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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

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Project: Methane Recovery and Power Generation Project in High-concentrated Organic Wastewater Treatment in Hubei, China

Version: 05
Date of submission: 03/11/2010

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

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Methane Recovery and Power Generation Project in High-concentrated Organic Wastewater Treatment in Hubei, China (hereinafter referred to as "**the proposed project**") is located in Huangshi City, Hubei Province, China and is owned by the Huangshi Xinghua Biochemical Ltd., one of the top ten citric acid producers in China. Prior to the proposed project, the citric acid production amount was 30,000ton/yr, and the wastewater was discharged into the surrounding water system after being conventionally treated by Upflow Anaerobic Sludge Bed (UASB) and following aerobic aeration treatment systems. There were two UASB reactors that were both constructed in 2003[1] with each remaining lifetime about 23 years[2]. The biogas generated through UASB treatment system was directly emitted into the atmosphere. In April 2010 the plant will increase production capacity to 60,000 ton/yr of citric acid. The proposed project will introduce an advanced Erratic Inner Circulation (EIC) technology which has higher wastewater treatment efficiency than UASB. Two EIC digesters will be invested and be added before the existing UASB treatment system to treat the wastewater. The biogas generated from EIC treatment system is captured for power generation, thus prevents methane being emitted to the atmosphere, as well as replacing power previously supplied from the grid.

The project activity started in May 2005, and expects to be in full operation by October 2010. At that time, it will capture and utilize about 9 million m^3 of biogas per year for power generation (the installed capacity is 5×500KW, and another 1×500KW is for standby) and the annual power generation is estimated to be 15,000 MWh. This electricity will substitute for the carbon intensive electricity previously imported from Central China Power Grid (CCPG) which is dominated by coal-fired power plants.

In the proposed project the annual emission reductions, estimated at 45,782 tCO_2e, are only based on the biogas captured and utilized from the EIC process. The emission reductions from the waste heat of the biogas generators and the combustion of biogas in the existing UASB process [3]are not claimed. This can be considered conservative.

As a renewable energy project, the proposed project will bring environmental and economic benefits and promote sustainable development through the following ways:

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[1] Refer to *UASB Construction Contract* dated on 05/06/2003

[2]Refer to http://www.chinaep.net/feishui_shili/102/feishui_shili-468.htm

[3]In the FSR, the biogas both from EIC and UASB is designed to be used for power generation, however, as the pressure of biogas generated from UASB is different from EIC, regarding the biogas generated from UASB, the project owner compares with other options and finally decides to collect the biogas from the UASB for combustion.

- The project encourages other similar facilities to adopt EIC technology for high-concentrated wastewater treatment and renewable energy utilization that will cut emissions of methane, reduce fossil fuel, and reduce negative impacts on the environment.
- The biogas from the organic wastewater will be used for power generation for self-use to displace part of power imported from the grid, thus reducing fossil fuel consumption, and contributes to the sustainable development of the industry and society.
- The implementation of the proposed project will improve the local wastewater treatment situation, improve the investment environment and create employment opportunities, which will all contribute to local economic development.

A.3. Project participants:

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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)
P.R.China (host)	Huangshi Xinghua Biochemical Ltd. (Project owner)	No
UK	Climate Bridge Ltd. (CER buyer)	No
UK	Noble Carbon Credits Limited (CER buyer)	No

Detailed information on participants is included in Annex 1.

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

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

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A.4.1.1. Host Party(ies):

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People's Republic of China

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

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Hubei province

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

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Huangshi City

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

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The project is located in Xisaishan District in Huangshi City, at a distance of 82km from the provincial capital, Wuhan. The geographical coordinates are east longitude 115°03′54″ and north latitude30°14′55″. Figure 1 shows the location of the proposed project.

Figure 1 Geographical Location of the Proposed Project

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

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According to Appendix B of the UNFCCC's *Simplified Modalities and Procedures for Small-scale CDM Project Activities,* the type and category of the proposed project is as follows:

Type III – *Other Project Activities;*

Category III.H. – *Methane Recovery in Wastewater Treatment;*

Type I - *Renewable Energy Project*

Category I.C. – *Thermal energy production with or without electricity*

Without the proposed project, the project owner would simply invest in two more UASBs to fulfil the wastewater treatment task (refer to section B.4 for details) which is the common practice for wastewater treatment in the citric acid sector. However, in order to utilize renewable energy and reduce fossil fuel consumption, as well as improving the efficiency of wastewater treatment, the project owner decided to develop the proposed project which introduces a more advanced EIC technology in the existing UASB treatment system and captures the biogas generated from EIC process for power generation. This process is shown more clearly in Figure 2.

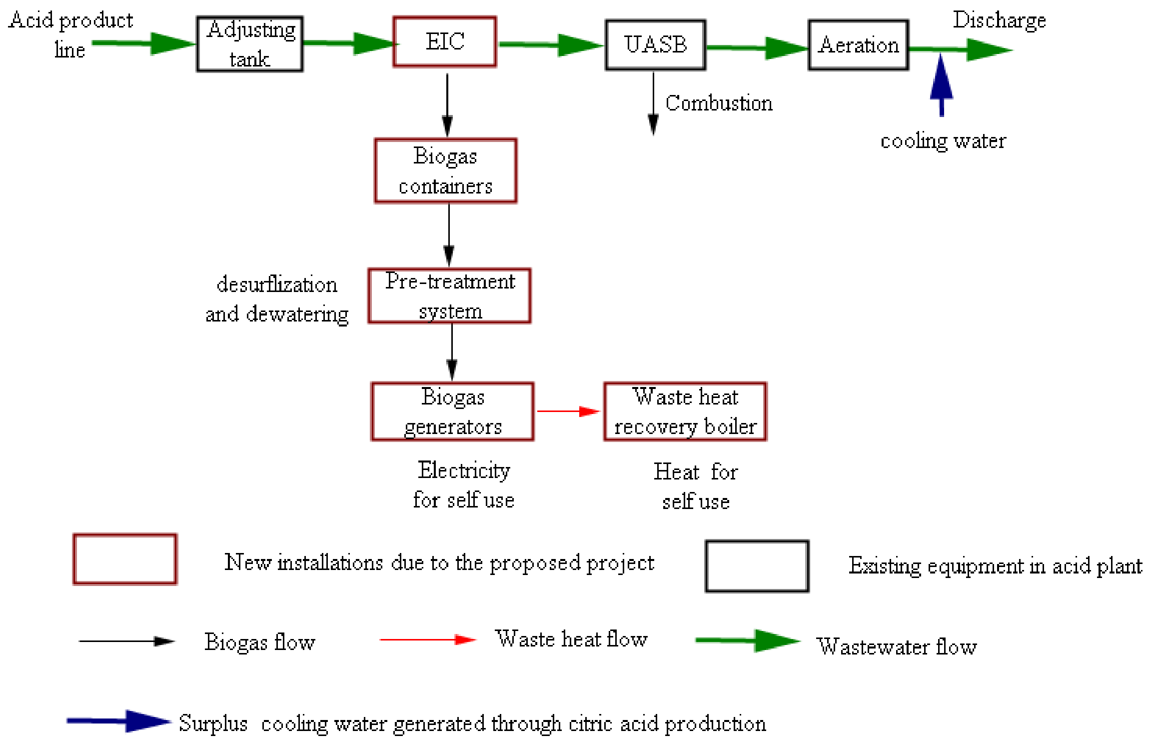

Figure 2. Process flow

The wastewater process begins with pre-treatment using a cooling tower and adjusting tank, then anaerobic treatment using EIC digesters and UASB reactor and finally aerobic treatment using aeration tank. The wastewater after being treated is mixed with surplus cooling water generated through citric acid production to reach a COD concentration below 150 mg/l and discharged in accordance with the *Discharge Standard of Pollutants for Citric Acid Industry* (GB 19430-2004).

In addition the biogas generated from EIC process is delivered to five biogas generators after pre-

treatment. These generators turn the biogas into usable electricity and replace electricity previously obtained from the grid. The waste heat from the generators will be used in the waste heat boiler. The biogas generated from the UASB process is combusted.

The measuring instruments include the liquid flow meter, the gas flow meter, the electricity meter, the gas analyzer and COD analysis instrument. (Refer to Section B.7.2 for details).

EIC technology is a renovated technology based on IC technology (Patent No. ZL200420023281.4). It adopts erratic technology to improve the water distribution system and circling efficiency, enhance organic degradation rate and conversion efficiency and therefore results in more gas production. EIC technology has been under pilot experiment from year 2004-2006.

Table A-1 is the key technical parameters of EIC digesters, biogas generators and boiler.

Table A-1 Key parameters of the equipment[4]

EIC digesters[5]	
Quantity	1
Volume (m^3)	2500
Efficiency	85%
Operation temperature	30-45℃
Manufacturer	E'zhou Changjiang Container & Machinery Co.,Ltd
Biogas generators[6]	
Set Model	500GF-NK
Quantity	1
Set Model	500GF-NK1
Quantity	3
Rated speed (r/min)	1000
Rated voltage	400V
Rated power	500KW
Power Factor	0.8
Manufacturer	CNPC Jinan Diesel Engine Company Limited
3.8t/h Waste heat boiler	
Quantity	1

[4] The parameters are cited from purchase contract and technical contract.

[5] One digester has been purchased and the other one is not yet at the time of PDD submission.

[6] Four biogas generators have been purchased and the other two are not yet at the time of PDD submission.

Type	Q27/550-3.8-1.25
Rated power	3.8t/h
Outlet steam pressure	1.25MPa
Outlet steam temperature	194℃
Designed heat efficiency	80%
Manufacturer	Wuxi Zhongzheng Boiler Co.,Ltd.

The technology adopted by the proposed project is domestic technology, so technology transfer was not involved in the proposed project.

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

The fixed crediting period of 10 years has been chosen for the proposed project. The ex-ante estimated amount of emission reductions over the crediting period is listed in Table A-2.

Table A-2 Ex-ante estimated amount of emission reductions over the first crediting period

Years	Estimation of annual emission reductions in tonnes of CO_2e
May.1st 2010-Dec.31st 2010	30,522
2011	45,782
2012	45,782
2013	45,782
2014	45,782
2015	45,782
2016	45,782
2017	45,782
2018	45,782
2019	45,782
Jan.1st 2020-Apr.30th 2020	15,260
Total estimated reductions (tonnes of CO_2e)	457,820
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period	45,782

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

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There is no public funding from Annex 1 countries involved in this project.

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

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According to Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity at the closest point.

The project owner has not registered and is not applying for the registration for other small-scale CDM project activities. Therefore the proposed project is not a debundled component of a large-scale project.

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SECTION B. Application of a baseline and monitoring methodology

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

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Methane avoidance component

AMS-III.H. "Methane Recovery in Wastewater Treatment" (version 12).

Electricity and heat generation component

AMS-I.C. "Thermal energy production with or without electricity" (version 14).

Tool to calculate the emission factor for an electricity system (version 02)

Baseline selection and additionality

Combined tool to identify the baseline scenario and demonstrate additionality (version 02.2)

For more information regarding the methodology, please refer to

http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

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

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The project activity utilizes biogas for power generation to displace the electricity imported from the grid by adopting EIC technology and biogas CHP generation technology in the existing UASB system. The project activity meets the criteria of the methodology AMS-III.H. "Methane Recovery in Wastewater Treatment" (version 12) and AMS-I.C. "Thermal energy production with or without electricity" (version 14) as indicated in Table B-1 below.

