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

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SECTION A. General description of project activity

A.1. Title of the project activity:

Title: Industrial Wastewater Methane Recovery Project of Bengbu Tushan Thermoelectricity Co., Ltd.
Version: 3.0
Date: 27/07/2012

A.2. Description of the project activity:

The Industrial Wastewater Methane Recovery Project of Bengbu Tushan Thermoelectricity Co., Ltd. (hereinafter referred to as the "Project") is to recover the biogas generated in the process of wastewater treatment as well as to create heat currently supplied by a fossil fuel. The Project is developed by the Bengbu Tushan Thermoelectricity Co., Ltd. (hereinafter referred to as the "Project Owner"), which is located at the Bengbu City, Anhui Province.

Before the implementation of the proposed project, The Anhui Fengyuan Fuel Alcohol Company produces 320,000 tonnes of ethanol fuel per year while discharging about 11,500 m^3 of wastewater per day with a primary COD of 35,000mg/L. The organic wastewater is treated by open lagoons followed by an oxidation ditch facility, so as to comply with Class 1 of the "Integrated Wastewater Discharge Standard (GB8978-1996)." Then it is discharged into a local wastewater treatment plant for further treatment. Methane generated from the treatment is released into the atmosphere without recovery. Furthermore, before the implementation of the proposed project, the Project Owner which has installed 8 sets of coal-fired boilers and 6 sets of steam turbo-generators utilizes fossil fuel coal to generate heat to supply the nearby users. As described in section B.4, before implementation of the project, the greenhouse gas (GHG) source is from the open lagoons without methane recovery and the coal-fired boilers.

The purpose of the proposed project is to recover biogas generated from the open lagoons while considering the CDM revenue. The main constructions would be newly-built MIC anaerobic reactors, a biogas cleaning system, a biogas coal-firing system and a retrofitting aerobic treatment facility. After the implementation of the project, the biogas generated from MIC anaerobic reactors would firstly be sent to the purification system, then the purified biogas would be transported into the retrofitted coal-fired boilers to generate steam. The sludge from the wastewater treatment would be combusted in the boilers after dewatering and drying. When the boiler is in trouble due to failure or malfunction or under maintenance, biogas collected from the MIC reactor will be open flared.

The Project will reduce greenhouse gas (GHG) emissions through avoiding methane and CO_2 emission. The recovered biogas from MIC anaerobic reactors is used as fuel that substitutes for some of the coal to heat the boiler. The amount of coal saved per year would be 44,756t. It is estimated that the proposed project activity will reduce 199,118 tCO2e of GHG annually.

The proposed project activity has both social and environmental benefits and contributes to sustainable development in the following aspects.

- It will reduce greenhouse gas emission of CH_4 through the Project implementation and improve the quality of the atmospheric environment around the world;

- The local people's health and safety problems will be eliminated, for example the malodor of the biogas and the risk of explosion and fire associated with uncontrolled emissions of methane;
- Methane partly replaces fossil fuel to generate heat so as to reduce air pollution and improve atmospheric environment quality.
- Create 26 working opportunities in the area where the Project located.

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)	Bengbu Tushan Thermoelectricity Co., Ltd.	No
United Kingdom of Great Britain and Northern Ireland	Lakewood Carbon Corp.	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, approval by the Party (ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Anhui Province

A.4.1.3. City/Town/Community etc.:

Bengbu City

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

The Project is located in Bengbu City, Anhui Province, which is at the confluence of Jinpu line and Huaihe. The geographic coordinates are north 32° 56' 01" and east 117° 17' 11", respectively. The physical location of the Project is shown in Figure A.4.1.

Figure A.4.1 Physical location of the Project

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

The proposed project activity falls under the following category:
Sectoral scope 13: Waste handling and disposal.

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

（1） Project activity

The proposed project is to recover the biogas from anaerobic wastewater treatment of ethanol fuel; the purified biogas co-fired with coal is transported to the boilers to generate steam. So, the technology employed by the Project is composed of wastewater treatment technology, a biogas cleaning system and a co-fired system. The process is shown in Figure A.4.3.2.

(a) Wastewater treatment system

Pre-treatment: Wastewater of ethanol fuel is cooled through cooler and then is sent into the regulation pond for quality and quantity moderation.

Anaerobic treatment: After pre-treatment the wastewater is sent to the 1st stage MIC anaerobic reactor, where the wastewater is biodegraded completely (the removal rate of the COD can be up to 80%). Effluent from the first stage MIC anaerobic reactors is degassed through the degassing tower and then is sent to the second stage MIC anaerobic reactors for further organic decomposition (where the removal rate of COD is around 60%).

Aerobic treatment: Effluent from the 2nd stage anaerobic reactors goes into the bio-trickling filter tower, where the wastewater on the one hand is further cooled to ensure the environment of the aerobic micro organism in the two stage aerobic reactors is suitable, and on the other hand to reduce foam generation and sludge bulking. Effluent from the bio-trickling filter tower is put into the bio-double pool for aeration treatment, and then the wastewater is pumped to the existing oxidation ditch which is used as the second stage aerobic treatment facility. The treated waste water finally drains into the efficient sedimentation devices for sedimentation. After that, the precipitation sludge at the bottom of settler is pumped back to the sludge treatment system for further treatment, while the separated fresh water from the fresh water tank meeting primary discharged standards is discharged to the wastewater treatment plant.

MIC reactor (Multi-Internal Circulation), which is the third generation anaerobic reactor based on the second. It is composed of two vertical series-connected chambers. The first is the high load chamber of which the bottom zone includes a water inlet and a back flow zone. The second reactor is low load. There is a biogas collector between the first chamber and the second chamber. The three-phase separators are installed at the upper part of them in addition to a three-phase separation cap on the top of the anaerobic reactor. The two reaction chambers and the three-phase separation cap are connected with a lift pipe and a backflow pipe. The structure is shown in Figure A.4.3.1.

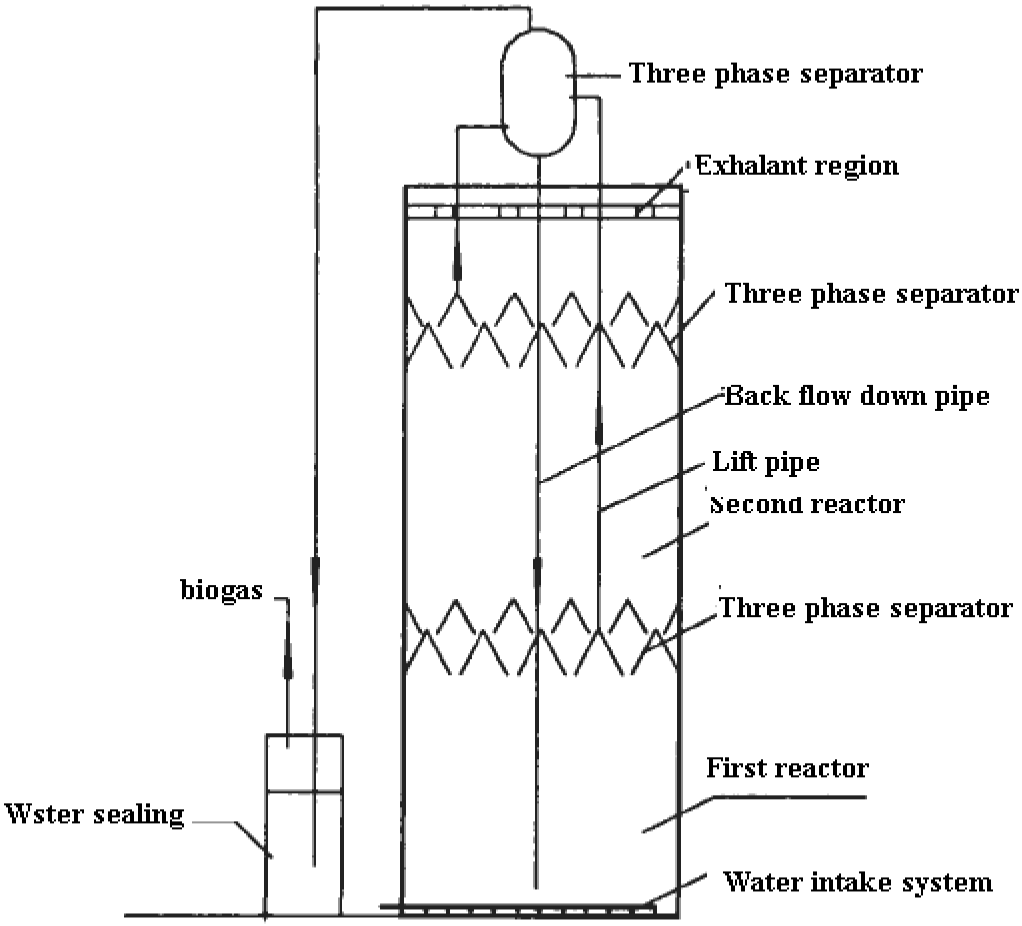

Figure A.4.3.1 Constructional diagram of MIC reactor

(b) Biogas purification and co-fired system

There is a biogas storage cabinet used to collect the biogas produced by degradation of organic matter from the MIC anaerobic reactors. The collected biogas is transported to the gas desulfurization system[1] for purification, and then the purified biogas is transported to Tushan Thermoelectricity Company's boiler room by the booster fan through the biogas mains and distributed to eight co-fired boilers. In both sides of each boiler are installed 2 biogas burner units. The biogas pipelines to the boilers will be explosion-proof and anti-tempering, will automatic turn off in case of fire and so on. The surplus sludge in the Project is combusted in the boilers after dehydration and drying.
The desulfurization system consists of an alkali washing tower and a bio-reactor. The alkaline liquid in the bio-reactor can be recycled.

Furthermore, when the boiler is in trouble due to failure or malfunction, biogas collected from the MIC reactor will be open flared.

[1] The concentration of CH4 in the inlet of desulfurization system is 63.32%. After desulfurization, the H_2S in the biogas (about 8.52g/m^3) will be removed.

The major equipment and technological parameters are shown in Table A.4.3.1.

Table A.4.3.1 Specifications of major equipment and parameters of the Project

Parameters			Value	Source
Wastewater treatment system	1stMIC reactor	Size	Φ15×22.8m	Feasibility Study Report (FSR)
		Number	6 units	FSR
		Capacity/unit	4,000m^3	FSR
		HRT	35h	FSR
	2ndMIC reactor	Size	Φ15×22.8m	FSR
		Number	2 units	FSR
		Capacity/unit	4,000m^3	FSR
		HRT	11.7h	FSR
	Bio-double pool	Size	73×30×6.3 m	FSR
	Bio-trickling filter tower	Size	Φ15×16m	FSR
Biogas utilization system	Biogas burner	Number	16units	FSR
		Model number	FRQ-21	FSR
		Manufacturer	Xuzhou Funi Control Fired Research Institute Co.,Ltd	FSR
	Co-fired steam boiler I	Number	3	FSR
		Model number	DG-260/9.81-2	FSR
		Manufacturer	Dongfang Boiler Plant	FSR
		Boiler efficiency	91%	FSR
		Water temperature	215℃	FSR
		Rated steam pressure	9.81MPa	FSR
		Rated steam temperature	540℃	FSR
		Rated output	260t/h	FSR
		Date of manufacture	2004.05/2004.06/2004.12	Nameplate
	Co-fired steam boiler II	Number	2	FSR
		Model number	CG-130/3.82-M×5	FSR
		Manufacturer	Sichuan Boiler Plant	FSR
		Boiler efficiency	90.21%	FSR
		Water temperature	150℃	FSR
		Rated steam pressure	3.82MPa	FSR
		Rated steam temperature	450℃	FSR
		Rated output	130t/h	FSR
		Date of manufacture	2003.03/2003.04	Nameplate
	Co-fired steam boiler III	Number	3	FSR
		Model number	SG-130/3.82-M247	FSR
		Manufacturer	Shanghai Boiler Plant	FSR
		Boiler efficiency	90.63%	FSR
		Water temperature	158℃	FSR

		Rated steam pressure	3.82MPa	FSR
		Rated steam temperature	450℃	FSR
		Rated output	130t/h	FSR
		Date of manufacture	2000.08/2000.08/2000.08	Nameplate
Boilers lifetime		25 years		*

*: Boilers' technical lifetime comes from the "Tool to determine the remaining lifetime of equipment"

The monitoring instruments used in the Project include: liquid flow meter, gas meter, gas analyzer, COD monitor, etc. The main monitoring variables are: wastewater flow, biogas flow, COD concentration of inflow and outflow of the anaerobic reactors and the methane concentration of the biogas.

As the Project uses domestic technology, no technology transfers will occur.

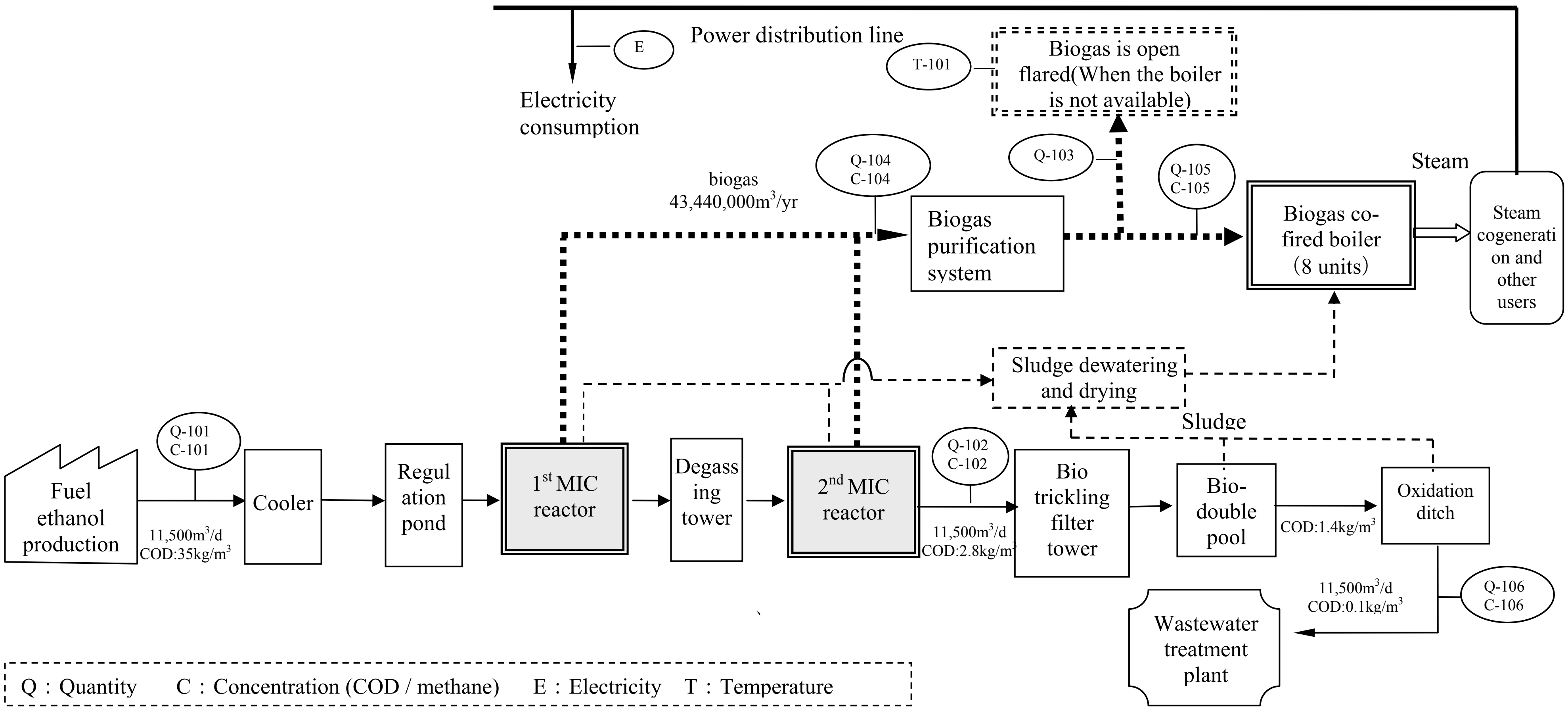

Figure A.4.3.2 Schematic diagram of wastewater treatment process

(2) Before the implementation of the project

The baseline scenario is described as follows (see Figure A.4.3.3):

- The wastewater generated from ethanol fuel production is discharged into the open lagoons;
- Coal-fired boilers are used to generate heat.

