is 1000mg/L.

Therefore, it is concluded that the Project will result in no increase of water pollution.

4. Solid waste

The Project will generate no solid waste and thus have no negative impact.

5. Ecosystem

[12] http://www.codeofchina.com/gb/environmental/200903/22-320.html

[13] http://www.nthb.cn/standard/standard06/20030411094608.html (in Chinese)

[14] http://www.nthb.cn/standard/standard02/20030414085954.html(in Chinese)

As the vegetation covered area within the construction site is small, and there is no important flora and fauna living in the site, so there shall be very little impact to the vegetation, habitat and ecosystem of the surroundings.

From the above, it can be concluded that the Project has little to no impact on the environment.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Both the project participants and the host party consider that there are no significant negative impacts on the environment from this Project.

SECTION E. Stakeholders' comments

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

In order to give stakeholders a clear and full understanding of the impacts which might be caused by the proposed CDM project activity, and to solicit opinions and comments on the project, the Linqu Qinchi Biological have carried out the following step-by-step actions in an open and transparent manner.

- The Linqu Qinchi Biological put an announcement on the bulletin board about the CDM project activity near the Project site, on Mar 5, 2008.
- The Project explanation meeting was held on 20 Mar, 2008 at the project site and the questionnaire was delivered and collected at the meeting.

Total of 20 questionnaires are distributed and collected. Respondents for the questionnaire are selected taking diversity of gender, age, level of education and profession into account. The structure of respondents is illustrated as follows.

Table E.1-1 Structure of respondents of questionnaire survey

Index	Category	Number (persons)	Proportion (%)
Gender	Male	10	50%
	Female	10	50%
Age	<30	5	25%
	30-55	14	70%
	>56	1	5%
Level of education	Primary	1	5%
	Secondary	14	70%
	Higher	5	20%
Profession	Farmer	10	50%
	Company employee	9	45%
	Officer	0	0%
	Others	1	5%

Contents of the questionnaire are as follows.

- What kind of impacts do you think would the Project give to the local ecosystem?
- What kind of impacts would the Project give to the local job opportunity?
- What kind of impacts would the Project give to the livelihood?
- What kind of impacts would the Project give to the local economic development?
- What kind of impacts would the Project give on the whole?
- What do you think of the Project itself? Do you support the Project?

E.2. Summary of the comments received:

The number of persons answered to the questionnaire survey is 20, all of which are local residents who have possibility to have impact by the project. The 20 persons are consisted of 8 workers and 12 local residents. Major comments are as follows:

- Almost all the answerers think the impacts are positive and give favourable effects to the local environment and sustainable development
- Almost all the answerers say that the Project give positive impacts
- All of the answerers agree with the Project
- There were no offensive comments to the Projective activity.

Details of the answers of the questionnaire are summarized as follows.

Table E.1-1 Summary of answers to the questionnaire survey

Questions	Answer Category	Number (persons)	Share (%)
1. What type of impacts do you think the CDM project activity will have on the local environment?	Positive impact	19	95%
	Negative impact	0	0%
	No impact	1	5%
	Both positive and negative	0	0%
2. What type of impacts do you think the CDM project activity will have on the local employment opportunity?	Positive impact	19	95%
	Negative impact	0	0%
	No impact	1	5%
	Both positive and negative	0	0%
3. What type of impacts do you think the CDM project activity will have on the living of local residents?	Positive impact	19	95%
	Negative impact	0	0%
	No impact	1	5%
	Both positive and negative	0	0%
4. What type of impacts do you think the CDM project activity will have on the local economical development?	Positive impact	20	100%
	Negative impact	0	0%
	No impact	0	0%
	Both positive and negative	0	0%
5. What type of impacts do you think the CDM project activity will have as a whole?	Positive impact	20	100%
	Negative impact	0	0%
	No impact	0	0%
6. Do you support the CDM project or not?	Yes	20	100%
	No	0	0%

The invited comments demonstrated that the local stakeholders fully support the CDM project.

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

As almost all the answerers comment that the Project impact is positive, there is no need to take further environmental measures.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This Project does not receive any public funding.

Annex 3

BASELINE INFORMATION

Baseline calculation for the emission factor from the Power Grid

The calculation of the emission factor from the power grid in this PDD is based on the formula and information given in the "2008 Baseline Emission Factors for Regional Power Grids in China"[15] issued by China DNA on 18th July, 2008, which is as follows:

STEP 1. Identify the relevant electric power system

According to instructions of Chinese DNA, the relevant electric power system is the North China Power Grid which supplies to Beijing, Tianjin, Heibei, Shanxi, Inner Mongolia and Shandong.

STEP 2. Choose whether to include off-grid power plants in the project electricicty system

The following two options are given in the "Tool to calculate the emission factor for an electricity system (ver.2)" to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation
Option II: Both grid power plants and off-grid power plants are included in the calculation

In this calculation, Option I is chosen.

Step 3. Select a method to determine operating margin (OM) method

The Operating Margin emission factor(s) ($EF_{OM, y}$) is calculated based on one of the four following methods:

1. Simple OM, or
2. Simple adjusted OM, or
3. Dispatch Data Analysis OM, or
4. Average OM.

"Average OM" cannot be applied to the project activity as the proportion of electricity generated by low-cost / must run resources in total grid electricity generation in the North China Power Grid is 0.89% in 2002, 0.86% in 2003, 0.76% in 2004, 0.75% in 2005 and 0.51% in 2006, respectively, which constitute less than 50% of total generation. Data necessary to calculate "Simple Adjusted OM" and "Dispatch Data Analysis OM" are not publicly disclosed in China. Therefore, "Simple OM" method is applicable to the project activity.

According to the "Tool to calculate the emission factor for an electricity system (ver.2)", the simple OM can be calculated using either of the following data vintages;

[15] http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=2871

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (*y*-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (*y*-2) may be used. The same data vintage (*y*, *y*-1 or *y*-2) should be used throughout all crediting periods.

For the proposed project activity, “ex ante option” is chosen to calculate simple OM.

STEP 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

Option A: Based on data on the net electricity generation and a CO_2 emission factor of each power unit or
Option B: Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system

For the proposed project activity, option B is applied since power plant / unit level information is not available. Where option B is used, simple OM emission factor is calculated as:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:
$EF_{grid,OMsimple,y}$: Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$: Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$: Net calorific value of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$: CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y: Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh)
i: All fossil fuel types combusted in power sources in the project electricity system in year *y*
y: Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (for ex ante option)

The simple OM for the North China Power Grid, calculated ex ante using data in 2004, 2005 and 2006, is 1.1169 tCO_2/MWh.

STEP 5: Identify the group of power units to be included in the build margin

The sample group of power units *m* used to calculate the build margin consists of either.

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

In China it is very difficult to obtain the data of the five existing power plants built most recently and the power plants capacity additions in the electricity system that comprise 20% of the system generation and that were built most recently. Taking notice of this situation, EB accepts the following deviation in calculation of build margin emission factor:

- Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1 - 3 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.
- Use proportional weights of installed capacity in place of electricity generation and plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency level of the best technology commercially available in the provincial / regional or national grid of China, as a conservative proxy.