Table B-1 Methodology applicability

AMS-III.H. "Methane Recovery in Wastewater Treatment"(version 12)		
No.	**Methodology applicability**	**Project activity**
1	Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an existing anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	The proposed project introduces EIC technology to the existing wastewater treatment systems, and utilizes biogas from EIC for CHP generation. Before implementing the proposed project, biogas is emitted into the atmosphere without recovery.
2	The recovered biogas may also be utilized for thermal or electrical energy generation directly in stead of combustion/flaring.	The recovered biogas is used for thermal and electrical energy generation directly in the proposed project.
3	Measures are limited to those that result in aggregate emission	The maximum annual CO_2 emission

	reductions of less than or equal to 60kt CO_2 equivalent annually from all type III components of the project activity.	reductions are estimated to be 45,782tCO_2e, which is less than the stipulated 60,000 tCO_2e.
4	New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the requirements in the General Guidance for SSC methodologies concerning there topics. In addition the requirements for demonstration of the remaining lifetime of the equipment replaced as described in the general guidance shall be followed.	Prior to the proposed project, the processing capacity of the citric acid facility was 30,000ton/yr. The project owner planned to increase capacity to 60,000ton/yr. The existing two UASB reactors were only able to treat wastewater from a facility with capacity under 30,000ton/yr, and thus the capacity of the wastewater treatment needed to be increased. The project therefore involves a capacity increase. The proposed project complies with the requirements in the General Guidance for SSC methodologies (Refer to Section B.4 for details). The lifetime of UASB is longer than 30 years as documented on the basis of common practice[7] in the sector and the country. The two existing UASB reactors were both constructed in 2003 [8], and each has a remaining lifetime of about 23 years.
AMS-I.C. "Thermal energy production with or without electricity"(version 14)		
1	According to AMS-III.H (version 12), if the recovered biogas is used for thermal or electrical energy generation directly, that component of the project activity can use a corresponding methodology under type I	The proposed project is a cogeneration project that utilizes the recovered biogas for thermal and electricity generation directly. The electricity and heat generated are for self-use in the company, thus displace the electricity imported from the grid and the heat generated by fossil fuels. Emission reductions achieved by the thermal generation component are excluded for conservative. The installed electrical energy equipment of the cogeneration unit is 2.5MW, and another 0.5MW for standby, less than the stipulated 15MW.
2	This category comprises renewable energy technologies that supply users with thermal energy that displaces fossil fuels. Biomass-based co-generating systems that produce heat and electricity are included in this category.	
3	If the emission reductions of the cogeneration project activity are solely on account of electrical energy production, the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed	

[7] Refer to http://www.chinaep.net/feishui_shili/102/feishui_shili-468.htm

[8] Refer to *UASB Construction Contract* dated on 05/06/2003

	15MW	

B.3. Description of the project boundary:

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According to AMS-I.C. (version 14), the project boundary encompasses the physical and geographical sites of the renewable energy generation.

According to AMS-III.H (version 12), the project boundary is the physical, geographical site where the wastewater and sludge treatment takes place in baseline and project situation. It covers all facilities affected by the project activity including sites where the processing, transportation and application or disposal of waste products as well as biogas takes place. AMS-III.H (version 12) also specifies that the treatment systems not affected by the project activity, shall be described in the PDD, but emissions from those sections do not have to be accounted for in the baseline and project scenarios. As the aeration system operates in the project scenario under the same operational conditions as in the baseline scenario[9]; the emissions from the aeration system and final discharge do not have to be accounted for.

Figure 3 below shows a representation of the project boundary.

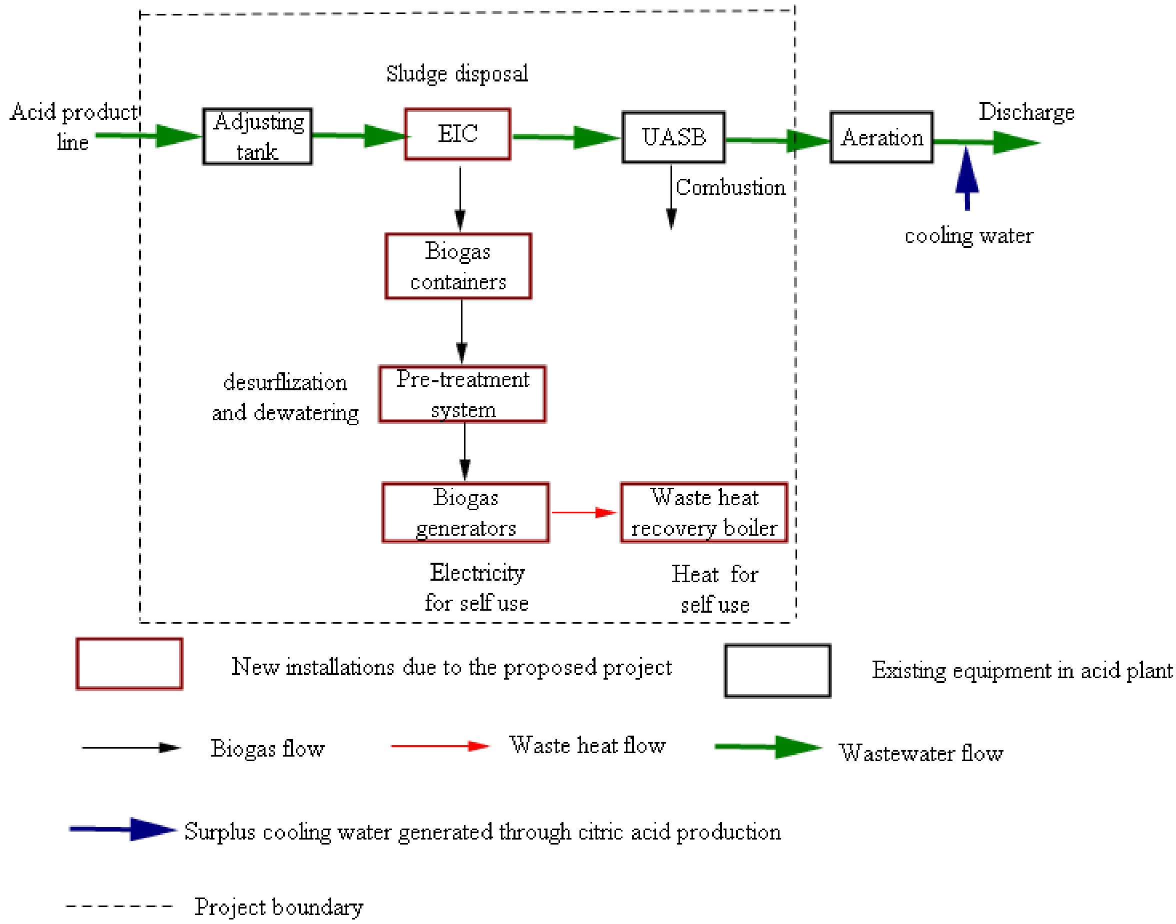

Figure 3 Project Boundary

[9] The COD content in aeration system in the project scenario is lower than that in the baseline scenario but is considered the same as in the baseline scenario conservatively, as per EB 22 annex 2 "Guidance regarding methodological issues" section E.

B.4. Description of baseline and its development:

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The baseline scenario for the proposed project includes two components, one is the baseline scenario for the replaced capacity, and the other is the baseline scenario for the additional capacity.

The baseline scenario for the replaced capacity is *Using UASB without methane recovery and electricity is imported from the grid (continuation of current situation)* according to AMS-III.H (version 12) and AMS I.C. (version 14).

As the proposed project is a Type III project activity involving capacity increase, according to the General Guidance for SSC methodologies[10] ,the baseline scenario for the additional capacity is identified using step 1-3 of the 'Combined tool to identify the baseline scenario and demonstrate additionality' (version 02.2).

Step 1: Identification of alternative scenarios

All alternative scenarios to the newly additional capacity portion of the proposed CDM project activity that can be the baseline scenario are analyzed through the following Sub-steps:

Sub-step 1a. Define alternative scenarios to the proposed CDM project activity:

As per the 'Combined tool to identify the baseline scenario and demonstrate additionality' (version 02.2), for the purpose of identifying relevant alternative scenarios, it is necessary to provide an overview of other technologies or practices that provide outputs or services with comparable quality, properties and application areas as the proposed CDM project activity and that have been implemented previously or are currently underway in the relevant geographical area. As the numbers of such projects are low, the whole of mainland China is taken as this geographic area. Eleven comparable (20,000-80,000 tons/year) citric acid plants in China have been surveyed on the measures for wastewater treatment and biogas utilization that have been implemented previously. The results of survey are summarized in the table below:

Table B-2 Wastewater treatment practices of similar plants in China

Wastewater treatment alternative	Practice
UASB and without methane recovery	8
IC and with methane recovery	2
IC and without methane recovery	1

Table B-3 Electricity generation practices of similar plants in China

Electricity generation alternative	Practice
Electricity is imported from the grid	9
Electricity is generated from biogas generators	2

Based on the common practices in the relevant sector/geographical area provided in the above survey, and the scenarios identified in the underlying methodology of AMS III.H (version 12) and AMS I.C. (version 14), alternative scenarios for wastewater treatment (W) that are available to the project participant include:

W1	Using UASB and without methane recovery
W2	Using UASB and with methane recovery

[10] Refer to "General guidance to indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories".

W3	Using IC and with methane recovery
W4	Using IC and without methane recovery
W5	Introducing EIC and without methane recovery
W6	Introducing EIC and with methane recovery, but without being registered as a CDM project activity

However, IC technology is an imported technology [11] and it costs around RMB 20,077,000 [12] (excluding the investment in the power generation component), which is almost equal to the total investment of the proposed project. The only three citric acid production plants that use this technology are foreign-owned or are part of a joint venture and thus have the financial resources to afford such technology. By contrast, the project owner has recently transferred from being a state-owned enterprise to a private-owned enterprise in 2004 and has a higher liability-asset ratio of 84% (See *Audit plan in 2005*), therefore it's not credible for the project owner to adopt such expensive technology and installation. W3 and W4 can therefore be discarded.

Therefore, the plausible alternative scenarios for wastewater treatment (W) that are available to the project participant include:

W1	Using UASB and without methane recovery
W2	Using UASB and with methane recovery
W5	Introducing EIC and without methane recovery
W6	Introducing EIC and with methane recovery, but without being registered as a CDM project activity

In the proposed project, the emission reductions from the waste heat of the biogas generators are not claimed. To be conservative, the baseline of heat consumption is defined as the project scenario, i.e. heat supplied by biogas. The heat source and utilization is therefore not demonstrated in the baseline analysis.

Alternative scenarios for electricity generation (P) that are available to the project participant include:

P1	Electricity is imported from the grid;
P2	Electricity is produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid);
P3	Electricity is produced in an on-site captive power plant using biomass (with a possibility of export to the grid);
P4	Electricity is produced in a co-fired system.
P5	Electricity is produced from biogas generators, but without being registered as a CDM project activity

However, as biomass is not available at the project site, scenario P3 is not credible so can be discarded. In scenario P4, co-fired system uses both fossil and renewable fuels, while in the project site, there are no renewable fuels available, thus scenario P4 can be discarded.

Therefore, the plausible alternative scenarios for electricity generation (P) that are available to the project participant include:

[11] Xu Yingjie, Feng Guiying "Biological characteristics of anaerobic granular sludge in industrial-scale IC reactor "*Techniques and Equipment for Environmental Pollution Control* 2005 4:Page 85

[12] Quotation on IC technology provided by PAQUES dated on 18/05/2004

P1	Electricity is imported from the grid;
P2	Electricity is produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid);
P5	Electricity is produced from biogas generators, but without being registered as a CDM project activity

The combinations of each scenario include:

W1+ P1; W1 + P2; W1+P5;

W2 + P1; W2 + P2; W2 +P5;

W5 +P1; W5 + P2; W5 + P5;

W6 + P1; W6 + P2; W6 + P5.

Scenario W1+P5 and scenario W5+P5 are not realistic as biogas could not be utilized for power generation if they are not recovered. For scenario W2+P1, scenario W2+P2 , scenario W6+P1 and scenario W6+P2, biogas are recovered but not utilized, which is neither realistic nor attractive for the project owner.

Outcome of step 1a:

Possible combinations of scenario to be as follows:

W1+P1	Using UASB without methane recovery and electricity is imported from the grid;
W1+P2	Using UASB without methane recovery and electricity is produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid);
W2+P5	Using UASB with methane recovery and electricity is produced from biogas generators, but without being registered as a CDM project activity;
W5+P1	Introducing EIC without methane recovery and electricity is imported from the grid;
W5+P2	Introducing EIC without methane recovery and electricity is produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid);
W6+P5	Introducing EIC with methane recovery and electricity is produced from biogas generators (The proposed project but not developed as CDM project)

Sub-step1b. Consistency with mandatory applicable laws and regulations:

The applicable regulations for wastewater treatment in citric acid industry include:

The discharge standard of pollutants for citric acid industry (GB 19430-2004);

Integrated emission standard of air pollutants (GB 16297-1996);

Ambient air quality standard (GB3095-1996)

These regulations have no specific requirements on capture or utilization of the methane gas generated through wastewater treatment. Prior to the proposed project, the project owner adopts the UASB process, which is also the common practice for wastewater treatment in the citric acid sector[13]. The EIC technology adopted in the project is a newly invented domestic technology. All of the above mentioned wastewater treatment technologies are in line with the applicable laws and regulations. Therefore, the plausible scenarios are still W1, W2, W5 and W6.