Before the implementation of the project activity, wastewater is derived from the ethanol fuel production at the neighboring Anhui Fengyuan Fuel Ethanol Co., Ltd., which is discharged into the open lagoons. Before entering the wastewater treatment plant, the effluent from the open lagoons has been treated though an aerobic treatment facility and is discharged, complying with the discharged standards. Methane from anaerobic wastewater treatment in the open lagoons is directly released into the atmosphere.

Meanwhile the Project Owner has 8 sets of existing circulating fluidized bed coal-fired boilers (5 × 130t / h +3 × 260t / h) to produce steam, which is then supplied to Anhui Fengyuan Fuel Ethanol Co., Ltd and other users. The boilers only consume coal.
The major equipment and technological parameters are shown in Table A.4.3.2.

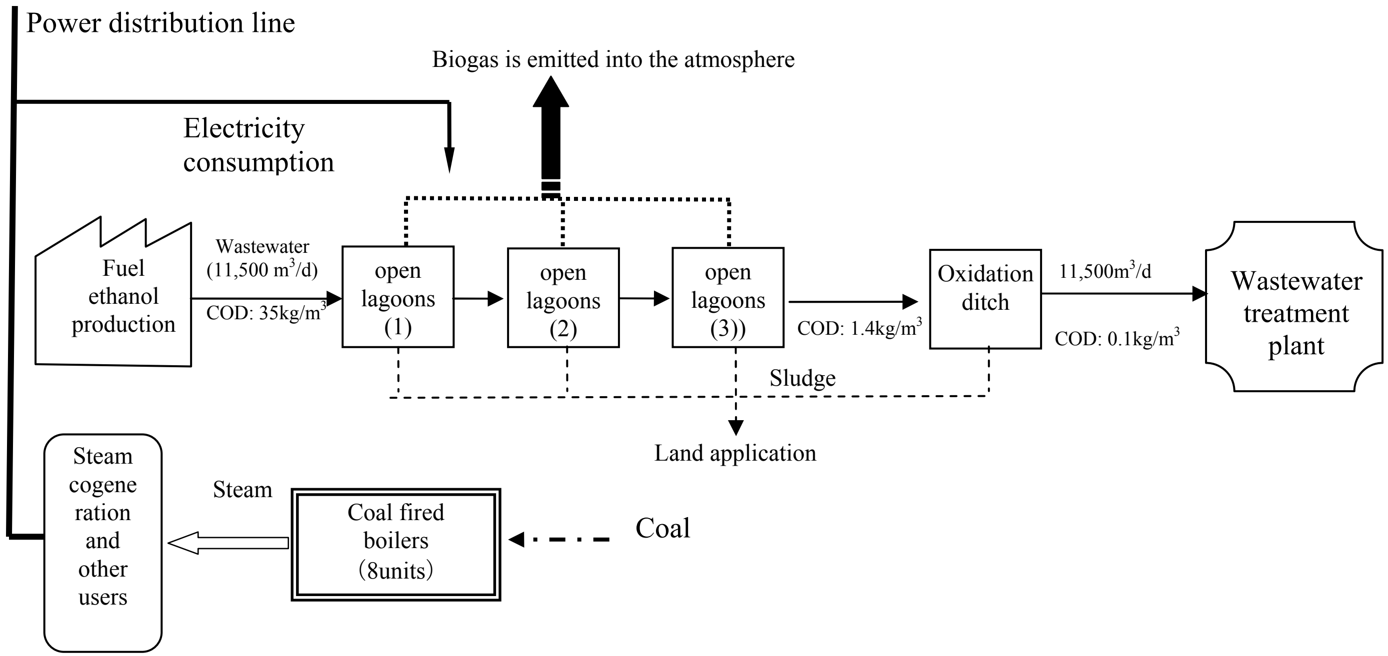

Figure A.4.3.3 the wastewater treatment process before the implementation of the Project

Table A.4.3.2 Specifications of major equipments and parameters of baseline

Parameter		Value	Source
Open lagoons (1)	Surface×Depth	84,525m^2×5m	FSR
	Removal rate of BOD_5	70%	FSR
	HRT	35d	FSR
Open lagoons (2)	Surface×Depth	25,358m^2×5m	FSR
	Removal rate of BOD_5	70%	FSR
	HRT	10.5d	FSR
Open lagoons (3)	Surface×Depth	15,215m^2×5m	FSR
	Removal rate of BOD_5	60%	FSR
	HRT	6.3d	FSR
Oxidation ditch	Diameter×Depth	76m×7m	FSR
	Removal rate of BOD_5	≥93%	FSR
	HRT	0.49d	FSR

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

The estimated amount of emission reductions from the project activity over the crediting period (15 Oct, 2012 to 14 Oct, 2022) of 10 years are 1,991,180 tCO_2e, as shown in the following Table A.4.4.1.

Table A.4.4.1 calculation of emission reductions over the crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2e
15/10/2012-14/10/2013	199,118
15/10/2013-14/10/2014	199,118
15/10/2014-14/10/2015	199,118
15/10/2015-14/10/2016	199,118
15/10/2016-14/10/2017	199,118
15/10/2017-14/10/2018	199,118
15/10/2018-14/10/2019	199,118
15/10/2019-14/10/2020	199,118
15/10/2020-14/10/2021	199,118
15/10/2021-14/10/2022	199,118
Total estimated reductions (tonnes of CO_2e)	**1,991,180**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**199,118**

A.4.5. Public funding of the project activity:

The Project receives no public funding from Annex I Parties.

SECTION B. Application of a baseline and monitoring methodology

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

This Project applies the approved consolidated baseline and monitoring methodology ACM0014 (Version 04.1.0) "Mitigation of greenhouse gas emissions from treatment of industrial wastewater".

The methodology also refers to the following tools:

- Tool for the demonstration and assessment of additionality (Version 06.0.0)
- Tool to determine project emissions from flaring gases containing methane;
- Tool to calculate the emission factor for an electricity system (Version 02.2.1);
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01) ;
- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 02).

The methodology and tools are available from the following website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

In the following section, it is confirmed if the ACM0014 (Version 04.1.0) is applicable to the Project via one-by-one check of its applicability conditions.

According to the ACM0014, the methodology is applicable to the scenarios 1 or 2 described in the following table:

Table B.2.1 Scenarios applicable to the methodology

Scenario	Description of the baseline situation	Description of the project activity
1	The wastewater is not treated, but directed to open lagoons that have clearly anaerobic conditions. In cases where solid materials are separated before directing the wastewater to the open lagoons, the solid materials have a different treatment than the wastewater.	The wastewater is either treated in a new anaerobic digester or dewatered and directed to land application. In cases where solid materials are separated from the wastewater (both in the project and baseline scenarios), they will be treated separately and not treated with the new anaerobic digester employed for treatment of liquid effluents. The biogas extracted from the anaerobic digester and, if applicable, biogas generated from the treatment of solid materials, is flared and / or used to generate electricity and / or heat. The residual from the anaerobic digester after treatment is directed to open lagoons or is treated under clearly aerobic conditions (e.g. dewatering and land application).

Scenario	Description of the baseline situation	Description of the project activity
2	The wastewater is treated in a wastewater treatment plant. Sludge is generated from primary and / or secondary settlers. The sludge is directed to sludge pit(s) that have clearly anaerobic conditions.	The wastewater is treated in the same wastewater treatment plant as in the baseline situation. The sludge from primary and / or secondary settler is treated in one or both of the following ways: (a) The sludge is treated in a new anaerobic digester. The biogas extracted from the anaerobic digester is flared and / or used to generate electricity and / or heat. The residual from the anaerobic digester after treatment is directed to open lagoons or is treated under clearly aerobic conditions (e.g. dewatering and land application). (b) The sludge is treated under clearly aerobic conditions (e.g. dewatering and land application).

Refer to Table B.2.1: the baseline scenario 1 is suitable for the project.The baseline scenario: Wastewater generated from ethanol fuel production is discharged into the existing open lagoons for treatment. Project activity will replace the open lagoons with newly-built MIC anaerobic reactors, recover the biogas produced by anaerobic treatment of wastewater and utilize the recovered biogas as fuel to produce steam. The effluent from anaerobic reactor will be aerobically treated. Finally, it is discharged into the wastewater treatment plant complying with wastewater discharge standards. The sludge after dewatering is controlled burned. When the co-fired boilers are broken or under repair, the biogas is burned with an open flare.

According to ACM0014 methodology, the Project meets other applicability conditions stated in ACM0014 as follows.

Table B.2.2 Scenarios applicable to the methodology

Type	Applicability Conditions	In the case of the Project
For all scenarios	The average depth of the open lagoons or sludge pits in the baseline scenario is at least 1 m.	In the baseline the depth of the anaerobic open lagoons are 5 meters.
	Heat and electricity requirements per unit input of the water treatment facility remain largely unchanged in the baseline scenario and the project activity	Heat is required neither for the baseline nor the project. Electricity requirement per unit input of the water treatment facility will be largely unchanged in the baseline scenario and the project activity.
	Data requirements as laid out in this methodology are fulfilled.	It is fulfilled at the time of completion of the PDD.
For scenario 1	The residence time of the organic matter in the open lagoon system should be at least 30 days	The detention time of the baseline anaerobic open lagoon is 52 days; the wastewater organic matter is at least longer than 52days.
	Local regulations do not prevent discharge of wastewater in open lagoons.	Chinese/provincial regulations do not prevent discharge of wastewater in anaerobic open lagoons.
	Inclusion of solid materials in the project activity is only applicable where: (i) Such solid materials are generated by the industrial facility producing the wastewater, and (ii) The solid materials would be generated	The solid materials are not separated before directing the wastewater to the open lagoons. The Project is applicable.

Type	Applicability Conditions	In the case of the Project
	both in the project and in the baseline scenario.	

Based on the discussion so far, it is concluded that the proposed project activity is eligible to apply ACM0014.

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

The project is to recover the biogas from the anaerobic treatment and use it as fuel for the steam boilers. According to ACM0014, the special extent of the project boundary includes:

- The site where the wastewater is treated in both the baseline and the project scenario: applicable to the Project;
- The sites where any sludge/dewatered wastewater is applied to lands: the Project combust sludge, before the Project the sludge for land application, and thus applicable to the project;
- Any on-site power plants that supply electricity to the wastewater or sludge treatment system: the Project consumption electricity is supplied from the owner's thermoelectricity plant and thus applicable to the Project;
- Any on-site facilities to generate heat that is used by the wastewater or sludge treatment systems: wastewater treatment system do not consume heat and thus N/A;
- If applicable, the anaerobic digester, the power and / or heat generation equipment and / or the flare installed under the project activity: The biogas co-fired boilers and an open flare are installed by the Project;
- If applicable, any dewatering system installed under the project activity: a dewatering system for sludge from wastewater treatment is installed;
- If grid electricity is displaced from electricity generation with biogas from an aerobic digester: the power plants connected to the grid, with the geographical boundary as specified in the latest approved version of the "Tool to calculate the emission factor for an electricity system": the recovered biogas is used as fuel of the co-fired boilers and thus N/A.

Therefore, the special extent of the proposed project activity includes the sequential wastewater treatment facilities, the co-fired boilers, the open flaring system and the dewatering facility for sludge. The following figure shows the schematic diagram of the project boundary.

