

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

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Revision history of this document

| Version Number | Date | Description and reason of revision |
|-----------------------|------------------|--|
| 01 | 21 January 2003 | Initial adoption |
| 02 | 8 July 2005 | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• 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. |

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

Title: Biogas Utilization Project in Zhejiang Jingxing Paper Joint Stock Co. Ltd.

Version of PDD: Version 2.0

Date of document: 05/07/2010

Revision history of PDD:

| Version | Date | Comments |
|---------|------|----------|
| | | |

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

The main purpose of the project activity (hereafter also referred to as Project) is to install a biogas-capturing device and a biogas based electricity generation system in the existing wastewater treatment systems at the paper mill of Zhejiang Jingxing Paper Joint Stock Co. Ltd. Zhejiang Jingxing Paper Joint Stock Co. Ltd. has two production lines with total paper production capacity of 600,000 tons per year. The production process produces up to 5,100,000 m³ of wastewater per year, which is sent to an onsite wastewater treatment system. As a part of the treatment process, the anaerobic digester system releases a methane rich biogas. The current anaerobic wastewater treatment system reduces the COD concentration of the wastewater from 4,000 mg/l to 1,000 mg/l. After the anaerobic digesters the wastewater passes through an aerobic treatment stage before is discharged into the municipal wastewater treatment plant for further treatment through a channel.

The scenario existing prior to the start of the implementation of the project activity

Zhejiang Jingxing Paper Joint Stock Co. Ltd. has two wastewater treatment plants with annual capacity of 5,100,000 tonnes. Anaerobic digesters integrated generate 13,000~15,000m³ of biogas everyday and will be piped to the biogas power plant (3x500kW capacity with additional 500kW as standby capacity). The existing wastewater treatment systems at the paper mill of Zhejiang Jingxing Paper Joint Stock Co. Ltd. have no biogas recovery devices and the methane-rich gas was released to the atmosphere in the baseline scenario.

The project scenario, including a summary of the scope of activities/measures that are being implemented within the proposed project activity

After implementation of the project activity, the biogas will be used for electricity generation. Power generation will be consumed on site in the paper mill. The project activity consists of implementing a biogas recovery system, a biogas purification device, and a power generation system. The biogas purification through desulphurization devices is required for utilisation of the biogas as a fuel. In total, 2MW generation capacity will be installed, i.e. four 500 kW gas-fired engines will be installed, one of which will be a back up in order to meet the varied flow of biogas. The project activity is expected to produce 11,500 MWh of electricity per year, displacing fossil fuel based electricity from the grid.

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For more technical details, please refer to Section A.4.2 of this PDD.

Table A.1 Key parameters of Project (Generators)

| Model | IFC 456-6LA42 |
|---------------------------------------|-------------------------------|
| Manufacturer | China Liuzhou Siemens Co. Ltd |
| Engine Speed | 1000 rpm |
| Application | 50 Hz |
| Engine Power (kW, at 100% load) | 550 |
| Generator Power (kW, at 100% load) | 500 |
| Fuel Consumption (nominal, MJ/bkW-hr) | 11 |
| Exhaust Stack Temperature (°C) | 650 |

The baseline scenario

Baseline scenario is same as situation existing prior to the project activity. For more information of baseline identification please refer to Section B.4 of this PDD.

How emission reductions will be achieved

The project activity will lead to green house gas (GHG) emission reductions in a twofold manner: (a) it will avoid methane emissions by capturing the biogas and using it as a fuel, and (b) it will displace fossil fuel based electricity from the Grid. The project activity is expected to avoid 49,993tCO₂e per year by capturing the biogas and around 8,540tCO₂e per year through displacement of electricity from the grid. The total expected amount of emission reductions is 58,533 tCO₂e.

Information Regarding Technology Transfer and Knowledge Innovation

Implementation of the proposed project involves imports of advanced engines and equipments from Germany, USA, and other countries from Europe. Although Chinese equipment suppliers are also capable of manufacturing these engines and equipments, the plant decided to buy from foreign suppliers due to the fact that the imported equipments have much higher power generation efficiency and reliability, especially more high-safety features. The concept of Clean Production Pattern and recycling economy being put into practice is still very advanced in paper industry of China, particularly the biogas-based electricity generation system.

Contribution to Sustainable Development of the Project

- Employment (including job quality, fulfilment of labour standards)
The project leads to employment generation in the power plant itself and in the implementation as a CDM project. These jobs do have a significant impact on job quality because most positions generated by proposed project are monitoring role and roles of operating of advanced equipments, computers and sophisticated equipments.
- Human and institutional capacity (including empowerment, education, involvement, gender)
People involved are trained with skills for operation of the power generation facility and knowledge of Kyoto Protocol. This is the first time local people in are organised to work on a project under the Kyoto Protocol.
- Employment (numbers)
Proposed project generates 10 working positions. Please see Table B.7 in Section B.7.2 for staff list and their responsibilities.
- Technological self-reliance (including project replicability, hard currency liability, institutional capacity, technology transfer)
Implementation of the proposed project involves imports of advanced engines and equipments from European. The project showcases an innovative way to use biogas from

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wastewater plant for power generation in paper industry of China. This is the first CDM project in paper industry in Zhejiang province and the first time local enterprise is introduced in the global collaboration against climate change in a sustainable manner.

A.3. Project participants:

The parties involved in the Project are the following:

| 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) | Zhejiang Jingxing Paper Joint Stock Co. Ltd. | No |
| Switzerland | Swiss Carbon Assets Ltd. | No |

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD publicat the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

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

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

A.4.1.1. Host Party(ies):

People's Republic of China

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

Zhejiang Province.

A.4.1.3. City/Town/Community etc:

Caoqiao Avenue, Pinghu City

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

The proposed project is located at Pinghu, Jiaying Municipality, Zhejiang Province, People's Republic of China. The project has geographical coordinates of E120°58'01'' and N30°41'56''¹.

¹ Location of the powerhouse.

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Figure 1. Location of the proposed project

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

Type and category:

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

Methane avoidance component:

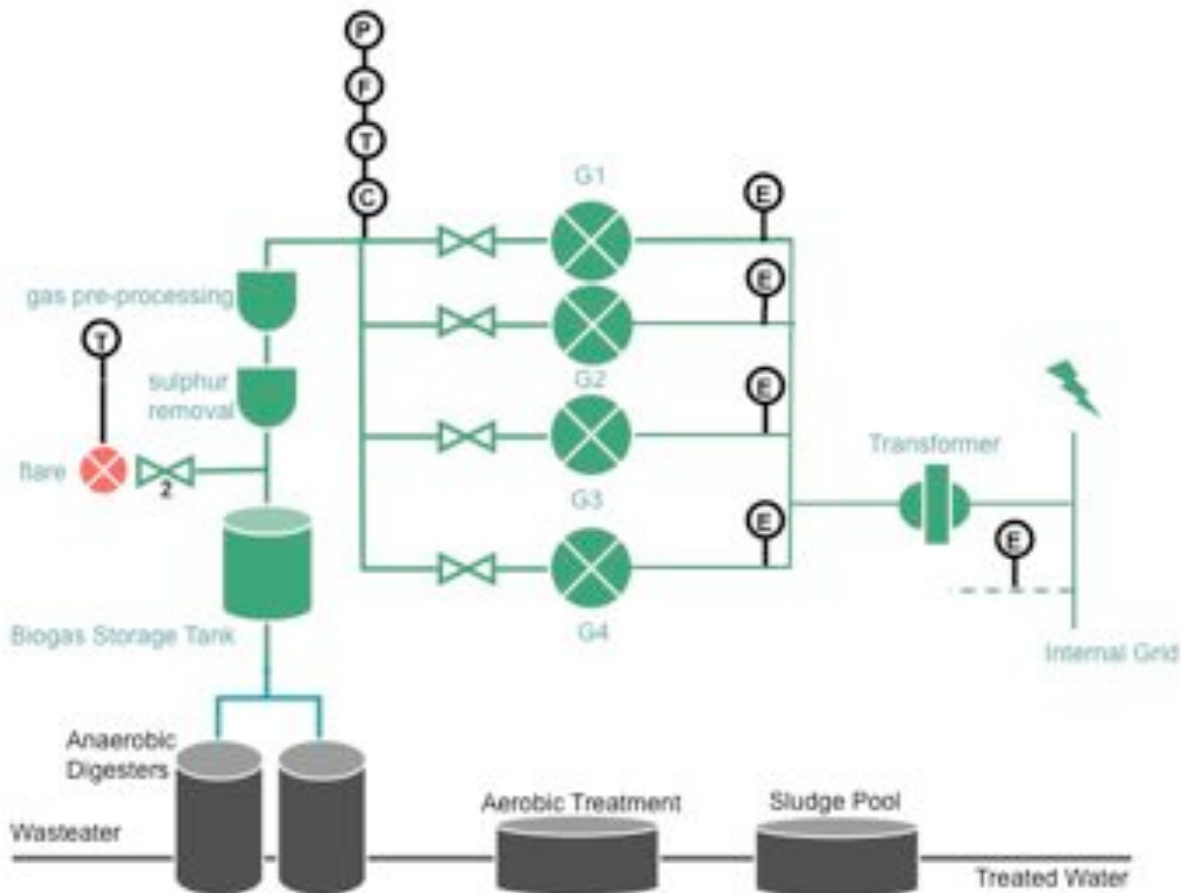
Type III: Other project activities
Category III.H: Methane Recovery in Wastewater Treatment
Sectoral Scope 13: Waste handling and disposal

Electricity generation component:

Type I: Renewable energy projects
Category I.F: Renewable electricity generation for captive use and mini-grid
Sectoral Scope 1: Energy industries (renewable /non-renewable sources)

Technology

Figure 2 shows the schematic diagram of the project. The proposed project is to install a biogas recovery and utilization system to the existing wastewater treatment facility. It consists of a biogas recovery system (a biogas storage tank), a biogas purification system (a sulphur removal unit and a gas processing unit), and a power generation system (four sets of methane/biogas fired internal combustion engines and generators will be installed).



**E: electricity meter P: pressure meter F: flow meter T: thermometer
C: concentration meter**

Figure 2. Schematic Diagram of the Project

Following table A.2 and A.3 show key parameters of the generators.

Table A.2 Key parameters of Project (Generators)

| Model | IFC6 465 -6LA42 |
|--|-------------------------------|
| Manufacturer | China Liuzhou Siemens Co. Ltd |
| Engine Speed | 1000 rpm |
| Application | 50 Hz GENSET |
| Combustion | Low Emission |
| Engine Power (KW, at 100% load) | 550 |
| Generator Power (KW, at 100% load) | 500 |
| Engine Efficiency (nominal, 100% load) | 80% |
| Fuel Consumption (nominal, MJ/bkW-hr) | 11 |

Environmentally safe and sound technology and know how

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Design of the project was done by China CEC Engineering Co., Ltd². Founded in 1953, the company is an A Class large-scale designing entity. Design of the project was performed in compliance with “Health Standards for Design of Industrial Facilities”, “Standards of Noise for Design of Industrial Facilities” and “Regulations of Safety Insurance for Light Industries”. Fireproofing, lightening protection and noise arresting measures have been taken into account. All staff has been trained with “*Operation Manual for Biogas-to-energy Plant*” for normal operation. A biogas detector will be installed at the workshop, which will start in case of biogas leakage. All major equipments have intrinsic emergency shut down systems that are linked to each other. Any serious malfunction in a machine will lead to shut down of the whole system.

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

The estimated amount of emission reductions from the small-scale project activity over the chosen crediting period is shown in the following Table A.4, the crediting period will start from 01/01/2011:

Table A.4 Estimation amount of emission reductions

| Years | Estimation of annual emission reductions (tCO ₂ e) |
|--|---|
| Year 1 | 58,533 |
| Year 2 | 58,533 |
| Year 3 | 58,533 |
| Year 4 | 58,533 |
| Year 5 | 58,533 |
| Year 6 | 58,533 |
| Year 7 | 58,533 |
| Year 8 | 58,533 |
| Year 9 | 58,533 |
| Year 10 | 58,533 |
| Total estimated reductions (tonnes of CO₂e) | 585,330 |
| Total number of crediting years | 10 |
| Annual average over the crediting period of estimated reductions (tones of CO₂e) | 58,533 |

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

The project does not receive any public funding from both Parties. The project does not use ODA directly or indirectly. The project owner, Zhejiang Jingxing Paper Joint Stock Co., Ltd will fund the project by itself through equity and bank loan.

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

The project participants confirm that there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity with the same project participants and

² <http://www.cecchina.com/en/index.html>

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whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

According to Appendix C to the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*, the Project is not a debundled component of a large-scale project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Methane avoidance component:

The approved CDM small-scale baseline and monitoring methodology AMS III.H “Methane Recovery in Wastewater Treatment” (Version 14) is applied to the methane avoidance component of the project activity.

Electricity generation component:

The approved CDM small-scale baseline and monitoring methodology AMS-I.F “Renewable electricity generation for captive use and mini-grid” (Version 01) is applied to the electricity generation component of the project activity.

For more information on both methodologies, please refer to the link:

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

For calculation of the combined margin baseline emission factor, the methodological tool “Tool to calculate the emission factor for an electricity system” (Version 02) is used.

For more information, please refer to the link:

<http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.pdf>

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

The approved small-scale methodology AMS-III.H is applicable to the project activity due to following reasons:

- The Project comprises measures that recover methane from biogenic organic matter in wastewaters by means of introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as an anaerobic reactor (paragraph 1-IV)
- The recovered biogas from the above measures is utilised for the following applications instead of combustion/flaring (a) Thermal or electrical energy generation directly (paragraph 2-a)
- The location of the wastewater treatment plant shall be uniquely defined as well as the source generating the wastewater.
- Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO₂ equivalent annually

The approved small-scale methodology AMS-I.F is applicable to the project activity due to following reasons:

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- The Project comprises a renewable energy generation unit with a maximum output capacity not surpassing 15 MW, and
- The generated electricity will be transferred to the paper mill, which imports electricity from the East China Power Grid and from the on-site coal-fired generation plant.