According to China's regulations, construction of fuel-fired power plants with the installed capacity lower than 135MW[14] is prohibited in the areas which can be covered by large grids such as provincial

[13] Xie Xin Zhang Zhenlin etc "Status in Quo of Citric Acid Industrial Wastewater Treatment" *Industrial Water Treatment* 2004 24 (1):8-11
Tian Zhihai Wang Zengzhang "Study on the treatment of citric acid wastewater" *Shanxi Architecture* Vol.33 No.35 Dec.2007 Page 19

[14] Notice of the General Office of the State Council concerning the Strict Prohibition for Construction of Thermal

grids, thus scenario P2 is not in line with the applicable laws and regulations. Therefore, the plausible scenarios are P1 and P5

Outcome of step 1b:

Possible combinations of each alternative scenario are described as follows:

W1+P1	Using UASB without methane recovery and electricity is imported from the grid;
W2+P5	Using UASB with methane recovery and electricity is produced from biogas generators, but without being registered as a CDM project activity;
W5+P1	Introducing EIC without methane recovery and electricity is imported from the grid;
W6+P5	Introducing EIC with methane recovery and electricity is produced from biogas generators (The proposed project but not developed as CDM project)

Step 2: Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. Apply the following Sub-steps:

Sub-step 2a: Identify barriers that would prevent the implementation of alternative scenarios

The investment, technical and prevailing practice barriers are described in Section B.5.

Outcome of step 2a:

In conclusion, investment, technical and prevailing practice barriers identified above may prevent one or more alternative scenarios from occurring.

Sub-step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

As described in Section B.5, the technical and prevailing practice barriers of installing biogas generation are high. Therefore scenario W2+P5 can be excluded.

As described in Section B.5, the technical and prevailing practice barriers of EIC wastewater treatment technology are high. Therefore scenario W5+P1 can be excluded.

As described in Section B.5, the technical, investment and prevailing practice barriers of EIC wastewater treatment technology with biogas treatment are high. Therefore scenario W6+P5 can be excluded.

Therefore, only scenario **W1+P1** is not prevented by any barriers and it is identified as the baseline scenario.

Step 3: Investment analysis

Step 3 is not adopted.

It can be concluded that the most plausible baseline scenario for the additional capacity is the same as the replaced capacity in the baseline of the methodology, i.e. *Using UASB without methane recovery and electricity is imported from the grid*.

Power Plants with the Capacity of less than 135 MW within the Grid Connected Area, GUOBANFAMINGDIAN
〔2002〕Document No.6

Table B-4 below delineates the data/ information about the project facility for calculation of baseline emissions as per the baseline scenario indicated above.

Table B-4 Parameters for baseline emissions calculation

Parameter	Variable	Value	Unit	Source
Annual wastewater treated in baseline from 2010-2020	$Q_{ww, BL,y}$	160	10,000m^3	FSR
COD in the untreated wastewater in baseline	$COD_{,ww, untreated BL,y}$	11,000	mg/L	FSR
COD removed by UASB in baseline	$COD_{removed,UASB, BL,,y}$	7,700	mg/L	Measured as the difference between inflow COD and outflow COD. Conservative data estimated based on historical records
Methane correction factor in the UASB in baseline	$MCF_{ww, treatment,BL,UASB}$	0.8		Table III.H.1 in AMS.III.H
Maximum methane producing capacity	$B_{0,ww}$	0.21	$kgCH_4/kgCOD$	AMS.III.H
Global warming potential for CH_4	GWP_{CH4}	21		UNFCCC
Grid emission factor of the CCPG	EF_{CO2}	0.9735	tCO_2/MWh	China DNA
Energy baseline	$EG_{BL,y}$	15,000	MWh	FSR

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

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According to Attachment A to Annex B of the simplified modalities and procedures for CDM small-scale project activities, explanation must be provided to show that the project activity would not have occurred anyway due to at least one of the following barriers: investment barrier, technological barrier, barrier due to prevailing practice and other barriers.

The proposed project activity faces the following barriers:

Investment barrier

The project faces significant investment barriers, both due to the financial situation of the project owner and the relatively high risk nature of the immature technology (see barriers to prevailing practice below) used in the project activity.

Firstly, the project owner's financial capacity is weak. The project owner has high levels of debt, with a liability-asset ratio of 84%[15]. The project owner only owns one factory[16] and is a private company.

[15] Refer to Financial audit report in 2005

In China it is also well documented that private companies struggle to raise finance compared to their state owned counterparts.[17]

Secondly the project owner was inexperienced in implementing this type of project. It was the first time the company had installed wastewater treatment systems that included biogas generators. Moreover, as described below, EIC wastewater treatment with power generation is a relatively new, untried technology. The project owner's lack of experience meant they could not accurately know the future costs of the project, as further maintenance, and further equipment may be required. Nor would the project owner be able to accurately predict revenue, as a new project is liable to increased downtime and uncertain efficiency levels.

These two factors led to the Huangshi City Commercial Bank rejecting the project owner's application for a loan in March 2005. Due to this lack of financial support for the project, the board decided to apply for CDM finance. The project owner then applied for a loan at the local branch of the Bank of Communications in April 2005, who agreed to grant a loan as long as CDM revenue would be used as a guarantee. The bank issued a loan intent letter stating clearly that the bank would issue a loan of RMB9m if the project owner applied for the loan within the next 24 months.

The PO, with confidence he would now receive future financial support from the bank, began to sign service agreements with certain suppliers, such as the EIC equipment provider, in May 2005. To avoid loan interest repayments, between May 2005 and December 2005 the project owner was able to pay deposits with a total value of RMB2m with their own finances. Then in January 2006 and May 2006[18] the two loan installments of RMB3m and RMB6m respectively were issued by the bank to cover the remaining costs of the equipment contracts.

Technical barrier

The project adopts EIC wastewater treatment technology, which, as described in the barriers to prevailing practice, is an immature technology. It has a high technology failure risk particularly in the heavy loss of sludge, which will decrease the EIC treatment efficiency, and might even lead to the failure of the treatment system[19]. The failure of the treatment system has the potential to reduce revenue, due to increased downtime.

In addition, the project adopts biogas generators technology which is also a relatively high risk technology. The exhaust temperature of the domestic gas generators is very high and the gas valves as well as the gas tank lids are very vulnerable. The lifespan of the domestic biogas generators are short, while the operational and maintenance cost is high.[20] The project's revenue may thus be reduced by frequent maintenance and shutdown.

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[16] Refer to Business License of the project owner

[17] http://www.usitc.gov/publications/332/journals/access_to_capital_china.pdf,
http://www2.mckinsey.com/mgi/mginews/chinacapital.asp

http://chinaperspectives.revues.org/614

http://www.fas.harvard.edu/~asiactr/publications/pdfs/Huang%20et%20al.pdf p5-8

[18] Refer to Bank Loan Contracts dated 14/01/2006 and 05/05/2006

[19] Chen Xie "Research on UASB retrofit and EIC"
http://www.paper.edu.cn/paper.php?serial_number=200511-243

[20] Ran Guowei,,Zhang Rukun etc " The Analysis of Present Situation of Methane Electricity Generation and its Discussion of Developing Direction" *Agricultural Engineering Study* 2006 3 (3):189-191
http://hnnh.haagri.gov.cn/asp/showdetail.asp?id=35868

The immaturity, high risk nature, and lack of experience of both types of technology made it very difficult for the project owner to quantify how such technical risks would impact on the project's revenue and costs, including training costs.

In the actual operation period training costs did not have a significant impact on the project's financial returns. However technical problems did directly affect the financial returns of the project. Operating hours in the first two and a half years have been 50% lower than expected (actual operating hours of 3,648 hours against predicted operation hours of 7,200), due to frequent maintenance and shutdown. These reduced operating hours demonstrate that the technical barriers were real and significant.

Barriers due to prevailing practice

The project was the first that used EIC technology in the citric acid in Hubei province. In China as a whole, using EIC wastewater treatment technology is not the prevailing practice in the citric acid sector. Nor is EIC the prevailing practice across all industries that produce organic wastewater. EIC was only patented in 2004[21], and at project start date there were only 3 other projects in all industries that used EIC in China[22].

EIC is a 'third generation' wastewater treatment technology. Other technologies that belong to this third generation include IC and EGSB technologies. IC and EGSB are also not the prevailing practice in the citric acid or in other industries. A paper published in 2005 showed that of the more than 16,000 facilities in China which produce large amounts of wastewater, less than 1% used third generation technologies.[23] [24] In addition, of the 30 Chinese wastewater plants applying for CDM, 18 projects use UASB technology, while only 2 use IC (incl.1 with UASB) and 5 use EGSB (incl.1 combined with UASB). Third generation technologies are not the prevailing practice in the citric acid sector, or elsewhere.

In addition, the proposed project includes biogas power generation, which is also not prevailing practice in China in industries that produce large amounts of wastewater. According to a survey published in 2007, only 3% of facilities that produce organic wastewater in all industries in China use biogas generation technology to produce electricity[25]. Biogas generation technology is not the prevailing practice across industries that produce organic wastewater in China.

As can be seen, the two important technical aspects of the project, EIC wastewater and biogas generation are not the prevailing practice in the citric acid sector, and elsewhere. Therefore the barriers to prevailing practice can be considered high.

Conclusion of the additionality assessment

From the barrier analysis it can be concluded that without the support from CDM and the additional revenues from CERs, the proposed project would not be able to overcome the investment, technology and prevailing practice barriers, and thus would not have occurred without CDM finance. The CDM

[21] Refer to Patent No. ZL200420023281.4

[22] Refer to Evidence on EIC first use in Hubei Province dated 25/09/2005

[23] Gushuhua "Biogas Resource and Development Utilization in China", 09/2005, , China Renewable Energy Development Strategy Workshop.

[24] Shen Zhenhuan " Current situation, problems and suggestions on the organic wastewater middle/large biogas projects in China" China Biogas 2005,23

[25] Wang Gang, Liu Wei "Current Status and Prospect of Biogas Technology in China", Application Energy Technology, 2007(12): P33.

incomes alleviate the barriers that prevent the proposed project activity from occurring. Therefore, the project is shown to be additional.

The following table shows the timelines of the key events of the proposed project. As per paragraph 67 of EB 41, the project start date is chosen as the EIC Service Agreement date (9th May 2005). The first supporting evidences for "CDM awareness" are dated in 2004 and are described in the table below. The decision to develop the proposed Project was taken during a board meeting held in 18th April 2005 based on the assumption that the technical risks could be reduced only if CDM revenues are taken into consideration. After the project start date, many actions were taken "to secure CDM status for the project in parallel with its implementation". The table reports many events as contact with CDM consultant on 26th October 2006 and first ERPA with Carbon Asset Management Sweden AB on 25th October 2007, and final ERPA with Climate Bridge Ltd on 18th June 2008, showing that the PO was actively and continuously looking for CDM services.

Table B-5 Timeline of project implementation and CDM consideration

Time	Project Implementation
May,2004	Project Environment Impact Assessment Report (EIA)
June 1st ,2004	Approval of project EIA
Novemeber,2004	Project Feasibility Study Report
December 4th 2004	Approval of project FSR
May 9th 2005[26]	EIC Service Agreement
June 3rd 2005	EIC Equipment Manufacturing Agreement
December 7th 2005	Biogas Generator Purchase Agreement
January 10th 2006	Powerhouse Construction Agreement
April 2010	Expected construction completion date
Time	**CDM Consideration**
April 18th 2005	Board Resolution with decision of implementation CDM activity
April 25th 2005	Bank Loan Intent Letter issued indicating CDM consideration
January 14th 2006	Bank Loan Contract indicating CDM consideration
October 26th 2006	CDM Consultation Agreement
January 26th 2007	Emissions Reduction Purchase Agreement with Carbon Asset Management Sweden AB
October 25th 2007	Letter delivered by Carbon Asset Management to terminate the ERPA and resign all rights to the project
June 18th 2008	Emission Reduction Purchase Agreement with Climate Bridge Ltd.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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[26] The starting date of the project activity

The ex-ante emission reductions for the methane recovery are estimated according to the approved methodology *Methane Recovery in Wastewater Treatment* AMS-III.H (version 12).