According to the above EB's clarification, the proposed project activity calculate BM emission factor based on sample group *m* which comprise 20% of the system generation based on proportional weights of installed capacity in place of electricity generation. Based on the latest official statistics data, comparing with the system capacity installed in 2006, system capacity in 2004 and 2005 are 66.2% and 78.3%, respectively. Therefore, system capacity in 2004 is chosen to compare with that in 2006 to determine the newly added amount as the sample group *m*.

Besides, two options are available for calculating $EF_{BM,y}$ in terms of vintage of data:

Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period
Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante*, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used

Option 1, to calculate build margin emission factor ex ante based on the most recent information, is chosen to calculate BM emission factor for the proposed project activity.

STEP 6. Calculate the build margin emission factor

The BM emission factor is calculated as:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:
$EF_{grid,BM,y}$: Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh)
$EF_{EL,m,y}$: CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m: Power units included in the build margin
y: Most recent historical year for which power generation data is available

As stated in Step 5, EB accept deviation in calculation of build margin emission factor for China. The build margin calculations featured below is derived from the "*2008 Baseline Emission Factors for Regional Power Grids in China* ", which is in according with the EB's clarification and has been renewed by the China DNA (Director Office of National Climate Change Coordination of NDRC) in July, 2008:

- First, according to the statistical data of the most recent one year, determine the ratio of CO_2 emissions produced by coal, oil and gas fuels consumption for power generation;
- Second, multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency; and
- Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

BM emission factor for the proposed project activity is calculated these steps, detailed procedures are:

Sub-step 1: Calculate the proportion of CO_2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO_2 emissions from the total fossil fuelled electricity generation (sum of CO_2 emissions from coal, oil and gas).

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,j} \times EF_{CO2,i,j}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j} \times EF_{CO2,i,j}}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,j} \times EF_{CO2,i,j}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j} \times EF_{CO2,i,j}}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,j} \times EF_{CO2,i,j}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j} \times EF_{CO2,i,j}}$$

Where:
$F_{i,j,y}$: the consumption of fuel *i* for power sources *j* in years *y*;

$NCV_{i,j}$: the net calorific value of fuel i for power sources j
$EF_{i,j,y}$: the emission factor of fuel i

Sub-step 2: Calculate the emission factor of fuel-based generation:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$$

Where, $EF_{coal,\ adv}$, $EF_{oil,\ adv}$ *and* $EF_{gas,\ adv}$ refers are the emission factors for coal-fired, oil-fired and gas-fired generation technology according to commercially available best practice technology in terms of efficiency.

A coal-fired power plant with a total installed capacity of 600MW distributed over 30 turbines is assumed to be the commercially available best practice technology in terms of efficiency, the estimated coal consumption of such a National Sub-critical Power Station with a capacity of 600MW is 324.94gce/kWh, which corresponds to an efficiency of 37.28% for electricity generation. For gas and oil power plants, a 200MW combined cycle power plant with a specific fuel consumption of 252gce/kWh, which corresponds to an efficiency of 48.81% for electricity generation, is selected as commercially available best practice technology in terms of efficiency.

Sub-step 3: Calculate the Building Margin emission factor

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$

Where, CAP_{Total} is the total capacity addition, and $CAP_{Thermal}$ is the total thermal (coal, oil and gas) power capacity addition.

According to above equation, BM emission factor ($EF_{BM,y}$) of the North China Power Grid is calculated as 0.8687tCO_2/MWh (Annex 3 for details).

STEP 7. Calculate the combined margin emissions factor

The combined margin emissions factor ($EF_{grid,\ CM,\ y}$) is calculated as:

$$EF_{grid,\ CM,\ y} = EF_{grid,\ OM,\ y} \times w_{OM} + EF_{grid,\ BM,\ y} \times w_{BM}$$

$EF_{grid,BM,y}$: Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$: Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}: Weighting of operating margin emissions factor (%)
w_{BM}: Weighting of build margin emissions factor (%)

According to"Tool to calculate the emission factor for an electricity system", default w_{OM} and w_{BM} applicable to projects other than wind and solar power generation are $w_{OM} = w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period. As the project is not wind or solar power generation, and selects fixed crediting period, thus the baseline emission factor $EF_{grid,\ y}$ of the project activity is calculated as 0.9928tCO_2/MWh by applying default weights 0.5 for w_{OM} and w_{BM}.

Table 1. Annual electricity generation of North China Power Grid 2002-2006

	2002	2003	2004	2005	2006
Thermal power (GWh)	403,919	457,675	526,772	603,231	721, 282
Hydro power and Other (GWh)	3,626	3,979	4,032	4,551	3,718
Total generation (GWh)	407,545	461,653	530,804	607,782	725,000
Proportion of low cost and must run resources. %	0.89%	0.86%	0.76%	0.75%	0.51%

Data source: China Electric Power Yearbook 2003-2007

Table 2. The fuel-fired electricity generation of North China Power Grid in 2004

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Electricity generation (MWh)	18,579,000	33,952,000	124,970,000	104,926,000	80,427,000	163,918,000
Auxiliary electricity consumption (%)	7.94	6.35	6.5	7.7	7.17	7.32
Electricity delivered to the grid (MWh)	17,103,827	31,796,048	116,846,950	96,846,698	74,660,384	151,919,202
Total Electricity delivered to the grid (MWh)	489,173,110					
Electricity importation from Northeast China Power Grid (MWh)	4,514,550					
Total electricity exportation (MWh)	493,687,660					

Data source: China Electric Power Yearbook 2005.

Table 3. The fuel-fired electricity generation of North China Power Grid in 2005

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Electricity generation (MWh)	20,880,000	36,993,000	134,348,000	128,785,000	92,345,000	189,880,000
Auxiliary electricity consumption (%)	7.73	6.63	6.57	7.42	7.01	7.14
Electricity delivered to the grid (MWh)	19,265,976	34,540,364	125,521,336	119,229,153	85,871,616	176,322,568
Total Electricity delivered to the grid (MWh)	560,751,013					
Electricity importation from Northeast China Power Grid (MWh)	3,929,000					
Total electricity exportation (MWh)	564,680,013					

Data source: China Electric Power Yearbook 2006.

Table4. The fuel-fired electricity generation of North China Power Grid in 2006

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong
Electricity generation(MWh)	20,705,000	35,924,000	143,888,000	150,250,000	139,593,000	230,922,000
Auxiliary electricity consumption (%)	7.51	6.86	6.63	7.45	7.58	7.12
Electricity delivered to the grid(MWh)	19,150,055	33,459,614	134,348,226	139,056,375	129,011,851	214,480,354
Total Electricity delivered to the grid (MWh)	669,506,473					
Electricity importation from Northeast and Central China Power Grid (MWh)	2,618,060+497,060=3,115,120					
Total electricity exportation(MWh)	672,621,593					

Data source: China Electric Power Yearbook 2007.