The project participants confirm that the installed capacity of the Project will not be increased throughout the crediting time of the project beyond the 15 MW threshold for small-scale CDM projects.

| |
|--|
| B.3. Description of the project boundary: |
|--|

The spatial extent of the project boundary is defined as the physical, geographical site where the wastewater and sludge treatment takes place (including all equipments for biogas use or flaring). As explained under Section B.4 the baseline for the electricity generation component of the project activity is defined as the East China Power Grid as the electricity generated from the captured biogas will be consumed on site and replace some amount of electricity imported from East China Power Grid.

1. In a country like China, with a layered dispatch system, grid boundary definitions shall be based on regional grids
2. The Project's electricity generation unit is connected to the Zhejiang Grid via local grid network, and thus finally to the East China Power Grid. The East China Power Grid is a large regional grid, which consists of five sub-grids: Shanghai Grid, Jiangsu Grid, Zhejiang Grid, Anhui Grid and Fujian Grid.
3. There is substantial inter-grid power exchange among the above-mentioned sub-grids of the East China Power Grid.
4. The East China Power Grid can be clearly identified as regional grid and information on the characteristics of this grid is publicly available.
5. There is guidance from the Chinese CDM Designated National Authority (National Climate Change Coordination Office) on project boundaries identifying the applicable grid as the project boundary.

Table B.1 Emission Sources in Baseline Scenario and Project Activity

| | Source | Gas | | Justification/Explanation |
|------------------|------------------------------------|------------------|----------|--|
| Baseline | Wastewater treatment | CH ₄ | Included | The major source of emissions in the baseline from wastewater plant |
| | | N ₂ O | Excluded | Excluded for simplification. This is conservative. |
| | | CO ₂ | Excluded | CO ₂ emissions from the decomposition of organic waste are not accounted for |
| | Electricity consumption/generation | CH ₄ | Excluded | Excluded for simplification. This is conservative. |
| | | N ₂ O | Excluded | Excluded for simplification. This is conservative. |
| | | CO ₂ | Included | Electricity is generated with biogas from an anaerobic digester under the project activity, electricity generation from the grid is displaced by the project activity. |
| Project Activity | Wastewater treatment | CH ₄ | Included | As the wastewater treatment plant remains unchanged, only installed methane emissions from flaring will be taken into account. |
| | | N ₂ O | Excluded | Not required by AMS.III.H |
| | | CO ₂ | Excluded | CO ₂ emissions from the decomposition of |

| | | | | |
|-------------------------|-----|----------|--|---|
| | | | | organic waste are not accounted for |
| On-site electricity use | CH4 | Excluded | | Excluded for simplification. This emission source is assumed to be very small. |
| | N2O | Excluded | | Excluded for simplification. This emission source is assumed to be very small. |
| | CO2 | Included | | As the wastewater treatment plant remains unchanged, only electricity consumption from the new material installed will be taken into account. |
| On-site fossil fuel use | CH4 | Excluded | | Project will not cause additional fossil fuel consumption |
| | N2O | Excluded | | Project will not cause additional fossil fuel consumption |
| | CO2 | Excluded | | Project will not cause additional fossil fuel consumption |

Following Figure 3 shows a schematic diagram of the project boundary.

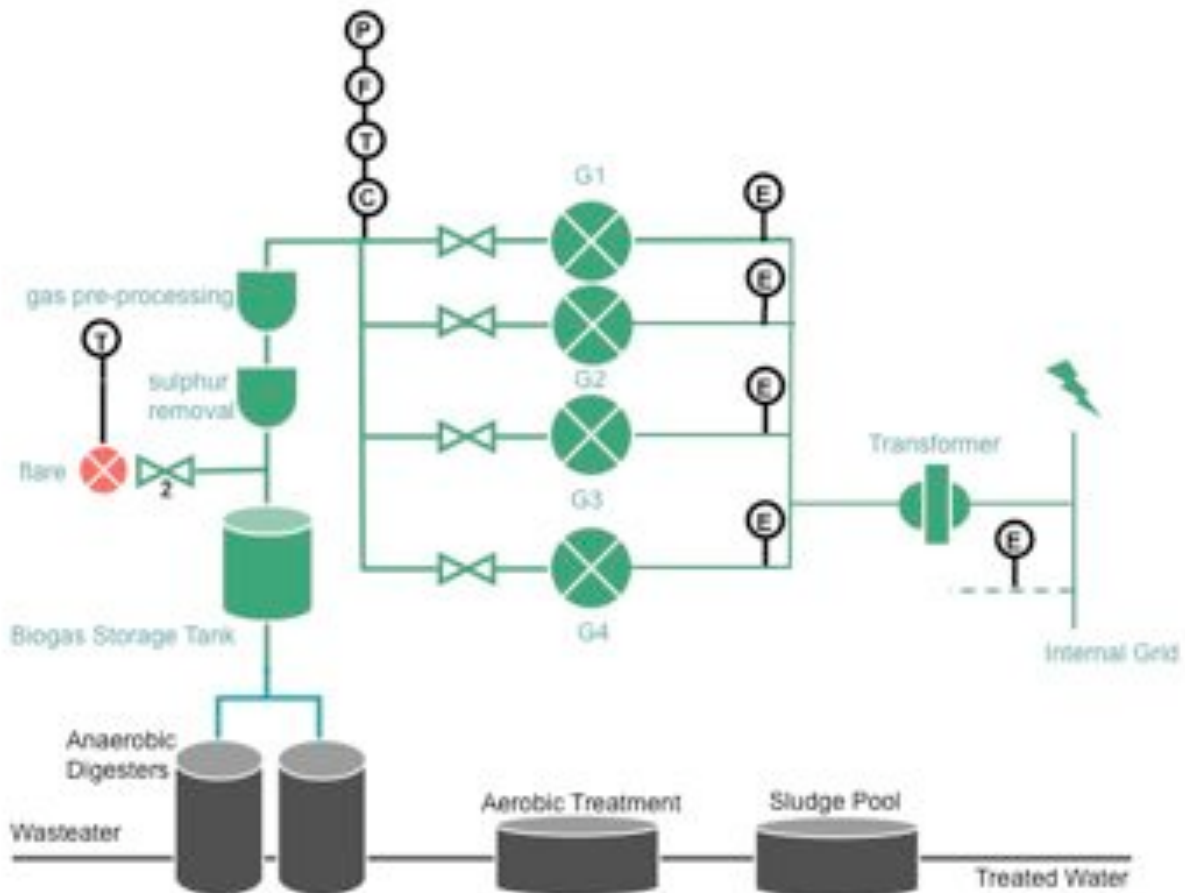


Figure 3. Project Boundary

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| |
|---|
| B.4. Description of <u>baseline and its development</u>: |
|---|

As applicable laws and regulation do not mandate the utilization and destruction, the project owner can only operate the wastewater treatment system without any collection and utilization of the methane. Furthermore, utilizing the biogas without CDM revenues is not financial attractive according to the analysis in Section B.5.

Based on the above situation, releasing biogas directly to the atmosphere and importing equivalent amount of electricity from the grid is the most likely baseline scenario, as they would face the least barriers. As a result, the baseline scenario of the project can be described as follows: In the absence of the proposed biogas recovery and electricity generation system, biogas would continue to be directly released to the atmosphere and electricity would continue to be generated by the mix of power plants connected to the East China Power Grid.

| |
|---|
| 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 <u>small-scale</u> CDM project activity: |
|---|

Project participants choose option (a) with a brief history of the project to demonstrate the additionality of proposed project activity.

Prior Consideration of CDM

The following table gives an overview of the project history. As per paragraph 67 of EB41, the project start date is chosen as the first equipment purchasing contract date (13th December 2008).

As per the “Guidelines on the demonstration and assessment of prior consideration of the CDM” (version 02)³, the proposed project activity is defined as an “existing project activity”. The first supporting evidences for “prior consideration of CDM” and of “CDM awareness” are dated as early 2007 and are described in the table below. The decision to develop the proposed Project was taken during a board meeting held in October 2008 based on the assumption that the project is only financially viable 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 consultants or negotiations with South Pole Carbon Ltd. showing that the PO was actively and continuously looking for CDM services.

³ <http://cdm.unfccc.int/UserManagement/FileStorage/MB6XIY1TWLS7KQO25EFDA98VPC3J0H>

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Table B.2. Brief history of the project

| Document | Date | Description |
|--|-------------|--|
| FSR | August 2008 | The FSR concluded |
| Project approval | 26/08/2008 | The project received FSR approval from Economy and Trade Bureau of Pinghu City |
| Board decision of project with CDM | 10/09/2008 | Based on conclusion of the feasibility study, the project will be only viable with CDM revenues taken into account, board of Jingxing Paper Joint Stock Co., Ltd. decided to construct the biogas recovery for energy generation project and apply for CDM registration. |
| EIA | Nov. 2008 | The EIA study was completed |
| Environmental approval (EIA approval) | 21/11/08 | The project received EIA approval from Environmental Protection Bureau of Pinghu City |
| Equipments purchasing contract signed and Project construction started | 13/12/08 | Project start date: First purchasing contract with equipment integrator and suppliers signed in December 2008. |
| Financial closure date | 20/12/08 | |
| ERPA signed with South Pole Carbon Asset Co. Ltd. | 01/05/09 | |
| CDM project notification (DNA) | 09/06/09 | |
| CDM project notification (UNFCCC) | 09/06/09 | |

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Additionally of the Project is demonstrated based on the requirement of Attachment A of Appendix B to the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*. As per Attachment A of Appendix B, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

- a. Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
- b. Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
- c. Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- d. Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Investment Barrier Analysis (Option a)

This section is to demonstrate that a financially more viable alternative to the project activity would have led to higher emissions. Because the *Simplified Modalities and Procedures for Small-scale CDM Project Activities* does not specify a method to demonstrate financial barrier, project participants here apply the benchmark analysis method of investment analysis from *Tool for the demonstration and assessment of additionality (Version 5.2)*.

The applicable environmental laws and regulations require only building wastewater treatment system and have not imposed any requirement on biogas recovery activities. Access to electricity supply is available for the plant, and moreover, Zhejiang Jinxing Paper Joint Stock Co., Ltd. already had a captive power plant. Hence power generation from biogas recovery is neither necessary nor indispensable. Proposed project not undertaken as a CDM project is not financially attractive, concluded from a financial analysis below. The construction started on 13th December 2008, after a serious consideration of CDM. Please refer to the brief history above for details. Relevant documents are available for DOE to review.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Following alternative scenarios have been identified as plausible and realistic alternatives for providing outputs or services comparable to the proposed project activity regarding biogas treatment:

Scenario M1: Implementation of the proposed Project without consideration of CDM revenues;

Scenario M2: Biogas capture and flaring without energy generation;

Scenario M3: Direct release of biogas to the atmosphere (continuation of current situation)

For power generation, the alternatives are:

Scenario E1: Implementation of the proposed Project without consideration of CDM revenues;

Scenario E2: Construction of a thermal power plant with an equivalent electricity output as the Project;

Scenario E3: Equivalent amount of electricity is supplied by the East China Power Grid.

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

All baseline alternatives are in compliance with the laws and regulations except **E2**. According to current regulations in China, thermal power plants of less than 135 MW are prohibited for construction in areas

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covered by the large electricity grids such as provincial grids⁴. At the same time, the construction of fossil-fuel-fired thermal power plants with an installed capacity of less than 100MW is strictly controlled by the authority⁵. Therefore, this scenario does not comply with Chinese relevant laws and regulations and cannot be considered a feasible alternative to the Project.

Outcome of Step 1b

From the analysis in Section B.4 it can be concluded that the **combination of M3 and E3**, say “direct release biogas to atmosphere” and “equivalent amount of electricity is supplied by East China Power Grid”, and **the project activity not undertaken as a CDM project (M1+E1)** are the realistic and credible alternatives.

*Step 2. Investment analysis**Sub-step 2a. Determine appropriate analysis method*

The CDM project activity does generate financial and economic benefits other than CDM related income, say by power generation; hence the project cannot apply the simple cost analysis (Option I). Instead the participants decided to apply benchmark analysis (Option III).

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

The proposed project uses project IRR as the financial indicator. The official IRR benchmarks are publicly available. Power generation will be consumed on site in the paper mill for captive use. According to the annex 59 of EB 51 and “*The Economic Assessment Method and Parameters for Construction Projects (version 03)*”⁶, the pulp and paper industrial benchmark, i.e. equity IRR of 14%, is used as the project’s benchmark IRR.

Sub-step 2c. Calculation and comparison of financial indicators:

The key figures and project IRR with and without revenue from CERs are listed in the following Tables B.3 and B.4. Without CERs revenue, the project IRR of the proposed project is only 5.6%, far lower than the benchmark IRR.

Table B.3. Basic parameters for calculation of the Project’s IRR

| Parameter | Unit | Value | Source |
|---|-------------|--------|-------------------------------------|
| Installed capacity | MW | 1.5 | FSR ⁷ and Nameplate |
| Standby capacity | MW | 0.5 | |
| Estimated annual electricity net output | MWh/yr | 10,914 | FSR |
| Project lifetime (FSR) | Yr | 15 | FSR |
| Total investment | Million CNY | 37.6 | FSR and approval |
| Equity | Million CNY | 0.62 | FSR |
| Electricity tariff | CNY/kWh | 0.65 | Electricity Tariff used in decision |

⁴ Notice on Strictly Prohibiting the Installation of Fuel fired Generators with a Capacity of 135MW or below issued by the State Council Office, Guo Ban Fa Ming Dian [2002] No. 6.