The ex-ante emission reductions resulting from the generation of electricity (the emission reductions resulting from heat generation is excluded from calculation as conservative) are estimated according to the approved methodology *Thermal energy production with or without electricity* AMS-I.C (version 14).

Baseline Emissions

The electricity generated by the project displaces part of the electricity imported from the CCPG. According to the approved methodology *Thermal energy production with or without electricity* AMS-I.C (version 14), it specifies that baseline emissions for supply of electricity to and/or displacement electricity from a grid shall be calculated as per the procedures detailed in AMS I.D, the emission factor is calculated with the "*Tool to calculate the emission factor for an electricity system*" (version 02). The baseline emission factor (EF_y) could be calculated as the weighted value (Combined Margin, *CM*) of grid operational margin (*OM*) and building margin (*BM*).

The calculation of EF_y follows three steps:

Step 1: Identify the relevant electricity systems

Power generation of the project activity will displace the electricity generated by power plants connected to the Central China Power Grid (CCPG) which is delineated by China's DNA. Therefore the project electricity system is CCPG that covers Henan Province, Hubei Province, Hunan Province, Jiangxi Province, Sichuan Province and Chongqing Municipality, according to the guideline by China DNA[27].

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option I: Only grid power plants are included in the calculation is chosen by the project participants to calculate the operating margin and build margin emission factor.

Step 3: Select a method to determine the operating margin (*OM*)

Four alternative methods are available for the calculation of operating margin emission factor ($EF_{OM,y}$) as follows:

a) Simple *OM,* or
b) Simple adjusted *OM*, or
c) Dispatch data analysis *OM*, or
d) Average *OM*.

For the proposed project, the method (a) Simple *OM* was chosen because low-cost/must-run resources constitute less than 50% of total grid generation. According to the *China Electric Power Yearbook* 2003-2007, in the most recent 5 years (2002-2006), the proportions of low-cost/must run resources in the total electricity output in CCPG were 37.86%, 34.8%, 40.45%, 38.67%, and 36.40% respectively, which are much less than 50%.

The Simple *OM* emission factor can be calculated using either of the two following data vintages for years(s) *y*:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of CDM-PDD to the DOE validation, without requirement to monitor and recalculate

[27] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889

the emission factor during the crediting period, or

- Ex post option: The year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring.

This PDD uses the most recent three years data for $EF_{OM,y}$ calculation.

Step 4: Calculate the operating margin emission factor according to method (a) the Simple *OM*

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

(A) Based on data on fuel consumption and net electricity generation of each power plant
(B) Based on data on net electricity generation, the average efficiency of each power unit and the fuel types used in each power unit, or
(C) Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project activity, since data for option A and B is not available, option C is used for calculating project OM as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad (1)$$

Where:

$EF_{grid,OM simple,y}$	is simple operating margin CO_2 emission factor in year *y* (tCO_2e/MWh)
$FC_{i,y}$	is amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	is net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ. mass or volume unit)
$EF_{co_2,i,y}$	is CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2e/GJ)
EG_y	is net electricity generated and delivered to the grid by all power sources serving the system, no including low-cost/must-run power plants/units, in year *y* (MWh)
I	is all fossil fuel types combusted in power sources in the project electricity system in year *y*
Y	is the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).

The $EF_{OM,y}$ of the CCPG is calculated as 1.2783 tCO_2e/MWh. Details of the calculations are presented in Annex 3.

Step 5: Identify the group of power units to be included in the build margin *(BM)*

The sample group of power unit *m* used to calculate the build margin consists of either:
(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation in MWh and that have been built most recently.

Project participants should use the set of power units that comprises the larger annual generation.

In terms of vintage of data, this PDD chooses option (a) among two options, that is, for the first crediting period, to calculate the build margin emission factor ex-ante based on the most recent

information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (2)$$

Where:

$EF_{grid,BM,y}$	is Build margin CO_2 emission factor in year *y* (CO_2e/MWh)
$EG_{m,y}$	is net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	is CO_2 emission factor of power unit m in year *y* (tCO_2e/MWh)
m	is power units included in the build margin
y	is most recent historical year for which power generation data is available.

However, the data that can be used to determine the sample group of power units m either from five existing power plants that are built most recently, or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently is not available in China. EB accepts [28] the following deviation in methodology application:

First, to calculate the newly added installed capacity and the contribution component of other various power generation technologies, then calculate the weight of newly added installed capacity of each power generation technology. Finally the commercial and efficient level of each power generation technology is adopted to calculate *BM* emission factor.

Since the generating capacity of coal-fired, oil-fired and gas-fired technologies can not be separated from the existing statistical data, the *BM* calculation in this PDD adopts the following method:

First, based on the available data of the most recent one year, determine the ratio of CO_2 emissions from coal, oil and gas fuels consumption for power generation to total CO_2 emissions;

Second, take the ratio as the weight to multiply with the respective emission factors based on commercially available best practice technology in terms of efficiency

Finally, this thermal emission factor is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the *BM* emission factor of grid.

Concrete steps and the formula for *BM* are as follows:

Sub-Step 1: Calculate the proportion of CO_2 emissions from solid, liquid and gaseous fuels corresponding to the total emissions of CO_2 emissions.

[28] http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM

$$\lambda_{Coal} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}} \quad (3)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}} \quad (4)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}} \quad (5)$$

Where:

$F_{i,j,y}$	is the amount of fuel *i* (tce) consumed by plants in province *j* in year *y*
NCV i, y	is the net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
EFco2,i,j,y	CO2 emission factor of fossil fuel type i in province j in year y

Coal, Oil and Gas is the feet for solid fuels, liquid fuels and gas fuels.

Sub-Step 2: Calculate the emission factor of thermal power ($EF_{Thermal}$)

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (6)$$

$EF_{Coal,\,Adv}$, $EF_{Oil,\,Adv}$, $EF_{Gas,\,Adv}$ represents the emission factors of the optimal efficient and commercial coal-fired, oil-fueled and gas-fueled technologies.

Sub-Step 3: Calculation of *BM* in the grid

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (7)$$

Where:

$CAP_{thermal,,y}$	is the added installed capacity of thermal power generation sources (MW) in year y
$CAP_{total,\ y}$	is the total added installed capacity of all kinds of power generation sources (MW) in year y which is close to but less than 20% of the existing installed capacity
$EF_{Thermal,y}$	is the emission factor of thermal power plants in year y

The key parameters used to calculate *BM* emission factor include: the low calorific value of each fuel, the oxidation rate, the potential emission factors and the efficiency of various power generation technologies. Please refer to the selection of these values in Annex 3 and DNA report for Central China Power Grid.

According to the latest and available data at the time of this PDD submission, $\boldsymbol{EF_{BM,y}}$ is calculated to be 0.6687 tCO_2/MWh. Please refer to Annex 3 for the details of calculation.

Step 7: Calculate the combined margin emission factor *(CM)*

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \quad (8)$$

For the proposed project, the weight ω_{OM} and ω_{BM}, by default, are 50%.
EF $_{grid,CM,y}$=1.2783*0.5+0.6687*0.5=0.9735 tCO_2/MWh

The baseline emissions for electricity imported from the grid should be calculated as the amount of electricity produced with the renewable energy technology (GWh) multiplied by the CO_2 emission factor of that grid. In the case of the proposed project, the grid where the electricity imported is the CCPG. Therefore, the baseline emissions for electricity imported from the CCPG are calculated as:

$$BE_{power,y} = EG_{BL,y} \times EF_{CO_2} \quad (9)$$

Where:

$BE_{power,y}$	Baseline emissions in year y , tCO_2e
$EG_{BL,y}$	Energy baseline in the year y , tCO_2e
EF_{CO2}	Emission factor of the CCPG, tCO_2e/MWh, refer to Annex 3 for the detailed calculation.

The baseline emissions in the wastewater treatment are calculated according to the approved methodology *Methane Recovery in Wastewater Treatment* AMS-III.H (version 12) and the baseline emissions from electricity consumption on wastewater treatment are excluded from calculation as conservative.

$$BE_{ww,y} = \{ BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y} \} \quad (10)$$

The sludge from UASB process in the baseline scenario and the sludge from UASB process in the project scenario are treated in the same way, the emissions from sludge treatment are considered as the same in the baseline and project scenario conservatively[29].Thus, $BE_{s,treatment,y}$ and $BE_{s,final,y}$ shall be neglected. The aeration system operates in the project scenario under the same operational conditions as in the baseline scenario[30]; the emissions from the aeration system and final discharge do not have to be accounted for. Thus, $BE_{ww,discharge,y}$ shall be neglected. Therefore,

$$BE_{ww,y} = BE_{ww,treatment,y} \quad (11)$$

Where:

$BE_{ww,y}$	Baseline emissions in wastewater treatment system year y , tCO_2e
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems affected by the project activity in year y , tCO_2e

$$BE_{ww,treatment,y} = \sum_{UASB} Q_{ww,UASB,BL,y} * COD_{removed,UASB,BL,y} * MCF_{ww,treatment,UASB,BL} * B_{0,ww} * UF_{BL} * GWP_{CH4} \quad (12)$$

Where:

$Q_{ww,UASB,BL,y}$	Volume of wastewater treated in baseline wastewater treatment system *UASB* in year y , m^3

[29] as per EB 22 annex 2 "Guidance regarding methodological issues" section E,

[30] The COD content in aeration system in the project scenario is lower than that in the baseline scenario but is considered the same as in the baseline scenario conservatively, as per EB 22 annex 2 "Guidance regarding methodological issues" section E.

$COD_{removed,UASB,BL,y}$	Chemical oxygen demand removed by baseline treatment system *UASB* in the year y , t/m[3], measured as the difference between inflow COD and the outflow COD in system *UASB*
$MCF_{ww,treatment,UASB,BL}$	Methane correction factor for baseline wastewater treatment system *UASB*
$B_{o,ww}$	Methane producing capacity of the wastewater ,kg CH_4/kg COD
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

In general, $BE_{y} = BE_{power,y} + BE_{ww,treatment,y}$ *(13)*

Project Emissions

The project emissions are the sum of the emissions through electricity consumption by wastewater treatment system (including sludge treatment system) and power generation system in the project scenario, methane emissions from sludge treatment in EIC process and methane emissions from UASB treatment[31], biogas release in capture systems.

$$PE_{y} = PE_{power,y} + PE_{ww,treatment,UASB,y} + PE_{s,treatment,y} + PE_{fugitive,y} \quad (14)$$

Where:

PE_y	Project activity emissions in the year *y* (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year *y* (tCO_2e)
$PE_{ww,treatment,,UASB,y}$	Emissions from UASB treatment in the year *y* (tCO_2e)
$PE_{s,\ treatment,y}$	Methane emissions from sludge treatment systems in the year *y* (tCO_2e)
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year *y*, (tCO_2e)

Emissions from electricity consumption are calculated as:

$$PE_{power,y} = EG_{power,PJ,y} \times EF_{CO_2} \quad (15)$$

$$EG_{power,PJ,y} = EG_{power,ww,PJ,y} + EG_{power,eg,PJ,y} \quad (16)$$

Where:

$PE_{power,PJ,y}$	Project emissions from electricity consumption in the year y , tCO_2e
$EG_{power\ ww,,PJ,y}$	Electricity consumption in the wastewater treatment system (including sludge treatment system) of the project activity in the year y , tCO_2e
$EG_{power,eg,PJ,y}$	Electricity consumption in the electricity generation system of the project activity in the year y , tCO_2e
EF_{CO2}	Grid emission factor of the CCPG , tCO_2e/MWh

Emissions from UASB treatment are calculated as:

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[31] In fact, as the pressure of biogas generated from UASB is different from EIC treatment system, regarding the biogas generated from UASB, the project owner compared with other options and finally decided to collect the biogas from the UASB treatment in the project scenario for combustion. Accords with simple and conservative principle, it is assumed that the biogas in this process is emitted into the atmosphere.

$$PE_{ww,treatment,UASB,y} = \sum_{UASB} Q_{ww,UASB,PJ,y} * COD_{removed,UASB,PJ,y} * MCF_{ww,treatment,UASB,PJ} * B_{0,ww} * UF_{PJ} * GWP_{CH4} \quad (17)$$