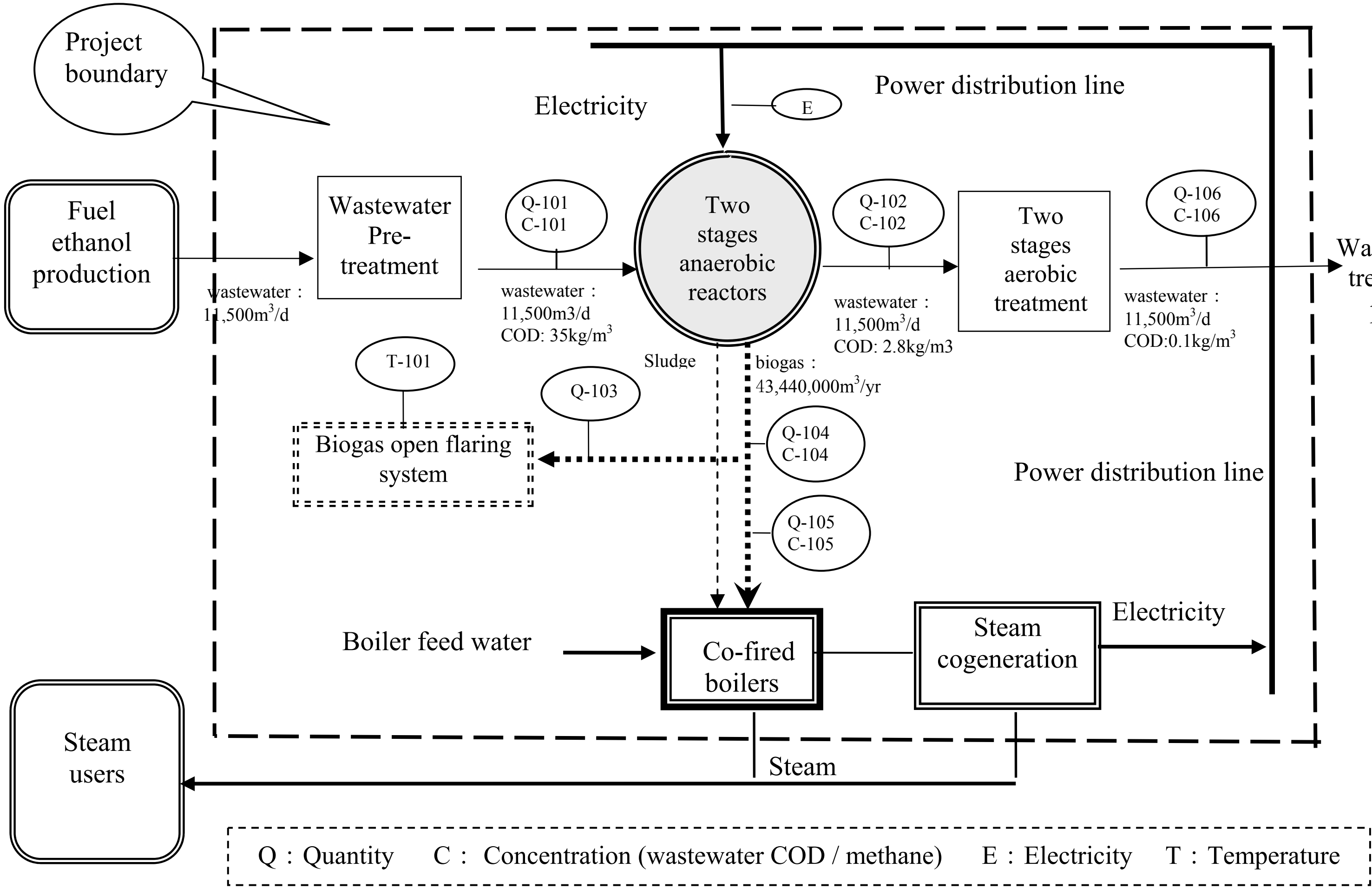

Figure B.3.1 Schematic diagram of the project boundary

The emission sources included in the project boundary is shown in the following Table B.3.1:

Table B.3.1 Emission Sources included and excluded from the project boundary

	Source	Gas		Justification / Explanation
Baseline	Wastewater Treatment processes or sludge disposal	CH_4	Included	The major source of emissions in the baseline from the open lagoons.
		N_2O	Excluded	Excluded for simplification. This is conservative.
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for, this is conservative
	Electricity consumption /generation	CO_2	Excluded	Power consumption before the project activity. Excluded for simplification. This is conservative.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Thermal energy generation	CO_2	Included	Thermal energy is generated with biogas from MIC reactor under the project activity. It displaces some thermal energy generation by an on-site coal fired boiler in the baseline scenario.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activities	Wastewater treatment processes or sludge treatment process	CH_4	Included: (ii) and (iii)	The treatment of wastewater or sludge under the project activity may cause different emissions: (i) Methane emissions from the lagoons (if effluent from the treatment under the project activity is directed to lagoons): the effluent from the digester is processed by aerobic treatment. So it is assumed to be zero. (ii) Physical leakage of methane from the digester system; (iii) Methane emissions from flaring (if biogas from the digester is flared); (iv) Methane emissions from land application of wastewater/sludge: this is applicable in case of projects that introduce a treatment of sludge and thus N/A; (v) Methane emissions from wastewater removed in the dewatering process: this is applicable if effluent from the treatment under the project activity is directed to a dewatering facility and thus N/A.
		CO_2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted for.
		N_2O	Excluded	The Project does not involve land application of sludge. The sludge is combusted in the co-fired boilers.
	On-site electricity use	CO_2	Included	The Project consumes electricity for operation of pumps, blowers, etc.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	On-site fossil fuel consumption	CO_2	Excluded	It needn't fossil fuel while the dry sludge is combusted in boilers, so it is excluded for simplification.
		CH_4	Excluded	Excluded for simplification. This emission source is

	Source	Gas		Justification / Explanation
				assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

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

According to ACM0014, the most plausible baseline scenario must be determined though the application of the following steps:

- Step 1: Identification of alternative scenarios
- Step 2: Eliminate alternatives that are not complying with applicable laws and regulations
- Step 3: Eliminate alternatives that face prohibitive barriers
- Step 4: Compare economic attractiveness of remaining alternatives

Step 1: Identification of alternative scenarios

As the Project will recover methane in wastewater treatment process and generate heat by combustion of recovered methane, wastewater treatment scenarios and heat generation scenarios are necessary to be discussed.

According ACM0014, plausible alternative scenarios for the treatment of wastewater (W) may include the following:

TableB.4.1 Scenarios applicable to the methodology

	alternative of scenarios	Applicable to the baseline scenario or not and the reason
W1	The use of open lagoons for the treatment of the wastewater.	This scenario complies with Chinese regulations. It is included in the alternative scenario. The status of the Project Owner belongs to this scenario.
W2	Direct release of wastewaters to a nearby water body	This project wastewater is high concentration of ethanol fuel sewage, this scenario does not meet the "The People's Republic of China Water Pollution Prevention Law" and "The People's Republic of China Integrated Wastewater Discharge Standard". It is forbidden to discharge directly, so it is not possible the baseline scenario.
W3	Aerobic wastewater treatment facilities (e.g., activated sludge or filter bed type treatment)	An aerobic system is appropriate technology when wastewater concentration of organic matter is low. As the proposed project activity will generate highly organic wastewater with 35,000mg/L of COD, aerobic treatment is inappropriate[2]. Therefore it is excluded from the alternative scenarios.
W4	Anaerobic digester with	There is no incentive for the owner of an industrial facility to install such a system as there are no laws and regulations in the host country

[2] Refer to *Organic industry wastewater treatment theory and technology,* P24,P36 Yangjian, Feijuan Zhang and Rongzhi Yu, Chemical Industry Press.

	methane recovery and flaring	which forbid methane emission from wastewater treatment facilities. This scenario generates no revenue unlike the scenario W5. The scenario W4 nearly has the same investment and operational cost as W5 while W4 with biogas flaring has no revenue. W5 is more financial attractive than W4. Therefore, this option is very unlikely to occur and thus excluded from the plausible alternative scenarios.
W5	Anaerobic digester with methane recovery and utilization for electricity or heat generation.	This scenario is the proposed project activity undertaken without being registered as a CDM project activity. The investment barrier results for the high investment and operational cost. It is encouraged as well as complying with Chinese regulations. Therefore, it is included in the alternative scenario.
W6	Wastewater is directed to land application without dewatering;	The national water standard for soil application requires that the COD of water for soil application should be less than 200mg/l, [3]so the Project's wastewater can not be directed to land application.
W7	Wastewater is dewatered and directed to land application/used as fuel in energy applications.	The water content of the Project's wastewater is higher than 90%[4], which is not appropriate for dewatering. Therefore, this option is very unlikely to occur and excluded from the plausible alternative scenarios.

TableB.4.2 Scenarios of biogas combustion to generate heat

	alternative of scenarios	Applicable to the baseline scenario or not and the reason
H1	Co-generation of heat using fossil fuels in a captive cogeneration power plant;	The heat produced by the Project is used for the steam turbo-generator or co-generation which is high quality steam, but the heat from co-generation is used by the final users which is low quality. The proposed heat energy of the Project offers dissimilar serve for consumer compared with the heat energy of the co-generation plant of this scenario. So the scenario is not a possible baseline scenario.
H2	Heat generation using fossil fuels in a boiler;	Bengbu Tushan Thermoelectricity Company use coal to generate heat, it is possible baseline scenario.
H3	Heat generation using renewable sources.	There is no renewable energy around here, so it is impossible to use renewable energy to supply heat.

From the above analysis, we can see that the possible wastewater alternatives includes W1 (open lagoons treatment) and W5 (anaerobic treatment system of collecting methane to generate electricity and heat). The possible heat alternative is H2 (fossil fuel boiler to generate heat).
In short, the possible alternative baseline scenarios including the combinations are shown in the Table B.4.3.

Table B.4.3. Possibilities of baseline scenario

[3] The data sources from "Standards for irrigation water quality(GB5084-2005)"

[4] The water content is 96.3% according to the material balance and water balance of the ethanol production.

alternative of scenarios	Alternatives of baseline scenario		Description of the scenario
	Treatment of wastewater	Heat generation	
1	W1	H2	Keeping on using the existing open lagoons system, the Bengbu Tushan Thermoelectricity Company continues to use coal fired boilers for heat generation.
2	W5	H2	Constructing the anaerobic reactor for recovering methane generated from the anaerobic treatment, the recovered methane is co-fired in a boiler with coal for heat generation. The scenario is same to the project but is not a CDM project activity.

Step 2: Eliminate alternatives that do not comply with applicable laws and regulations

Alternative Option 1: The treated wastewater from the existing open lagoon system has been discharged into the wastewater treatment plant. The final discharged wastewater satisfies the standard of Chinese environmental regulations. Meanwhile the Tushan Thermoelectricity Company uses the coal-fired boilers for generating heat which complies with national and local laws and regulations.
Alternative Option 2: Using anaerobic reactors to treat wastewater complies with the standards and recovers biogas for generating heat which could displace some heat generated by coal.
The above alternatives are likely to be the baseline scenarios.

Step 3: Eliminate alternatives that face prohibitive barriers

According to the Step 1 and Step 2, the likely baseline scenarios are shown in Table B.4.3.
Wastewater treatment option W5, namely, anaerobic digester with methane recovery and utilization biogas for heat generation (project activity without CDM) faces investment and technological barriers. The investment barrier is distinct as demonstrated in section B.5 below although it has revenue from the recovery biogas utilization.

Step 4: Compare economic attractiveness of remaining alternatives
According to ACM0014 (Version 04.1.0) and "Tool for the demonstration and assessment of additionality (Version 06.0.0)", without considering the CERs revenue, the IRR is used as financial Indicator to analyse the investment.

According to investment analysis described in section B.5, the second alternative without CERs faces investment barriers, so the alternative is not applicable to be the baseline scenario.

Through above analysis, the alternative 1 (the keeping on using of open lagoons for the treatment of the wastewater(W1) and the coal fired boilers for heat generation(H2)) faces no barriers which is the existing status of the Project Owner and is the baseline scenario.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

Early Consideration of CDM

The purpose of the project activity is to recover the methane generated from the wastewater treatment and utilize it for steam generation. The Project Owner seriously considered the incentive from the CDM by making a third party consultant assess the feasibility of the project and application of CDM. The feasibility study (F/S) concluded that the project is the only viable option when CER revenue is considered. Based on the results of the F/S, the Project Owner decided to invest in the project on the basis that the project will be registered as a CDM project activity. After the investment decision, the Project Owner has been taking actions to secure CDM status in parallel with its implementation. The specific timeline of the proposed project activity is shown in the following Table B.5.1:

Table B.5.1 Timeline of the proposed project activity

Date	Event	Source
Jan 2008	Completion of the FSR	Feasibility study report implemented by Hefei Design and Research Institute of Coal Industry
15 Jan 2008	Investment decision	the meeting of the board of directors
14 Feb 2008	Request for stakeholders' comment invitation	Request for comment invitation by the project owner
25 Feb 2008	Obtaining of project approval by Bengbu Economic Commission[5]	FSR was approved by Bengbu Economic Commission with the approval Official document (No. [2008]41)
27 Feb 2008	Stakeholders' comment meeting[6]	Questionnaires of stakeholder
Mar 2008	Completion of the EIA	EIA Report implemented by Bengbu Environmental Impact Assessment Center
6 Mar 2008	Signing consulting agreement	Consulting agreement by Bengbu Tushan Thermoelectricity Co., Ltd with Beijing UNIUFA Energy Technology Co., Ltd.
18 Mar 2008	Sign construction contract	The start date of the project activity. Anaerobic wastewater treatment system contract agreement by Suzhou Kete Environmental Protection Equipment Co., Ltd and Bengbu Tushan Thermoelectricity Co., Ltd.
20 Mar 2008	EIA approval	Official document (No. [2008]36)
2 May 2008	Sign the biogas recovery and utilization contract	Bengbu Tushan Thermoelectricity Co., Ltd and Jiangsu Huaneng Construction Engineering Group Co., Ltd signed the design, purchase and construction general contract.
3 Dec 2008	Emit signed joint development agreement with UNIUFA	Joint Development Agreement
26 Dec 2008	Report of unit project completion about the anaerobic digesters	1-4# anaerobic digesters completion report is accepted by project owner of Bengbu Tushan Thermoelectricity Co., Ltd.
12 May 2009	Sign the service agreement	Lakewood Carbon CORP. and Beijing

[5] The project approval is same as the FSR approval.

[6] In the meeting, the residents were asked to fill in the questionnaires. The project owner summarized the content of the meeting and formed the MOM.

		UNIUFA Energy Technology Co., Ltd signed the service agreement.
15 Oct 2009	Sign the aerobic wastewater treatment system contract	Design, purchase and construction general contract is signed between Bengbu Tushan Thermoelectricity Co., Ltd and Jiudayang Wastewater Treatment Technology Co., Ltd.
25 Nov 2009	Emission Reduction Purchase Agreement	CDM ERPA signed between project owner and Lakewood Carbon CORP.
24 Jun 2010	CDM project audit meeting of China NDRC	The notification of the 76th audit meeting of National DNA of China.
30 Sep 2010	Host NDRC approval	The host LOA
1 Jul 2011	Contract with JCI for Validation Service	Contract between LCC and JCI
26 Jul 2011-24 Aug 2011	PDD published on the UNFCCC website	Conformation email from UNFCCC
9 Sep 2011	LoA of UK DNA	LoA issued by DNA of United Kingdom of Great Britain and Northern Ireland

Additionality

According to ACM0014, it is demonstrated that the proposed project activity is additional based on the "Tool for the demonstration and assessment of additionality" (Version 06.0.0).

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Sub-step 1a: Define alternatives to the project activity:
According to the "Tool for the demonstration and assessment of additionality" (Version 06.0.0) and description in B.4, the project activity alternatives are shown in the Table B.5.2.

Table B.5.2 Possible alternatives

	W1	W5
H2	√	√

Sub-step 1b: Consistency with mandatory laws and regulations:

Both alternatives above comply with Chinese laws and regulations.
Therefore, the proposed project activity is not only viable option for the project participant when registered as CDM project activity. Therefore, it is concluded that the proposed project activity has the precondition of the additionality.

The project activity will generate heat and power from the captured biogas and displace some of the heat energy supplied by fossil fuel fired in the boilers; the project scenario is the combination of Scenario W5 and Scenario H2.

Step 2: Investment analysis
Sub-step 2a: Determine appropriate analysis method

"Tool for the demonstration and assessment of additionality" (Version 06.0.0) provides the following three

analysis methods: simple cost analysis (Option I), invest comparison analysis (Option II) and benchmark analysis (Option III). The simple cost analysis is applied only when the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income. As the proposed CDM project activity will generate revenue through coal saving, the simple cost analysis is not applicable. The alternative in Step 1: For the existing open lagoon treatment system, it is not necessary to add the investment cost, so the benchmark analysis (Option III) is selected.