⁵ The Management Provisional Regulation on the Construction of Small Fuel fired Generators (Aug. 1997)

⁶ Issued by the National Development and Reform Commission and the Ministry of Construction, published by China Planning Publishing House.

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| | | | |
|-------------------|-------------|--------|--------------------------------------|
| | | | making |
| VAT rate | % | 17% | National Tax Policies |
| O&M Cost | Million CNY | 4.993 | FSR |
| Salary | Million CNY | 0.25 | FSR |
| Maintenance Costs | Million CNY | 0.75 | FSR |
| Materials | Million CNY | 1.4863 | FSR |
| CER price | EUR | 8 | ERPA |
| IRR Benchmark | % | 14 | Benchmark of pulp and paper industry |

Using the values above, the IRR of the Project is only 5.6% without consideration of CERs sales revenues, which is considered to be economically not attractive. While considering CERs revenue, the IRR will reach to 16.82%. Therefore, the Project faces severe investment barriers and fulfils the requirement of additionality.

Sensitivity Analysis

The tool for the demonstration and assessment of additionality requires that a sensitivity analysis is conducted to check whether, under reasonable variations in the critical assumptions, the results of the analysis remain unaltered.

The following key parameters have been selected as sensitivity indicators to test the financial attractiveness for the proposed project:

- Power/heat generation
- Electricity tariff
- Total Investment
- Operational and Maintenance Costs

Variations of $\pm 10\%$ have been considered for the parameters. The figure below shows when these four key parameters change within $\pm 10\%$, IRR of the project is always lower than 14%.

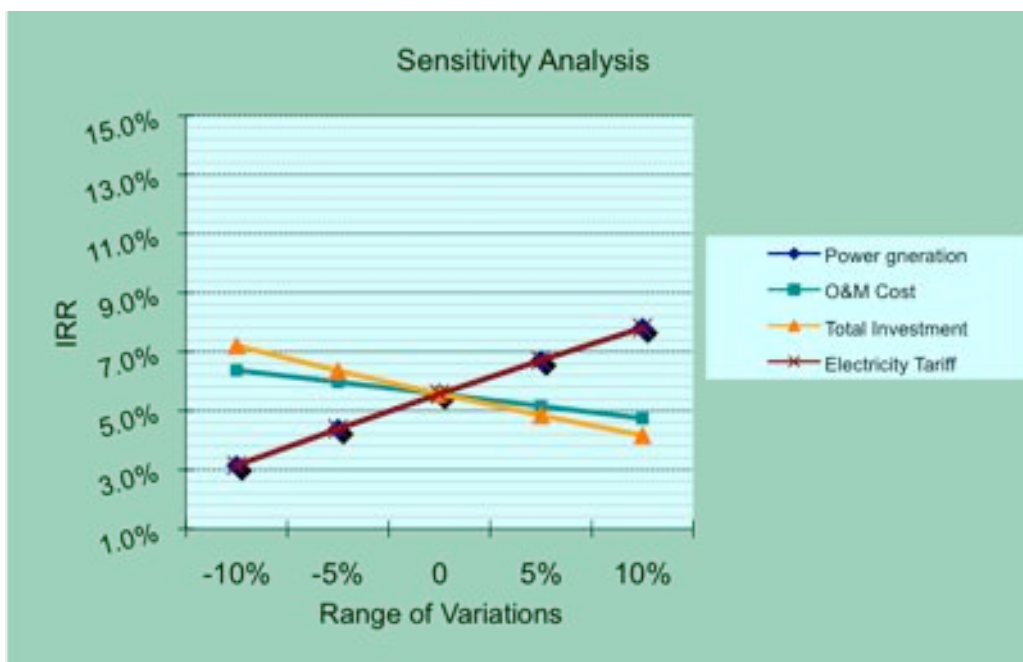


Figure 5 Sensitivity Analysis: Power/Heat Generation

Power/heat generation estimation in FSR is based on 340 days of operation at 100% load. 10% higher in power/heat generation would lead to operation days of 374 days, more than total number of days in a whole year. Thus absolutely impossible, and space of higher power/heat generation is little. The net generation is calculated based on output of methane from the wastewater treatment system. Daily methane generation is estimated as 1500Nm³, and one cubic metre CH₄ can produce about 2.2kwh electricity according the engine and generators' efficiency. Considering the annual supply and capacity, the average operation hour of generators should be 7667 hours. Even if the operation hour increases to 8760 hours that is theoretical total hours in a year, the IRR will be only 8.7%, which is still far lower than the benchmark of 14%. And also, the operation hours of 8760 hours is unfeasible if taken maintenance and repairing into consideration.

Although the IRR will increase when the tariff becomes higher, the IRR will not cross the benchmark unless the tariff is over 42% higher than expected. This possibility should be negligible in the next 15 years according to historical tariff level. Evidences on tariff of last several years are available to the auditor. Furthermore, the actual import tariff from the grid is 0.65 RMB/kWh, the cost of supplying electricity by the captive thermal power plant is even lower than grid tariff, and thus applying 0.65 RMB/kWh in the IRR calculation is conservative. Corresponding evidence of 0.65 RMB/kWh is available and will be provided to the DOE.

O&M costs wise, food and oil prices have soared rapidly worldwide during recent years, which results costs rising in world's economy as well as for the project owner. In China, low-costs advantages are disappearing amid the economy's growth and human costs' raising as well as raw materials price's going upward. Chance for reduction in O&M costs is little. Hence range of $\pm 10\%$ in O&M cost is conservative. Generally, difference between actual total investment and total investment in FSR is limited within $\pm 10\%$ in China.

Due to inflation, the price of building materials and equipments increased during the past few years. From the year 2004 to 2007, the annual wages and the purchase price of raw materials and fuel (both key

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determinants for investment cost and O&M cost), increased by 59.58% and 33.51% respectively (please see details in Table B.3.2). Furthermore, in 2008 the price of building materials increased by 11.2% in Jan to Nov of 2008. Hence, the actual IRR calculation based on currently available data (post investment decision) would lead to lower values than the IRR based on data available at the time of investment decision.

As can be seen from investment analysis above, proposed project is not financially attractive without benefits from CERs.

Conclusion of Additionality Analysis

The proposed project activity is additional due to its poor IRR without considering CDM revenue, which is far lower than the benchmark of 14%. Without carbon revenue, plant owner would rather choose to go on with current situation, under which biogas from wastewater plant is released into atmosphere directly and East China Power Grid supplies equivalent amount of electricity. This would lead to more greenhouse gas emissions than project activity.

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| |
|----------------------------------|
| B.6. Emission reductions: |
|----------------------------------|

| |
|--|
| B.6.1. Explanation of methodological choices: |
|--|

Calculation of emission reductions of the project activity is in accordance with methodology of AMS III.H. Version 14. Here the project participants clarify that project activity of the proposed project falls under category (iv) of the paragraph 1 of AMS.III.H. Version 14, say, introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant. The emission reduction achieved by biogas heat and electricity generation is estimated according to the AMS I.F (Version 01).

I) Emission reductions due to methane avoidance***1.1) The calculation of Baseline emissions***

As explained under Section B.4, the baseline scenario for the methane avoidance component of the Project is the existing anaerobic wastewater treatment system without methane recovery and combustion (option (iv) as per AMS.III.H). As per Paragraph 16 of AMS III.H Version 14, baseline emissions are calculated as follows:

$$BE_{methane,y} = \left\{ BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y} \right\} \quad \text{Equation (1)}$$

Where:

BE_{methane,y} Baseline emissions due to methane avoidance in year *y* (tCO₂e)*BE_{power,y}* Baseline emissions from electricity or fuel consumption in year *y* (tCO₂e)*BE_{ww,treatment,y}* Baseline emissions of the wastewater treatment systems affected by the project activity in year *y* (tCO₂e)*BE_{s,treatment,y}* Baseline emissions of the sludge treatment systems affected by the project activity in year *y* (tCO₂e)*BE_{ww,discharge,y}* Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year *y* (tCO₂e).*BE_{s,final,y}* Baseline methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO₂e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected.

For this project activity, *BE_{power,y}*, *BE_{s,treatment,y}* are not applicable, as the power consumption of the wastewater treatment system remains unchanged both in the baseline scenario and project activity, and also, sludge produced by the wastewater treatment will be collected by Bureau of City Appearance Environmental and Sanitation of Guangzhou Municipality for harmless treatment. The proposed project will report final disposal of sludge for DOE validation and verification. Furthermore, according to paragraph 14, *BE_{ww,discharge,y}* and *BE_{s,final,y}* can also be neglected as the project activity will not have impacts to both of these two factors. The wastewater treatment system is still the same as baseline.

Therefore,

$$BE_{methane,y} = BE_{ww,treatment,y} \quad \text{Equation (1.1)}$$

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According to paragraph 20, in AMS.III.H version 14, methane emissions from the baseline wastewater treatment systems affected by the project activity ($BE_{ww,treatment,y}$) are determined using the methane generation potential of the waste water treatment systems:

$$BE_{ww,treatment,y} = \sum_i Q_{ww,i,y} * COD_{removed,i,y} * MCF_{ww,treatment,BL,i} * B_o * UF_{BL} * GWP_{CH4} \quad \text{Equation (1.2)}$$

Where:

| | |
|---------------------------|---|
| $Q_{ww,i,y}$ | Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3) |
| $COD_{removed,i,y}$ | Chemical oxygen demand removed by baseline treatment system i in year y (tonnes/ m^3), measured as the difference between inflow COD and the outflow COD in system i |
| $MCF_{ww,treatment,BL,i}$ | Methane correction factor for baseline wastewater treatment systems i (MCF values as per table III.H.1) |
| $B_{o,ww}$ | Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.25 kg CH_4 /kg COD) ⁶ |
| UF_{BL} | Model correction factor to account for model uncertainties (0.89) |
| GWP_{CH4} | Global Warming Potential for methane (value of 21) |

1.2) The calculation of project emissions

The project activity emissions due to methane avoidance are calculated as follows (Paragraph 26 of ASM III.H Version 12):

$$PE_{methane,y} = \langle PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \rangle \quad \text{Equation (2)}$$

Where:

| | |
|-----------------------|---|
| $PE_{methane,y}$ | Project activity emissions due to methane avoidance in the year “ y ” (tCO ₂ e) |
| $PE_{power,y}$ | Emissions from electricity or fuel consumption in the year y (tCO ₂ e). These emissions shall be calculated as per paragraph 11, for the situation of the project scenario, using energy consumption data of all equipment/devices used in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use. |
| $PE_{ww,treatment,y}$ | Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO ₂ e). |
| $PE_{s,treatment,y}$ | Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO ₂ e). |
| $PE_{ww,discharge,y}$ | Methane emissions from degradable organic carbon in treated wastewater in year y (tCO ₂ e). |
| $PE_{s,final,y}$ | Methane emissions from anaerobic decay of the final sludge produced in year y (tCO ₂ e). |
| $PE_{fugitive,y}$ | Methane emissions from biogas release in capture systems in year y , |
| $PE_{biomass,y}$ | Methane emissions from biomass stored under anaerobic conditions. In case storage of biomass under anaerobic conditions takes place due to the project activity that doesn't occur in the baseline situation, methane emissions due to anaerobic decay of this biomass shall be considered and be determined as per the procedure in the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” (tCO ₂ e) |
| $PE_{flaring,y}$ | Methane emissions due to incomplete flaring in year y as per the “Tool to determine project emissions from flaring gases containing methane”(tCO _e) |

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In terms of $PE_{power,y}$, as the wastewater treatment plant remains unchanged, and only electricity consumption from the new material installed will be taken into account, and this part of the emissions will be deducted from the baseline emissions of electricity component. The baseline emissions of electricity component will be defined as the net electricity exported to the grid times emission factor. Therefore, here $PE_{power,y}$ will not be calculated.

$PE_{ww,treatment,y}$, $PE_{s,treatment,y}$, $PE_{ww,discharge,y}$, $PE_{s,final,y}$, $PE_{biomass,y}$ are all not applicable. According to paragraph 14, AMS.III.H version 14, $PE_{ww,treatment,y}$, $PE_{ww,discharge,y}$, $PE_{biomass,y}$ remain unchanged as the treatment water treatment system remain unchanged, and only methane capture system was installed. As per AMS.III.H, $PE_{s,treatment,y}$ methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO₂e). ($PE_{s,treatment,y}$) can be neglected if the sludge is combusted in a controlled manner, disposed in a landfill with methane recovery or used for soil application. After implementation of the project activity, same as business as usual, the sludge produced by the wastewater treatment will be collected by Bureau of City Appearance Environmental and Sanitation of Guangzhou Municipality⁸ for harmless treatment. The proposed project will report final disposal of sludge for DOE validation and verification, therefore, $PE_{s,final,y}$ are also not applicable under the calculation of emission reductions.

Hence,

$$PE_{methane,y} = PE_{fugitive,y} + PE_{flaring,y} \quad \text{Equation (2.1)}$$

a) $PE_{fugitive,y}$

$PE_{fugitive,y}$ Methane emissions from biogas release in capture systems in year y , calculated as per paragraph 27 (tCO₂e)

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y} \quad \text{Equation (2.2)}$$

Where:

$PE_{fugitive,ww,y}$ Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment in year “ y ” (tCO₂e);

$PE_{fugitive,s,y}$ Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment in the year “ y ” (tCO₂e)

Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment in the year “ y ” is not applicable because the project activity does not comprise an anaerobic treatment system for sludge and it only consists of an anaerobic treatment system for wastewater only. Hence, the term $PE_{fugitive,s,y}$ is neglected.