Where:

$Q_{wwUASB,PJ,,y}$	Volume of wastewater treated in UASB treatment system in the project scenario in year y , m^3
$COD_{removed,UASB,PJ,y}$	Chemical oxygen demand removed by UASB treatment system in the project scenario in the year y , t/m^3, measured as the difference between inflow COD and the outflow COD
$MCF_{ww,treatment,UASB,PJ}$	Methane correction factor for UASB treatment system in the project scenario
$B_{o,ww}$	Methane producing capacity of the wastewater ,kg CH_4/kg COD
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

The sludge generated through EIC process can be used for anaerobic digestion in other facilities, which are assumed to be not equipped with biogas recovery, the methane emissions from the sludge treatment system affected by the project activity is calculated in a conservative manner as follows:

$$PE_{s,treatment,y} = \sum_{EIC} S_{EIC,PJ,y} * MCF_{s,treatment,EIC,PJ} * DOC_s * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad (18)$$

Where:

$S_{EIC,PJ,y}$	Amount of dry matter in the sludge that is treated by the sludge treatment system j in the project activity; (tonne)
DOC_s	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis). Default values of 0.5 for domestic sludge and 0.257 for industrial sludge;
$MCF_{s,treatment,EIC,,PJ}$	Methane correction factor for the sludge treatment system EIC in the project activity;
UF_{PJ}	Model correction factor to account for model uncertainties (1.06);
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5);
F	Fraction of CH_4 in biogas (IPCC default value of 0.5);

As the project activity assumes the sludge generated through EIC process is used for anaerobic digestion in other facilities without biogas recovery, it involves no methane release in the sludge treatment system, the project activity emissions from methane release in capture systems are determined as follows:

$$PE_{fugitive,y} = PE_{ww,fugitive,y} \quad (19)$$

Where:

$PE_{ww,fugitive,y}$	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO_2e)

$$PE_{ww,fugitive,y} = (1 - CEF_{ww}) \times MEP_{ww,treatment,y} \times GWP_{CH4} \quad (20)$$

Where:

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)
$MEP_{ww,treatment,y}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (t)

$$MEP_{ww,treatment,y} = Q_{ww,y} \times B_{o,ww} \times UF_{PJ} \times \sum_k COD_{removed,PJ,EIC,y} \times MCF_{ww,treatment,EIC,PJ} \quad (21)$$

Where:

$COD_{removed,PJ,EIC,y}$	The chemical oxygen demand removed by EIC of the project activity equipped with biogas recovery in the year *y* (tonnes/ m^3)
$MCF_{ww,treatment,EIC,PJ,}$	Methane correction factor for the project wastewater treatment EIC equipped with biogas recovery equipment
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)

Project leakage

The project involves no equipment transfer, so LE_y is considered as 0 tCO_2e as per AMS III.H.

Emission Reductions

According to AMS-III.H. (version 12), the emission reductions achieved by the project activity is limited to the ex-post calculated baseline emissions minus project emissions using the actual monitored data for the project activity. The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,\exp ost} = \min\left(\left(BE_{y,\exp ost} - PE_{y,\exp ost} - LE_{y,\exp ost}\right),\left(MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,\exp ost}\right)\right)$$
(22)

Where:

$ER_{y,ex\,post}$	Emission reductions achieved by the project activity based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\,post}$	Baseline emissions calculated using *ex post* monitored values
$PE_{y,ex\,post}$	Project emissions calculated using *ex post* monitored values
$LE_{y,ex\,post}$	Project leakage calculated using *ex post* monitored values
MD_y	Methane captured and destroyed/gainfully used by the project activity in the year *y* (tCO_2e).
$PE_{power,y}$	Emissions from electricity consumption in the year *y*(tCO_2e)
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. No biomass stored due to the project activity, it is not necessary to monitor $PE_{biomass,y}$

In the proposed project,

$$MD_y = MD_{electricity,y} = Q_{biogas,y} * w_{CH4,y} * D_{CH4} * GWP_{CH4} \quad (23)$$

Where:

$Q_{biogas,y}$	biogas combusted in year *y* (m^3)
$w_{CH4,y}$	Methane content in the biogas in the year *y* (mass fraction)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year *y* (tonnes/ m^3)
GWP_{CH4}	Global Warming Potential of methane

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

Data / Parameter:	$FC_{i,j,y}$
Data unit:	10^4t or 10^8m^3
Description:	The amount of fuel *i* consumed in the project electricity system in the province *j* in year *y*
Source of data used:	*China Energy Statistical Yearbook 2005-2007*
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics data
Any comment:	Used for the calculation of $EF_{OM, y}$ and $EF_{BM, y.}$

Data / Parameter:	$NCV_{i,y}$
Data unit:	TJ/t , or TJ/km^3
Description:	The net calorific value (energy content) of fossil fuel type *i*
Source of data used:	*China Energy Statistical Yearbook 2007*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Used for the calculation of $EF_{OM,y}$ and $EF_{BM,y}$

Data / Parameter:	$EF_{CO2,,i,j,y}$
Data unit:	tC/TJ (which can be converted to tCO_2e/TJ)
Description:	The CO_2 emission factor per unit of energy of fossil fuel type *i* in province *j*
Source of data used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the latest version of '*Tool to calculate the emission factor for an electricity system*' (version 02), the proposed project uses the IPCC default values.
Any comment:	Used for the calculation of $EF_{OM,y}$ and $EF_{BM,y}$

Data / Parameter:	GWP_{CH4}
Data unit:	
Description:	Global warming potential for CH_4
Source of data used:	*IPCC1995*
Value applied:	21
Justification of the choice of data or description of	

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$B_{o,ww}$
Data unit:	$kgCH_4/kgCOD$
Description:	Methane producing capacity of wastewater treatment
Source of data used:	IPCC default value, refer to AMS-III.H (version 12)
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$MCF_{ww,treatment, UASB ,BL}$
Data unit:	
Description:	Methane correction factor in baseline
Source of data used:	IPCC default value, refer to Table III.H.1 in AMS-III.H (version 12)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	UASB treatment in baseline can be regarded as type of *anaerobic reactor without methane recovery,* whose MCF value is 0.8.
Any comment:	

Data / Parameter:	$COD_{removed, UASB,BL,,y}$
Data unit:	mg/L
Description:	Chemical oxygen demand removed in baseline
Source of data used:	Determined by COD inlet and outlet as well as COD removal efficiency of UASB in baseline
Value applied:	7,700
Justification of the choice of data or description of measurement methods and procedures actually applied :	Conservative data from historical records
Any comment:	

Data / Parameter:	DOC_s
Data unit:	
Description:	Degradable organic content of the untreated sludge generated (fraction, dry basis)
Source of data used:	Default value, refer to AMS-III.H (version 12)
Value applied:	0.257

Justification of the choice of data or description of measurement methods and procedures actually applied :	The sludge generated by citric acid production sector belongs to industrial sludge.
Any comment:	

Data / Parameter:	DOC_F
Data unit:	
Description:	Fraction of DOC dissimilated to biogas
Source of data used:	IPCC default value, refer to AMS-III.H (version 12)
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	F
Data unit:	
Description:	Fraction of CH_4 in biogas
Source of data used:	IPCC default value, refer to AMS-III.H (version 12)
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$MCF_{s,treatment,EIC,\ PJ}$
Data unit:	
Description:	Methane correction factor in the sludge treatment system in the project activity
Source of data used:	IPCC default value, refer to AMS-III.H (version 12)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	EIC treatment in project scenario can be regarded as type of *anaerobic digester for sludge without methane recovery,* whose MCF value is 0.8.
Any comment:	

Data / Parameter:	$Q_{ww,BL,y}$
Data unit:	m^3
Description:	Volume of treated wastewater in the baseline situation

Source of data used:	Feasibility Study Report
Value applied:	1,600,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	CFE_{ww}
Data unit:	
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems
Source of data used:	AMS-III.H (version 12) default value
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$MCF_{ww,treatment, EIC,PJ}$
Data unit:	
Description:	Methane correction factor of the EIC wastewater treatment system in the project situation.
Source of data used:	IPCC default value, refer to AMS-III.H (version 12)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	EIC treatment in project scenario can be regarded as type of *anaerobic reactor without methane recovery,* whose MCF value is 0.8.
Any comment:	

Data / Parameter:	$MCF_{ww,treatment, UASB, PJ}$
Data unit:	
Description:	Methane correction factor of the UASB wastewater treatment system in the project situation.
Source of data used:	IPCC default value, refer to AMS-III.H (version 12)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	UASB treatment in project scenario can be regarded as type of *anaerobic reactor without methane recovery,* whose MCF value is 0.8.
Any comment:	

Data / Parameter:	$\rho_{CH4,n}$
Data unit:	kg/m^3
Description:	Density of methane in normal state
Source of data used:	UNFCCC annex 13
Value applied:	0.716
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

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

>>

The baseline emissions and project emissions are calculated based on the following data:

Table B-6 Parameters and data for emission reductions calculation

Parameter / year	**2010-2020**	**Source**
$Q_{ww,PJ,y}$（$10,000m^3/a$）	160	FSR
COD inlet（mg/L）	11,000	FSR
$Q_{ww,UASB,PJ,y}$（$10,000m^3/a$）	160	FSR(conservative data)
$COD_{removed, EIC ,PJ, y}$ (mg/L)	9,350 (11,000-1,650)	FSR
$COD_{removed, UASB, PJ,y}$ (mg/L)	650(1,650-1,000)	FSR
S_{EIC}(t)	29.92	Literature[32]
$EG_{ww,power,PJ,y}$ (MWh)	152	FSR
$EG_{BL,y}$（MWh）	15,000	FSR

Baseline emissions

According to AMS.I.C (version 14), the baseline emissions realised by the biogas generated electricity are calculated as:

$$BE_{y} = BE_{power,y} + BE_{ww,treatment,y}$$

$$= EG_{BL,y} \times EF_{CO_2} + \sum_{UASB} Q_{ww,UASB,BL,y} * COD_{removed,UASB,BL,y} * MCF_{ww,treatment,BL,UASB} * B_{0,ww} * UF_{BL} * GWP_{CH4}$$

=15,000*0.9735+1,600,000*0.0077*0.8*0.21*0.94*21

=14,602+40,857

=55,459 tCO_2e

Project emissions

According to AMS.I.C (version 14), the project emissions are 0 tCO_2e.

According to AMS.III.H (version 12), the project emissions are calculated as:

[32] Refer to http://www.iwatertech.com/sludge-reduce/3926.htm, http://wenda.tianya.cn/wenda/thread?tid=4108e08cf7b5f5f8&clk=wttpcts

$$PE_{y} = PE_{power,y} + PE_{ww,treatment,UASB,y} + PE_{s,treatment,y} + PE_{fugitive,y}$$

$$PE_{power,y} = EG_{power,PJ,y} \times EF_{CO_2}$$

=152*0.9735

=148 tCO_2e

$$PE_{ww,treatment,UASB,y} = \sum_{UASB} Q_{ww,UASB,PJ,y} * COD_{removed,UASB,PJ,y} * MCF_{ww,treatment,UASB,PJ} * B_{0,ww} * UF_{PJ} * GWP_{CH4}$$

=1,600,000*0.00065*0.8*0.21*1.06*21

=3,889 tCO_2e

$$PE_{s,treatment,y} = \sum_{j} S_{EIC,PJ,y} * MCF_{s,treatment,EIC,PJ} * DOC_{s} * UF_{PJ} * DOC_{F} * F * 16/12 * GWP_{CH4}$$

=29.92*0.8*0.257*1.06*0.5*0.5*16/12*21

=46 tCO_2e

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

=1,600,000*0.21*1.06* 0.00935*0.8

=2,664 t

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

=（1-0.9）*2,664*21

=5,594 tCO_2e

$$PE_{y} = PE_{power,y} + PE_{ww,treatment,UASB,y} + PE_{s,treatment,y} + PE_{fugitive,y}$$

=148+3,889+46+5,594

=9,677 tCO_2e

Emission Reductions

$ER_{y,\ ex\ ante} = BE_{y,ex\ ante} - PE_{y,ex\ ante}$

=55,459-9,677

=45,782 tCO_2e

And the annual emission reductions during the fixed 10 year crediting period are calculated as 45,782 tCO_2e.