Sub-step 2b: Option III. Apply benchmark analysis

The project can be determined by comparing the IRR without CER revenue with an appropriate benchmark IRR, or maintaining the status with open lagoons wastewater treatment and coal-fired boilers for heat generation.

According to the "Construction Project Economic Evaluation Methods and Parameters (Version 3)" published by National Development Reform Commission and Ministry of Construction, the benchmark IRR (after tax) for the thermal power station project is 10%. Therefore, 10% is widely used for thermal power station project.
Though the project is to recover the biogas in the process of wastewater treatment, the owner Bengbu Tushan Thermoelectricity Company is a thermal power station, so IRR is considered to be the most suitable financial indicator for the proposed project activity. The benchmark selected is 10%.
In fact, the project owner will invest in wastewater treatment for recovering biogas to be used as fuel, which is essentially different from the owner’s core business that of heat and power generation. The owner utilizes common coal as fuel to generate thermal energy and power, whose risk is lower than the risk of using biogas generated from wastewater treatment process, the risk sources of using biogas are from:

1) The upstream product of ethanol fuel and raw materials (the corn market) risk: ethanol fuel and the condition of its feedstock, the corn market, will determine the amount of ethanol fuel production, which in turn will determine the quantity of sewage generated and the quantity of biogas. Therefore, the market risk of ethanol fuel and its feedstock corn directly affects the production of biogas.
2) Ethanol fuel business operational risks: the stability of ethanol fuel availability will affect the stability of the volume of wastewater and the stability of production of the biogas.
3) Wastewater treatment facilities operational risk: Project Owner has no experience of running the wastewater treatment facilities, so the sewage treatment facilities’ operation status will affect the amount of recovered methane. At the same time, for the owner it is a new problem to ensure the treated wastewater discharged according the standard.

Therefore, the project activity using an IRR of 10% as a financial evaluation benchmark is reasonable.

The main parameters used for financial analysis are shown in Table B.5.3.

Sub-step 2c: Calculation and comparison of financial indicators
Parameters used for financial analysis
According to the FSR, the basis parameters for calculating the finance are shown in the Table B.5.3.

Table B.5.3 Parameters used for financial analysis

Parameters	Value	Source

Displaced coal	44,756 t[7]	FSR P44
Coal price(without tax)	500RMB/t	FSR P40
Total investment	122,650×10^3RMB	FSR P39
Loan	0 RMB	FSR P39
Annual running cost	10,040×10^3RMB	FSR P46
Depreciation cost	7,280×10^3RMB	FSR P45
CERs	€8.00/tCO_2e	ERPA
Coal VAT	13%	FSR P40
Electricity VAT	17%	FSR P40
Urban construction tax	7%	FSR P40
Education surtax	3%	FSR P40
corporate tax	25%	FSR P40
Depreciation method	Straight line method	FSR P39
Building depreciation period	20 years	FSR P39
Equipment depreciation period	15 years	FSR P39
Salvage value	5%	FSR P39

The IRR of the project is shown in Table B.5.4.

Table B.5.4 IRR of the project with and without CER

	IRR
Without revenue from CDM	4.31%
With revenue from CDM	13.11%

Without CER revenues, the equity IRR of the proposed project activity is 4.31%, lower than the thermal power station benchmark IRR of 10%. While considering revenue from CDM, the IRR of the proposed project is increased to 13.11%（CERs price is €8.00/tCO_2e）and exceeds the thermal station benchmark. Therefore, the Project was not financially attractive in the absence of CER revenue.

Sub-step 2d: Sensitivity analysis

In order to assess the above conclusion regarding the economic attractiveness, it must be demonstrated that it is robust to reasonable variations in critical assumptions. According to paragraph 20 “Guidelines on the assessment of investment analysis” (Version 05), only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subject to reasonable variation (all parameters varied need not necessarily be subject to both negative and positive variations of the same magnitude). For the project activity, the following variables are selected to be subject to the sensitivity analysis based on their quantitative materiality as per the guidance:

1. Coal tariff
2. Fixed assets investment
3. Annual running cost

The Table B.5.5 shows the change of IRR (without CERs revenue) when the above parameters changed:

[7] This value is the displaced raw coal which NCV is 5,000Kcal/kg.

Table B.5.5 Results of the sensitivity analysis

	-10%	0%	10%
Coal tariff	2.40%	4.31%	6.08%
Fixed assets investment	5.75%	4.31%	3.06%
Annual running cost	5.13%	4.31%	3.46%

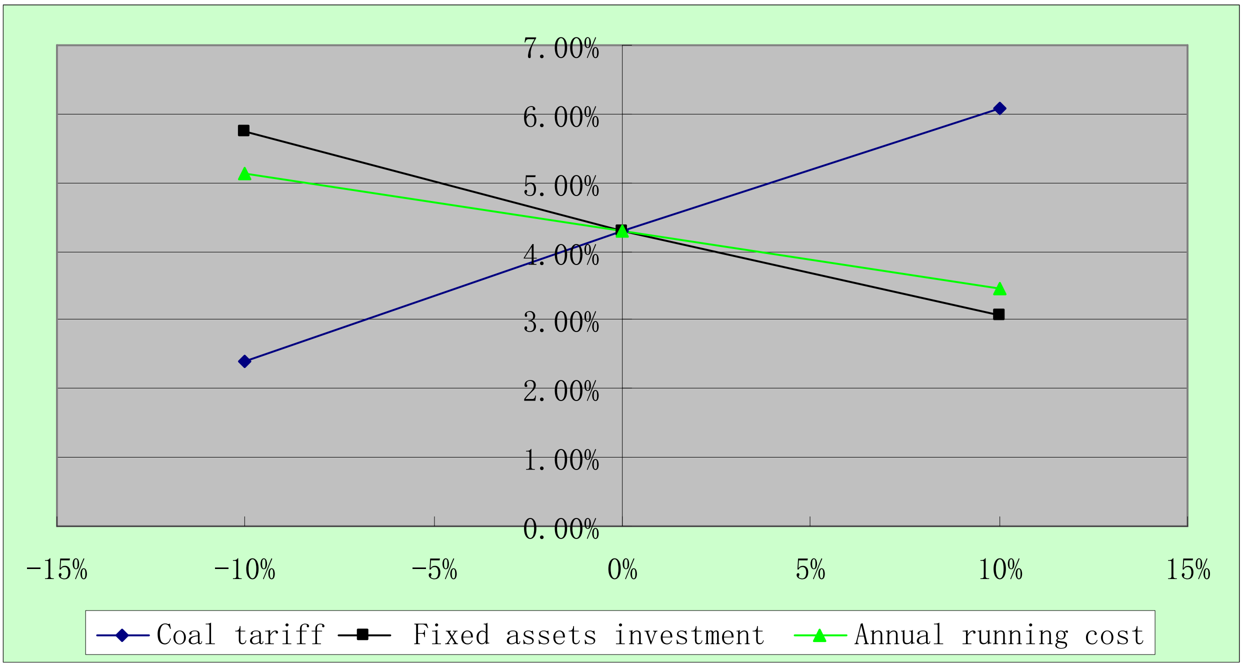

Figure B.5.1 Results of the sensitivity analysis

It is assumed that the coal tariff, fixed assets investment and annual running cost varies in the reasonable range of ±10%, without the revenue from the CERs, the IRR is changed correspondingly, the results are shown in the Table B.5.5 and the Figure B.5.1. The above three parameters within -10% ~ 10% of changes in the Project's internal rate of return IRR are always less than 10% of the benchmark. Only when the tariff of coal, fixed assets investment and annual running cost respectively are +35%, -33% and -76% can the Project reach the benchmark. These changes cannot occur for the following reasons:

- The coal tariff: according to the “Anhui statistical yearbook”, the annual fluctuation of fuel price has on average been 7.06% for the past 15 years (1994-2008) so a 35% increase in coal price is not likely to occur.
- Annual running cost: Operating cost is composed of the raw material, fuel, power cost and labour cost. As previously mentioned, according to the data in the past 15 years (1994-2008), the increasing in the purchasing price of raw material, fuel and power is 6.23% per year in average. The Anhui labour wage rate increases 15.25%. Therefore a decrease of 76% in running costs is unlikely.
- Fixed assets investment: the statistical data of the same past 15 years (1994-2008) show that the annual average increasing rate of the purchasing price of raw material, fuel and power is 6.23%, so the possibility that the Owner increases the investment is far greater than the possibility of them reducing the investment. The investment cost is unlikely to be less than 33%.

According to the analysis above, the project is not financially attractive without considering the CDM revenues.

Step 3: Barrier analysis

The investment analysis above fully demonstrated the additionality of the Project and thus this step is not taken.

Step 4: Common practice analysis

According to the tool of "Tool for the demonstration and assessment of additionality" (Version 06.0.0) paragraph 47, the common practice analysis may be processed by four steps to analyze.

First, the project participants may provide justification that the applicable geographical area based on local conditions.
As we all know, China is a very large country. The investment climate for each province in China is different[8]. This is due to variation of available natural resources such as coal, the economic development level, the industrial structure, the fundamental infrastructure, development strategy and the policy framework. These all affect the demand for the products in terms of amount as well as the types of products and technologies. As such a number of key economic factors vary from province to province. Also, difference province has different climate. Therefore, Anhui province is chosen for the applicable geographical area.

The statistics of alcohol plants in Anhui province is shown in table B.5.6.

Table B.5.6 The statistics of alcohol plants in Anhui province

No.	Name of company	Output of product (t/yr)
1	Anhui Bilvchun alcohol Co., Ltd.	80,000[9]
2	Anhui Bengbu Juxing alcohol Co., Ltd.	33,000[10]
3	Anhui Ante Bio-chemical Co., Ltd.	120,000[11]
4	Wuhe Jiangda Industrial trade Co., Ltd.	50000[12]

[8] http://www.stats.gov.cn/tjsj/ndsj/2010/html/C0214e.htm

[9] http://www.ahblc.com/index.htm

[10] http://baike.baidu.com/view/3934228.htm

[11] http://baike.baidu.com/view/5887575.htm

[12] http://whjdgm.b2b.hc360.com/shop/show.html

No.	Name of company	Output of product (t/yr)
5	Anhui Sizhou Alcohol Plant	5000[13]
6	Anhui Ruifuxiang Food Co.,Ltd.	80,000[14]
7	Bengbu Tushan Thermoelectricity Co., Ltd (This proposed CDM project activity)	320,000

Sub-step 4-1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The output of production where the wastewater derives from is selected as the capacity assessment parameter. So the applicable alcohol product range as +/-50% is 160,000 -480,000t/yr.

Sub-step 4-2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Sub-step 4-1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

So, $N_{all} = 0$.

Sub-step 4-3: Within plants identified in Sub-step 4- 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

$N_{diff}=0$.

Sub-step 4-4: Calculate factor F=1-Ndiff/Nall representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

The proposed project activity is a .common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:
(a) the factor F is greater than 0.2, and
(b) N_{all}-N_{diff} is greater than 3.

As stated in Sub-step 4-4, F=*1-0/0* is incomputable, but N_{all}- N_{diff}=0<3. Therefore, this project is not a common practice.

In conclusion, it is demonstrated that the proposed project type is not diffused in the relevant sector and region.

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[13] http://www.dy88.cn/zhuanlan/3204.html

[14] http://www.ahrfx.com/include/content.php?id=57

Based on the discussion so far, the proposed project activity is less financially attractive than the baseline scenario (continuing with the anaerobic open lagoons wastewater treatment and steam generation by a coal-fired boiler). Also after the implementation of the Project GHG emission would decrease. Therefore it is concluded that the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to ACM0014, baseline emissions and project emissions are determined as follows.
As stated in sector B.4, the baseline scenario is that the wastewater is treated in the open lagoons and heat is generated by coal fired boilers.

(1) Baseline Emissions

Baseline emissions are given as:

$$BE_y = BE_{CH4,y} + BE_{EL,y} + BE_{HG,y} \quad (1)$$

Where:

BE_y:	Baseline emissions in year y (tCO_2e / yr)
$BE_{CH4,y}$:	Methane emissions from anaerobic treatment of the wastewater in open lagoons (scenario 1) or the anaerobic treatment of sludge in sludge pits (scenario 2) in the absence of the project activity in year *y* (tCO_2e / yr)
$BE_{EL,y}$:	CO_2 emissions associated with electricity generation that is displaced by the project activity and / or electricity consumption in the absence of the project activity in year y (tCO_2 / yr)
$BE_{HG,y:}$	CO_2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year y (tCO_2 / yr)

The scenario applicable to the proposed project activity is scenario 1, namely, anaerobic treatment of the wastewater in open lagoons is for BE_{CH4}.

According to the ACM0014, baseline emissions are calculated in three steps, as follows:

Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater;
Step 2: Calculation of baseline emissions from consumption of electricity;
Step 3: Calculation of baseline emissions from heat generation;

Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater or sludge

Before the Project, the wastewater is treated in the open lagoons, making it difficult to acquire data to calculate baseline emissions using the organic removal ratio (ORR) method so the Methane Conversion Factor Method should conservatively be applicable.