Table 5. Average OM emissions factor of North China and Central China Power Grid (2004-2006)

	2004	2005	2006
Northeast China	1.1738371	1.15763963	1.16687886
Central China			0.87599

Table 6. Fuel consumption and emission of North China Power Grid in 2004

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+C+D+E+F
Coal	10^4t	823.09	1410	6299.8	5213.2	4932.2	8550	27,228.29
Cleaned coal	10^4t						40	40
Other washed coal	10^4t	6.48		101.04	354.17		284.22	745.91
Coke	10^4t					0.22		0.22
Coke oven gas	10^8m^3	0.55		0.54	5.32	0.4	8.73	15.54
Other gas	10^8m^3	17.74		24.25	8.2	16.47	1.41	68.07
Crude oil	10^4t							0
Gasoline	10^4t							0
Diesel	10^4t	0.39	0.84	4.66				5.89
Fuel oil	10^4t	14.66		0.16				14.82
LPG	10^4t							0
Refinery gas	10^4t		0.55	1.42				1.97
Natural gas	10^8m^3		0.37		0.19			0.56
Other oil fuel	10^4t							0
Other coking	10^4t							0
Other energy	10^4tce	9.41		34.64	109.73	4.48		158.26

China Energy Statistical Yearbook (2005),

Table 7. CO2 emissions from thermal power plants of the North China Power Grid (2004)

Energy	Unit	Total fuel G	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m3) J	CO_2emissions(tCO_2e) K=G*H*I*J*44/12/10000(unite of volume) K= G*H*I*J*44/12/1000 (unite of weight)
Coal	10^4t	**27,228.29**	25.8	100	20,908	538,547,477
Cleaned coal	10^4t	**40**	25.8	100	26,344	996,857
Other washed coal	10^4t	**745.91**	25.8	100	8,363	5,901,191
Coke	10^4t	**0.22**	25.8	100	28,435	6,698
Coke oven gas	10^8m^3	**15.54**	12.1	100	16,726	1,153,187
Other gas	10^8m^3	**68.07**	12.1	100	5,227	1,578,574
Crude oil	10^4t	**0**	20	100	41,816	0
Gasoline	10^4t		18.9	100	43,070	0
Diesel	10^4t	**5.89**	20.2	100	42,652	186,070
Fuel oil	10^4t	**14.82**	21.1	100	41,816	479,451
LPG	10^4t	**0**	17.2	100	50,179	0
Refinery gas	10^4t	**1.97**	18.2	100	46,055	52,229
Natural gas	10^8m^3	**0.56**	15.3	100	38,931	122,306
Other oil fuel	10^4t	**0**	20	100	38,369	0
Other coking	10^4t	**0**	25.8	100	28,435	0
Other energy	10^4t	**158.26**	0	100	0	0
CO2 emission from imported electricity form		$1.1738371 \times 4{,}514{,}550 = 5{,}299{,}346$ tCO_2e				
Total emission (tCO_2e)		554,323,387 tCO_2e				
Total electricity exportation (MWh)		493,687,660 MWh				
OM emission factor of the NCPG (tCO_2e/MWh)		1.12282 tCO_2e/MWh				

China Energy Statistical Yearbook (2005), 2006 IPCC Guidelines for National Greenhouse Gas Inventories,Volume II Capter 1, p1.21-1.22Table1.3

Table 8. Fuel consumption and emission of North China Power Grid in 2005

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+C+D+E+F
Coal	10^4t	897.75	1,675.2	6,726.5	6,176.5	6,277.23	10,405.4	32,158.53
Cleaned coal	10^4t						42.18	42.18
Other washed coal	10^4t	6.57		167.45	373.65		108.69	656.36
Coke	10^4t					0.21	0.11	0.32
Coke oven gas	10^8m^3	0.64	0.75	0.62	21.08	0.39		23.48
Other gas	10^8m^3	16.09	7.86	38.83	9.88	18.37		91.03
Crude oil	10^4t					0.73		0.73
Gasoline	10^4t			0.01				0.01
Diesel	10^4t	0.48		3.54		0.12		4.14
Fuel oil	10^4t	12.25		0.23		0.06		12.54
LPG	10^4t							0
Refinery gas	10^4t			9.02				9.02
Natural gas	10^8m^3	0.28	0.08		2.76			3.12
Other oil fuel	10^4t							0
Other coking	10^4t							0
Other energy	10^4tce	8.58		32.35	69.31	7.27	118.9	236.41

China Energy Statistical Yearbook (2006).

Table 9. CO2 emissions from thermal power plants of the North China Power Grid (2005)

Energy	Unit	Total fuel G	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m3) J	CO_2emissions(tCO_2e) K=G*H*I*J*44/12/10000(unite of volume) K= G*H*I*J*44/12/1000 (unite of weight)
Coal	10^4t	**32,158.53**	25.8	100	20,908	636,062,536
Cleaned coal	10^4t	**42.18**	25.8	100	26,344	1,051,186
Other washed coal	10^4t	**656.36**	25.8	100	8,363	5,192,725
Coke	10^4t	**0.32**	29.2	100	28,435	8,608
Coke oven gas	10^8m^3	**23.48**	12.1	100	16,726	1,742,396
Other gas	10^8m^3	**91.03**	12.1	100	5,227	2,111,027
Crude oil	10^4t	**0.73**	20	100	41,816	22,385
Gasoline	10^4t	**0.01**	18.9	100	43,070	298
Diesel	10^4t	**4.14**	20.2	100	42,652	130,786
Fuel oil	10^4t	**12.54**	21.1	100	41,816	405,690
LPG	10^4t	**0**	17.2	100	50,179	0
Refinery gas	10^4t	**9.02**	15.7	100	46,055	277,221
Natural gas	10^8m^3	**3.12**	15.3	100	38,931	681,417
Other oil fuel	10^4t	**0**	20	100	38,369	0
Other coking	10^4t	**0**	25.8	100	28,435	0
Other energy	10^4t	**236.41**	0	100	0	0
CO2 emission from imported electricity form Northeast China Power Grid		1.15763963×3,929,000= 4,548,366 tCO_2e				
Total emission (tCO_2e)		652,197,697 tCO_2e				
Total electricity exportation (MWh)		564,680,013 MWh				
OM emission factor of the NCPG (tCO_2e/MWh)		1.15499 tCO_2e/MWh				

China Energy Statistical Yearbook (2006). ; 2006 IPCC Guidelines for National Greenhouse Gas Inventories,Volume II, Capter 1, p1.21-1.22Table1.3

Table 10. Fuel consumption and emission of North China Power Grid in 2006

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+C+D+E+F
Coal	10^4t	796.63	1,639.20	6,867.99	6,968.88	8,404.05	10,930.66	35,607.41
Cleaned coal	10^4t						39.77	39.77
Other washed coal	10^4t	6.36		214.13	371.14	61.77	544.6	1,198
Coal Briquettes	10^4t	7.97					27.77	35.74
Coke	10^4t						3.23	3.23
Coke oven gas	10^8m^3	0.38	0.63	5.8	22.32	0.64	5.79	35.56
Other gas	10^8m^3	20.66	6.58	69.72	13.79	22.76	7.22	140.73
Crude oil	10^4t					0.74		0.74
Gasoline	10^4t			0.01				0.01
Diesel	10^4t	0.21		3.01		0.07	6.32	9.61
Fuel oil	10^4t	6.38		0.08			4.1	10.56
LPG	10^4t						0.01	0.01
Refinery gas	10^4t			2.43			2.32	4.75
Natural gas	10^8m^3	3.41	0.73		0.53			4.67
Other oil fuel	10^4t						0.28	0.28
Other coking	10^4t							0
Other energy	10^4t	6.83		47.11	230.76	12.51	132.29	429.5