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)
May 1st 2010- Dec.31st 2010	6,451	36,973	0	30,522
2011	9,677	55,459	0	45,782
2012	9,677	55,459	0	45,782
2013	9,677	55,459	0	45,782
2014	9,677	55,459	0	45,782
2015	9,677	55,459	0	45,782
2016	9,677	55,459	0	45,782
2017	9,677	55,459	0	45,782
2018	9,677	55,459	0	45,782
2019	9,677	55,459	0	45,782
Jan.1st 2020- Apr.30th 2020	3,226	18,487	0	15,260
Total (tonnes of CO_2e)	96,770	554,590	0	457,820

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

B.7.1. Data and parameters monitored:

The data and parameters monitored are described in the following figure and tables

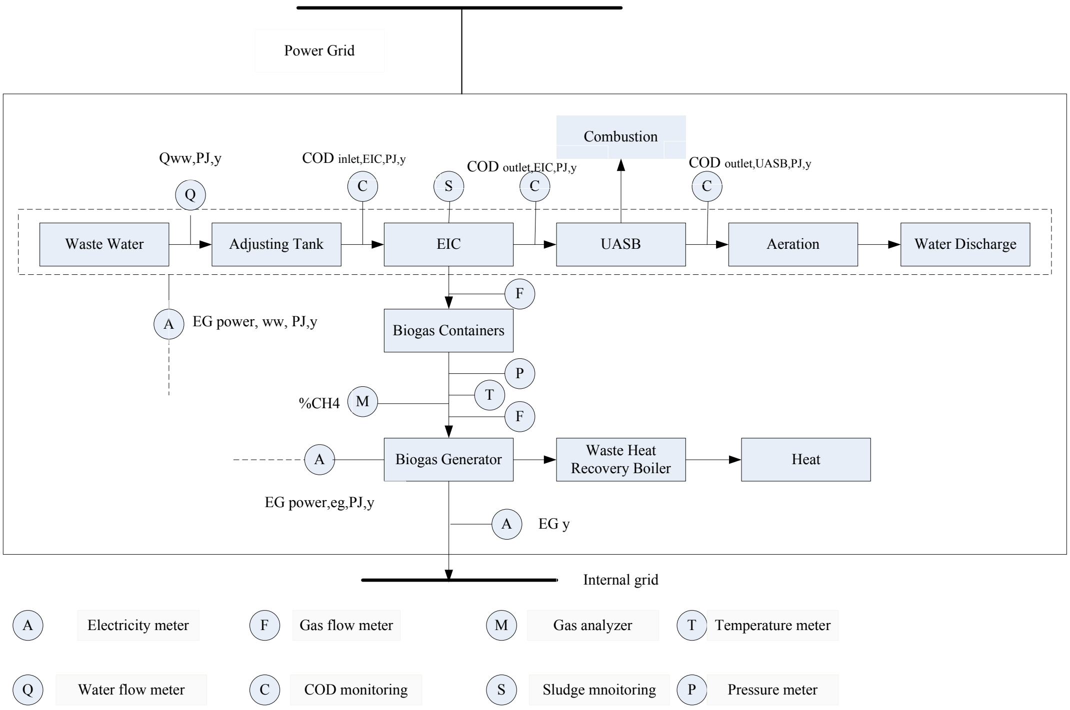

Figure 3 Monitoring points

Parameter:	$EG_{,y}$
Unit:	MWh
Description:	Electricity generated by the proposed project
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of electricity meter will be continuously measured and monthly aggregated.
QA/QC procedures to be applied (if any):	The measurement/monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	$EG_{power\ ww,\ ,PJ,y}$
Unit:	MWh
Description:	Electricity consumed in the whole wastewater treatment system(including sludge treatment system) by the proposed project
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of electricity meter will be continuously measured and monthly aggregated.
QA/QC procedures to	The measurement/monitoring equipment should adopt the colligated

be applied (if any):	automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	$EG_{power,eg,PJ,y}$
Unit:	MWh
Description:	Electricity consumed in the electricity generation system by the proposed project
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of electricity meter will be continuously measured and monthly aggregated.
QA/QC procedures to be applied (if any):	The measurement/monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Data / Parameter:	$Q_{ww,PJ,y}$
Unit:	m^3
Description:	Wastewater to be treated by the proposed project
Source of data:	On-site measurement
Brief description of measurement methods and procedures to be applied:	The readings of flow meter will be continuously measured and weekly aggregated.
QA/QC procedures to be applied (if any):	Use and calibration of the flow meter will be conducted in accordance with manufacturer's standards. A calibration/service log will be maintained for each flow meter.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the crediting period.

Parameter:	$COD_{inlet, EIC,PJ,y}$
Unit:	t/m^3
Description:	COD of the wastewater to be treated by the proposed project
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The data will be monitored through on site laboratory experiment weekly.
QA/QC procedures to be applied (if any):	Weekly measured through sampling.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	$COD_{outlet, EIC,PJ,y}$

Unit:	t/m^3
Description:	COD of the wastewater in the outlet of EIC process by the proposed project
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The data will be monitored through on site laboratory experiment weekly.
QA/QC procedures to be applied (if any):	Weekly measured through sampling.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	$COD_{outlet, UASB,PJ,y}$
Unit:	t/m^3
Description:	COD of the wastewater in the outlet of UASB process by the proposed project
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The data will be monitored through on site laboratory experiment weekly.
QA/QC procedures to be applied (if any):	Weekly measured through sampling.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	$COD_{removed, EIC,PJ, y}$
Unit:	t/m^3
Description:	COD removed by EIC system in the project scenario
Source of data:	Calculated based on $COD_{inlet, EIC,PJ,y}$- $COD_{outlet, EIC,PJ,y}$
Value of data:	
Brief description of measurement methods and procedures to be applied:	The parameter will be calculated and recorded for the purpose of project verification.
QA/QC procedures to be applied (if any):	The calculation will be conducted by the internal CDM verifier at the project site.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the crediting period.

Parameter:	$COD_{removed, UASB, PJ,,y}$
Unit:	t/m^3
Description:	COD removed by UASB system in the project scenario
Source of data:	Calculated based on $COD_{outlet, EIC,PJ,y}$ - $COD_{outlet, UASB,PJ,y}$
Value of data:	
Brief description of	The parameter will be calculated and recorded for the purpose of project

measurement methods and procedures to be applied:	verification.
QA/QC procedures to be applied(if any):	The calculation will be conducted by the internal CDM verifier at the project site.
Any comment:	All the electronic data and the hard copies will be kept for 2 years after the end of the last crediting period.

Parameter:	$S_{EIC,y}$
Unit:	T
Description:	The amount of dry matter in the sludge generated through EIC process and then used by other anaerobic digestion facilities
Source of data:	Calculated based on the volume and dry matter content
Value of data:	
Brief description of measurement methods and procedures to be applied:	According to Paragraph 28 of AMS-III.H (Version 12), and as the sludge is extracted in a slurry phase in the proposed project, the volume (m^3) and dry matter content (tones/m^3) shall be used to calculate the $S_{EIC,y}$.
QA/QC procedures to be applied (if any):	The volume of the slurry is crosschecked by the volume of the slurry container and the net weight of each load of slurry. The dry matter content will be monitored according to the industry standard for three times per load of wet sludge and the mean will be adopted to guarantee accuracy.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the crediting period.

Parameter:	$Q_{biogas,y}$
Unit:	m^3
Description:	The amount of biogas into the gas generators in year *y*
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of gas flow meter will be continuously measured and monthly aggregated.
QA/QC procedures to be applied(if any):	The measurement/monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least for 2 years after the end of the last crediting period.

Parameter:	WCH4,y
Unit:	%
Description:	Methane concentration in the biogas
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of gas analyzer will be regularly measured and monthly recorded. The monitored data shall guarantee the accuracy of 95%.

QA/QC procedures to be applied(if any):	The measurement/monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	T_{biogas}
Unit:	℃
Description:	Temperature of the captured biogas
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of thermocouple will be regularly measured and monthly recorded. The monitored data shall guarantee the accuracy of 95%.
QA/QC procedures to be applied(if any):	The measurement/monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

Parameter:	P_{biogas}
Unit:	Atm
Description:	Pressure of the captured biogas
Source of data:	On-site measurement
Value of data:	
Brief description of measurement methods and procedures to be applied:	The readings of pressure meter will be regularly measured and monthly recorded. The monitored data shall guarantee the accuracy of 95%.
QA/QC procedures to be applied: (if any)	The measurement/monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked regularly.
Any comment:	All the electronic data and the hard copies will be kept for at least 2 years after the end of the last crediting period.

B.7.2. Description of the monitoring plan:

>>

The monitoring plan defines a standard against which the performance in terms of the project emission reductions during the crediting period can be monitored and verified.

1. Purpose of the monitoring plan

Monitoring is a key procedure to verify the actual and measurable emission reductions from the proposed project. The project owner established monitoring plan in order to guarantee the actual long-term measurement of GHG emission reductions of the proposed project.

2. The organizational structure of monitoring

The project owner will establish a monitoring management structure which identifies the relative staff for data recording, collection and preservation. The detailed structure is as follow:

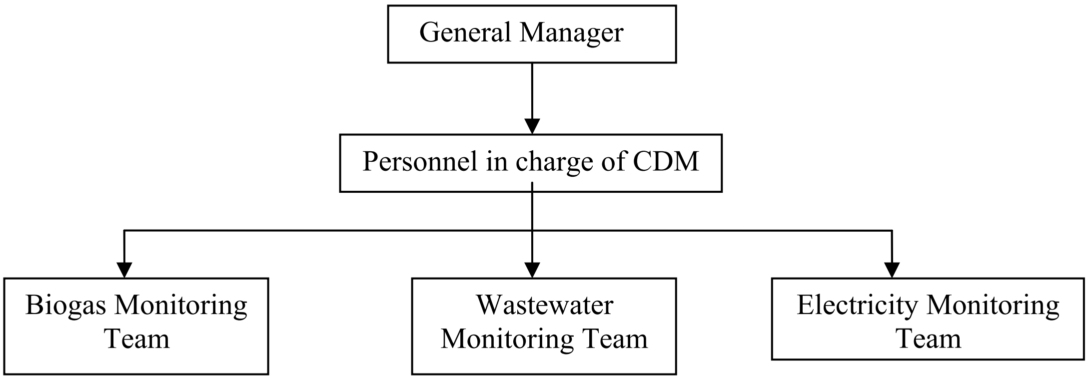

Figure 4 Operations and Management Structure of the Project

3. Responsibilities of monitoring team

（1） Biogas monitoring team: being responsible for the measurement and record of the data including $Q_{electricity}$ (the amount of biogas to gas generator), $w_{CH4,y}$ (methane concentration), P_{biogas} (pressure) and T_{biogas} (temperature); recording the data monthly after being verified by the responsible person of CDM monitoring team; regularly checking the monitoring system on errors to guarantee the data accuracy

（2） Wastewater monitoring team: being responsible for the measurement and record of the data including $Q_{ww,PJ,y}$ (the amount of wastewater to be treated by the proposed project), COD in each process ($COD_{inlet,PJ,y}$, $COD_{removed,EIC,PJ,y}$ and $COD_{removed,UASB,PJ,y}$), $S_{EIC,y}$ (sludge production amount),etc,; recording the data after being verified by the responsible person of CDM monitoring team weekly; regularly checking the monitoring system on errors to guarantee the data accuracy.

（3） Electricity monitoring team: being responsible for the measurement and record of the data including $EG_{, y}$ (electricity generation by the gas generators), $EG_{power\ ww,\ PJ,y}$ and $EG_{power,eg,PJ,y}$ (project electricity consumption); recording the data after being verified by the responsible person of CDM monitoring team weekly; regularly checking the monitoring system on errors to guarantee the data accuracy.

4. Monitoring instruments

The monitoring instruments include the liquid flow meter, the gas flow meter, the electricity meters and the analysis instruments. The installation location, monitoring objective and precision of there monitoring instruments are listed in Table B-7 below:

Table B-7 Information on monitoring instruments

Instrument	Location	Objective	Precision	Calibration period
Liquid flow meter	On the pipe in front of the adjusting tank	$Q_{ww,PJ,y}$	0.5	National standard JJG 1037-2008
Gas flow meter[33]	On the pipe in front of the gas generators	$Q_{biogas,y}$	manufacturer's manual	National standard JJG 1037-2008

[33] The gas flow meter has not purchased yet at the time of PDD submission, the actual precision, calibration period and other information will be confirmed when it is available.