The first term of the equation above is calculated as follows:

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) \cdot MEP_{ww,treatment,y} \cdot GWP_{CH4} \quad \text{Equation (2.2.1)}$$

Where:

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

GWP_{CH4} Global Warming Potential for methane (value of 21 is used)

⁸ <http://www.gzsrhw.gov.cn/>

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$MEP_{ww,treatment,y}$ Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (tonnes) which is calculated according to the equation below:

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} \cdot MCF_{ww,treatment,PJ,k} \quad (2.2.2)$$

Where:

- $Q_{ww,y}$ Volume of wastewater treated in the year y (m)
 $B_{o,ww}$ Methane producing capacity of the wastewater (IPCC default value for domestic wastewater of 0.25kg CH₄/kg COD)
 $COD_{removed,PJ,k,y}$ The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y (tonnes/m³)
 $MCF_{ww,treatment,PJ,k,y}$ Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment (MCF values as per table III.H.1 is 0.8)
 UF_{PJ} Model correction factor to account for model uncertainties (1.12)

b) PE_{flaring,y}

Methane emissions due to incomplete flaring in year y are calculated as per the “Tool to determine project emissions from flaring gases containing methane” (tCO₂e). The project owner has installed open flaring system. For the determination of the flare efficiency, the default value of 50% will be used for the calculation of project emissions from flaring gases. According to the description in the “Tool to determine Project emissions from flaring gases containing methane” the Project emissions from flaring gases are calculated as follows:

$$PE_{flare,y} = \sum_{i=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH_4}}{1000} \quad \text{Equation 2.3}$$

Where:

- $PE_{flare,y}$: Project emissions from flaring of the residual gas stream in a year y ; tCO₂e
 $TM_{RG,h}$ Mass flow rate of methane in the residual gas in the hour h ; kg/h
 $\eta_{flare,h}$ Flare efficiency in hour h ; %

The mass flow rate of methane in the residual gas is calculated as follows:

$$TM_{RG,h} = FV_{RG,h} \times fV_{CH_4,RG,h} \times \rho_{CH_4,n} \quad \text{Equation 2.3.1}$$

Where:

- $TM_{RG,h}$ Mass flow rate of methane in the residual gas in the hour h ; kg/h
 $FV_{RG,h}$ Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h ; Nm³/h
 $fV_{CH_4,RG,h}$ Volumetric fraction of methane in the residual gas on dry basis in hour h ;
 $\rho_{CH_4,n}$ Density of methane at normal conditions (0.7168 Kg/Nm³)

1.3) Leakage

As per AMS.III.H leakage effects do not have to be considered since the used technology equipment is not being transferred from or to another activity. The proposed project activity does not involve upgrading and bottling of biogas and no leakage will happen from this part either, hence:

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$$Leakage_y = 0 \quad \text{Equation (3)}$$

I.4) Emission reductions due to methane avoidance

The emission reductions related to methane avoidance in the wastewater treatment process are calculated as the difference between the baseline emissions (Section 1.b above) and the sum of the project emissions (Section 1.a) and leakage (Section 1.c):

$$ER_{methane,y,ex:ante} = BE_{methane,y,ex:ante} - (PE_{methane,y,ex:ante} + LE_{methane,y,ex:ante}) \quad \text{Equation (4)}$$

Where:

$ER_{y,ex\ ante}$ *Ex ante* emission reduction in year y due to the methane avoidance (tCO₂e)

$LE_{y,ex\ ante}$ *Ex ante* leakage emissions in year y due to methane avoidance (tCO₂e)

$PE_{y,ex\ ante}$ *Ex ante* project emissions in year y due to methane avoidance (tCO₂e)

$BE_{y,ex\ ante}$ *Ex ante* baseline emissions in year y due to methane avoidance (tCO₂e)

In accordance with the paragraph 31 of AMS III.H, emission reductions from the methane recovery component 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:

$$ER_{y,ex:post} = \min(BE_{methane,y,ex:post} - PE_{methane,y,ex:post} - LE_{methane,y,ex:post}), \quad \text{Equation (4.1)}$$

$$(MD_{methane,y} - PE_{methane,y,ex:post} - LE_{methane,y,ex:post})$$

Where:

$ER_{y,ex\ post}$ Emission reductions achieved by methane avoidance based on monitored values for year y (tCO₂e)

$BE_{y,ex\ post}$ Baseline emissions due to methane avoidance calculated as per paragraph 16 using *ex post* monitored values (tCO₂e)

$PE_{y,ex\ post}$ Project emissions due to methane avoidance calculated as per paragraph 26 using *ex post* monitored values (tCO₂e)

$MD_{methane,y}$ Methane captured and destroyed/gainfully due to methane avoidance in the year y (tCO₂e)

$$MD_{methane,y} = BG_{burnt,y} * W_{CH4} * D_{CH4} * FE * GWP_{CH4} \quad \text{Equation (4.1.1)}$$

Where:

$BG_{burnt,y}$ Biogas flared/combusted in year y (m³)

$W_{CH4,y}$ Methane content₁₂ 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/m³)

FE Flare efficiency in year y (fraction)

II) Emission reductions due to electricity displacement

As per AMS.I.F version 01,

$$ER_y = BE_y - PE_y - Leakage_y \quad \text{Equation (5)}$$

Where:

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| | |
|----------------------|---|
| ER_y | Emission reductions in year “y”, tCO ₂ e |
| BE_y | Baseline emissions in year “y”, tCO ₂ e |
| PE_y | Project emissions in year “y”, tCO ₂ e |
| Leakage _y | Leakage emissions in year “y”, tCO ₂ e |

Project emissions are not applicable as the project activity will not consume electricity, and EG_y refers to net electricity supplied to the grid. According to AMS-I.F Version 01, because there is neither energy generating equipment transferred from another activity nor existing equipment transferred to another activity, so no leakage calculation is required for the proposed project activity.

Hence,
 $ER_y = BE_y$

As per AMS I.F version 01 paragraph 14: Baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the ‘Tool to calculate the emission factor for an electricity system’.

OR

(b) The weighted average emissions (in kg CO₂e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The option (a) has been used which prescribes use of “Tool to calculate the emission factor for an electricity system.” Furthermore,

$$BE_y = ER_y = EG_{BL,y} * EF_{CO_2,y} \quad \text{Equation (5.1)}$$

Where:

| | |
|---------------|---|
| $EG_{BL,y}$ | Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year y (MWh) |
| $EF_{CO_2,y}$ | Emission factor (tCO ₂ /MWh) |

At this point, it is important to clarify the nature of electricity replaced by the project activity. On-site there is already a coal-fired cogeneration for internal heat and electricity supply. Surplus amount of electricity is exported to the grid. The biogas plant is connected to the company grid and replaces therefore electricity from the East China power grid and from the coal-fired power plant. As grid emission factor, the PPs can therefore consider the 3 following options:

1. The emission factor is the one from the East China grid.
2. The emission factor is the one from the coal-fired power plant.
3. The emission factor is a mix of the coal-fired power plant and from the East China grid.

Options 2 and 3 have been excluded by the PPs respectively for the following reasons:

- As the coal-fired cogeneration power plant is driven by heat demand, heat demand is unchanged by biogas plant. As consequence, electricity production by coal plant should also remain unchanged.
- It is not possible to measure exactly how much electricity produced by biogas plant is consumed internally and how much is exported.

Hence, electricity produced by biogas system is assumed to be surplus electricity, which is exported to the grid. The PPs therefore consider the grid emission factor from the East China grid, which is conservative assumption when compared to the coal plant emission factor.

a) Calculation of Baseline Emission Factor from the East China Power grid

The baseline emission factor is calculated according to method (a) selected from the methodology AMS-I.F (Version 01) as the Combined Margin (CM): the equally weighted average of the Operating Margin (OM) emission factor ($EF_{OM,y}$) and the Build Margin (BM) emission factor ($EF_{BM,y}$). Combined, Operating and Build Margin emission factors are calculated according to the procedures prescribed in the “*Tool to calculate the emission factor for an electricity system*” (Version 2). The detailed calculation approach and the applied formulae are provided in this section, whereas all calculation tables and parameters are listed in Annex 3.

Step 1. Identify the relevant electricity systems

As per delineation of Chinese national electric system published by *National Development and Reform Commission*, which is also Chinese DNA, the relevant electric power system is *East China Power Grid*. The Project’s electricity generation unit is connected to the *company’s internal* and consumed totally on site replacing same amount of electricity imported from East China Power Grid. The *East China Power Grid* is a large regional grid, which consists of four sub-grids: *Shanghai Grid, Zhejiang Grid, Jiangsu Grid, Anhui Grid* and *Fujian Grid*. There is substantial inter-grid power exchange among the above-mentioned sub-grids of the *East China Power Grid*. The *East China Power Grid* can be clearly identified as regional grid and information on the characteristics of this grid is publicly available.⁹

For the purpose of determining the operating margin emission factor, use the simple operating margin emission rate of the exporting grid, determined as described in step 3 (a) to determine the CO₂ emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from a connected electricity system within the same host country(ies).

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

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

The project chooses only to include the grid power plants in the calculation (Option I), as information of the off-grid power plants is not completely publicly accessible.

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

⁹ National Development and Reform Commission of China published delineation of the electricity grid of China. Please visit <http://cdm.ccchina.gov.cn/web/index.asp> for more details.

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“*Tool to calculate the emission factor for an electricity system*” (Version 2) outlines four options for the calculation of the Operating Margin emission factor(s) ($EF_{grid,OM,y}$):

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch Data Analysis OM, or
- (d) Average OM.

As per “*Tool to calculate the emission factor for an electricity system*” (Version 2), any of the four methods can be used. “Dispatch Data Analysis” method is not selected herein, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, the simple adjusted OM methodology cannot be used.

The Simple OM method has been chosen instead. This is possible because low cost/ must run resources account for less than 50% of the power generation in the grid in most recent years. From 2002 to 2006, according to gross annual power generation statistics for the East China Power Grid, the ratio of power generated by hydro-power and other low cost/compulsory resources was: 11.86% in 2002, 10.96% in 2003, 9.77% in 2004, 11.65% in 2005 and 11.34% in 2006 respectively, significantly lower than 50%.¹⁰

The simple OM of the grid for the proposed project is calculated using the Ex ante option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

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

The simple Operating Margin (OM) emission factor ($EF_{grid,OMsimple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO₂/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. As per “*Tool to calculate the emission factor for an electricity system*” (Version 2), it may be calculated:

Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit; or

Option B: Based 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.

Option B can only be used if:

- (a) The necessary data for Option A is not available; and
- (b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
- (c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

Since neither the data of fuel consumption nor the net electricity generation for every single electricity generation plant/unit is publicly available for *East China Power Grid*, nuclear and renewable power

¹⁰ *China Energy Year Book, 2003-2007*

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generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known and off-grid power plants are not included in the calculation, the proposed project uses Option B for simple OM calculation.

Option B - Calculation based on total fuel consumption and electricity generation of the system

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

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

Where:

| | |
|------------------------|--|
| $EF_{grid,OMsimple,y}$ | Simple operating margin CO2 emission factor in year y (tCO ₂ /MWh) |
| $FC_{i,y}$ | Amount of fossil fuel type i consumed by project electricity system in year y (mass or volume unit) |
| $NCV_{i,y}$ | Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit) |
| $EF_{CO2,i,y}$ | CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ) |
| EG_y | Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh) |
| i | All fossil fuel types combusted in power plant / unit m in year y |
| y | The relevant year as per the data vintage chosen in Step 3 |

The Operating Margin emission factors for 2004, 2005 and 2006 are calculated separately and then the three-year average is calculated as a full-generation-weighted average of the emission factors. For details please refer to Annex 3. The result of the Operation Margin Emission Factor calculation is 0.8825 tCO₂e/MWh.

The operating margin emission factor of the baseline is calculated as a fixed ex-ante value and will not be renewed within the first crediting period of the project activity.

Step 5. Identify the group of power units to be included in the build margin

As per the emission factor tool, the sample group of power units m used to calculate the build margin consists of either:

- The set of five power units that have been built most recently, or
- 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.

However, in China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system

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generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts¹¹ the following deviation in methodology application:

- 1) Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1 - 3 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.
- 2) Proportional weights that correlate to the distribution of installed capacity in place during the selected period above are applied, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency levels of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex- post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Project participants have chosen *Option 1* for BM calculation.

Step 6. Calculate the build margin emission factor

As per the method of Chinese NDRC accepted by EB, since there is no way to separate the different generation technology capacities based on coal, oil or gas fuel etc from the generic term “thermal power” in the present energy statistics, the following calculation measures will be taken:

First, according to the energy statistics of the selected period in which approximately 20% capacity has been added to the grid, determine the ratio of CO₂ emissions produced by solid, liquid, and gas fuel consumption for power generation; then multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency. Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

¹¹ This is in accordance with the “Request for guidance: Application of AM0005 and AMS-I.D in China”, a letter from DNV to the Executive Board, dated 07/10/2005, available online at:

<http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM>.

This approach has been applied by several registered CDM projects so far.

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Sub-step 1

Calculate the proportion of CO₂ emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO₂ emissions from the total fossil fuelled electricity generation (sum of CO₂ emissions from coal, oil and gas).

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}} \quad \text{Equation (5.1.2)}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}} \quad \text{Equation (5.1.3)}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}} \quad \text{Equation (5.1.4)}$$

Where,

$F_{i,m,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power sources j in year(s) y ,
 $COEF_{i,j,m}$ is the CO₂ emission coefficient of fuel i (tCO₂e/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power plants m and the oxidation percentage of the fuel in year(s) y ,
Coal, *Oil* and *Gas* stands for solid, liquid and gas fuels respectively.