Step 1a: Methane Conversion Factor Method

The baseline methane emissions from anaerobic treatment of the wastewater in open lagoons are estimated based on the chemical oxygen demand (COD) of the wastewater that would enter the lagoon in the

absence of the project activity ($COD_{PJ,y}$), the maximum methane producing capacity (B_o) and a methane conversion factor ($MCF_{BL,y}$) which expresses the proportion of the wastewater that would decay to methane, as follows:

$$BE_{CH4,y} = GWP_{CH4} \times MCF_{BL,y} \times B_o \times COD_{BL,y} \tag{2}$$

Where:

$BE_{CH4,y}$:	Methane emissions from anaerobic treatment of the wastewater in open lagoons in the absence of the project activity in year *y* (tCO_2e / yr)
$GWP_{CH4:}$	Global Warming Potential of methane valid for the commitment period (tCO_2e / tCH_4)
$B_{o:}$	Maximum methane producing capacity, expressing the maximum amount of CH4 that can be produced from a given quantity of chemical oxygen demand (tCH_4 / tCOD)
$MCF_{BL,y:}$	Average baseline methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,y}$ x B_o) that would be degraded to CH_4 in the absence of the project activity
$COD_{BL,y}$:	Quantity of chemical oxygen demand that would be treated in open lagoons in the absence of the project activity in year *y* (tCOD/yr)

<u>Determination of $COD_{BL,y}$</u>

In principle, the baseline chemical oxygen demand ($COD_{BL,y}$) corresponds to the chemical oxygen demand that is treated under the project activity ($COD_{PJ,y}$) because the wastewater is treated under the project activity would in the absence of the project activity be directed to the open lagoon, and thus $COD_{BL,y} = COD_{PJ,y}$. If there would be an effluent from the lagoons in the baseline, COD_{BL} should be adjusted by an effluent adjustment factor which relates the COD supplied to the lagoon with the COD in the effluent. According to the FSR, before the Project the quantity of COD in the treated wastewater after the open lagoons is less than 1,400mg/L. According to conservative calculation principles, effluent from the open lagoons is 1,400mg/L. As per formulas (3), (4) to calculate the total COD in the baseline:

$$COD_{BL,y} = AD_{BL} \times COD_{PJ,y} \tag{3}$$

Where:

$COD_{BL,y}$:	Quantity of chemical oxygen demand that would be treated in open lagoons in the absence of the project activity in year *y* (t COD / yr)
$COD_{PJ,y}$:	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year *y* (t COD / yr)
AD_{BL}:	Effluent adjustment factor expression the percentage of COD that is degraded in open lagoons in the absence of the project activity

AD_{BL} is determined as follows:

$$AD_{BL} = 1 - \frac{COD_{out,x}}{COD_{in,x}} \tag{4}$$

Where:

AD_{BL}:	Effluent adjustment factor expression the percentage of COD that is degraded in open lagoons in the absence of the project activity
$COD_{out,x}$:	Design COD outflow from the baseline anaerobic lagoon in the period x (t COD)
$COD_{in,x}$:	Design COD inflow to the baseline anaerobic lagoon in the period x (t COD)

$COD_{PJ,y}$ is determined as follows:

$$COD_{PJ,y} = \sum_{m=1}^{12} F_{PJ,dig,m} \times w_{COD,dig,m} \qquad (5)$$

Where:

$COD_{PJ,y}$:	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year y (t COD / yr)
$F_{PJ,dig,m}$:	Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month m (m³ / month)
$w_{COD,dig,m}$:	Average chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month m (t COD / m³)
m:	Months of year y of the crediting period

<u>Determination of $MCF_{BL,y}$</u>

$MCF_{BL,y}$ is calculated as follows:

$$MCF_{BL,y} = f_d \times f_{T,y} \times 0.89 \qquad (6)$$

Where:

$MCF_{BL,y}$:	Average baseline methane conversion factor (fraction) in year y, representing the fraction of ($COD_{PJ,y}$ x B_o) that would be degraded to CH_4 in the absence of the project activity
f_d:	Factor expressing the influence of the depth of the open lagoons or sludge pit on methane generation; the depth of the lagoons are 1-5m, according to methodology, the value 0.5 is applied.
$f_{T,y}$:	Factor expressing the influence of the temperature on the methane generation in year y
0.89:	Conservativeness factor

<u>Determination of $f_{T,y}$</u>

The amount of organic matter available for degradation to methane ($COD_{available,m}$) is assumed to be equal to the amount of organic matter directed to the open lagoon, minus any effluent, plus the COD that may have remained in the lagoon or sludge pit from previous months, as follows:

$$COD_{available,m} = COD_{BL,m} + (1 - f_{T,m}) \times COD_{available,m-1} \text{ with} \qquad (7)$$

$$COD_{BL,m} = AD_{BL} \times COD_{PJ,m} \text{ and} \qquad (8)$$

$$COD_{PJ,m} = F_{PJ,dig,m} \times w_{COD,dig,m} \qquad (9)$$

Where:

$COD_{available,m}$:	Quantity of chemical oxygen demand available for degradation in the open lagoon in month m (t COD / month)
$COD_{BL,m}$:	Quantity of chemical oxygen demand that would be treated in open lagoons in the absence of the project activity in month m (t COD / month)

$COD_{PJ,m}$: Quantity of chemical oxygen demand that is treated in the anaerobic digester in the project activity in month m (t COD / month)
AD_{BL}: Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the absence of the project activity
$F_{PJ,dig,m}$: Quantity of wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month m (m^3 / month)
$w_{COD,dig,m}$: Average chemical oxygen demand in the wastewater or sludge that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in month m (t COD / m^3)
$f_{T,m}$: Factor expressing the influence of the temperature on the methane generation in month m
m: Months of year y of the crediting period

According to ACM0014, The monthly factor to account for the influence of the temperature on methane generation is calculated based on the following "van't Hoff - Arrhenius" approach:

$$f_{T,m} = \begin{cases} 0 & \text{if} \quad T_{2,m} < 283K \\ \exp\left(\frac{E * (T_{2,m} - T_1)}{R * T_1 * T_{2,m}}\right) & \text{if} \quad 283K < T_{2,m} < 303K \\ 1 & \text{if} \quad T_{2,m} > 303K \end{cases} \qquad (10)$$

Where:
$f_{T,m}$: Factor expressing the influence of the temperature on the methane generation in month m
E: Activation energy constant (15,175 cal / mol)
$T_{2,m}$: Average temperature at the project site in month m (K)
T_1: 303.16 K (273.16 K + 30 K)
R: Ideal gas constant (1.987 cal / K mol)
M: Months of year y of the crediting period

Based on the monthly values $f_{T,m}$ the annual value $f_{T,y}$ is calculated as follows:

$$f_{T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{available,m}}{\sum_{m=1}^{12} COD_{BL,m}} \qquad (11)$$

Where:
$f_{T,y}$: Factor expressing the influence of the temperature on the methane generation in year *y*
$f_{T,m}$: Factor expressing the influence of the temperature on the methane generation in month *m*
$COD_{available,m}$: Quantity of chemical oxygen demand available for degradation in the open lagoon or sludge pit in month *m* (t COD / month)
$COD_{BL,m}$: Quantity of chemical oxygen demand that would be treated in open lagoons in the absence of the project activity in month *m* (t COD /month)
m: Months of year *y* of the crediting period

Ex ante calculation of $f_{T,m}$ is based on monthly temperature where the project is located, and then calculate the annual temperature $f_{T,y}$, $MCF_{BL,y}$ can be calculated. The calculation of $f_{T,y}$ is shown in Annex 3.

Step 1b: **Organic removal ratio (ORR) method**

Not applicable.

Step 2: Baseline emissions from generation and/or consumption of electricity

As per methodology ACM0014, in this step, baseline emissions from the following sources are estimated:
1. Baseline emissions from consumption of electricity;
2. If electricity is generated with biogas from a new anaerobic digester under the project activity: baseline emissions from the generation of electricity in the grid and/or with a captive fossil fuel fired power plant in the absence of the electricity generation with biogas.

The Project does not straightaway generate electricity utilizing the recovered biogas but firstly generate stream. The baseline scenario consumption of electricity is from the Owner's Heat and Power Plant which does not connect with the East China Power Grid. According to ACM0014, as a simplification, project participants may neglect one or both emission sources. So, it is conservative that the project activities neglect baseline emissions from the consumption of electricity.

Step 3: Baseline emissions from the generation of heat

According to ACM0014, baseline emissions from the generation of heat are calculated as follows:

$$BE_{HG,y} = \frac{HG_{PJ,y} \times EF_{CO2,FF,boiler}}{\eta_{BL,boiler}} \quad (12)$$

Where:

$BE_{HG,y}$: CO_2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year y (tCO_2 / yr)

$HG_{PJ,y}$: Net quantity of heat generated in year y with biogas from the new anaerobic digester (GJ)

$EF_{CO2,FF,boiler}$: CO_2 emission factor of the fossil fuel type used in the boiler for heat generation in the absence of the project activity (tCO_2 / GJ)

$\eta_{BL,boiler}$: Efficiency of the boiler that would be used for heat generation in the absence of the project activity

According to feasibility study report, at the baseline scenario, the efficiency of boiler is based on the max value 91% in the FSR. The parameter $EF_{CO2,FF,boiler}$ adopts coal emission factor. According to ACM0014, $HG_{PJ,y}$ will be determined by the following measure: Calculated on the basis measurement of the volume of biogas captured and used for heat generation ($F_{biogas,y}$) multiplied by the methane content of the gas ($w_{CH4,biogas,y}$), CV methane(NCV_{CH4}), and the efficiency of the boiler during the project (i.e. with biogas)

$$HG_{PJ,y} = F_{biogas,y} \times w_{CH4,y} \times NCV_{CH4} \times \eta_{PJ,boiler} \quad (12\text{-}1)$$

Where:

$HG_{PJ,y}$ Net quantity of heat generated in year *y* with biogas from the new anaerobic digester (TJ)

$F_{biogas,y}$ Total amount of biogas collected in the outlet of the new digester (m^3). For ex-ante calculation, the amount of biogas that is pumped into boiler ($F_{boiler,biogas,y}$) is equal to the amount of $F_{biogas,y}$.

$w_{CH4,y}$ Methane content of the biogas (%)

NCV_{CH4} Net calorific value of CH_4 (GJ/ m^3)

$\eta_{PJ,boiler}$ Efficiency of the boiler during the project (%), for ex-ante calculation, its value adopts 91% as the $\eta_{BL,boiler}$.

(2) Project Emissions

Baseline emissions are given as:

$$PE_y = PE_{\mathbf{CH4},effluent,y} + PE_{CH4,digest,y} + PE_{flare,y} + PE_{sludge,LA,y} + PE_{\mathbf{ww},LA,y} + PE_{EC,y} + PE_{FC,y} \quad (13)$$

Where:

PE_y: Project emissions in year y (tCO_2e / yr)

$PE_{CH4,\ effluent,y}$: Project emissions from treatment of wastewater effluent from the anaerobic digester in year y (tCO_2e / yr).

$PE_{CH4,\ digest,y}$: Project emissions from physical leakage of methane from the anaerobic digester in year y (tCO_2e / yr)

$PE_{flare,y}$: Project emissions from flaring of biogas generated in the anaerobic digester in year y (tCO_2e / yr). When the co-fired boilers are faulty or under maintenance, the recovered biogas is flared.

$PE_{sludge,LA,y}$: Project emissions from land application of sludge in year y (tCO_2e / yr). The dewatered sludge is control combusted in the boilers, the item is ignored.

$PE_{ww,LA,y}$ Project emissions from land application of wastewater in year *y* (tCO_2e/yr).It is excluded since the project does not cover land application of wastewater.

$PE_{EC,y}$: Project emissions from electricity consumption in year y (tCO_2e / yr)

$PE_{FC,y}$: Project emissions from fossil fuel consumption in year y (tCO_2e / yr). It is also excluded as the recovered biogas replaces some fossil fuel through the co-fired boilers introduced by the project activity. The consumption of fossil fuel coal will decrease after the Project implement.

Therefore, the project emissions for the proposed project activity are simplified as:

$$PE_y = PE_{\mathbf{CH4},effluent,y} + PE_{CH4,digest,y} + PE_{flare,y} + PE_{EC,y} \quad (14)$$

According to the equation (14), the project emission is calculated by the following three items:

(i) Project emissions related to treatment of wastewater effluent from the anaerobic digester

As the Project adopted (a) Methane Conversion Factor Method for baseline emissions calculation, the project methane emissions from effluent from the digester are calculated by:

$$PE_{\mathbf{CH4},effluenty} = GWP_{CH4} \times MCF_{PJ,y} \times B_o \times (COD_{PJ,effl,dig,y} - COD_{PJ,effl,lag,y}) \quad (15)$$

$$COD_{PJ,effl,dig,y} = \sum_{m=1}^{12} \mathbf{F}_{PJ,effl,dig,m} \times w_{COD,effl,dig,m} \quad (16)$$

$$COD_{PJ,effl,lag,y} = \sum_{m=1}^{12} \mathbf{F}_{PJ,effl,lag,m} \times w_{COD,effl,lag,m} \quad (17)$$

Where:

$PE_{CH4,effluent,y}$	Project emissions from treatment of wastewater effluent from the anaerobic digester in year *y* (tCO_2e / yr)
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period (tCO_2e / tCH_4)
$MCF_{PJ,y}$	Project methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,effluent,y}$ x B_o) that degraded to CH_4
B_o	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (tCH_4 / tCOD)
$COD_{PJ,effl,dig,y}$	Quantity of chemical oxygen demand in the effluent from the digester in year *y* (tCOD / yr)
$COD_{PJ,effl,lag,y}$	Quantity of chemical oxygen demand in the effluent of the open lagoon in which the effluent from the digester is treated in year *y* (tCOD / yr)
$F_{PJ,effl,dig,m}$	Quantity of effluent from the digester in month *m* (m^3 / month)
$w_{COD,effl,dig,m}$	Average chemical oxygen demand in the effluent from the digester in month *m* (t COD / m^3)
$F_{PJ,effl,lag,m}$	Quantity of effluent from the open lagoon in which the effluent from the digester is treated in month *m* (m^3 / month)
$w_{COD,effl,lag,m}$	Average chemical oxygen demand in the effluent from the open lagoon in which the effluent from the digester is treated in month *m* (t COD / m^3)

Determination of $MCF_{PJ,y}$

$MCF_{PJ,y}$ is calculated as follows:

$$MCF_{PJ,y} = f_d \times f_{PJ,T,y} \quad (18)$$

Where:

$MCF_{PJ,y}$	Project methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,effluent,y}$ x B_o) that degrades to CH_4
f_d	Factor expressing the influence of the depth of the lagoon on methane generation
$f_{PJ,T,y}$	Factor expression the influence of the temperature on the methane generation under the project activity in year *y*

Determination of $f_{PJ,T,y}$

The amount of organic matter available for degradation to methane ($COD_{available,m}$) is assumed to be equal to the amount of organic matter directed to the open lagoon, less any effluent, plus the COD that may have remained in the lagoon or sludge pit from previous months, as follows:

$$COD_{PJ,available,m} = (COD_{PJ,effl,dig,m} - COD_{PJ,effl,lag,m}) + (1 - f_{T,m}) \times COD_{PJ,available,m-1} \quad (19)$$

$$COD_{PJ,effl,dig,m} = F_{PJ,effl,dig,m} \times w_{COD,effl,dig,m} \quad (20)$$

$$COD_{PJ,effl,lag,m} = F_{PJ,effl,lag,m} \times w_{COD,effl,lag,m} \quad (21)$$

Where:

$COD_{PJ,available,m}$	Quantity of chemical oxygen demand available for degradation in the open lagoon under the project activity in month *m* (t COD / month)
$COD_{PJ,effl,dig,m}$	Quantity of chemical oxygen demand in the effluent from the digester in month *m* (tCOD / month)
$COD_{PJ,effl,lag,m}$	Quantity of chemical oxygen demand in the effluent of the open lagoon in which the effluent from the digester is treated in month *m* (tCOD / month)
$F_{PJ,effl,dig,m}$	Quantity of effluent from the digester in month *m* (m^3 / month)
$w_{COD,effl,dig,m}$	Average chemical oxygen demand in the effluent from the digester in month *m* (t COD / m^3)
$F_{PJ,effl,lag,m}$	Quantity of effluent from the open lagoon in which the effluent from the digester is treated in month *m* (m^3 / month)
$w_{COD,effl,lag,m}$	Average chemical oxygen demand in the effluent from the open lagoon in which the effluent from the digester is treated in month *m* (t COD / m^3)
$f_{T,m}$	Factor expressing the influence of the temperature on the methane generation in month *m*
m	Months of year y of the crediting period

$f_{T,m}$ is calculated based on the equation provided in calculation of baseline emission.