Temperature meter[34]	On the pipe in front of the gas generators	T_{biogas}	manufacturer's manual	manufacturer's manual
Pressure meter[35]	On the pipe in front of the gas generators	$P_{biogas,}$	manufacturer's manual	manufacturer's manual
Electricity meter	At the low voltage line after the transformer	$EG_{power\ ww,\ ,PJ,y;}$ $EG_{power,eg,PJ,y}$	0.5	National standard JJG 596-1999
Electricity meter	Outlet of the gas generators	$EG_{,y}$	0.5	National standard JJG 596-1999
Gas analyzer	On the pipe in front of the gas generators	WCH4,y	GB level	Appropriate intervals according to manufacturer specification
Analysis instruments	On-site in the laboratory under control of project participants	$COD_{inlet,\ PJ,y,}$ $COD_{removed,EIC,\ ,PJ\ y,}$ $COD_{removed,UASB,PJ,y}$ S_y	GB level	

5. QA/QC procedures

（1） The electricity meters should be used as a pair, one for the main operation and another as backup. The backup meters should have the same accuracy level as the main operation meters and the readings will be recorded if the main meters fail. If the backup meter fails at the same time, the corresponding emission reductions will not be claimed. The readings of the gas flow meters and liquid flow meters will be cross checked to guarantee the data validity .If the gas analyzer is in malfunction, the potable gas analyzer will be used to analyze the methane concentration in biogas.All the monitoring instruments applied in the project shall meet the measurement accuracy and shall be subject to regular maintenance and testing regime to ensure accuracy according to relevant laws and regulations. The monitoring equipment should be calibrated in accordance with the relevant national and industrial regulations periodically by a qualified calibration entity.

（2） The monitored data recorded and collected by different monitoring teams should be internally verified to guarantee the data validity before handing to the CDM monitoring responsible person.

（3） Monitoring teams are responsible for the monitoring instruments checking and maintenance in order to guarantee the normal operation. If data monitoring failure occurs resulted from equipment malfunction, the monitoring teams should not claim emission reductions due to the project activity for the duration of emergency.

（4） Training on CDM monitoring will be provided to the relevant staff to guarantee the success of the implementation of the monitoring plan. Regular held meetings will be commenced for discussing and solving the monitoring problems during the operation period.

6. The procedure of emergency preparedness

There will be two biogas containers in the project site when in full operation, if technical failure of the gas generators or regular maintenance or other emergency occurs, the biogas can be stored in the two

[34] The temperature meter has not purchased yet at the time of PDD submission, the actual precision, calibration period and other information will be confirmed when it is available.

[35] The pressure meter has not purchased yet at the time of PDD submission, the actual precision, calibration period and other information will be confirmed when it is available.

biogas containers temporarily. If the shutdown period lasts a long time (e.g. several days or weeks), the biogas would be emitted into the atmosphere and during this period, emission reductions will not be claimed.

7. Monitoring results and verification
The verification of the monitoring results of the project activity is required for each crediting period. The monitoring results will be combined in a monitoring report that will be served as a basis for project verification in each crediting year.

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

>>

The baseline study and monitoring methodology of the proposed project was completed on 30/11/2008.

Name of person/entity determining baseline study and monitoring methodology:

Gao Zhiwen, Climate Bridge Ltd.

Email: gao.zhiwen@climatebridge.com

Tel: ＋86 21 6246 2036； Fax: ＋86 21 2301 9950

Climate Bridge Ltd. is one of 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:

>>

09/05/2005[36]

C.1.2. Expected operational lifetime of the small-scale project activity:

>>

10 years

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

C.2.1. Renewable crediting period:

>>

Not applicable.

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

>>

Not applicable.

C.2.1.2. Length of the first crediting period:

>>

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/05/2010 or the date of registration whichever is later

C.2.2.2. Length:

>>

10 years

[36] Signature of EIC Service Agreement

SECTION D. Environmental impacts

>>

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

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The project owner retained a third party, Huangshi Environmental Protection Institute, to conduct the *Environmental Impact Assessment (EIA) on Organic Wastewater Treatment and Renewable Energy Utilization Project*. The EIA report was completed in May 2004 and was approved by the Huangshi Environmental Protection Bureau on June 1st, 2004 (refer to Huangshi Environment Document [2004] No.39). The impacts of the proposed project on the environment are summarized as follows in the period of construction and operation.

1. <u>Construction Period</u>

The main activity during the construction period is the installation of equipment with only a little civil work. The noise, dust, soil and solid waste during the construction period have no significant impact to the local environment and vulnerable targets.

<u>2. Operation Period</u>

2.1 Wastewater

Desulphurization of the wastewater is achieved by using the waste lye produced from the anionic conversion (desulfurization rate is 95%), thus no extra fresh water is needed. The wastewater will be delivered into the wastewater treatment system after sedimentation. The proposed project is the recovery of the original existing wastewater, and no wastewater will be discharged out.

2.2 Waste gas

The biogas tank is enclosed, so no gas will be leaked out to pollute the atmosphere. Combustion of biogas will lead to CO_2 and H_2O emissions, and some SO_2 and NO_x emissions. As the biogas has been treated before combustion, the waste gas has little impact on the surrounding environment.

2.3 Solid wastes

The proposed project generates only solid waste from on site living activities, which can be treated comprehensively and negative impacts can thus be avoided.

2.4 Noise pollution

Noise principally comes from the operation of the waste heat recovery boiler, circulating cooling system and gas generators. The level of the noise is about 75-85dB (A).The noise sources are listed below:

Table D-1 Noise Source

Item	Quantity	Noise level dB(A)	Operation
Gas generator	6	86	Indoor, continuously
Waste heat recovery boiler	1	89	Indoor, continuously
Circulating cooling tower	1	85	Outdoor, continuously

During the operation period, the noise will be minimised by adopting low noise equipment and measures to isolate, absorb, and eliminate noise to a maximum extent. Noise source can reach the standard of noise at boundary of industrial enterprises.

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 EIA concludes that 1) the proposed project complies with the industry policy and general city plan; 2) The project site is feasible and meets the environment requirements;3) the environmental conditions around the project site are positive; 4) The implementation of the project will have no significant impact on the local environment.

SECTION E. Stakeholders' comments

>>

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

>>

The project owner and the CDM buyer worked together to investigate the stakeholders' opinions and suggestions on the proposed project.

The project owner published a notice on "Huangshi Daily" newspaper and Huangshi Science and Technology Innovation Web on Sept. 8th, 2008, informing of the time and location of the stakeholders' meeting, as well as the questionnaire distribution. At the same time a public notice was posted in public places to inform the local people. Representatives from the local government, Huangshi Science and Technology Bureau, Huangshi Water Resources Bureau, Huangshi Development and Reform Committee, Huangshi Environmental Protection Bureau, Xisaishan District Science and Technology Bureau etc, were invited to the meeting by means of phone calls. The meeting was held on September 26th, 2008 at the meeting room of Huangshi Xinghua Biochemical, Ltd.

E.2. Summary of the comments received:

>>

30 questionnaires were distributed to the local people, and 29 questionnaires were returned. The response rate is therefore 96.7%. The result of this investigation shows that all the public support the proposed project, 82.8% believe it improves the local water and air environment, and 62% believe it can promote local employment opportunities. In general, local people are supportive of and expect that the construction can be commenced as soon as possible so as to contribute to the local economic, environmental and social benefits.

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

>>

The project owner addressed to the concern collected from the stakeholders' meeting and the survey:

1. Biogas leakage

The biogas containers are located on an uninhabited hill 200m away from the residential areas and are equipped with fire control facilities and devices. The daily operation management will be enforced to avoid any leakage accidents.

2. Biogas to power generation safety

The proposed project uses Jichai 190 Series Gas Generators, which have advanced safety protection devices, such as gas leakage alarm, explosion-proof device, alarms that automatically shut-down the system when over-speeding and these guarantee the safety of power generation.

3. Technology improvement

The proposed project is the first project that uses EIC technology and biogas cogeneration technology. The project owner has conducted a lot of technical research and investigation and has got some preliminary positive feedback. The project owner expects the CDM finance can contribute to technology improvement.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I countries is involved in this project activity.

Annex 3

BASELINE INFORMATION

The baseline information on wastewater treatment, please refer to Section B.4 and B.6.1.

The baseline information for calculation of OM, BM and CM emission factors of Central China Grid is shown in the Report on 2008 Baseline Emission Factors for Regional Power Grids in China by China DNA at http://cdm.ccchina.gov.cn on December, 30th, 2008.The concrete processes are shown in the flowing tables:

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

The low calorific value, CO_2 emission factor and oxidation factor of fuels are listed in Table1 below.

Table 1 Low calorific values,CO_2 emission factor and oxidation factor of fuels

Fuel type	Low Calorific Value	EF (tC/TJ)	OXID
Raw coal	20908 kJ/kg	25.8	1
Cleaned coal	26344 kJ/kg	25.8	1
Other cleaned coal	8363 kJ/kg	25.8	1
Coke	28435 kJ/kg	29.2	1
Briquette	20908 kJ/kg	26.6	1
Crude oil	41816 kJ/kg	20.0	1
Petrol	43070 kJ/kg	18.9	1
Coal oil	43070 kJ/kg	19.6	1
Diesel	42652 kJ/kg	20.2	1
Fuel oil	41816 kJ/kg	21.1	1
Other petroleum products.	38369 kJ/kg	20.0	1
Other Coke Products	28435 kJ/kg	35.8	1
Natural gas	38931 kJ/m3	15.3	1
Coke oven gas	16726 kJ/m3	12.1	1
Other gas	5227 kJ/m3	12.1	1
LPG	50179 kJ/m3	17.2	1
Refinery Dry Gas	46055 kJ/m3	15.7	1

Data source: *The net calorific values are quoted from China Energy Statistical Yearbook 2007, Page 287.* The emission factors and oxidation factors are quoted from *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 1.3, 1.4, page 1.21-1.24, Chapter 1, Volume 2.*

Table 2 Fuel-fired Electricity Generation of CCPG for year 2004

Province	Total generation （10^8kWh)	Total generation （MWh)	Self-consumption electricity （%）	Total supply （MWh)
Jiangxi	301.27	30127000	7.04	28,006,059
Henan	1093.52	109352000	8.19	100,396,071
Hubei	430.34	43034000	6.58	40,202,363
Hunan	371.86	37186000	7.47	34,408,206
Chongqing	165.2	16520000	11.06	14,692,888
Sichuan	346.27	34627000	9.41	31,368,599
Total				249,074,186

Data source: *China Electric Power Yearbook 2005*

Table 3 Fuel-fired Electricity Generation of CCPG for year 2005

Province	Total generation （10^8kWh)	Total generation （MWh)	Self-consumption electricity （%）	Total supply （MWh)
Jiangxi	300	30000000	6.48	28,056,000
Henan	1315.9	131590000	7.32	121,957,612
Hubei	477	47700000	2.51	46,502,730
Hunan	399	39900000	5	37,905,000
Chongqing	175.84	17584000	8.05	16,168,488
Sichuan	372.02	37202000	4.27	35,613,475
Total				286,203,305

Data source: *China Electric Power Yearbook 2006*

Table 4 Fuel-fired Electricity Generation of CCPG for year 2006

Province	Total generation （10^8kWh)	Total generation （MWh)	Self-consumption electricity （%）	Total supply （MWh)
Jiangxi	344.49	34449000	6.17	32,323,497
Henan	1512.35	151235000	7.06	140,557,809
Hubei	548.41	54841000	2.75	53,332,873
Hunan	464.08	46408000	4.95	44,110,804
Chongqing	234.87	23487000	8.45	21,502,349
Sichuan	441.93	44193000	4.51	42,199,896
Total				334,027,226

Data source: *China Energy Statistic Yearbook 2007 China Electric Power Yearbook 2007*