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

$$EF_{Thermal} = \lambda_{Coal} \cdot EF_{Coal,Adv} + \lambda_{Oil} \cdot EF_{Oil,Adv} + \lambda_{Gas} \cdot EF_{Gas,Adv} \quad \text{Equation(5.1.5)}$$

Where,

$EF_{Thermal}$ is the weighted emissions factor of thermal power generation with the efficiency level of the best commercially available technology in China in the previous three years.

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$ are the emission factors of coal, oil and gas-fired power generation with efficiency levels of the best commercially available technology in China in the previous three years.

A coal-fired power plant with a total installed capacity of 600 MW is assumed to be the best commercially available technology in terms of efficiency, the estimated coal consumption of such a National Sub-critical Power Station with a capacity of 600MW is 329.94 gce/kWh, which corresponds to an efficiency of 37.28% for electricity generation.

For gas and oil power plants a 200MW power plant with a specific fuel consumption of 252gce/kWh, which corresponds to an efficiency of 48.81% for electricity generation, is selected as the best commercially available technology in terms of efficiency.

The main parameters used for calculation of the thermal power plant emission factors $EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$ are provided in Annex III.

Sub-step 3: Calculate the Build Margin emission factor

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$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \cdot EF_{Thermal} \quad \text{Equation(5.1.6)}$$

Where,

CAP_{Total} is the total capacity addition of the selected period in which approximately 20% capacity has been added to the grid,

$CAP_{Thermal}$ is the total thermal power capacity addition of the selected period in which approximately 20% capacity has been added to the grid.

Detailed calculations are provided in Annex 3.

The result of the Build Margin emission factor calculation is 0.6826 tCO₂e/MWh.

As mentioned above, the build margin emission factor of the baseline is calculated as a fixed ex-ante value and will not be renewed within the first crediting period.

The data sources for calculating OM and BM are:

1. Installed capacity, power generation and the rate of internal electricity consumption of thermal power plants for the years 2005 to 2007
Source: *China Electric Power Yearbook* (2006-2008)
2. Fuel consumption and the net caloric value of thermal power plants the years 2005 to 2007
Source: *China Energy Statistics Yearbook* (figures are for 2006-2008)
3. Carbon emission factor and carbon oxidation factor of each fuel
Source: *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*, P1.23 and P1.24 in Chapter one.

Step 7. Calculate the combined margin emissions factor

The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the Operating Margin and Build Margin.

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y} \quad \text{Equation(5.1.7)}$$

The operating margin emission factor ($EF_{grid,OM,y}$) of East China Power Grid is 0.8825 tCO₂e/MWh and the build margin emission factor ($EF_{grid,BM,y}$) is 0.6826 tCO₂e/MWh. The defaults weights are used as specified in the emission factor tool: $w_{OM} = 0.5$; $w_{BM} = 0.5$

The result of the Baseline Emission Factor (EF_y) calculation is 0.78255 tCO₂e/MWh.

III. Total emission reductions

Overall,

$$ER_{total,y} = ER_{methane,y} + ER_{electricity,y} \quad \text{Equation(6)}$$

Where:

$ER_{total,y}$ total emission reductions in year “y”, tCO₂e
 $ER_{methane,y}$ emission reductions due to methane avoidance in year “y”, tCO₂e
 $ER_{electricity,y}$ emission reductions due to electricity displacement in year “y”, tCO₂e

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

| | |
|---|--|
| Data / Parameter: | $B_{o,ww}$ |
| Data unit: | kg CH ₄ /kg COD |
| Description: | methane producing capacity of the wastewater |
| Source of data used: | Methodology's default value |
| Value applied: | 0.25 kg CH ₄ /kg COD |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Methodology's default value using conservative correction factor |
| Any comment: | As per AMS.III.H Version 12, the IPCC default value of 0.25 kg CH ₄ /kg COD was corrected to take into account the uncertainties. |

| | |
|---|--|
| Data / Parameter: | GWP_{CH_4} |
| Data unit: | - |
| Description: | Global Warming Potential for methane |
| Source of data used: | IPCC: Climate Change 1995, The Science of Climate Change: Summary for Policymakers and Technical Summary of the Working Group I Report, pg. 26 |
| Value applied: | 21 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Standard value recommended by UNFCCC |
| Any comment: | |

| | |
|--|---|
| Data / Parameter: | MCF |
| Data unit: | Fraction |
| Description: | methane correction factor for the wastewater treatment system |
| Source of data used: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 5, Chapter 6), value for anaerobic reactors |
| Value applied: | $MCF_{ww,treatment,PJ,ky} = 0.8$ (for calculation of project emissions) $MCF_{ww,treatment,BL} = 0.8$ (for calculation of baseline emissions) |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | IPCC default value |
| Any comment: | As per AMS.III.H Version 14, the higher IPCC value is used for calculation of project emissions and the lower value for baseline emissions as a conservative measure. |

| | |
|--------------------------|--|
| Data / Parameter: | UF_{BL} |
| Data unit: | Factor |
| Description: | Model correction factor to account for model uncertainties |
| Source of data used: | AMS III.H/ Version 14 |
| Value applied: | 0.89 |

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| | |
|---|--|
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the AMS III.H, Correction factor will be used for estimation of baseline emissions. |
| Any comment: | |

| | |
|---|--|
| Data / Parameter: | UF_{PJ} |
| Data unit: | Factor |
| Description: | Model correction factor to account for model uncertainties |
| Source of data used: | AMS III.H/ Version 14 |
| Value applied: | 1.12 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the AMS III.H, Correction factor will be used for estimation of project activity emissions. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | CFE_{ww} |
| Data unit: | Fraction |
| Description: | Capture efficiency of the biogas recovery equipment in the wastewater treatment systems |
| Source of data used: | AMS III.H Version 14 |
| Value applied: | 0.9 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Default value |
| Any comment: | |

| | |
|--|--|
| Data / Parameter: | $EF_{grid,CM,y}$ |
| Data unit: | tCO ₂ /MWh |
| Description: | Combined margin CO ₂ emission factor of East China Power Grid in year <i>y</i> |
| Source of data used: | <i>China Electric Power Yearbook 2006-2008, China Energy Statistics Yearbook 2008, 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> |
| Value applied: | 0.78255 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Based on officially released statistics; publicly accessible and reliable data source with emission data for some fuels revised in compliance with IPCC 2006's default values. |
| Any comment: | Based on combined margin calculation of OM and BM of East China Power Grid. Weighting of OM and CM are both 50%. The proposed project uses fixed ex ante emission factor in the first crediting period. Detailed calculation is provided in Annex 3. |

| | |
|--------------------------|------------------------|
| Data / Parameter: | $EF_{grid,OMsimple,y}$ |
|--------------------------|------------------------|

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| | |
|---|--|
| Data unit: | tCO ₂ /MWh |
| Description: | Simple operating margin CO ₂ emission factor of East China Power Grid in year <i>y</i> |
| Source of data used: | <i>China Electric Power Yearbook 2006-2008, China Energy Statistics Yearbook 2008, 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> |
| Value applied: | 0.8825 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Based on officially released statistics; publicly accessible and reliable data source with emission data for some fuels revised in compliance with IPCC 2006's default values. |
| Any comment: | The proposed project uses fixed ex ante emission factor in the first crediting period. Detailed calculation is provided in Annex 3. |

| | |
|---|--|
| Data / Parameter: | $EF_{grid, BM, y}$ |
| Data unit: | tCO ₂ /MWh |
| Description: | Build margin of East China Power Grid in year <i>y</i> |
| Source of data used: | <i>China Electric Power Yearbook 2006-2008, China Energy Statistics Yearbook 2007, 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> |
| Value applied: | 0.6826 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | The proposed project used Chinese NDRC method to calculate BM emission factor. This alternative method was accepted by EB in registered projects from China. The proposed project uses fixed ex ante emission factor in the first crediting period. Detailed calculation is provided in Annex 3. |

| | |
|---|---|
| Data / Parameter: | $EG_{m, y}$ |
| Data unit: | MWh |
| Description: | Electricity delivered to the grid by relevant power sources <i>m</i> in (years) <i>y</i> (2005-2007, East China Power Grid) |
| Source of data used: | <i>China Electric Power Yearbook 2006-2008</i> |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate the OM and BM |

| | |
|--------------------------|---|
| Data / Parameter: | <i>Electricity Imports from Connected Electricity Systems to East China Power Grid</i> |
| Data unit: | MWh |
| Description: | Electricity Imports from Connected Electricity Systems to East China Power Grid in (years) <i>y</i> (2005-2007) |

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| | |
|---|--|
| Source of data used: | <i>China Electric Power Yearbook 2006-2008</i> |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate the OM |

| | |
|--|---|
| Data / Parameter: | $FC_{i,m,y}$ |
| Data unit: | $10^4\text{t}/10^8\text{m}^3$ |
| Description: | Amount of fuel i consumed by relevant power sources m in (years) y (2005-2007, East China Power Grid) |
| Source of data used: | <i>China Energy Statistics Yearbook 2006-2008</i> |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate OM and BM |

| | |
|--|---|
| Data / Parameter: | NCV_i |
| Data unit: | TJ/ 10^3 t |
| Description: | Net calorific value per mass or volume unit of fuel i |
| Source of data used: | <i>Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | IPCC 2006 default value |
| Any comment: | To calculate OM and BM |

| | |
|--|---|
| Data / Parameter: | $EF_{CO_2,i}$ |
| Data unit: | tCO ₂ /TJ |
| Description: | CO ₂ emission factor per energy unit of fuel i |
| Source of data used: | <i>Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | IPCC 2006 default value |
| Any comment: | To calculate OM and BM |

| | |
|--------------------------|--|
| Data / Parameter: | <i>Efficiency level of best technology commercially available in China for coal-fired power generation</i> |
| Data unit: | % |
| Description: | Efficiency level of best technology commercially available in China for |

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| | |
|--|---|
| | coal-fired power generation |
| Source of data used: | <i>China DNA: Notification on Determining the Regional Grid Emission Factors of China</i> |
| Value applied: | 38.10% |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate BM |

| | |
|--|---|
| Data / Parameter: | <i>Efficiency level of best technology commercially available in China for oil and gas-fired power generation</i> |
| Data unit: | % |
| Description: | Efficiency level of best technology commercially available in China for oil and gas-fired power generation |
| Source of data used: | <i>China DNA: Notification on Determining the Regional Grid Emission Factors of China</i> |
| Value applied: | 49.99% |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate BM |

| | |
|--|--|
| Data / Parameter: | $CAP_{y,i}$ |
| Data unit: | MW |
| Description: | The installed capacity of power generation sources j in (years) y (2005-2007, East China Power Grid) |
| Source of data used: | <i>China Electric Power Yearbook 2006-2008</i> |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate BM |

B.6.3 Ex-ante calculation of emission reductions:

| Short Description | Variable | Value | Unit | Equation |
|--|----------------------------|----------------------|------------------------|--------------|
| <u>I). Emission reduction due to methane avoidance</u> | <u>ER methane,y</u> | <u>49,993</u> | <u>tCO2e/yr</u> | Equation 4 |
| <u>I.1) Baseline emissions due to methane avoidance</u> | BE _{methane,y} | 57,191 | tCO2e/yr | |
| Volume of treated wastewater | Q _{ww,y} | 5,100,000 | m ³ /yr | Equation 1.2 |

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| | | | | |
|---|--|-----------------------|------------------------|----------------|
| COD of removed by the anaerobic reactor | CODremoved,y | 0.003 | t/m3 | Equation 1.2 |
| Methane producing capacity of wastewater | Bo,ww | 0.25 | t CH4/t COD | |
| Methane correction factor for wastewater treatment system | MCF _{ww,treatment} | 0.8 | - | |
| Model correction factor to account for model uncertainties | U _{FBL} | 0.89 | - | |
| Global warming potential of methane | GWP CH4 | 21 | - | |
| <u>I.1) Baseline emissions methane</u> | <u>BE methane,y</u> | <u>57,191</u> | <u>tCO2e/yr</u> | |
| <u>I.2) Project emissions due to methane avoidance</u> | <u>PE methane,y</u> | <u>7,198</u> | <u>tCO2e/yr</u> | |
| Volume of treated wastewater | Q _{ww,y} | 5,100,000 | m3/yr | Equation 2.2.2 |
| COD removed by the anaerobic reactor | COD _{y,ww,removed,PJ,k,y} | 0.003 | t/m3 | |
| Methane producing capacity of wastewater | Bo,ww | 0.25 | t CH4/t COD | |
| Methane correction factor for wastewater treatment system | MCF _{ww,treatment,PJ,k} | 0.8 | - | |
| Model correction factor to account for model uncertainties | U _{fpj} | 1.12 | - | |
| <i>Methane emission potential of wastewater treatment systems equipped with biogas recovery system</i> | <i>MEP_{ww,treatment,y}</i> | <i>3,427.2</i> | <i>t CH4/yr</i> | |
| Capture efficiency of the biogas recovery equipment in the wastewater treatment systems | CFE _{ww} | 0.9 | - | Equation 2.2.1 |
| Methane emission potential of wastewater treatment plant | MEP _{ww,treatment,y} | 3427.2 | t CH4/yr | |
| Global warming potential of methane | GWP CH4 | 21 | - | |
| <u>a) Fugitive project emissions</u> | <u>PE_{y,fugitive,ww}</u> | <u>7,198</u> | <u>tCO2e/yr</u> | |
| <u>b) Project emissions due to incomplete flaring</u> | <u>PE_{flaring,y}</u> | <u>0</u> | <u>tCO2e/yr</u> | Equation 2.3 |
| Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h | <u>FVRG,h</u> | <u>0</u> | <u>Nm3/h</u> | Equation 2.3.1 |
| Volumetric fraction of methane in the residual gas on dry basis in hour | <u>fv_{CH4,RG,h}</u> | <u>0</u> | | |
| Density of methane at normal conditions | <u>ρ_{CH4,n}</u> | <u>0.7168</u> | <u>Kg/Nm3</u> | |
| <i>Mass flow rate of methane in the residual gas in the hour h</i> | <u>TMRG,h</u> | <u>0</u> | <u>kg/h</u> | Equation 2.3.1 |
| <u>Flare efficiency in hour h</u> | <u>η_{flare}</u> | <u>50%</u> | | |
| Global warming potential of methane | <u>GWP</u> | <u>21</u> | | Equation 2.3 |
| <u>I.3) Leakage</u> | | <u>0</u> | <u>tCO2e/yr</u> | |
| <u>Emissions due to leakage effects</u> | <u>Leakage y,ww</u> | <u>0</u> | <u>tCO2e/yr</u> | Equation 3 |
| <u>I.4) Emission reductions due to methane avoidance</u> | | | | |
| <u>Emission Reductions due to methane avoidance</u> | <u>ER methane,y</u> | <u>49,993</u> | <u>tCO2e/yr</u> | Equation 4 |