China Energy Statistical Yearbook (2007)

Table 11. CO2 emissions from thermal power plants of the North China Power Grid (2003)

Energy	Unit	Total fuel G	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m3) J	CO_2emissions(tCO_2e) K=G*H*I*J*44/12/10000(unite of volume) K= G*H*I*J*44/12/1000 (unite of weight)
Coal	10^4t	35,607.41	25.8	100	20,908	704,277,823
Cleaned coal	10^4t	39.77	25.8	100	26,344	991,125
Other washed coal	10^4t	1,198	25.8	100	8,363	9,477,855
Coal Briquettes	10^4t	35.74	26.6		20,908	728,820
Coke	10^4t	3.23	29.2	100	28,435	98,335
Coke oven gas	10^8m^3	35.56	12.1	100	16,726	2,638,825
Other gas	10^8m^3	140.73	12.1	100	5,227	3,263,593
Crude oil	10^4t	0.74	20	100	41,816	22,692
Gasoline	10^4t	0.01	18.9	100	43,070	298
Diesel	10^4t	9.61	20.2	100	42,652	303,589
Fuel oil	10^4t	10.56	21.1	100	41,816	341,633
LPG	10^4t	0.01	17.2	100	50,179	316
Refinery gas	10^4t	4.75	15.7	100	46,055	125,934
Natural gas	10^8m^3	4.67	15.3	100	38,931	1,019,942
Other oil fuel	10^4t	0.28	20	100	38,369	7,878
Other coking	10^4t	0	25.8	100	28,435	0
Other energy	10^4tce	429.5	0	100	0	0
CO_2 emission by imported electricity form Northeast China Power Grid		1.16687886×2,618,060+0.87599×497,060= 3,490,378.46 tCO_2e				
Total emission (tCO_2e)		726,789,593tCO_2e				
Total electricity exportation (MWh)		672,621,593 MWh				
OM emission factor of the NCPG (tCO_2e/MWh)		1.08053 tCO_2e/MWh				

China Energy Statistical Yearbook (2007); 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume II, Capter 1, p1.21-1.22Table1.3

Table 12. OM emission factor for the North China Power Gird

Year	2004	2005	2006
Total emission (tCO_2e)	554,323,387	652,197,697	726,789,593
Total electricity exportation (MWh)	493,687,660	564,680,013	672,621,593
The Simple OM emission factor	= (554,323,387+652,197,697+726,789,593) / (493,687,660+564,680,013 +672,621,593) = 1.1169tCO_2e/MWh		

Table 13. Calculation of the CO2 emission proportion among the total respectively of solid, liquid and gas fuel used for power generation

Fuel	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Calorific Value (kJ/kg)	EF (tC/TJ)	Oxidation rate	Emission (tCO_2e)	Proportion (%)
Raw Coal	10^4t	796.63	1639.2	6,867.99	6,968.8	10,930.6	8,404.05	35,607.4	20,908	25.8	1	**704,277,82**	-
Cleaned Coal	10^4t	0	0	0	0	39.77	0	39.77	26,344	25.8	1	**991,125**	-
Other washed	10^4t	6.36	0	214.13	371.14	544.6	61.77	1,198	8,363	25.8	1	**9,477,855**	-
Coal Briquettes	10^4t	7.97	0	0	0	27.77	0	35.74	20,908	26.6	1	**728,820**	
Coke	10^4t	0	0	0	0	3.23	0	3.23	28,435	29.2	1	**98,335**	-
Sub-total	-											**715,573,95**	**98.93%**
Crude Oil	10^4t	0	0	0	0	0	0.74	0.74	41,816	20	1	**22,692**	-
Gasoline	10^4t	0	0	0.01	0	0	0	0.01	43,070	18.9	1	**298**	-
Coal oil	10^4t	0	0	0	0	0	0	0	43,070	19.6	1	**0**	-
Diesel	10^4t	0.21	0	3.01	0	6.32	0.07	9.61	42,652	20.2	1	**303,589**	-
Fuel Oil	10^4t	6.38	0	0.08	0	4.1	0	10.56	41,816	21.1	1	**341,633**	-
Other	10^4t	0	0	0	0	0.28	0	0.28	38,369	20	1	**7,878**	-
Oter Coke	10^4t	0	0	0	0	0	0	0	28,435	25.8	1	**0**	
Sub-total	-											**676,091**	**0.09%**
Natural Gas	10^7m^3	34.1	7.3	0	5.3	0	0	46.7	38,931	15.3	1	**1,019,942**	-
Coke Oven Gas	10^7m^3	3.8	6.3	58	223.2	57.9	6.4	355.6	16,726	12.1	1	**2,638,825**	-
Other gas	10^7m^3	206.6	65.8	697.2	137.9	72.2	227.6	1407.3	5,227	12.1	1	**3,263,593**	-
LPG	10^4t	0	0	0	0	0.01	0	0.01	50,179	17.2	1	**316**	-
Refinery Gas	10^4t	0	0	2.43	0	2.32	0	4.75	46,055	15.7	1	**125,934**	-
Sub-total	-											**7,048,610**	**0.98%**
Tota	-											**723,298,65**	**100%**

China Energy Statistical Yearbook (2007)

Table 14. Emission factor of best technology

	Variable	Electricity supply efficiency L	Emission factor of fuel H (tc/TJ)	Oxidation rate I	Emission factor (tCO_2e /MWh) =3.6L/1000*H* I*44/12
Coal-based power plants	$EF_{Coal,Adv}$	37.28%	25.8	1	0.9135
Gas-based power plants	$EF_{Gas,Adv}$	48.81%	15.3	1	0.4138
Oil-based power plants	$EF_{Oil,Adv}$	48.81%	21.1	1	0.5706

Corresponding thermal power emissions factor：

$$EF_{Thermal} = \lambda_{Coal,y} \times EF_{Coal,Adv} + \lambda_{Oil,y} \times EF_{Oil,Adv} + \lambda_{Gas,y} \times EF_{Gas,Adv} = 0.9083 tCO_2 / MWh$$

Table 15. Installed capacity of the North China Power Grid in 2006

Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mogonlia	Shandong	Total
Thermal power	MW	3,984	6,512	26,087	26,661	28,899	49,395	141,538
Hydro power	MW	1,053	5	785	790	818	553	4,004
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and Other	MW	24	24	218	0	565	106	937
Total	MW	5,061	6,541	27,090	27,451	30,282	50,054	146,479

Date Source：China Electric Power Yearbook 2007

Table 16. Installed capacity of the North China Power Grid in 2005

Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mogonlia	Shandong	Total
Thermal power	MW	3833.5	6149.9	22333.2	22246.8	19173.3	37332	111068.7
Hydro power	MW	1025	5	784.5	783	567.9	50.8	3216.2
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and Other	MW	24	24	48	0	208.9	30.6	335.5
Total	MW	4882.5	6178.9	23165.7	23029.8	19950.2	37413.4	114620.5