Table 5 Calculation of Simple OM Emission Factors of CCPG for Year 2004

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Sub-total	Effective CO_2 EF (tc/TJ)	OXID （%）	Average low caloric value （MJ/t,m^3）	CO_2 emissions （tCO2e） K=G*H*I*J*44/ 12/10000 （mass）
		A	**B**	**C**	**D**	**E**	**F**	**G= A+B+C +D+E+F**	**H**	**I**	**J**	**K=G*H*I*J*44/ 12/1000 (volume)**
Raw coal	10^4 t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	**17144.1**	25.8	100	20908	339,092,605
Cleaned coal	10^4 t		2.34					**2.34**	25.8	100	26344	58,316
Other cleaned coal	10^4 t	48.93	104.22			89.72		**242.87**	25.8	100	8363	1,921,441
Coke	10^4 t		109.61					**109.61**	29.2	100	28435	3,337,011
Coke oven gas	10^8m^3			1.68		0.34		**2.02**	12.1	100	16726	149,900
Other coal gas	10^8m^3					2.61		**2.61**	12.1	100	5227	60,527
Crude oil	10^4 t		0.86	0.22				**1.08**	20	100	41816	33,118
Petrol	10^4 t		0.06			0.01		**0.07**	18.9	100	43070	2,089
Diesel	10^4 t	0.02	3.86	1.7	1.72	1.14		**8.44**	20.2	100	42652	266,627
Fuel oil	10^4 t	1.09	0.19	9.55	1.38	0.48	1.68	**14.37**	21.1	100	41816	464,893
LPG	10^4 t							**0**	17.2	100	50179	0
Refinery gas	10^4 t	3.52	2.27					**5.79**	15.7	100	46055	153,506
Natural gas	10^8m^3						2.27	**2.27**	15.3	100	38931	495,775
Other petroleum prdt.	10^4 t							**0**	20	100	38369	0
Other coking Prdt	10^4 t							**0**	25.8	100	28435	0
Other energy	10^4 t tce		16.92		15.2	20.95		**53.07**	0	100	0	0
											Sub-total (tCO_2e)	**346,035,810**

Data source: *China Energy Statistic Yearbook 2005*

Table 6 Calculation of Simple OM Emission Factors of CCPG for Year 2005

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Sub-total	Effective CO_2 EF (tc/TJ)	OXID （%）	Average low caloric value （MJ/t,m^3）	CO_2 emissions （tCO2e） K=G*H*I*J*44/12/ 10000（mass）
		A	B	C	D	E	F	G= A+B+C+ D+E+F	H	I	J	K=G*H*I*J*44/12/ 1000 (volume)
Raw coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	20908	352,614,497
Cleaned coal	10^4 t	0.02						**0.02**	25.8	100	26344	498
Other cleaned coal	10^4 t		138.12			89.99		**228.11**	25.8	100	8363	1,804,669
Coke	10^4 t		25.95		105			**130.95**	29.2	100	28435	3,986,695
Coke oven gas	10^8m^3			1.15		0.36		**1.51**	12.1	100	16726	112,054
Other coal gas	10^8m^3		10.2			3.12		**13.32**	12.1	100	5227	308,897
Crude oil	10^4 t		0.82	0.36				**1.18**	20	100	41816	36,185
Petrol	10^4 t		0.02			0.02		**0.04**	18.9	100	43070	1,194
Diesel	10^4 t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	42652	299,798
Fuel oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	41816	286,959
LPG	10^4 t							**0**	17.2	100	50179	0
Refinery gas	10^4 t	0.71	3.41	1.76	0.78			**6.66**	15.7	100	46055	176,572
Natural gas	10^8m^3						3	**3**	15.3	100	38931	655,209
Other petroleum prdt	10^4 t							**0**	20	100	38369	0
Other coking Prdt.	10^4 t				1.5			**1.5**	25.8	100	28435	40,349
Other energy	10^4 t tce		2.88		1.74	32.8		**37.42**	0	100	0	0
											Sub-total (tCO_2e)	**360,323,575**

Data source: *China Energy Statistic Yearbook 2006*

Table 7 Calculation of Simple OM Emission Factors of CCPG for Year 2006

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Sub-total	Effective	OXID	Average low	CO_2 emissions

									CO_2 EF (tc/TJ)	（%）	caloric value （MJ/t,m³）	（tCO2e） K=G*H*I*J*44/12/ 10000（mass）
		A	**B**	**C**	**D**	**E**	**F**	**G= A+B+C+ D+E+F**	**H**	**I**	**J**	**K=G*H*I*J*44/12/ 1000 (volume)**
Raw coal	10^4 t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	**20127.82**	25.8	100	20908	398,107,508
Cleaned coal	10^4 t					5.79		**5.79**	25.8	100	26344	144,295
Other cleaned coal	10^4 t	4.51	104.12		8.59	79.21		**196.43**	25.8	100	8363	1,554,036
Mould coal	10^4 t						0.01	**0.01**	26.6	100	20908	204
Coke	10^4 t		17.23		0.32			**17.55**	29.2	100	28435	534,299
Coke oven gas	$10^8 m^3$		0.52	1.07	4.24	0.38	0.01	**6.22**	12.1	100	16726	461,572
Other coal gas	$10^8 m^3$	12.69	3.95		1.7	4.36	0.01	**22.71**	12.1	100	5227	526,655
Crude oil	10^4 t		0.49					**0.49**	20	100	41816	15,026
Petrol	10^4 t		0.01					**0.01**	18.9	100	43070	298
Diesel	10^4 t	0.91	2.23	1.41	1.78	0.96		**7.29**	20.2	100	42652	230,298
Fuel oil	10^4 t	0.51	1.26	1.31	0.8	0.57	3.49	**7.94**	21.1	100	41816	256,872
LPG	10^4 t							**0**	17.2	100	50179	0
Refinery gas	10^4 t	0.86	8.1	1	0.97			**10.93**	15.7	100	46055	289,780
Natural gas	$10^8 m^3$			0.28		0.16	18.63	**19.07**	15.3	100	38931	4,164,943
Other petroleum prdt	10^4 t							**0**	20	100	38369	0
Other coking Prdt.	10^4 t						0.01	**0.01**	25.8	100	28435	269
Other energy	10^4 t tce	17.45	37.36	31.55	18.29	29.35		**134**	0	100	0	0
											Sub-total (tCO_2e)	**406,286,055**

Data source: *China Energy Statistic Yearbook 2007*

Table 8 Calculation of Simple OM Emission Factors of CCPG

	Total power supply	Total emission	OM

	MWh	tCO_2	tCO_2/MWh
2004	249,074,186	346,035,810	1.38929
2005	286,203,305	360,323,575	1.25898
2006	337,056,176	408,776,276	1.212784
Weighted average OM			1.2783

Data source: *China Electric Power Yearbook 2005-2007 China Energy Statistic Yearbook 2005-2007*

The Operating Margin (OM) emission factor is the weighted average emission factors of year 2004-2006, as follows: EF_{OM} = 1. 2783 tCO_2/MWh

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

1. Calculation of percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

Table.9 Calculation of percentages of CO_2 emissions from solid, liquid and gas fuels in total emissions in CCPG

Fuels	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	NCV	EF	OXID	CO_2 emission
		A	B	C	D	E	F	G=A+…+F	H	I	J	K=G*H*I*J*44/12/100
Raw coal	10^4t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	20127.82	20908	25.8	1	398,107,508
Cleaned coal	10^4t	0	0	0	0	5.79	0	5.79	26344	25.8	1	144,295
Other cleaned coal	10^4t	4.51	104.12	0	8.59	79.21	0	196.43	8363	25.8	1	1,554,036
Mould coal	10^4t	0	0	0	0	0	0.01	0.01	20908	26.6	1	204
coke	10^4t	0	17.23	0	0.32	0	0	17.55	28435	29.2	1	534,299
Subtotal												**400,340,342**
Crude oil	10^4t	0	0.49	0	0	0	0	0.49	41816	20	1	15,026
petrol	10^4t	0	0.01	0	0	0	0	0.01	43070	18.9	1	298
Coal oil	10^4t	0	0	0	0	0	0	0	43070	19.6	1	0
Diesel	10^4t	0.91	2.23	1.41	1.78	0.96	0	7.29	42652	20.2	1	230,298

Fuel oil	10^4t	0.51	1.26	1.31	0.8	0.57	3.49	7.94	41816	21.1	1	256,872
Other oil prdt.	10^4t	0	0	0	0	0	0	0	38369	20	1	0
Other coke prdt.	10^4t	0	0	0	0	0	0.01	0.01	28435	25.8	1	269
Subtotal												**502,763**
Natural gas	10^7m^3	0	0	2.8	0	1.6	186.3	190.7	38931	15.3	1	4,164,943
Coking oven gas	10^7m^3	0	5.2	10.7	42.4	3.8	0.1	62.2	16726	12.1	1	461,572
Other coal gas	10^7m^3	126.9	39.5	0	17	43.6	0.1	227.1	5227	12.1	1	526,655
LPG	10^4t	0	0	0	0	0	0	0	50179	17.2	1	0
Refinery gas	10^4t	0.86	8.1	1	0.97	0	0	10.93	46055	15.7	1	289,780
Subtotal												**5,442,950**
Total												**406,286,055**

Data source：*China Energy Statistic Yearbook 2007*

Based on the table above and equation to calculate λ, the result is λ_{Coal}=98.54%, λ_{Oil}=0.12%, λ_{Gas} =1.34%.

2. Calculating the fuel-fired emission factor ($EF_{Thermal}$)

The most advanced commercialized technologies for coal-fired power plants in China are domestic 600MW sub-critical generators, with the standard coal consumption of power supply of 343.33gce/kWh. For gas-fired and oil-fired power plants in China, the most advanced commercialized technologies are 200MW combined cycle generators. The standard coal consumption (equivalent) for power supply of oil-fired and gas-fired power plants is 258gce/kWh.

Parameters used for calculating fuel-fired emission factor are shown in Table 10 below:

Table 10 Parameters used for calculating fuel-fired emission factor

	Variables	Power supply efficiency	EF of the fuel (tC/TJ)	OXID	EF (tCO2/MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coal fired power plant	$EF_{Coal,Adv}$	37. 28 %	25.8	1	0.9135
Gas fired power plant	$EF_{Gas,Adv}$	48.81 %	15.3	1	0.4138
Oil fired power plant	$EF_{Oil,Adv}$	48.81 %	21.1	1	0.5706

Data source: *China Energy Statistic Yearbook 2005-2007*

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ = 0.9064 tCO_2e/MWh.

3: Calculating the Build Margin (BM) emission factor ($EF_{BM,y}$)

Table 11 Installed Capacities of CCPG

Installed capacity	Unit	2004	2005	2006
Fuel-fired	MW	53825.7	60167.2	76658
Hydro	MW	34642	38405.2	42719
Nuclear	MW	0	0	0
Wind & Others	MW	0	24	106
Total	MW	88467.7	98596.4	119483

Data source: *China Electric Power Yearbook 2005-2007*

Table 12 Newly Added Installed Capacities from Year 2004-2006

	Installed capacity in 2004	Installed capacity in 2005	Installed capacity in 2006	Newly added installed capacity between 2004-2006	Percentage in newly added installed capacity
	A	B	C	D=C-A	
Thermal	53825.7	60167.2	76658	22832.3	73.77%
Hydro	34642	38405.2	42719	8077	26.10%
Nuclear	0	0	0	0	0.00%
Wind power etc.	0	24	41	41	0.13%
Total	88467.7	98596.4	119418	30950.3	**100.00%**
Percentage in installed capacity in 2006	74.08%	82.56%	100%		

Data source: *China Electric Power Yearbook 2005-2007*

It can be concluded from Table 12 that capacity additions from year 2004 to 2006 is closer to 20% of the total additions and it is obvious that the capacity additions during year 2004 to 2006 are larger than the capacity of five plants, so year 2004 and 2006 are chosen to calculate the *BM* emission factor of CCPG.

According to Table 12 and formula (7) in section B.6.1, the $EF_{BM,y}$ is calculated as:

$$EF_{BM,y} = 0.9064 \times 73.77\% = 0.6687\ tCO_2/MW$$

Calculating the baseline emission factor (EF_y)

According to formula (8) in section B.6.1, the baseline emission factor of CCPG is calculated as:

$$EF_y = 1.2783 \times 0.5 + 0.6687 \times 0.5 = 0.9735\ tCO_2/MWh$$

The EF_y applied in this report is fixed for a crediting period and may be revised at the renewal of the crediting period.

Annex 4

MONITORING INFORMATION

Please refer to the Monitoring plan in Section B.7