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| | | | | |
|---|--------------------------------|----------------|------------------------|--------------|
| <u>II) Emission reductions due to electricity displacement</u> | <u>ER electricity,y</u> | 8,540 | <u>tCO2e/yr</u> | Equation 5 |
| <u>Grid Emission Factor Calculation 2008</u> | | | | |
| Operating Margin emission factor of regional grid | EFOM | 0.8825 | tCO2e/MWh | |
| Build Margin emission factor of regional grid | EFBM | 0.6826 | tCO2e/MWh | |
| Weight factor operating margin | w OM | 0.5 | - | |
| Weight factor build margin | w BM | 0.5 | - | |
| Combined Margin emission factor of regional grid | EFCM | 0.78255 | tCO2e/MWh | |
| Net Electricity supplied to the grid | EGy | 10,914 | Mwh/yr | |
| Combined margin emission factor of East China Power Grid 2008 | Efcm | 0.78255 | tCO2e/MWh | |
| <u>1.2) Baseline emissions due to electricity displacement</u> | <u>BE electricity,y</u> | 8,540 | <u>tCO2e/yr</u> | Equation 5.1 |
| <u>III) Total emission reductions</u> | <u>ER total ,y</u> | 58,533 | <u>tCO2/yr</u> | Equation 6 |

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

| Year | Estimations of project activity emissions (tCO ₂ e) | Estimation of baseline emissions (tCO ₂ e) | Estimations of leakage (tCO ₂ e) | Estimations of overall emission reductions (tCO ₂ e) |
|--|--|---|---|---|
| Year 1 | 7,198 | 65,731 | 0 | 58,533 |
| Year 2 | 7,198 | 65,731 | 0 | 58,533 |
| Year 3 | 7,198 | 65,731 | 0 | 58,533 |
| Year 4 | 7,198 | 65,731 | 0 | 58,533 |
| Year 5 | 7,198 | 65,731 | 0 | 58,533 |
| Year 6 | 7,198 | 65,731 | 0 | 58,533 |
| Year 7 | 7,198 | 65,731 | 0 | 58,533 |
| Year 8 | 7,198 | 65,731 | 0 | 58,533 |
| Year 9 | 7,198 | 65,731 | 0 | 58,533 |
| Year 10 | 7,198 | 65,731 | 0 | 58,533 |
| Total (tonnes of CO₂e) | 71,980 | 657,310 | 0 | 585,330 |

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

B.7.1 Data and parameters monitored:

1) Methane avoidance component:

| | |
|--------------------------|------------------|
| Data / Parameter: | $EC_{y,project}$ |
| Data unit: | MWh/yr |

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| | |
|--|--|
| Description: | Amount of electricity consumed by the equipment installed in addition to the existing wastewater treatment facility |
| Source of data to be used: | Measured by meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 286 MWh/year for power generation unit. |
| Description of measurement methods and procedures to be applied: | Measured continuously by a electricity meter and recorded on a monthly basis by monitoring personnel |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards |
| Any comment: | |

| | |
|--|---|
| Data / Parameter: | $Q_{ww,y}$ |
| Data unit: | m^3/yr |
| Description: | Volume of wastewater treated in the year “y” |
| Source of data to be used: | Measured by a flow meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Expected annual wastewater volume to be treated 5,100,000 m^3/yr |
| Description of measurement methods and procedures to be applied: | Measured continuously by a flow meter and recorded on a daily basis by monitoring personnel |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for recording data from the flow meter ▪ Meter will be calibrated periodically according to relevant national standards |
| Any comment: | Since calculation of emission reductions will be calculated based on actual methane captured and utilized or flared, volume of wastewater treated in year and COD value are only for crosscheck purpose. In case of methane flow meter failure, volume of wastewater and COD value can be used for estimation of amount of methane in a conservative way in crediting period. |

| | |
|----------------------------|--|
| Data / Parameter: | $COD_{removed,y}$ |
| Data unit: | tonnes/ m^3 (or mg/l) |
| Description: | Chemical oxygen demand removed in the wastewater through the anaerobic treatment reactor/system with methane capture in the year “y” |
| Source of data to be used: | Measured via lab test in compliance with national standard of <i>Methods of Monitoring and Analyzing of Water and Wastewater (Version 4) (GB11914)</i> |

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| | |
|--|---|
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Expected COD value of untreated wastewater is 3,000 mg/l |
| Description of measurement methods and procedures to be applied: | The Chemical Oxygen Demand (COD) test uses a strong chemical oxidant ($K_2Cr_2O_7$ or $Mn_2(SO_4)_3$) in an acid solution and heat to oxidize organic carbon to CO_2 and H_2O . By definition, chemical oxygen demand is “a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant. Oxygen demand is determined by measuring the amount of oxidant consumed using titrimetric or photometric methods. Measured and recorded on a daily basis by monitoring personnel. |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards |
| Any comment: | Since calculation of emission reductions will be calculated based on actual methane captured and utilized or flared, volume of wastewater treated in year and COD value are only for crosscheck purpose. In case of methane flow meter failure, volume of wastewater and COD value can be used for estimation of amount of methane in crediting period. |

| | |
|--|---|
| Data / Parameter: | $P_{biogas,y}$ |
| Data unit: | kPa |
| Description: | Pressure of biogas at entrance of power/heat generation system in the year “y” |
| Source of data to be used: | Measured by pressure meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | ER estimation in Section B.5 does not use biogas pressure. Biogas pressure is monitored and used for ex-post calculation of biogas density. Typical pressure is 15 kPa. |
| Description of measurement methods and procedures to be applied: | Measured continuously by a pressure meter and recorded on a daily basis by monitoring personnel |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for recording data from the flow meter ▪ Meter will be calibrated periodically according to relevant national standards |
| Any comment: | One biogas flow meter will be installed at the entrance of the electricity generators. Temperature and pressure of the gas are required to determine the density of methane combusted. |

| | |
|--------------------------|--|
| Data / Parameter: | $T_{biogas,y}$ |
| Data unit: | $^{\circ}C$ |
| Description: | Temperature of methane at entrance of power/heat generation system in the year |

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| | |
|--|---|
| | “y” |
| Source of data to be used: | Measured by a meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | ER estimation in Section B.5 does not use biogas temperature. Biogas temperature is monitored and used for ex-post calculation of biogas density. Typical temperature is 25 °C. |
| Description of measurement methods and procedures to be applied: | Measured by a temperature meter and recorded on a daily basis by monitoring personnel |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for recording data from the flow meter ▪ Meter will be calibrated periodically according to relevant national standards |
| Any comment: | One biogas flow meter will be installed at the entrance of the electricity generators. Temperature and pressure of the gas are required to determine the density of methane combusted. |

| | |
|--|---|
| Data / Parameter: | <i>Flow</i>_{biogas,y} |
| Data unit: | m ³ /yr |
| Description: | Amount of methane recovered, fuelled or flared in the year “y” |
| Source of data to be used: | Measured by flow meter corrected with temperature and pressure |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Expected amount of methane to be recovered 6,120,000 m ³ /yr under normal conditions (0 °C and 1 atm) |
| Description of measurement methods and procedures to be applied: | Measured continuously by a flow meter and recorded on a monthly basis by monitoring personnel |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for recording data from the flow meter ▪ Meter will be calibrated periodically according to relevant national standards |
| Any comment: | One biogas flow meter will be installed at the entrance of the electricity generators. Temperature and pressure of the gas are required to determine the density of methane combusted. |

| | |
|----------------------------|---|
| Data / Parameter: | <i>Fraction</i>_{biogas,y} |
| Data unit: | % volume |
| Description: | fraction of methane in biogas in year “y” |
| Source of data to be used: | Measured with a gas analyser |

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| | |
|--|---|
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Typical fraction of methane in biogas is 65% to 75% |
| Description of measurement methods and procedures to be applied: | Measured continuously by qualified staff |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for carrying out the measurements ▪ Analyser will be calibrated before measurements |
| Any comment: | |

| | |
|--|---|
| Data / Parameter: | Time for Flaring |
| Data unit: | Min |
| Description: | n/a |
| Source of data to be used: | Online temperature gauge, logging temperature reading every minute when gas is sent to flare. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 50% - for open flare. However no biogas is expected to be flared. |
| Description of measurement methods and procedures to be applied: | Amount of minutes per hour where a flame has a higher temperature than 500°C, whenever biogas is sent to the flare for more than 40 minutes, then the flare efficiency is assumed to be 50% during this period of time. Whenever the flame temperature is detected to be lower than 500°C, the same is recorded and the same is detected for less than 20 minutes in an hour (whenever biogas is sent to flare), flare efficiency is assumed to be 0%. If the temperature in the exhaust gas of the flare is above 500°C for more than 40 minutes during the hour h and the manufacture's specifications on proper operation of the flare are met continuously during the hour h, then the flare efficiency is 90%. |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for carrying out the measurements ▪ Meter will be calibrated before measurements |
| Any comment: | |

| | |
|--|--|
| Data / Parameter: | <i>Final disposal of sludge</i> |
| Data unit: | - |
| Description: | For the proposed project, the final sludge will be put into a controlled landfill. |
| Source of data to be used: | Sludge generated from wastewater treatment will be sent to Guangzhou Mingde (Jinsheng) Sludge Treatment Plant for final treatment. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | n/a |

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| | |
|--|--|
| Description of measurement methods and procedures to be applied: | And the sludge will be put into a controlled landfill. |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Trained and qualified staff is responsible for carrying out the measurements ▪ Meter will be calibrated before measurements |
| Any comment: | |

| | |
|--|---|
| Data / Parameter: | <i>Final disposal of treated water</i> |
| Data unit: | - |
| Description: | For the proposed project, the final treated water will be discharged into a channel that will diverse the water to Pinghu Municipal Wastewater Treatment Plant. |
| Source of data to be used: | Monitoring report of the wastewater treatment plant |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Discharged into a channel that will diverse the water Pinghu Municipal Wastewater Treatment Plant. |
| Description of measurement methods and procedures to be applied: | Operating of the wastewater treatment plant is monitored on a daily basis. Final discharge of treated water will be recorded on a monthly basis. Amount and quality of the treated water will be covered in the report. |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ |
| Any comment: | Final discharging of treated water is also under inspection of Zhejiang EPA. Annual Environmental Certification issued by Zhejiang EPA will be used for crosscheck. |

2) Electricity generation component:

| | |
|--|--|
| Data / Parameter: | <i>EG_{1,y}, EG_{2,y}, EG_{3,y}, EG_{4,y}</i> |
| Data unit: | <i>MWh</i> |
| Description: | Net electricity delivered in the year <i>y</i> |
| Source of data to be used: | Measured by electricity meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | The annual total net power supply by these four generators is expected to be 10,914 MWh/year. |
| Description of measurement methods and procedures to be | Measured continuously by four kilowatt meters and recorded on a monthly basis by monitoring personnel. |

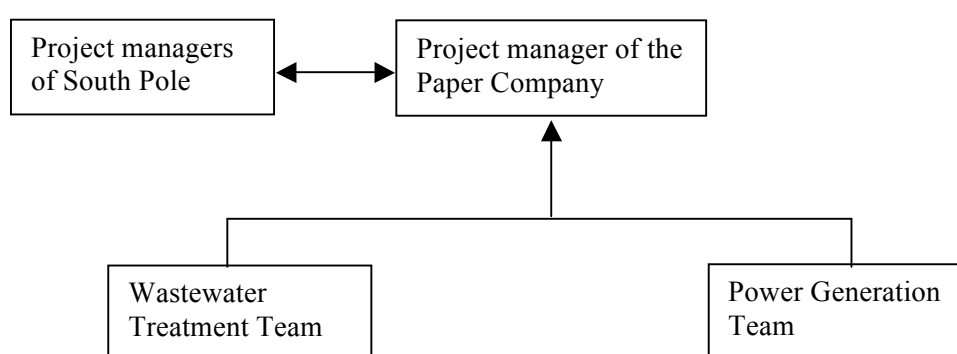
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| | |
|---------------------------------|--|
| applied: | |
| QA/QC procedures to be applied: | <ul style="list-style-type: none"> ▪ Exported electricity to the internal grid is measured by kilowatt meters, which are controlled by the company itself; ▪ Trained and qualified staff is responsible for recording electricity export data from the kilowatt meters; ▪ Meters will be calibrated periodically according to relevant national standards. For last calibration information please refer to Annex IV. |
| Any comment: | <ul style="list-style-type: none"> ▪ Only the net electricity generation shall be taken into account in ER calculation. |

| | |
|--|--|
| Data / Parameter: | <i>Emission Levels</i> |
| Data unit: | ppm |
| Description: | Particulate emission levels measured periodically at the stack of the biogas based cogeneration plant. The major emissions of from SO ₂ and NO _x will also be monitored. |
| Source of data to be used: | Measured by online continuous monitoring system |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | SO ₂ ≤100mg/l and NO _x ≤400mg/l |
| Description of measurement methods and procedures to be applied: | Particulate emission levels will be determined based on a stack gas analysis using calibrated analyzers. Measurements will be carried out according to international standards by qualified professionals with qualified equipment continuously and recorded on a monthly basis. |
| QA/QC procedures to be applied: | Calibration will be conducted by qualified institutions, which guarantee for the accuracy of the measurement procedures and equipment. Live emission levels are sent to Guangzhou EPA. |
| Any comment: | Standards from Emission Limits of Atmospheric Pollutants (DB44/27-2001) will be met. The limits by this standard are SO ₂ ≤100mg/l and NO _x ≤400mg/l. |

B.7.2 Description of the monitoring plan:
1. Management Structure

Following figure shows basic management structure of the Project. Project managers of South Pole Carbon Asset Management Co., Ltd. will make direct communication with project manager of Zhejiang Jingxing Paper Joint Stock Co., Ltd. regarding monitoring requirements of CDM. The project manager directly leads two teams, e.g. wastewater treatment plant team and power generation team. Team leaders report to project managers and manage team of operators. System maintenance, repairing and calibration service will be provided by a department of the plant on demand of the Project.