Date Source：China Electric Power Yearbook 2006

Table 17. Installed capacity of the North China Power Grid in 2004

Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mogonlia	Shandong	Total
Thermal power	MW	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro power	MW	1055.9	5	783.8	787.3	567.9	50.8	3250.7
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and Other	MW	0	0	13.5	0	111.8	12.4	137.7
Total	MW	4514.4	6013.5	20730	18480.5	14321.2	32923.6	96983.2

Date Source ：China Electric Power Yearbook 2005

Table 18. installed capacity addition in 2004−2006 and the share of which the different technologies account for

	Installed capacity in 2004	installed capacity in 2005	installed capacity in 2006	New installed capacity during 2005-2006	Share in the new installed capacity
Thermal power(MW)	93,594.9	111,068.7	141,538.0	30,469.3	95.64%
Hydro power(MW)	3,250.7	3,216.2	4,004	787.8	2.47%
Nuclear power(MW)	0	0	0	0	0.00%
Wind power and Other(MW)	137.5	335.5	937	601.5	1.89%
Total(MW)	**96,983.1**	**114,620.4**	**146,479.0**	31,858.6	100.00%
Percentage of total installed capacity in 2006	66.21%	78.25%	100%		

$$EF_{grid,BM,y} = 0.9083 \times 95.64\% = 0.8687 tCO_2e/MWh$$

Table 19 Historical records of major parameters

Record Date	Inlet of Lagoon	Outlet of lagoon	Discharge point	Inlet of Lagoon	Discharge point	Inlet of Lagoon	Outlet of lagoon	Discharge point	Number of monthly
	COD (mg/L)	COD (mg/L)	COD (mg/L)	Wastewater Volume(m3/h)	Wastewater Volume(m3/h)	PH	PH	PH	Operational days
2007/9/3	58,722	892	385	46	46	4.47	7.66	7.52	
2007/9/10	58,927	1,134	379	47	47	4.38	7.43	7.36	
2007/9/17	57,856	765	365	52	51	4.46	7.47	7.40	
2007/9/24	57,732	633	364	50	50	4.33	7.39	7.33	29
2007/10/1									
2007/10/8	57,120	743	355	49	48	4.58	7.42	7.36	
2007/10/15	57,643	964	383	50	50	4.49	7.67	7.62	
2007/10/22	58,330	1,187	386	45	44	4.43	7.72	7.68	
2007/10/29	59,223	832	388	45	45	4.47	7.44	7.40	28
2007/11/5	58,869	834	323	46	46	4.63	7.64	7.58	
2007/11/12	57,332	729	285	50	49	4.56	7.53	7.49	
2007/11/19	58,550	1,035	393	45	45	4.52	7.56	7.52	
2007/11/26	58,743	878	324	45	45	4.44	7.52	7.47	27
2007/12/3	57,660	729	364	51	51	4.58	7.83	7.74	
2007/12/10	57,932	1,092	383	52	51	4.40	7.76	7.71	
2007/12/17	58,765	889	356	46	46	4.54	7.54	7.50	
2007/12/24									
2007/12/31	57,642	852	364	48	47	4.40	7.65	7.60	24
2008/1/7	58,634	837	303	48	48	4.50	7.44	7.38	
2008/1/14	58,024	933	351	49	49	4.52	7.73	7.66	
2008/1/21	57,654	1,141	385	44	44	4.32	7.65	7.60	
2008/1/28	57,453	834	330	45	45	4.55	7.31	7.28	28
2008/2/4	57,387	976	346	41	41	4.56	7.28	7.25	
2008/2/11	58,743	889	330	43	42	4.55	7.74	7.70	
2008/2/18	57,881	844	328	48	48	4.44	7.87	7.82	
2008/2/25	57,964	765	382	46	45	4.46	7.69	7.64	26
2008/3/3	58,765	879	392	49	48	4.47	7.62	7.57	
2008/3/10	57,717	796	309	51	50	4.56	7.53	7.47	
2008/3/17	59,634	1,027	367	47	47	4.57	7.43	7.36	
2008/3/24	58,934	733	380	47	47	4.56	7.55	7.50	
2008/3/31	58,342	878	392	47	46	4.53	7.72	7.66	29
2008/4/7	58,632	783	370	46	46	4.41	7.49	7.44	
2008/4/14	57,012	837	302	51	50	4.50	7.48	7.43	
2008/4/21									
2008/4/28	58,245	738	344	48	48	4.41	7.72	7.65	24
2008/5/5	57,740	828	344	45	44	4.54	7.48	7.44	
2008/5/12	58,054	1,082	380	48	48	4.46	7.63	7.55	
2008/5/19	57,854	933	357	44	44	4.41	7.58	7.51	
2008/5/26	58,349	792	364	48	48	4.37	7.37	7.33	27
2008/6/2	58,023	647	315	52	51	4.57	7.34	7.28	
2008/6/9	57,643	771	320	52	51	4.41	7.63	7.51	
2008/6/16									
2008/6/23	57,863	634	334	48	47	4.50	7.22	7.16	
2008/6/30	57,832	892	354	52	51	4.46	7.50	7.45	26
2008/7/7	58,028	923	375	45	45	4.57	7.43	7.38	
2008/7/14	58,573	836	383	48	47	4.47	7.69	7.57	
2008/7/21									
2008/7/28	57,124	731	344	49	48	4.38	7.38	7.34	28
2008/8/4	56,827	775	358	50	49	4.44	7.23	7.17	
2008/8/11	57,836	692	332	47	46	4.47	7.63	7.57	
2008/8/18	58,563	654	313	49	48	4.51	7.77	7.70	
2008/8/25									21
Annual Average	58,095	854	354	47.70	47.22	4.48	7.55	7.49	0
COD removal efficiency	**98.53%**								

Table 20 Calculation sheet of emission reduction

Methane Recovery Project of Linqu Qinchi Biological Co., Ltd: Spreadsheet for emission reduction calculation

Step 1 Baseline emission

BE	82,301 tCO2/yr

Step 1.1 Methane recovery component (ex-ante)

Methodology AMS II.H (version13) -case (vi)

BEtreatment = Qww* CODremoved*MCFww,treatment,BL*Bo,ww*UF_BL*GWP_CH4

	Description	Value	Unit	Source
Vh	Volume treated water per hour	47.70	m3/h	Average of historical data
Vd	Volume treated water per day	1,145	m3/day	
OpD	Number of op. days per year	317	days/yr	Histoical data of operational days
Qww	Volume of treated wastewater per year	362,965	m3	=Vd*OpPD
CODuntreated	COD at the entrance of anaerobic reactor	58,095	mg/L	Average of historical data
COD untreated	COD at the entrance of anaerobic reactor (t/m3)	0.058	t/m3	
RE COD,BL	COD removal efficiency of baseline lagoon	98.53%		Calculated from recorded one year data
CODremoved,BL	COD removed from the Baseline Lagoon	0.057	t/m3	=CODuntreated *COD removal efficiency
MCFww,treatment	Methane correction factor for the existing anaerobic treatment systems	0.8		AMS III.H (ver13) Anaerobic reactor without methane recovery
Bo,ww	Methane producing capacity of the wastewater	0.21	tCH4/tCOD	2006 IPCC report
UF BL	Model correction factor	0.94		AMSIII.H(ver13)
GWP CH4	Global Warming Potential of Methane	21	tCO2e/tCH4	IPCC 2006 guidelines
BE treatment		68,611	tCO2e/yr	