Based on the monthly values $f_{T,m}$ the annual value $f_{T,PJ,y}$ is calculated as follows:

$$f_{PJ,T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{PJ,available,m}}{\sum_{m=1}^{12} (COD_{PJ,effl,dig,m} - COD_{PJ,effl,lag,m})} \quad (22)$$

Where:

$f_{PJ,T,y}$	Factor expressing the influence of the temperature on the methane generation under the project activity in year *y*
$f_{T,m}$	Factor expressing the influence of the temperature on the methane generation in month *m*
$COD_{PJ,available,m}$	Quantity of chemical oxygen demand available for degradation in the open lagoon under the project activity in month *m* (t COD / month)
$COD_{PJ,effl,dig,m}$	Quantity of chemical oxygen demand in the effluent from the digester in month *m* (tCOD / month)
$COD_{PJ,effl,lag,m}$	Quantity of chemical oxygen demand in the effluent of the open lagoon in which the effluent from the digester is treated in month *m* (tCOD / month)
m	Months of year *y* of the crediting period

(ii) Project emissions related to physical leakage from the digester

The proposed project activity includes construction of a new anaerobic digester. The emissions directly associated with the operation of digesters involve the physical leakage of methane from the digester

system although physical leakage of methane from the new digester is unlikely in fact. Methane emissions from the new digester are calculated as follows:

$$PE_{CH4,digest,y} = F_{biogas,y} \times FL_{biogas,digest} \times w_{CH4,biogas,y} \times GWP_{CH4} \times 0.001 \qquad (23)$$

Where:

$PE_{CH4,\ digest,y}$: Project emissions from physical leakage of methane from the anaerobic digester (tCO_2e / yr)

$F_{biogas,y}$: Amount of biogas collected in the outlet of the new digester in year y (m^3/ yr); the data used for ex-ante calculation in FSR is $43,440\times10^3 m^3$.

$FL_{biogas,digest}$: Fraction of biogas that leaks from the digester (m^3 biogas leaked / m^3 biogas produced). The IPCC default value is 0.05

$w_{CH4,biogas,y}$: Concentration of methane in the biogas in the outlet of the new digester (kg CH_4 / m^3). The calculation ex-ante is based on the standard methane density 0.716kg/m^3 and the methane content in the biogas 0.60m^3CH_4/m^3biogas, the quality methane per unit volume is 0.4296kg CH_4/ m^3

GWP_{CH4}: Global Warming Potential of methane valid for the commitment period (tCO_2e / tCH_4), the default value is 21.

(iii) Methane emissions from flaring

The Project will install an open type gas flare in order to burn biogas when the boiler is not available because of failure or maintenance. According to ACM0014, methane release as a result of incomplete combustion in the flare is calculated based on the "Tool to determine project emissions from flaring gases containing methane". The tool involves the following seven steps:

STEP 1: Determination of the mass flow rate of the residual gas that is flared
STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas
STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis
STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis
STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis
STEP 6: Determination of the hourly flare efficiency
STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Equation and parameters used each step is explained below.

STEP 1: Determination of the mass flow rate of the residual gas that is flared

The Project uses the open flare system. It is suitable to use the method addressed in Step 5 below to calculate the mass flow rate of methane.

STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

This step is not applicable as the project use simplified approach as stated in the (ii) - STEP 1.

STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis

This step is only applicable if the methane combustion efficiency of the flare is continuously monitored and thus N/A.

STEP 4. Determination of methane mass flow rate in the exhaust gas on a dry basis

Same as the previous step, this step is only applicable if the methane combustion efficiency of the flare is continuously monitored and thus N/A.

STEP 5. Determination of methane mass flow rate in the residual gas on a dry basis

It is necessary to refer both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) to the same reference condition that may be on a dry or wet basis. If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas that is usually referred to on a wet basis should be corrected to a dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before sample analysis).

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad (24)$$

Where:

$TM_{RG,h}$: Mass flow rate of methane in the residual gas in the hour *h* (kg/h)
$FV_{RG,h}$: Volumetric flow rate of the residual gas on a dry basis at normal conditions in hour *h* (m^3/h)
$fv_{CH4,RG,h}$: Volumetric fraction of methane in the residual gas on a dry basis in hour *h* (NB: this corresponds to $fv_{i,RG,h}$ where *i* refers to methane).
$\rho_{CH4,n}$: Density of methane at normal conditions (0.716 kg/m^3)

STEP 6. Determination of the hourly flare efficiency

According to the tool, in case of an open flare, the flare efficiency in the hour *h* ($\eta_{flare,h}$) is

- 0% if the flame is not detected for more than 20 minutes during the hour *h*.
- 50%, if the flare is detected for more than 20 minutes during the hour *h*.

STEP 7. Calculation of annual project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions from each hour h, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour h($\eta_{flare,h}$), as follows:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000} \quad (25)$$

Where:

$PE_{flare,y}$: Project emissions from flaring of the residual gas stream in year y (tCO_2e)
$TM_{RG,h}$: Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$: Flare efficiency in hour h
GWP_{CH4}: Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

Under normal conditions, all recovered biogas is supplied to a boiler to generate steam. Therefore, in ex-ante calculation provided in section B.6.3, project emissions resulted from flaring is not considered and thus $PE_{flare,y}$ is assumed to be zero. Equations provided so far are used for ex-post calculation of emission reductions.

(iv) Project emissions from electricity consumption in the project

The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01)" should be applied to calculate project emissions from electricity consumption. The project consumes electricity from the Owner's captive heat and power plant, which is not associated with East China Grid. The project activity is suitable for the Scenario B in the tool: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).
The project emissions from consumption of electricity are calculated based on the formula as follows:

$$PE_{EC,y} = \sum_{j} EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (26)$$

Where,

$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source j in year y, according to FSR, the value is 6521 MWh/yr.
$EF_{EL,j,y}$	Emission factor for electricity generation for source j in year y (tCO2/MWh)
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source j in year y

The emission factor ($EF_{EL,j,y}$) for the Owner's heat and power plant, according to the description in the tool, project participants may choose among the following options:

Option B1: The emission factor for electricity generation is determined based on the CO_2 emissions from fuel combustion and the electricity generation in the captive power plant(s) installed at the site of the electricity consumption source. In case of plants that co-generate heat and power (cogeneration plants)

Option B2: Use the following conservative default values:

- A value of 1.3 tCO_2/MWh if

(a) The electricity consumption source is a project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; <u>and</u> the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is **<u>less</u>** than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).

- A value of 0.4 tCO_2/MWh if

(a) The electricity consumption source is a baseline electricity consumption source; or
(b) The electricity consumption source is a project electricity consumption source <u>and</u> the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is **<u>greater</u>** than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).

The project activities choose Option B2: Use the default factor 1.3 tCO_2/MWh to calculate the emissions from the project activity's electricity consumption. According to the tool, in case of the captive power plant scenario B, assume $TDL_{j,y} = 0$

(3) Leakage

According to ACM0014, leakage is not necessary to be considered.

$L_y = 0$ (27)

(4) Emission Reductions

Emission Reductions (ER_y) by the project activity during the year *y* is a difference between Baseline Emissions (BE_y) and Project Emissions (PE_y).

$ER_y = BE_y - PE_y$ (28)

Where:
ER_y: Total emissions reductions during the year y (tCO_2)
BE_y: baseline emissions for the project activity during the year y (tCO_2)
PE_y: Emissions from the project activity during the year y (tCO_2)

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

Data / Parameter:	$COD_{out,x}$
Data unit:	tCOD/y or m
Description:	COD of the effluent in the period x (a year or m)
Source of data used:	FSR
Value applied:	4,830tCOD/yr
Justification of the choice of data or description of measurement methods and procedures actually applied :	In the FSR, the quantity of the open lagoons effluent COD is less than 1400mg/, the COD value is conservative
Any comment:	

Data / Parameter:	$COD_{in,x}$
Data unit:	ton COD/y or m
Description:	COD directed to the open lagoons in the period x (a year)
Source of data used:	FSR
Value applied:	120,750tCOD/yr
Justification of the choice of data or description of measurement methods and procedures actually applied :	In FSR, the value is monitored actually and conservative
Any comment:	

Data / Parameter:	B_o
Data unit:	t_{CH4} / t_{COD}
Description:	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of

	chemical oxygen demand (COD)
Source of data used:	2006 IPCC Guidelines
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default IPCC value for Bo is 0.25 kg CH_4 / kg COD. If the methodology is used for wastewater containing materials not akin to simple sugars, a CH_4 emissions factor different from 0.21 tCH4 / tCOD has to be estimated and applied. Taking into account the uncertainty of this estimate, project participants should use a value of 0.21 kg CH4 / kg COD as a conservative assumption for Bo
Any comment:	

Data / Parameter:	**f_d**
Data unit:	-
Description:	Factor expressing the influence of the depth of the lagoon or sludge pit on methane generation
Source of data used:	Apply the following values for the corresponding average depth of the open lagoon or the sludge pit: Depth > 5 m: 70% Depth 1 - 5 m: 50% Depth < 1 m: 0%
Value applied:	For the baseline: 50%
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**D**
Data unit:	M
Description:	Average depth of the lagoon
Source of data used:	Specification of the baseline anaerobic lagoon
Value applied:	For the baseline activity: 5m
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$EF_{CO2,FF,boiler}$**
Data unit:	tCO_2 / GJ
Description:	CO_2 emission factor of the fossil fuel type used in the boiler for heat generation in the absence of the project activity
Source of data used:	IPCC 2006 default value for Other Bituminous Coal
Value applied:	0.0946
Justification of the choice of data or description of measurement methods and procedures actually applied :	Most recent Version of IPCC Guidelines for National Greenhouse Gas Inventories.
Any comment:	For ex-ante and ex-post calculation of $BE_{HG,y}$

Data / Parameter:	**$\eta_{BL,boiler}$**

Data unit:	%
Description:	Efficiency of the boiler that would be used for heat generation in the absence of the project activity
Source of data used:	FSR
Value applied:	91%
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$FL_{biogas,digest}$**
Data unit:	m^3 biogas leaked/m^3 biogas produced
Description:	Fraction of biogas that leak from the digester
Source of data used:	IPCC (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 4, Page 4.4)
Value applied:	0.05 m^3 biogas leaked/m^3 biogas produced
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	Applicable to the new anaerobic digester.

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2 / tCH_4
Description:	Global warming potential for CH_4
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Available in the first crediting period
Any comment:	

Data / Parameter:	**A**
Data unit:	Ha
Description:	Surface of the lagoon
Source of data used:	Specification of the baseline anaerobic lagoon
Value applied:	12.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$\rho_{CH4,n}$
Data unit:	kg/m^3
Description:	Density of methane gas at normal conditions
Source of data used:	
Value applied:	0.716
Justification of the choice of data or description of measurement methods	"Tool to calculate the project emissions of the methane combustion"

and procedures actually applied :	
Any comment:	

B.6.3. Ex-ante calculation of emission reductions:

The project emission reductions are calculated as the following equation:

$$ER_y = BE_y - PE_y - L_y$$

Ex-ante calculation for the proposed project activity is:
(1) Baseline Emissions

Baseline emissions are given as:

$$BE_y = BE_{CH4,y} + BE_{EL,y} + BE_{HG,y}$$

Where:

$$BE_{CH4,y} = GWP_{CH4} \times MCF_{BL,y} \times B_o \times COD_{BL,y}$$
$$MCF_{BL,y} = f_d \times f_{T,y} \times 0.89$$

Ex-ante calculation for the proposed project activity is:

Table B.6.3.1 Baseline emissions of wastewater anaerobic treatment

Parameter	Description	Value	Unit
f_d	Factor expressing the influence of the depth of the lagoon on methane generation	0.5	
$f_{T,y}$	Factor expressing the influence of the temperature	0.6977	
$MCF_{BL,y}$	Average baseline methane conversion factor (fraction) in year *y*	0.3105	
AD_{BL}	Effluent adjustment factor	0.96	
B_o	Maximum methane producing capacity	0.21	tCH_4/tCOD
$COD_{BL,y}$	Quantity of chemical oxygen demand that would be treated in open lagoons in the absence of the project activity in year *y*	120,750	tCOD/yr
GWP_{CH4}	Global Warming Potential of methane	21	tCO_2e/tCH_4
$BE_{CH4,y}$	**Methane emissions from anaerobic treatment of the wastewater in open lagoons**	**158,730**	**tCO_2e/yr**

$$BE_{EL,y} = EC_{BL} \times EF_{BL,EL,y}$$

In baseline scenario, this term can be ignored, $BE_{EL,y}$ =0.

$$BE_{HG,y} = \frac{HG_{PJ,y} \times EF_{CO2,FF,boiler}}{\eta_{BL,boiler}}$$

$$HG_{PJ,y} = F_{biogas,y} \times w_{CH4,y} \times NCV_{CH4} \times \eta_{PJ,boiler}$$

Table B.6.3.2 Baseline emission for biogas heat generation replacing fossil fuel

Parameter	Description	Value	Unit
$F_{biogas,y}$	Volume of biogas captured and used for heat generation	43,440,000	m^3
$w_{CH4,y}$	Methane content of the biogas	60	%
NCV_{CH4}	Net calorific value of CH_4	0.0359	GJ/m^3
$\eta_{PJ,boiler}$	Efficiency of the boiler during the project	91	%
$EF_{CO2,FF,boiler}$	CO2 emission factor of coal	0.0946	tCO_2/GJ
$\eta_{BL,boiler}$	Efficiency of the boiler that would be used for heat generation in the absence of the project activity	91	%
$BE_{HG,y}$	**CO2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project**	**88,523**	**tCO_2e/yr**

BE_y = 158,730+0+88,523= 247,253tCO_2e/yr

(2) Project Emissions

Project emissions are given as:

$$PE_y = PE_{CH4,\ effluent,\ y} + PE_{CH4,digest,\ y} + PE_{CH4,\ flaret,y} + PE_{EC,y}$$

Where:

$$PE_{\mathbf{CH4},effluenty} = GWP_{CH4} \times MCF_{PJ,y} \times B_o \times (COD_{PJ,effl,dig,y} - COD_{PJ,effl,lag,y}) \text{ with}$$

$$COD_{PJ,effl,dig,y} = \sum_{m=1}^{12} \mathbf{F}_{PJ,effl,dig,m} \times w_{COD,effl,dig,m} \text{ and}$$

$$COD_{PJ,effl,lag,y} = \sum_{m=1}^{12} \mathbf{F}_{PJ,effl,lag,m} \times w_{COD,effl,lag,m}$$