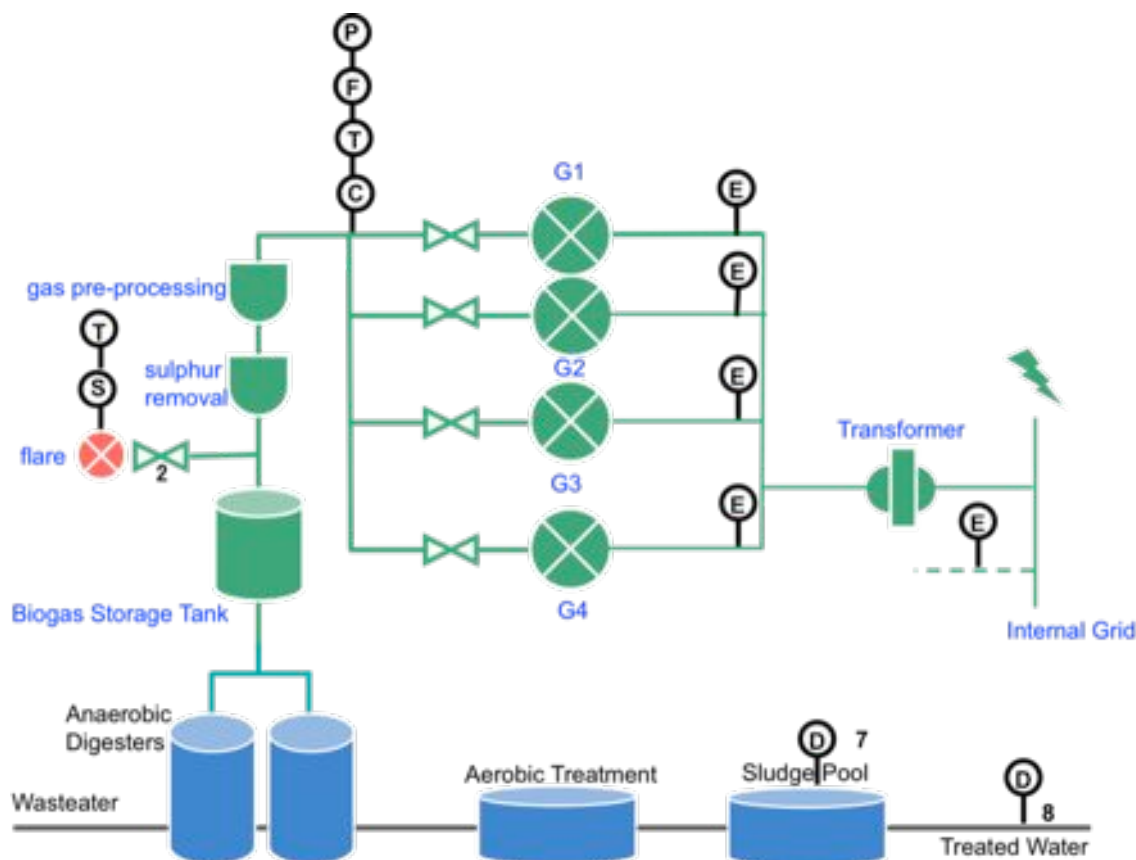

2. Monitors and Installation Positions

Following Figure 7 shows major monitoring equipments and their positions. Table B.9 has short descriptions.

Table B.9 Monitored parameters and monitors locations

| Name | Name in Section B.7 | Descriptions |
|------|---------------------|---|
| E | EG_y | Net electricity generation of four generators and net electricity supplied to internal grid in year y . See Section B.7 for detail. |
| P | $P_{biogas,y}$ | Pressure of biogas at entrance of generators and air conditioner. See Section B.7 for details. |
| T | $T_{biogas,y}$ | Temperature of biogas at entrance of generators and air conditioner. See Section B.7 for details. |
| F | $F_{biogas,y}$ | Flow of biogas at entrance of generators and air conditioner. See Section B.7 for detail. |
| C | $C\%_{biogas,y}$ | Fraction of methane in biogas recovered at entrance of generators and air conditioner. See Section B.7 for detail. |

Figure 7 Monitors and their installation positions



3. Quality Assurance, Quality Control

The plant has published “Regulations of Operation for Biogas-to-energy Plant” and “Operation Manual for Biogas-to-energy Plant” for staff to follow and ensure normal operation.

4. Procedures for Calibration of Equipment

The plant operator carries out calibration according to relevant national standards. Please see Annex IV for calibration certificates of monitors. Following table indicates entities that performed calibration and inspection to major monitors.

5. Data Storage and Filing – Electric Workbook

All relevant data is stored electronically with the process control computer unit, external storage media and transferred. A daily log is printed and archived. Please see Annex IV for operation log forms and controlled parameters with target values.

6. Measures to take in case of malfunction in major meters and equipments

Emission reductions are generally calculated based on amount of biogas recovered and power generation. While, in case of emergency or malfunctions in major meters, following measures will be taken for ER calculation:

- In case of emergency/malfunction in generators, a flare will start working and emission reductions will be calculated as zero during this period for simplicity and conservative;
- Proposed project will install backup meters for power generation;
- Ratio between power generation and biogas amount will be used in case of biogas monitoring is in abnormal conditions. Proper conservative approach will be taken.

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

Name of persons determining the baseline and monitoring methodology:

South Pole Carbon Asset Management Ltd.
Technoparkstrasse 1
8005 Zurich, Switzerland
Phone: +41 44 633 78 70
Fax: +41 44 633 14 23
info@southpolecarbon.com

South Pole Carbon Asset Management Ltd. is a project participant of the project. Please refer to Annex 1 for detailed contact information.

Date of final revision of baseline study and monitoring plan: 9th April 2010

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SECTION C. Duration of the project activity / crediting period**C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**13/12/2008¹²**C.1.2. Expected operational lifetime of the project activity:**

The expected operational lifetime of the project activity is 15 years.

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**Jan. 1st. 2011**C.2.2.2. Length:**

10 year

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

According to the relevant environmental law and regulations, an Environmental Impact Assessment Form has been prepared on November 2008, which has been approved by Pinghu Municipal EPA on 21st Nov. 2008. The main assessment conclusions are provided below:

1. Impact on the air quality

The dust generated during the construction period will effectively controlled through effective onsite management and related bylaws which will have less impact on the environment. After the project put into operation, the major products of combustion is CO₂ and H₂O, which do not harm atmosphere at all. There will be a few of SO₂ and NO_x. By venting through a flue at height of over 200 meters, Emission Limits of Atmospheric Pollutants (DB44/27-2001) will be met. The limits by this standard are SO₂≤100mg/l and

¹² Equipment purchasing contract

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$\text{NO}_x \leq 400 \text{ mg/l}$. Considering that in absence of the project activity all methane would have been directly vented into atmosphere and cause more GHG emissions, the implementation of the project will improve the regional air quality significantly.

2. Noise impact

The major noise resources during the construction period are the operating equipments, the transportation and so on, and the noise impacts the builders and the residents nearby. In order to minimize the noise impacts, few measures are carried out, such as constructing under Noise Limits for Construction Site (GB 12523-90 1991-03-01) strictly, enforcing the onsite management and establishing related bylaws. The noise during the construction period has locality and temporality characteristic; it will disappear when the construction work finished. After the project is put into operation, the major resource of noise pollution is from running of the generator. The muffler is installed to avoid the noise impact on the local citizens and employees.

3. Impact on the aquatic environment

The project activity only consists of methane recovery and combustion for electricity generation. Hence there will not be additional wastewater generated.

4. Impact of solid waste on the environment

Solid waste generated by the proposed project is mainly sulphur with amount of 3.67 tonnes per year. While the plant will sell the sulphur periodically to fertilizer plant or sulphuric acid plant as feedstock, hence the impacts would be minimal.

5. Impact on water and soil loss

Construction of the project will not lead to any water and soil loss.

6. Impact on the ecological environment

All construction activity will take place on vacant factory building. Occupied area is quite small hence plants of the factory will not be destroyed. Therefore, the project has little impact on the local environment.

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

The project participants and the host party involved consider negative environmental impacts of the project to be marginal. Comparing the environmental impacts and the mitigation measures mentioned above to the contribution of the project towards sustainable development on a regional and national level, the project will have an overall positive impact on the local and global environment.

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

30 questionnaires were distributed to residents who may be impacted by the project in May 2010 to collect comments and advices. The aim of these questionnaires is to collect opinions concerning the influence that the project might have on the local society, environment, economy, daily life etc.

Project participants will also upload the project documents to the Internet to invite comments from global stakeholder.

Preparation of the questionnaire forms was in compliance with:

- Appendix E of the Gold Standard Manual: Public Consultation: Checklist

E.2. Summary of the comments received:

The questions on the questionnaires are:

1. Do you know the methane recovery and utilization project in Jingxing Paper Co., Ltd?
2. What kind of impact do you think will the project exert on the local environmental?
3. Do you think the project will promote the local economic development?
4. What is your attitude towards the project?
5. Do you support the project to apply for CDM?
6. Do you have any comments or advices?

All 50 questionnaires have been returned; the results are summarized as below:

97% people involved in the survey have known the project, 3% did not know.

94% people believed the project would improve local environmental quality, 6% didn't know.

97% people believed the project would promote local economic development, 3% did not care.

97% people supported the project, 3% did not care.

100% people supported the project to apply for CDM.

No comments or advices were received during the survey.

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

No comments were received.

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Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**The Project Owner

| | |
|------------------|--|
| Organization: | Zhejiang Jingxing Paper Joint Stock Co., Ltd. |
| Street/P.O.Box: | |
| Building: | Jingxing Industry Area, Pinghu City |
| City: | Jiaxing City |
| State/Region: | Zhejiang Province |
| Postfix/ZIP: | |
| Country: | P. R. China |
| Telephone: | + 86 573 85960666 |
| FAX: | +86 573 85966983 |
| E-Mail: | |
| URL: | |
| Represented by: | Mr. Zhang Aiqi |
| Title: | |
| Salutation: | |
| Last Name: | Zhang |
| Middle Name: | |
| First Name: | Aiqi |
| Department: | |
| Mobile: | 13600551266 |
| Direct FAX: | + 86 573 85960666 |
| Direct tel: | +86 573 85966983 |
| Personal E-Mail: | Zhangaiqi5768924@163.com |

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The CER Purchase Facility Manager:

| | |
|------------------|--|
| Organization: | South Pole Carbon Asset Management Ltd. |
| Street/P.O.Box: | Technoparkstr. 1 |
| Building: | / |
| City: | Zurich |
| State/Region: | Zurich |
| Postfix/ZIP: | 8005 |
| Country: | Switzerland |
| Telephone: | +41 44 633 78 70 |
| FAX: | +41 44 633 14 23 |
| E-Mail: | info@southpolecarbon.com |
| URL: | www.southpolecarbon.com |
| Represented by: | Renat Heuberger |
| Title | / |
| Salutation: | Mr. |
| Last Name: | Heuberger |
| Middle Name: | / |
| First Name: | Renat |
| Department: | / |
| Mobile: | / |
| Direct FAX: | +41 44 633 14 23 |
| Direct tel: | +41 44 633 78 70 |
| Personal E-Mail: | r.heuberger@southpolecarbon.com |

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

Annex 3

BASELINE INFORMATION

Table 1–Fuels Parameters

| Fuel | NCVs (kJ/kg) | Emission Factor (kgCO ₂ /TJ) |
|--------------------------|--------------|---|
| Coal | 20908 | 87,300 |
| Washed coal | 26344 | 87,300 |
| Other washed coal | 8363 | 87,300 |
| Moulded coal | 20908 | 87,300 |
| Coke | 28435 | 95,700 |
| Crude oil | 41816 | 71,100 |
| Gasoline | 43070 | 67,500 |
| Diesel | 42652 | 72,600 |
| Fuel oil | 41816 | 75,500 |
| Other petroleum products | 41816 | 75,500 |
| Natural gas | 38931 | 54,300 |
| Coke oven gas | 16726 | 37,300 |
| Other gas | 5227 | 37,300 |
| LPG | 50179 | 61,600 |
| Refinery gas | 46055 | 48,200 |

Data sources:

NCVs are from *China Energy Statistical Yearbook 2008*, P283.