BEdischarge = Qww*GWP_CH4*Bo,ww*UFbl*CODww,discharge,BL,y*MCFww,BL,discharge

	Description	Value	Unit	Source
Qww	the above in t/m3	362,965	m3	=Vd*OpPD
GWP_CH4	Global Warming Potential of Methane	21	tCO2e/tCH4	IPCC 2006 guidelines
Bo,ww	Methane producing capacity of the wastewater	0.21	tCH4/tCOD	2006 IPCC report
UFbl	Model correction factor	0.94		AMSIII.H(ver13)
CODww,discharge,BL,y	COD at the discharge point (mg/L)	354	mg/L	Average of historical data
CODww,discharge,BL,y	COD at the discharge point (mg/L)	0.000354	t/m3	
MCFww,BL,discarge	Methane correction factor for aerobic treatment, well managed	0		AMS III.H (ver13) value of aerobic treatment, well managed
BE discharge		0	tCO2e/yr	

BEcomponent1 = BE treatment + BE discharge

BEcomponent1		68,611		

Step 1.2 Heat utilization component (ex-ante)

Methodology AMS I.C(version16)

BEcomponent2 = BEcofire = (Σ (FCbiomass,k,y*NCVbiomass,k,y)/(SEC_PJ* η BL))*EF_BL
SEC_PJ= (Σ FCj * NCVj)/EGpj

		Value	Unit	Source
EGpj =BC*OpD*OpH				
BC	Boiler rated capacity	14	MWth	Feasibility Study Report
OpD	Number of Operational Days	317	days	Historical Data
OpH	Daily operational hours	24	hours/day	
(EG (MWh))	Net quantity of heat in MWh	106,512	MWh	
ECF	Energy Conversion Factor	3.6E-03	TJ/MWh	
EGpj,y		**383.4432**	TJ/y	
SEC_PJ				
FCmethane, y = CFEww*Qww*Bo,ww*UFbl*CODremoved,PJ*MCFww,treatment				
CFEww	Capture and utilization efficiency of methane recovery	0.9		Default value, from AMS III.H
Qww	Volume of treated wastewater per year	362,965	m3	Average of historical data
Bo,ww	Methane producing capacity of the wastewater	0.21	tCH4/tCOD	2006 IPCC report
UFbl	Model Correction factor	0.94		
CODuntreated(mg)	COD before the anaerobic treatment at the entrance of anaerobic treatment facility	*58,095*	mg/L	Average of historical data
CODuntreated(t)	the above in t/m3	*0.058095*	t/m3	=COD untreated (mg)*0.000001
CODafter treatment(mg)	COD after the anaerobic treatment	*2320*	mg/L	FSR
CODafter treatment(t)	the above in t/m3	*0.00232*	t/m3	=COD after treatment (mg)*0.000001
COD removed, PJ	COD removed from the UASB reactor	0.056	t/m3	Removed COD in the Project Activity
MCFww, treatment	Methane correction factor for the existing anaerobic treatment systems	0.8		AMS III.H (ver13) Anaerobic reactor without methane recovery
FCmethane,y (mass)	Quantity of methane combusted in mass unit	2889	t	
D_CH4	Density of methane at normal conditions	0.000716	tCH4/Nm3	Tool to determine project emissions from flaring gases containing methane
FCmethane,y (volume)	Volume of combusted methane	**4,034,916**	**m3CH4**	
NCV_CH4	Net Calorific Value of Methane	**0.035865**	GJ/m3	The fundamentals and technology of furnace", Chemical Industry Press.
FC sludge,y	Amount of sludge to be combusted in the boiler	*0*	t/y	
(NCV sludge)				
HHV sludge	Higher Heating Value for sludge	7500	kJ/kg	"Research for sludge combustion process of fluid bed", Beijing University
WC sludge	Water content of sludge	85%		"Research for sludge combustion process of fluid bed", Beijing University
HVW	Heat of vaporization for water	2257	kJ/kg	
NCV sludge		**-793.45**	kJ/kg	=HHV*(1-WC)+HVW*WC
		-0.79345	GJ/t	
FC coal,y*NCVcoal	Quantity of heat from the of coal combusted	238,731	GJ	
SEC_PJ		**1.0000**		
NCV coal	Net Calorific Value of raw coal	20.908	GJ/t	China Energy Statistics Yearbook 2005
CCdisplaced	*Amount of coal displaced by methane*	***6,921***	*t*	
EFcoal CO2	Carbon Emission factor of coal	94600	kgCO2/TJ	2006 IPCC guidelines
EFcoal CO2(GJ)		*0.0946*	*tCO2/GJ*	
η BL,thermal	Boiler efficiency	100%		AMSI.C (ver16) para 18 (c)
BEcofire		**13,690**	**tCO2**	
BEcomponent2		13,690	tCO2/yr	

Step 2 Project Emission

PE	9,835 tCO2e/yr

Step 2.1 Methane Recovery Component

Basic formu PEcomponent1=PEpower+PEdischarge+PEfinal+PEfugitive

PEpower Emissions from electricity or diesel consumption

PEpower=EC*EFgrid,cm

	Description	Value	Unit	Source
EC	Power consumption	2,250	MWh/yr	FSR
EFgrid	The grid emission factor of East China Power Grid	0.9928	tCO2e/MWh	China DNA 2008
PEpower		2,234	tCO2e/yr	

PEdischarge Emissions from degradable organic carbon in **treated water**

PEdischarge=Qww*GWP_CH4*Bww*UFpj*CODdischarge*MCFdischarge

		Value	Unit	Source
Qww	Volume of treated wastewater per year	362,965	m3/yr	= Volume per day * Number of operating days
GWP_CH4	Global Warming Potential of Methane	21	tCO2e/tCH4	2006 IPCC guidelines
Bww	Methane producing capacity of the wastewater	0.21	kgCH4/kgCOD	2006 IPCC guidelines
UFpj	Model correction factor	1.06		AMSIII.H (ver13)
CODdischarge(mg)	COD after the full treatment in mg/L	*200*	mg/L	FSR
CODdischarge(t)	COD after the full treatment in t/m3	0.0002	t/m3	=CODtreated(mg)*0.000001
MCFdischarge	Methane correction factor for aerobic treatment, well managed	0		AMS III.H (ver13) value of aerobic treatment, well managed
PEdischarge=Qww*GWP_CH4*Bww*UFpj*CODdischarge*MCFdischarge		0	tCO2/yr	