Table B.6.3.3 Project emissions from effluent from the digester

Parameter	**Description**	**Value**	**Unit**
$PE_{CH4,effluent,y}$	Project emissions from treatment of wastewater effluent from the anaerobic digester in year y	20,063	tCO_2e / yr
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period	21	tCO2e / tCH4
$MCF_{PJ,y}$	Project methane conversion factor (fraction) in year y, representing the fraction of ($COD_{PJ,effluent,y}$ x B_o) that degraded to CH4	0.4884	-
B_o	Maximum methane producing capacity, expressing the maximum amount of CH4 that can be produced from a given quantity of chemical oxygen demand	0.21	tCH4 / tCOD
$COD_{PJ,effl,dig,y}$	Quantity of chemical oxygen demand in the effluent from the digester in year y	9,660	tCOD / yr

Parameter	Description	Value	Unit
$COD_{PJ,effl,lag,y}$	Quantity of chemical oxygen demand in the effluent of the open lagoon in which the effluent from the digester is treated in year y	345	tCOD / yr
$F_{PJ,effl,dig,m}$	Quantity of effluent from the digester in month m	287,500	m³ / month
$w_{COD,effl,dig,m}$	Average chemical oxygen demand in the effluent from the digester in month m	0.0028	t COD / m³
$F_{PJ,effl,lag,m}$	Quantity of effluent from the open lagoon in which the effluent from the digester is treated in month m	287,500	m³ / month
$w_{COD,effl,lag,m}$	Average chemical oxygen demand in the effluent from the open lagoon in which the effluent from the digester is treated in month m	0.0001	t COD / m³

$$PE_{CH4,digest,y} = F_{biogas,y} \times FL_{biogas,digest} \times w_{CH4,biogas,y} \times GWP_{CH4} \times 0.001$$

Table B.6.3.4 Project emissions from physical leakage of methane from the anaerobic digester

Parameter	Description	Value	Unit
$F_{biogas,y}$	Amount of biogas collected in the outlet of the new digester in year y	43,440,000	m^3/yr
$FL_{biogas,digest}$	Fraction of biogas that leaks from the digester	0.05	
$w_{CH4,biogas,y}$	Concentration of methane in the biogas in the outlet of the new digester	0.4296	kg CH_4/ m^3
GWP_{CH4}	Global Warming Potential of methane	21	tCO_2e/tCH_4
$PE_{CH4,digest,y}$	**Project emissions from physical leakage of methane from the anaerobic digester**	**19,595**	**tCO_2e/yr**

About the Project of $PE_{flare,y}$, ex-ante calculating it is zero.

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Table B.6.3.5 Project emissions from electricity consumption

Parameter	Description	Value	Unit
$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source j in year y	6,521	MWh/yr
$EF_{EL,j,y}$	Emission factor for electricity generation for source j (= East China Power Grid) in year y	1.3	tCO_2/MWh
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source j (= East China Power Grid) in year y	0	%
$PE_{EC,y}$	**Project emissions from electricity consumption**	**8,477**	**tCO_2e/yr**

PEy=20,063+19,595+0+8,477=48,135CO_2e/yr

(3).Leakage

No leakage is estimated.

(4).project emission reductions

$$ER_y=BE_y-PE_y= 247,253-48,135-0=199,118\ tCO_2e/yr$$

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

Year	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
15/10/2012-14/10/2013	48,135	247,253	0	199,118
15/10/2013-14/10/2014	48,135	247,253	0	199,118
15/10/2014-14/10/2015	48,135	247,253	0	199,118
15/10/2015-14/10/2016	48,135	247,253	0	199,118
15/10/2016-14/10/2017	48,135	247,253	0	199,118
15/10/2017-14/10/2018	48,135	247,253	0	199,118
15/10/2018-14/10/2019	48,135	247,253	0	199,118
15/10/2019-14/10/2020	48,135	247,253	0	199,118
15/10/2020-14/10/2021	48,135	247,253	0	199,118
15/10/2021-14/10/2022	48,135	247,253	0	199,118
Total (tCO_2e)	481,350	2,472,530	0	1,991,180

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$F_{PJ,dig,m}$
Data unit:	m^3 / month
Description:	Quantity of wastewater that is treated in the anaerobic digester in the project activity in month *m*
Source of data to be used:	Measured by electromagnetic flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Average 287,500 m^3 / month

Description of measurement methods and procedures to be applied:	Parameter monitored continuously with a flow meter and recorded everyday, but aggregated monthly and annually for calculation.
QA/QC procedures to be applied:	The meter will be calibrated according to national standard of Verification regulation of electromagnetic flowmeters (JJG1033-2007). According this regulation, the meter will be calibrated every two years.
Any comment:	-

Data / Parameter:	$w_{COD,dig,m}$
Data unit:	t COD / m^3
Description:	Average chemical oxygen demand in the wastewater that is treated in the anaerobic digester in the project activity in month m
Source of data to be used:	Measurements by testing in lab
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0.035 t COD / m^3
Description of measurement methods and procedures to be applied:	Measured in lab and recorded everyday, calculated monthly and annually
QA/QC procedures to be applied:	Measured periodically according to the national standard of Water quality-Determination of the chemical oxygen demand-Dichromate method (GB11914-89), aggregated monthly and annually for calculation.
Any comment:	-

Data / Parameter:	$F_{PJ,effl,dig,m}$
Data unit:	m^3 / month
Description:	Quantity of effluent from the digester in month m;
Source of data to be used:	Measured by electromagnetic flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Average 287,500m^3 / month
Description of measurement methods and procedures to be applied:	Parameter monitored continuously with a flow meter and recorded everyday, but aggregated monthly and annually for calculation.
QA/QC procedures to be applied:	The meter will be calibrated according to national standard of Verification regulation of electromagnetic flowmeters (JJG1033-2007). According this regulation, the meter will be calibrated every two years.
Any comment:	*m* = Months of year *y* of the crediting period;

Data / Parameter:	$w_{COD,effl,dig,m}$
Data unit:	t COD / m^3
Description:	Average chemical oxygen demand in the effluent from the digester in month m
Source of data to be used:	Measurements by testing in lab
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0.0028tCOD/m^3
Description of measurement methods	measured in lab and recorded everyday, calculated monthly and

and procedures to be applied:	annually
QA/QC procedures to be applied:	Maintain and calibrate COD according to the national standard of Water quality-Determination of the chemical oxygen demand-Dichromate method (GB11914-89), aggregated monthly and annually for calculation.
Any comment:	-

Data / Parameter:	$\mathbf{F_{PJ,effl,lag,m}}$
Data unit:	m^3 / month
Description:	Quantity of effluent from the open lagoon in which the effluent from the digester is treated in month m
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	287,500 m^3 / month
Description of measurement methods and procedures to be applied:	Measured by a flow meter. Parameter monitored continuously but aggregated annually for calculations
QA/QC procedures to be applied:	The flow meter undergoes maintenance and calibration in line with manufacture's recommendation.
Any comment:	

Data / Parameter:	$\mathbf{w_{COD,\ effl,lag,m}}$
Data unit:	t COD / m^3
Description:	Average chemical oxygen demand in the effluent from the open lagoon in which the effluent from the digester is treated in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0001
Description of measurement methods and procedures to be applied:	Measure the COD according to national or international standards. Measure the COD regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The meter undergoes maintenance and calibration in line with manufacture's recommendation.
Any comment:	

Data / Parameter:	$\mathbf{T_{2,m}}$
Data unit:	K
Description:	Average temperature at the project site in month *m*
Source of data to be used:	Weather statistics from the Anhui Province Meteorological Administration
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Data provided in China Meteorological Data Shared Net, see Annex 3.
Description of measurement methods and procedures to be applied:	Continuously, aggregated in monthly average values
QA/QC procedures to be applied:	Official statistic data

Any comment:	

Data / Parameter:	**$HG_{PJ,y}$**
Data unit:	GJ / yr
Description:	Net quantity of heat generated in year *y* with biogas from the new anaerobic digester
Source of data to be used:	Calculated on the basis if measurement of the volume of biogas captured and used for heat generation ($F_{boiler,biogas,y}$) multiplied by the methane content of the gas ($w_{CH4,biogas,y}$), CV methane (NCV_{CH4}), and the efficiency of the boiler during the project (i.e. with biogas: $\eta_{PJ,boiler}$). The efficiency of the boiler during the project ($\eta_{PJ,boiler}$) is set as 91.0%, which is the boiler specification data for efficiency of the existing equipment for simplification and conservativeness.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	This parameter is 851,540 calculated based the datum in FSR
Description of measurement methods and procedures to be applied:	Monitored daily
QA/QC procedures to be applied:	The meter undergoes maintenance and calibration in line with manufacture's recommendation.
Any comment:	-

Data / Parameter:	**$F_{biogas,y}$**
Data unit:	m^3 / yr
Description:	Total amount of biogas collected in the outlet of the new digester in year *y*
Source of data to be used:	Parameter monitored continuously but aggregated annually for calculations.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	43,440,000(Feasibility Study)
Description of measurement methods and procedures to be applied:	Monitored continuously and recorded daily, aggregated annually for calculation.
QA/QC procedures to be applied:	Maintain and calibrate the meter according to natioal standard of Verification regulation of differential pressure type flowmeter (JJG640-94). According to this standard, this meter will be calibrated annually.
Any comment:	Applied to estimate emissions associated with physical leakage from the digester. When the boiler is under maintenance and the biogas is flared, this parameter will be recorded hourly and is used to calculate the amount of biogas that is flared.

Data / Parameter:	**$F_{boiler,biogas,y}$**
Data unit:	m^3 / yr
Description:	Amount of biogas of the pumped into boiler
Source of data to be used:	Measured continuously by gas flowmeter.
Value of data applied for the purpose of calculating expected	43,440,000(Feasibility Study)

emission reductions in section B.6	
Description of measurement methods and procedures to be applied:	Monitored continuously and recorded daily, aggregated annually for calculation.
QA/QC procedures to be applied:	Maintain and calibrate the meter according to national standard of Verification regulation of differential pressure type flowmeter (JJG640-94). According to this standard, this meter will be calibrated annually.
Any comment:	When the boiler is under maintenance and the biogas is flared, this parameter will be recorded hourly and is used to calculate the amount of biogas that is flared.

Data / Parameter:	$\mathbf{FV_{RG,h}}$
Data unit:	m^3 / h
Description:	Volumetric flow rate of the biogas in the hour h
Source of data to be used:	Measured continuously by gas flowmeter.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be applied:	Monitored continuously
QA/QC procedures to be applied:	Maintain and calibrate the meter according to national standard of Vortex shedding flowmeter (JJG1029-2007). According to this standard, this meter will be calibrated annually.
Any comment:	When the boiler is under maintenance and the biogas is flared, this parameter will be recorded hourly and is used to calculate the amount of biogas that is flared.

Data / Parameter:	$\mathbf{w_{CH4,biogas,y}}$/ $\mathbf{w_{CH4,y}}$
Data unit:	kg CH_4 / m^3/%
Description:	Concentration of methane in the biogas
Source of data to be used:	Measured by gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0.4296/60 (Feasibility Study)
Description of measurement methods and procedures to be applied:	Monitored once with every there days which periodic measurement may meet the 95% confidence level
QA/QC procedures to be applied:	The project proponents will define the error for different level of measurement frequency. The level of accuracy will be deducted from average concentration of measurement. The gas analyzer will be calibrated annually. The calibration may be in accordance with the national standard of Carbon monoxide and carbon dioxide infrared gas analyzer (JJG635-1999).
Any comment:	Applied to 1) calculate net quantity of heat generated in year *y* with biogas from the new anaerobic digester and 2) estimate emissions associated with physical leakage from the digester.

Data / Parameter:	**$TDL_{j,y}$**
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
Source of data to be used:	According to "Tool to calculate baseline project and/ or leakage emissions from electricity consumption", default value 0% for captive power plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	N/A
Any comment:	-

Data / Parameter:	**$EC_{PJ,j,y}$**
Data unit:	MWh/yr
Description:	Quantity of electricity consumed by the project electricity consumption source *j* in year *y*
Source of data to be used:	Measurements by watt-hour meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	6521MWh (F/S)
Description of measurement methods and procedures to be applied:	Parameter monitored continuously with a watt-hour meter and aggregated daily and monthly for calculation.
QA/QC procedures to be applied:	The watt-hour meter undergoes maintenance, and will be calibrated in line with national standard of Verification regulation of electromechanical meters for measuring alternating-current electrical energy (JJG307-2006).
Any comment:	-

Data / Parameter:	**$T_{flare,y}$**
Data unit:	℃
Description:	Temperature of the flare
Source of data to be used:	Measurements, Parameter monitored continuously with a thermocouple.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	-
Description of measurement methods and procedures to be applied:	Measure the temperature of the gas stream in the flare by a thermocouple. A temperature above specific value indicates that a significant amount of gases are still being burnt and that the flare is operating. It will be recorded hourly.
QA/QC procedures to be applied:	Thermocouples should be calibrated annually according to the national standard of Verification regulation of working base metal thermocouple (JJG351-1996).
Any comment:	Flare operation detection

B.7.2. Description of the monitoring plan:

In order to collect reliable and credible date to calculate emissions reductions, the following monitoring plan is implemented.

1. Monitoring Organization

An organization dedicated for monitoring of CDM project activity will be set up. The Project Owner will appoint one CDM monitoring manager and several CDM monitoring staff. The organization will implement data collection, maintenance and calibration of meters, recording and archiving of collected data, writing a monitoring report, etc. The managing structure for the CDM monitoring is shown in Figure B.7.2.1.

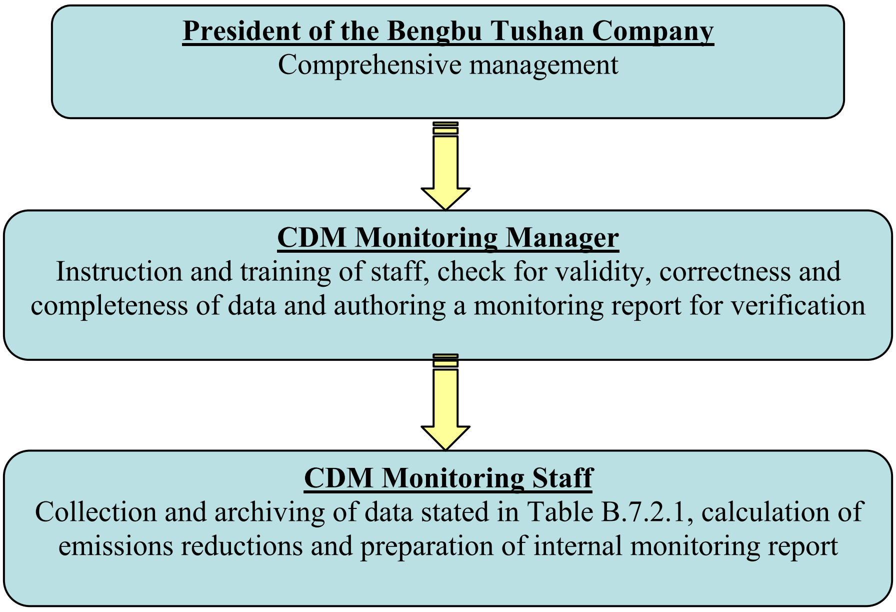

Figure B.7.2.1 CDM Monitoring Structure

2. Monitoring equipment and installation

Meters are equipped according to Table B.7.2.1; all the meters and analyzers are to be installed according to the manufacturer's specifications to ensure proper operation and measuring accuracy. The installations of monitoring instrumentation are shown in Figure B.7.2.2. Introductions for all monitoring meters are listed in Table B.7.2.1.