PEfugitive Emissions from methane release in capture and utilization

PEfugitive= PEfugitive,ww

PEfugitive,ww=(1-CFEww)*MEPww,treatment*GWP_CH4

MEPww,treatment=Qww*Bww*UFpj*CODremoved,PJ*MCFtreatment

		Value	Unit	Source
Qww	Volume of treated wastewater per year	362,965	m3/yr	FSR
CODuntreated(mg)	COD before the anaerobic treatment at the entrance of anaerobic treatment facility	*58,095*	mg/L	Average of historical data
CODuntreated(t)	the above in t/m3	*0.058095*	t/m3	=COD untreated (mg)*0.000001
CODafter treatment(mg)	COD after the anaerobic treatment	*2320*	mg/L	FSR
CODafter treatment(t)	the above in t/m3	*0.00232*	t/m3	=COD after treatment (mg)*0.000001
CODremoved,PJ	COD removed from the UASB reactor	0.056	t/m3	=COD untreated (t)-COD after treatment (t)
Bww	Methane producing capacity of the wastewater	0.21	kgCH4/kgCOD	2006 IPCC guideliens
UFpj	Model correction factor	1.06		AMSIII.H(ver 13)
MCFtreatment	Methane correction factor	0.8		AMS III.H value of anaerobic reactor
MEP ww, treatment	Methane emission potential of wastewater treatment plant	**3619.661203**	**tCH4/yr**	(see above for equation)
CFEww	Capture and utilization efficiency of methane recovery	0.9		Default value, from AMS III.H
GWP_CH4	Global Warming Potential for Methanse	21	tCO2e/tCH4	2006IPCC guidelines
PE_fugitive, ww		7601	tCO2/yr	

PE (methan	PEbio		9,835	tCO2/yr	

Step 1.2 Heat supply component

PE_component2		0.0	tCO2/yr	

Step 3 Emission reduction

Yearly emission reduction

	BE	PE	ER	
Methane recovery	68,611	9,835	58,776	tCO_2e
Heat supply	13,690	0	13,690	tCO_2e
Total	**82,301**	**9,835**	**72,466**	**tCO_2e**

Table 21 Calculation sheet of Investment Analysis

Methane Recovery Project of Linqu Qinchi Biological Co., Ltd: Spreadsheet for investment analysis
Table 1. Basic parameters for Investment Analysis

No.	Item	Value	Unit	Source
1.	**Total investment**	**7,175**	**1,000 RMB**	
1.1.	**Investment on fixed asset**	**6,675**	**1,000RMB**	
	Equipment cost	5,000	1,000RMB	FSR
	Construction cost	1,375	1,000RMB	FSR
	Other s	300	1,000RMB	FSR
1.2.	**Working capital**	**500**	**1,000RMB**	FSR
2.	**Annual operation cost**	**4,014**	**1,000RMB/yr**	
2.1	**Labor cost**	**393.3**	**1,000RMB/yr**	
	Monthly labour cost per person	23,000	RMB/person/year	FSR
	Number of staff	15	person	FSR
	Social welfare rate	14%		FSR
2.2	**Biogas treatment cost**	**1,047**	**1,000RMB/yr**	
	Amount of biogas generated	10,470,000	m3/year	
	Amount of H2S in the biogas	104,700	kg	
	Amount of desulfirization agent needed	349,000	kg	
	Desulfirization agent cost	3,000	RMB/t	
2.2	**Operation and maintenance cost**	**66.8**	**1,000RMB/yr**	
	Rate per investment on fixed asset	1.0%		FSR / a technical literature (1%)
2.3	**Equipment insurance cost**	**49.1**	**1,000RMB/yr**	
	Rate per investment on fixed asset (insurance for e	0.7%		FSR
	Liability insurance fee	2.40	1,000RMB/yr	FSR
2.4	**Water tariff**	**160**	**1,000RMB/yr**	
	Water tariff	2.53	RMB/m3	FSR
	Volume of water used	63,718	m3/year	FSR
2.5	**Electricity cost**	**1,350.0**	**1,000RMB/yr**	
	Electricity tariff	0.60	RMB/kWh	FSR
	Amount of electricity used	2250.00	MWh/year	
2.6	**General Administrative Cost**	**364.9**	**1,000RMB/yr**	FSR
	Rate per investment on annual operation cost	10%		
2.7	**Overhaul cost**	**160.2**	**1,000RMB/yr**	FSR
	Rate per investment on fixed asset	2.4%		
3	**Depreciation cost**	**422.8**	**1,000RMB/yr**	
	Salvage value	5.0%		FSR
	Period of depreciation	15	years	FSR
3.	**Annual financial merit**	**10,674**	**1,000RMB/yr**	with CER
3.1.	**Fuel cost saving**	**3,688**	**1,000RMB/yr**	Excluding VAT
	Annual amount of displaced coal	8,630	t/yr	FSR
	Coal price (excluding VAT)	500.0	RMB/t	FSR
3.2.	**CER revenue**	**6,985**	**1,000RMB/yr**	
	Annual emissions reductions amount	77,000	tCO2e/yr	FSR
	SOP-adaptation	2%	of generated CER	CP/2001/13/Ad2, page 23,15(a)
	Taken by the Government of China	2%	of generated CER	NDRC (2005) Measures for Operation and Management of Clean Development Mechanism Projects in China
	CER price	9	Euro/tCO2e	Chinese floor price
	Exchange rate	10.5	EURO/RMB	
4.	**Tax**			
4.1.	**VAT**	**17%**		FSR
4.2.	**Urban construction tax and educational surtax**	**8%**	**of VAT**	FSR
4.3.	**Corporate tax**	**25%**	**of annual revenue**	

Table 2. P/L (without CDM)

No.	Item	Unit	Sum	Construction 2008	Project-1 2009	Project-2 2010	Project-3 2011	Project-4 2012	Project-5 2013	Project-6 2014	Project-7 2015	Project-8 2016	Project-9 2017	Project-10 2018	Project-11 2019	Project-12 2020	Project-13 2021	Project-14 2022	Project-15 2023
1	**Total revenue**	**1000RMB**	**64,726**		**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**
1.1	Fuel cost saving	1000RMB	64,726		4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315
1.1.1	Coal price	RMB/t	-		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1.1.2	Amount of coal saved	t	129,452		8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630
1.2	CER revenue	1000RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	**Urban construction tax and educational surtax**	**1000RMB**	**880**		**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**
3	**Total expenditure**	**1000RMB**	**53,869**		**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**
3	Labor cost	1000RMB	5,900		393	393	393	393	393	393	393	393	393	393	393	393	393	393	393
3	Biogas treatment cost	1000RMB	15,705		1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047
3	Operation and maintenance cost	1000RMB	1,001		67	67	67	67	67	67	67	67	67	67	67	67	67	67	67
3	Equipment insurance cost	1000RMB	737		49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
3	Water tariff	1000RMB	2,400		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
4	Electricity cost	1000RMB	20,250		1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
4	Administrative cost	1000RMB	5,474		365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
4	Overhaul cost	1000RMB	2,403		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
4	**Depreciation cost**	**1000RMB**	**6,341**		**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**
5	**Capital cost and interest**	**1000RMB**	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	**Profit before tax**	**1000RMB**	**3,635**		**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**	**242**
7	**Corporate tax**	**1000RMB**	**909**		**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**
8	**Profit after tax**	**1000RMB**	**2,726**		**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**	**182**

Table 3. C/F (without CDM)

No.	Item	Unit	Sum	Construction 2008	Project-1 2009	Project-2 2010	Project-3 2011	Project-4 2012	Project-5 2013	Project-6 2014	Project-7 2015	Project-8 2016	Project-9 2017	Project-10 2018	Project-11 2019	Project-12 2020	Project-13 2021	Project-14 2022	Project-15 2023
1	**Inflow**	**1000RMB**	**65,560**		**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**	**5,149**
1.1	Total revenue	1000RMB	64,726		4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315
1.2	Return of working capital	1000RMB	500																500
1.3	Return of salvage value	1000RMB	334																334
2	**Outflow**	**1000RMB**	**62,833**	**7,175**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**	**3,711**
2.1	Construction cost	**1000RMB**	6,675	6,675															
2.2	Working capital	1000RMB	500	500															
2.3	Total expenditure	1000RMB	53,869		3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591
2.4	Urban construction tax and educational surtax	1000RMB	880		59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
2.5	Corporate tax	1000RMB	909		61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
2.6	Others	1000RMB	0																
3	**Cash flow after tax**	1000RMB	**2,726**	**-7,175**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**605**	**1,438**
4	**Cumulative cash flow after tax**	1000RMB	**-41,425**	**-7,175**	**-6,570**	**-5,966**	**-5,361**	**-4,757**	**-4,152**	**-3,548**	**-2,943**	**-2,339**	**-1,734**	**-1,130**	**-525**	**79**	**684**	**1,288**	**2,726**
5	**Cash flow before tax**	1000RMB	**3,635**	**-7,175**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**665**	**1,499**
6	**Cumulative cash flow before tax**	**1000RMB**	**-34,154**	**-7,175**	**-6,510**	**-5,845**	**-5,180**	**-4,515**	**-3,849**	**-3,184**	**-2,519**	**-1,854**	**-1,189**	**-524**	**141**	**806**	**1,471**	**2,136**	**3,635**
	Index					After tax			Before tax										
		IRR				4.0	%		5.3	%									
		NPV	@Discount rate=		12%	4,270	RMB		4,682	RMB									
		Payback period				13	years		12	years									

Table 10. P/L (with CDM)

No.	Item	Unit	Sum	Construction	Project-1	Project-2	Project-3	Project-4	Project-5	Project-6	Project-7	Project-8	Project-9	Project-10	Project-11	Project-12	Project-13	Project-14	Project-15
				2,008	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	2,017	2,018	2,019	2,020	2,021	2,022	2,023
1	**Total revenue**	**1000RMB**	**134,580**		**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**4,315**	**4,315**	**4,315**	**4,315**	**4,315**
1	Fuel cost saving	1000RMB	64,726		4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315
1.1.1	Coal price	RMB/t	7,500		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1.1.2	Amount of coal saved	t	129,452		8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630	8,630
1	CER revenue	1000RMB	69,854		6,985	6,985	6,985	6,985	6,985	6,985	6,985	6,985	6,985	6,985	0	0	0	0	0
2	**Urban construction tax and educational surtax**	**1000RMB**	**880**		**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**	**59**
3	**Total expenditure**	**1000RMB**	**53,869**		**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**	**3,591**
3.1	Labor cost	1000RMB	5,900		393	393	393	393	393	393	393	393	393	393	393	393	393	393	393
3.2	Biogas treatment cost				1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047
3.3	Operation and maintenance cost	1000RMB	1,001		67	67	67	67	67	67	67	67	67	67	67	67	67	67	67
3.4	Equipment insurance cost	1000RMB	737		49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
3.5	Water tariff	1000RMB	2,400		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
3.6	Electricity cost	1000RMB	20,250		1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
3.7	Administrative cost	1000RMB	5,474		365	365	365	365	365	365	365	365	365	365	365	365	365	365	365
3.8	Overhaul cost	1000RMB	2,403		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
4	**Depreciation cost**	**1000RMB**	**6,341**		**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**	**423**
5	**Capital cost and interest**	**1000RMB**	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
6	**Profit before tax**	**1000RMB**	**79,831**		**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**665**	**665**	**665**	**665**	**665**
7	**Corporate tax**	**1000RMB**	**19,958**		**1,913**	**1,913**	**1,913**	**1,913**	**1,913**	**1,913**	**1,913**	**1,913**	**1,913**	**1,913**	**166**	**166**	**166**	**166**	**166**
8	**Profit after tax**	**1000RMB**	**59,873**		**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**499**	**499**	**499**	**499**	**499**

Table 11. C/F (with CDM)

Unit:10,000RMB

No.	Item	Unit	Sum	Construction	Project-1	Project-2	Project-3	Project-4	Project-5	Project-6	Project-7	Project-8	Project-9	Project-10	Project-11	Project-12	Project-13	Project-14	Project-15
				2,008	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	2,017	2,018	2,019	2,020	2,021	2,022	2,023
1	**Inflow**	**1000RMB**	**135,414**		**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**11,301**	**4,315**	**4,315**	**4,315**	**4,315**	**5,149**
1.1	Total revenue	1000RMB	134,580		11,301	11,301	11,301	11,301	11,301	11,301	11,301	11,301	11,301	11,301	4,315	4,315	4,315	4,315	4,315
1.3	Return of working capital	1000RMB	500																500
1.4	Return of salvage value	1000RMB	334																334
2	**Outflow**	**1000RMB**	**81,882**	**7,175**	**5,563**	**5,563**	**5,563**	**5,563**	**5,563**	**5,563**	**5,563**	**5,563**	**5,563**	**5,563**	**3,816**	**3,816**	**3,816**	**3,816**	**3,816**
2.1	Construction cost	**1000RMB**	6,675	6,675															
2.2	Working capital	1000RMB	500	500	0														
2.3	Total expenditure	1000RMB	53,869		3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591	3,591
2.4	Urban construction tax and educational surtax	1000RMB	880		59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
2.5	Corporate tax	1000RMB	19,958		1,913	1,913	1,913	1,913	1,913	1,913	1,913	1,913	1,913	1,913	166	166	166	166	166
2.6	Others	1000RMB	0																
3	**Cash flow after tax**	1000RMB	**53,532**	**-7,175**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**5,738**	**499**	**499**	**499**	**499**	**1,333**
4	**Cumulative cash flow after tax**	1000RMB	**495,996**	**-7,175**	**-1,437**	**4,301**	**10,039**	**15,777**	**21,515**	**27,252**	**32,990**	**38,728**	**44,466**	**50,204**	**50,703**	**51,202**	**51,701**	**52,199**	**53,532**
5	**Cash flow before tax**	1000RMB	**73,490**	**-7,175**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**7,651**	**665**	**665**	**665**	**665**	**1,499**
6	**Cumulative cash flow before tax**	**1000RMB**	**699,317**	**-7,175**	**476**	**8,126**	**15,777**	**23,427**	**31,078**	**38,728**	**46,379**	**54,029**	**61,680**	**69,330**	**69,996**	**70,661**	**71,326**	**71,991**	**73,490**
	Index					After tax			Before tax										
		IRR				79.8	%		107	%									
		NPV	@Discount rate=		12%	33,152	RMB		44,152	RMB									
		Payback period				2	years		#REF!	years									

Annex 4

MONITORING INFORMATION

Please refer to section B.7.2