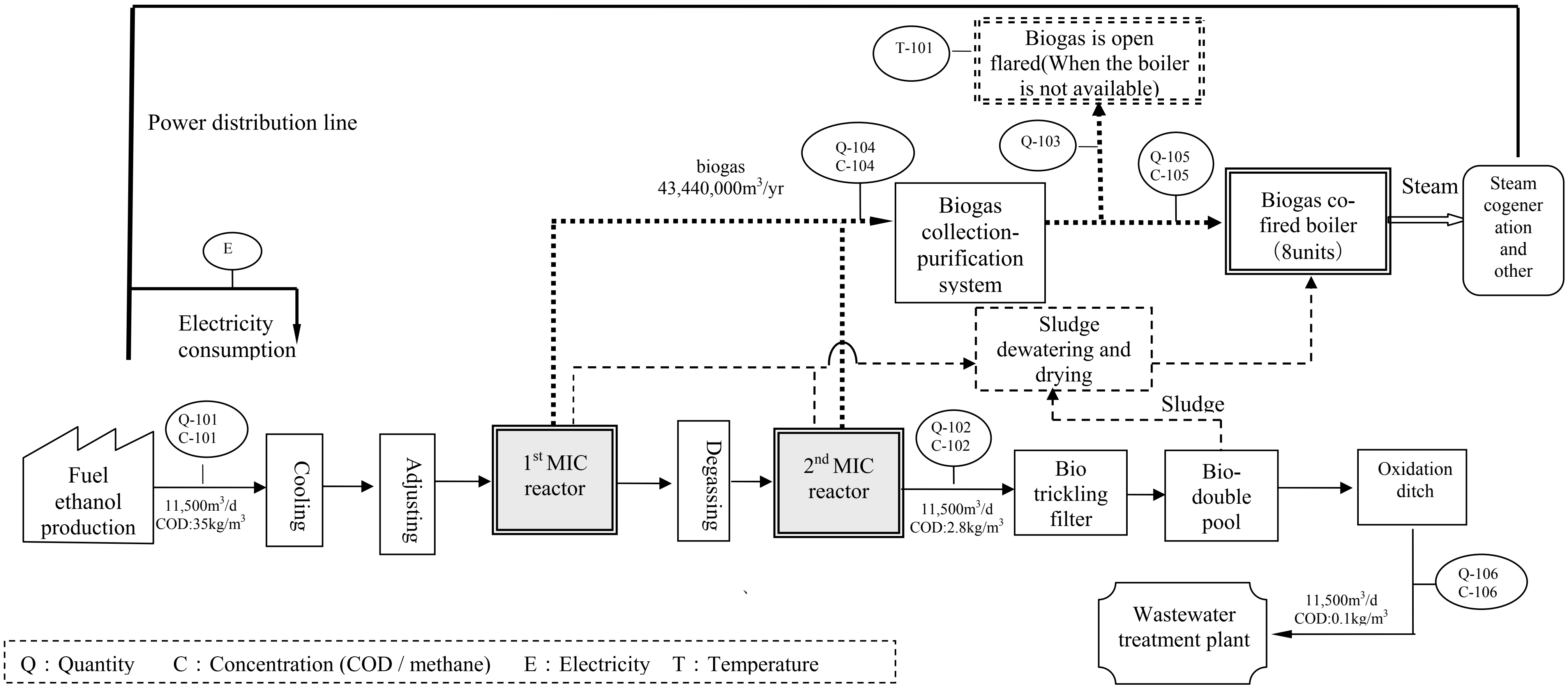

Figure B.7.2.2 Schematic diagram of wastewater treatment process

Table B.7.2.1 Summary of monitoring equipment

No.	Parameter	Location	Remark
Q-101	Wastewater flow	Inlet of anaerobic digester	
C-101	Inflow COD of anaerobic reactor	Inlet of anaerobic digester	Measured periodically
Q-102	Wastewater flow	outlet of anaerobic digester	
C-102	Outflow COD of anaerobic reactor	outlet of anaerobic digester	Measured periodically
C-104	Methane content	outlet of anaerobic digester, biogas pipe	Measured periodically
C-105	Methane content	Biogas boiler entrance pipe / Torch entrance pipe	Measured periodically
Q-104	Biogas flow meter	Outlet of anaerobic reactor	
Q-105	Biogas flow meter	Inlet of co-fired boiler	
Q-103	Biogas flow meter	Inlet of flaring system	
Q-106	Wastewater flow	Outlet of aerobic reactor	
C-106	Outflow COD of aerobic reactor	Outlet of aerobic reactor	
E	Total energy meter	Power distribution cabinet	
T-101	Temperature of the flare	The open flare	

All the meters and analyzers are to be installed according to the manufacturer's specifications to ensure proper operation and data collection. Maintenance and calibration also have to be implemented in accordance with national standards, industrial standards and/or manufacturer's instruction.

3. Data Collection and Archiving

Data collection and archiving is carried out in conformity with the method stated in section B.7.1, and the 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 a transparent and reasonable manner. At the same time, the CDM monitoring manager will 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 member of 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 in electronic and a paper form at the end of every month. The paper form record must have at least one backup copy. The electronic data should be saved on digital recording media like a CD for backup. All relevant written documentation such as the 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 the crediting period.

4. Quality Assurance and Quality Control (QA and QC)
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. 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 at least once a year. In the internal audit, a 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.

5. Monitoring Report
Monitoring Report Author: responsible person designated by Project Owner and the CERs buyer write the report.
Monitoring report: the Project Owner provides a monitoring report to DOE for verification. The monitoring report includes monitoring data such as biogas flow rate, fraction of methane in biogas and end use of the final sludge, record of calibration of meters, calculations of emission reductions, etc.

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

Date of completion: 27/07/2012

Name of responsible person: Mr. Haijiang Tian, Mr. Haiting Shi and Ms Yiping Qu
Telephone: 86-10-84505948/84505001
Email: thj@uniufa.com, shihaiting@uniufa.com, qyp@uniufa.com

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:

18/03/2008 (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:

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

15/10/2012 or date of registration, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The Project Owner conducted environmental impact assessment (EIA) and was approved by the Environmental Protection Agency of the Bengbu City with approval No. 36 [2008]. Results of the EIA are summarized as follows.

1. Air Quality
Environmental impact: after the project operation, ① Stench generated from wastewater treatment grating, anaerobic adjustment tank, MIC anaerobic reactor and sludge dewatering room, the main components are NH_3, H_2S and methanthiol. ② Boiler exhaust gas, mainly SO_2 and dust.
Control measures: ① Plant green belts to prevent the stench around the plant; ② Set desulfurization system to control the SO_2 concentration in the exhaust gas after combustion in the boiler.
Achieve the expected effect: The concentration of SO_2 will be to achieve the 2,3 timeframe standard of "thermal power plant emission standards for air pollutants" (GB13223-2003) after the biogas is combusted in the co-boilers.

2. Noise
Environment impact: Noise sources by the Project are limited to pumps and fans:

Control measures: Use low-noise equipment, absorption noise material, and insulation noise measures;
Achieve the expected effect: After the reduction noise measurement, the noise does not disturb the resident to meet the 3 class standards of "urban regional environmental noise standard" (GB3096-93).

3. Water quality
Environment impact: The treated wastewater after the treatment includes pollutions: COD, SS, NH_3-Nand TP.
Control measures: The treated wastewater is discharged into the Bengbu first wastewater treatment plant for the advanced treatment.
Achieve the expected effect: The treated wastewater is to meet the 1st class standard of the "Integrated wastewater discharge standard" (GB8978-1996) and then discharged to a Bengbu first wastewater treatment plant. After the advanced treatment the final discharged wastewater will have met the A standard of the first class in table one of the "Municipal wastewater treatment plant pollutants discharge standard" (GB18918-2002), ensuring that there is no negative impact on the local water environment.

4. Solid Waste
Solid wastes mainly include: wastes generated in the process of wastewater treatment grid slag, setting sand, sulfur generated in the desulfurization process and boiler slag.
Control measures: Sulfur is to be recovered. There is less boiler waste compared with the baseline scenario and other waste is treated in the same way as in the baseline.
Achieve the expected effect: Satisfy comprehensive utilization and environmental management requirements.

5. Eco-environmental impact analysis
In the Project area vegetation is little and there are no rare and endangered plant and animal species, therefore there is little impact on plant growth, terrestrial animal habitat, and regional eco-environment, the impact on the local ecological integrity is ignored.

As stated above, the Project has many environmentally cleaner aspects as well as achieving effective utilization of energy. Therefore, the Project is environmentally acceptable as the environmental impact caused by the proposed project activity is very small.

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

The project is considered to be an environmental project and negative environmental impacts will be reduced in total. Therefore, environmental impacts associated to the Project are not considered significant.

SECTION E. Stakeholders' comments

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

In accordance with the rule of the CDM project activity, on 27 Feb, 2008 the Project Owner invited stakeholders to the project site in order to comment on the project activity. Comments were collected from

local officers, residents and workers by distribution of the questionnaire including the following questions[15].

1. What type of impacts do you think the CDM Project activity will have on the local environment?
2. What type of impacts do you think the CDM Project activity will have on the local employment opportunity?
3. What type of impacts do you think the CDM Project activity will have on the living of local residents?
4. What type of impacts do you think the CDM Project activity will have on the local economical development?
5. Do you think the environment measures of the Project taken can effectively prevent the environment pollution?
6. What is your opinion on the CDM Project?

E.2. Summary of the comments received:

Total 20 questionnaires were distributed and collected. All the respondents were possibly affected by the Project. 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.

Index	Category	Number (persons)	Proportion (%)
Gender	Male	8	40%
	Female	12	60%
Age	<30	10	50%
	30-55	10	50%
	>56	0	0%
Level of education	Primary	1	5%
	Secondary	5	25%
	Higher	14	70%
Profession	Farmer	1	5%
	Company employee	10	50%
	Others	9	45%

The survey shows that the stakeholders have positive attitude toward the construction and operation of biogas recovery and heat generation. Collected comment is summarized that:

- All the respondents think that the CDM Project activity will have positive impacts on the local environment;
- All the investigated stakeholders think that the CDM Project is positive on the local employment opportunity, it will increase local employment opportunity;
- 85% of the investigated stakeholders have a positive opinion on their lives and the remainder think that the CDM Project has no influence.
- All the investigated stakeholders think that it is positive on the local economical development;
- All the investigated stakeholders think that the measures of environment protection are effective.
- All the investigated stakeholders support the implementation of the CDM project;

[15] In the meeting, the stakeholders were asked to fill in the questionnaires. The project owner summarized the content of the meeting and formed the MOM

Therefore, it is concluded that the local stakeholders support the CDM project on the ground that it will improve local living standards through additional employment and income.

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

As stated in E.2., stakeholders consider the CDM project to have positive impacts as a whole. Therefore, it is unnecessary to take additional measures in addition to planned ones.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Personal E-Mail:	/

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

BASELINE INFORMATION

Calculation of factor expressing the influence of the temperature ($T_{2,m}$) on the methane generation in year y ($f_{T,y}$)

According to the description in B.6.1, the calculation of the $f_{T,y}$ as follows:

1. According to the quantity of the wastewater （11,500m^3/d）, concentration of COD(0.035tCOD/m^3) and operation days (300 days) in FSR, monthly treated COD can be calculated.
2. HRT of the wastewater in open lagoons is 52 days;
3. AD_{BL} is calculated as per Table 1;
4. The wastewater COD discharged from the open lagoons is less than 1,400mg/L.

The intermediate data is calculated as per the equation in B.6.1, which is shown in Table 2. The $f_{T,m}$ and $f_{T,y}$ are calculated according to the formula(10) and (11), to achieve the result through inputting the Table 2 data:

$$f_{T,y} = 0.6977$$

Table 1 The calculation of adjustment factor AD_{BL}

AD_{BL}		
	$COD_{out,x}$	$COD_{in,x}$
day/x	1,400mg/L	35,000mg/L
AD_{BL}	0.96	

Table 2 Calculation of factor expressing the influence of the temperature ($T_{2,m}$) on the methane generation in year *y* ($f_{T,y}$; baseline scenario)

Month	Quantity of COD that is treated in the anaerobic digester in the project activity in month m ($COD_{PJ,m}$)	Quantity of COD that would be treated in open lagoons in the absence of the project activity in month m ($COD_{BL,m}$)	Quantity of COD available for degradation in the open lagoon in month m ($COD_{available,m}$)	Factor expressing the influence of the temperature on the methane generation in month m ($f_{T,m}$)	Monthly average temperature ($T_{2,m}$)[16]	Quantity of COD available for degradation in the open lagoon or sludge pit in month m-1 ($COD_{available,m-1}$)	$f_{T,m}$*$COD_{available,m}$
	tCOD/month	tCOD/month	tCOD/month	-	K	tCOD/month	
Oct	10,063	9,660	9,660.00	0.32	290.06	0	3,096
Nov	10,063	9,660	17,689.87	0.17	283.16	9,660	2,985
Dec	10,063	9,660	27,349.87	0.00	277.36	17,690	0
Jan	10,063	9,660	37,009.87	0.00	274.96	27,350	0
Feb	10,063	9,660	46,669.87	0.00	276.96	37,010	0
Mar	10,063	9,660	56,329.87	0.00	281.86	46,670	0
Apr	10,063	9,660	49,804.51	0.29	288.86	56,330	14,310
May	10,063	9,660	36,421.84	0.46	294.16	49,805	16,851
Jun	10,063	9,660	21,796.22	0.67	298.36	36,422	14,533
Jul	10,063	9,660	13,172.43	0.84	301.06	21,796	11,050
Aug	10,063	9,660	12,417.04	0.79	300.36	13,172	9,818
Sep	10,063	9,660	15,465.85	0.53	295.76	12,417	8,234

[16] http://cdc.cma.gov.cn/shishi/climate.jsp?stprovid=安徽&station=58221

Annex 4

MONITORING INFORMATION

Refer to B.7.2.

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