EFco2 are from *2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy, Chapter 1, P1.21-1.22, Table 1-3, and Table 1-4.*

Table 2- OM Emission Factor of East China Power Grid in 2005

| Calculation of simple OM emission factor of East China Power Grid in 2005 | | | | | | | | | | | | |
|---|---|---------------------------|------------------------------------|--------------------------------------|--|----------------|--------------------|---------------------------|----------|-----------------------------|-------------------------|---|
| Fuels | Units | Shanghai | Jiangsu | Zhejiang | Anhui | Fujian | Total | Potential emission factor | OXID | Fuel Emission Factor | NCV | Emission(tCO ₂ e) |
| | | A | B | C | D | E | F=A+B+C+D+E | (tC/TJ) | (%) | (kgCO ₂ /TJ) | (MJ/t,km ³) | K=F×I×J/100000 (in mass) K=F×I×J/10000 (in volume) |
| | | | | | | | | G | H | I | J | |
| Raw coal | 10000tones | 2847.31 | 9888.06 | 4801.52 | 3082.9 | 2107.69 | 22727.48 | 25.8 | 100 | 87,300 | 20,908 | 414,837,511 |
| Washed coal | 10000tones | | | | | | 0 | 25.8 | 100 | 87,300 | 26,344 | 0 |
| other washed coal | 10000tones | | | | | | 0 | 25.8 | 100 | 87,300 | 8,363 | 0 |
| coke | 10000tones | | | 0.03 | | | 0.03 | 29.2 | 100 | 95,700 | 28,435 | 816 |
| coke oven gas | 0.1billion m3 | 1.68 | 1.38 | | 1.71 | | 4.77 | 12.1 | 100 | 37,300 | 16,726 | 297,591 |
| other gas | 0.1billion m3 | 83.72 | 24.97 | 0.06 | 30 | | 138.75 | 12.1 | 100 | 37,300 | 5,227 | 2,705,169 |
| crude oil | 10000tones | | | 27.01 | | | 27.01 | 20 | 100 | 71,100 | 41,816 | 803,039 |
| Gasoline | 10000tones | | | | | | 0 | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | 10000tones | 1.25 | 16 | 4.52 | | 1.67 | 23.44 | 20.2 | 100 | 72,600 | 42,652 | 725,828 |
| Fuel oil | 10000tones | 59.39 | 13.22 | 153.22 | | 7.45 | 233.28 | 21.1 | 100 | 75,500 | 41,816 | 7,364,902 |
| LPG | 10000tones | | | | | | 0 | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | 10000tones | 0.57 | 0.83 | | | | 1.4 | 15.7 | 100 | 48,200 | 46,055 | 31,078 |
| Natural gas | 0.1billion m3 | 1.09 | 1.85 | 0.62 | | | 3.56 | 15.3 | 100 | 54,300 | 38,931 | 752,567 |
| other petroleum products | 10000tones | 21 | 8.38 | 34.8 | | | 64.18 | 20 | 100 | 75,500 | 41,816 | 2,026,232 |
| other coking products | 10000tones | | | | | | 0 | 25.8 | 100 | 95,700 | 28,435 | 0 |
| other energy | 10000tCe | 12.36 | | 15.29 | | | 27.65 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | Total | 429,544,732 |
| China Energy Statistical Yearbook 2006 | | | | | | | | | | | | |
| Thermal Power Generation within Northeast in 2005 | | | | | | | | | | | | |
| Provinces | Power Generation (10 ⁸ kWh) | Power Generation (MWh) | Auxiliary Power Consumption (%) | Power Delivered to the Grid (MWh) | | | | | | | | |
| | | | | | Net Import from Shanxi Yangcheng(MWh) | 11,282,000 | | | | Net import from Central MWh | | 27,039,000 |
| Shanghai | 746.06 | 74,606,000 | 5.05 | 70,838,397 | Average OM of Yangcheng(tCO ₂ /MWh) | 1.06604 | | | | Central OM | | 1.16148 |
| Jiangsu | 2114.29 | 211,429,000 | 5.96 | 198,827,832 | | | | | | | | |
| Zhejiang | 1081.1 | 108,110,000 | 5.59 | 102,066,651 | | | | | | | | |
| Anhui | 629.18 | 62,918,000 | 5.9 | 59,205,838 | Total emission tCO ₂ | 472,977,179 | | | | | | |
| Fujian | 486 | 48,600,000 | 4.57 | 46,378,980 | Total power generation | 515,638,698 | | | | | | |
| Total | | | | 477,317,698 | 2005 OM | 0.91726 | | | | | | |
| China Electric Power Yearbook 2006 | | | | | | | | | | | | |

EF_{om,2005}=0.91726 tCO₂/MWh

Table 3- OM Emission Factor of East China Power Grid in 2006

| Fuels | Units | Shanghai | Jiangsu | Zhejiang | Anhui | Fujian | Total | Potential emission factor (tc/TJ) | OXID (%) | Fuel Emission Factor (kgCO ₂ /TJ) | NCV (MJ/t,km ³) | Emission(tCO ₂ e) |
|---|--|------------------------|---------------------------------|-----------------------------------|---|---------|----------------|-----------------------------------|----------|--|-----------------------------|---|
| | | A | B | C | D | E | F=A+B+C+D+E | G | H | I | J | K=F×I×J/100000 (in mass) K=F×I×J/10000 (in volume) |
| Raw coal | 10000tones | 2744.45 | 10945.42 | 6065 | 3455.2 | 2369.63 | 25579.7 | 25.8 | 100 | 87,300 | 20,908 | 466,898,181 |
| Washed coal | 10000tones | | | | | | 0 | 25.8 | 100 | 87,300 | 26,344 | 0 |
| other washed coal | 10000tones | | 150.54 | | 23.06 | | 173.6 | 25.8 | 100 | 87,300 | 8,363 | 1,267,436 |
| coke | 10000tones | | | 39.07 | | | 39.07 | 29.2 | 100 | 95,700 | 28,435 | 1,063,184 |
| coke oven gas | 0.1billion m3 | 1.71 | 3.13 | 0.23 | 0.71 | | 5.78 | 12.1 | 100 | 37,300 | 16,726 | 360,603 |
| other gas | 0.1billion m3 | 84.64 | 106.54 | 3.28 | 25.12 | | 219.58 | 12.1 | 100 | 37,300 | 5,227 | 4,281,088 |
| crude oil | 10000tones | | | 20.3 | | | 20.3 | 20 | 100 | 71,100 | 41,816 | 603,543 |
| Gasoline | 10000tones | | | | | | 0 | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | 10000tones | 2.13 | 3.7 | 4.11 | 1.21 | 1.11 | 12.26 | 20.2 | 100 | 72,600 | 42,652 | 379,635 |
| Fuel oil | 10000tones | 44.51 | 3.77 | 71.98 | 0.02 | 4.5 | 124.78 | 21.1 | 100 | 75,500 | 41,816 | 3,939,439 |
| LPG | 10000tones | | | | | | 0 | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | 10000tones | 0.29 | 0.4 | | 2.95 | | 3.64 | 15.7 | 100 | 48,200 | 46,055 | 80,803 |
| Natural gas | 0.1billion m3 | 3.2 | 13.5 | 9.18 | | | 25.88 | 15.3 | 100 | 54,300 | 38,931 | 5,470,911 |
| other petroleum products | 10000tones | 18.82 | 3.57 | | | | 22.39 | 20 | 100 | 75,500 | 41,816 | 706,876 |
| other coking products | 10000tones | | | | | | 0 | 25.8 | 100 | 95,700 | 28,435 | 0 |
| other energy | 10000tCe | 6.66 | 2.8 | 27.45 | 3.21 | | 40.12 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | Total | 485,051,699 |
| China Energy Statistical Yearbook 2007 | | | | | | | | | | | | |
| Thermal Power Generation within East Grid in 2006 | | | | | | | | | | | | |
| Provinces | Power Generation (10 ⁸ kWh) | Power Generation (MWh) | Auxiliary Power Consumption (%) | Power Delivered to the Grid (MWh) | | | | | | | | |
| | | | | | Net Import from Yangcheng (MWh) | | 11,150,820 | | | Net Import from Central Grid (MWh) | | 24,029,150 |
| Shanghai | 720.33 | 72,033,000 | 5.06 | 68,388,130 | Average OM of Yangcheng (tCO ₂ /MWh) | | 0.997020 | | | Average OM Central China (tCO ₂ /MWh) | | 1.12157 |
| Jiangsu | 2512.58 | 251,258,000 | 5.69 | 236,961,420 | | | | | | | | |
| Zhejiang | 1403.49 | 140,349,000 | 5.62 | 132,461,386 | | | | | | | | |
| Anhui | 718.67 | 71,867,000 | 6.05 | 67,519,047 | total emission tCO ₂ | | 523,119,600 | | | | | |
| Fujian | 555.8 | 55,580,000 | 4.51 | 53,073,342 | Total power generation | | 593,583,295 | | | | | |
| Total | | | | 558,403,325 | 2006 OM | | 0.88129 | | | | | |

$EF_{om,2006}=0.88129 \text{ tCO}_2/\text{MWh}$

Table 4- OM Emission Factor of East China Power Grid in 2007

| Fuels | Units | Shanghai | Jiangsu | Zhejiang | Anhui | Fujian | Total | Potential emission factor | OXID | Fuel Emission Factor | NCV | Emission(tCO2e) |
|---|---|---------------------------|------------------------------------|--------------------------------------|--------|---------|---|---------------------------|------|--|-------------------------|---|
| | | A | B | C | D | E | F=A+B+C+D+E | (tc/TJ) | (%) | (kgCO ₂ /TJ) | (MJ/t,km ³) | K=F×I×J/100000 (in mass) K=F×I×J/10000 (in volume) |
| | | | | | | | | G | H | I | J | |
| Raw coal | 10000tones | 2754.04 | 11060.78 | 7350 | 3929.9 | 3097.87 | 28192.59 | 25.8 | 100 | 87,300 | 20,908 | 514,590,436 |
| Washed coal | 10000tones | | | | | | 0 | 25.8 | 100 | 87,300 | 26,344 | 0 |
| other washed coal | 10000tones | | 459.17 | | 29.32 | | 488.49 | 25.8 | 100 | 87,300 | 8,363 | 3,566,416 |
| coke | 10000tones | | | 35.06 | | | 35.06 | 29.2 | 100 | 95,700 | 28,435 | 954,063 |
| coke oven gas | 0.1billion m3 | 0.89 | 9.73 | 0.22 | 1.56 | 0.75 | 13.15 | 12.1 | 100 | 37,300 | 16,726 | 820,402 |
| other gas | 0.1billion m3 | 98.92 | 70.45 | 3.41 | 36.3 | 1.71 | 210.79 | 12.1 | 100 | 37,300 | 5,227 | 4,109,712 |
| crude oil | 10000tones | | | 15.15 | | | 15.15 | 20 | 100 | 71,100 | 41,816 | 450,427 |
| Gasoline | 10000tones | | | | | | 0 | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | 10000tones | 1.23 | 5.37 | 2.76 | | 1.01 | 10.37 | 20.2 | 100 | 72,600 | 42,652 | 321,111 |
| Fuel oil | 10000tones | 40.76 | 1.55 | 29.52 | | 2.04 | 73.87 | 21.1 | 100 | 75,500 | 41,816 | 2,332,156 |
| LPG | 10000tones | | | | | | 0 | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | 10000tones | 0.2 | 0.63 | | 2.55 | | 3.38 | 15.7 | 100 | 48,200 | 46,055 | 75,031 |
| Natural gas | 0.1billion m3 | 4.61 | 19.17 | 11.01 | | | 34.79 | 15.3 | 100 | 54,300 | 38,931 | 7,354,444 |
| other petroleum products | 10000tones | 20.39 | 2.78 | | | | 23.17 | 20 | 100 | 75,500 | 41,816 | 731,502 |
| other coking products | 10000tones | | | | | | 0 | 25.8 | 100 | 95,700 | 28,435 | 0 |
| other energy | 10000tCe | 6.89 | 28.88 | 44.93 | 7.52 | 9.43 | 97.65 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | total | 535,305,699 |
| China Energy Statistical Yearbook 2007 | | | | | | | | | | | | |
| Thermal Power Generation within East Grid in 2007 | | | | | | | | | | | | |
| Provinces | Power Generation (10 ⁸ kWh) | Power Generation (MWh) | Auxiliary Power Consumption (%) | Power Delivered to the Grid (MWh) | | | | | | | | |
| Shanghai | 726 | 72,600,000 | 4.72 | 69,173,280 | | | | | | | | |
| Jiangsu | 2709 | 270,900,000 | 5.55 | 255,865,050 | | | | | | | | |
| Zhejiang | 1723 | 172,300,000 | 5.83 | 162,254,910 | | | | | | | | |
| Anhui | 848 | 84,800,000 | 5.92 | 79,779,840 | | | | | | | | |
| Fujian | 723 | 72,300,000 | 5.59 | 68,258,430 | | | | | | | | |
| Total | | | | 635,331,510 | | | | | | | | |
| China Electric Power Yearbook 2008 | | | | | | | | | | | | |
| | | | | | | | Net Import from Yangcheng (MWh) | 12,773,620 | | Net Import from Central Grid (MWh) | | 31,823,310 |
| | | | | | | | Average OM of Yangcheng (tCO ₂ /MWh) | 0.972544 | | Average OM Central China (tCO ₂ /MWh) | | 1.10197 |
| | | | | | | | Total emission tCO ₂ | 582,797,047 | | | | |
| | | | | | | | Total Power generation | 679,928,440 | | | | |
| | | | | | | | 2007 OM | 0.85714 | | | | |

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EF_{om,2007}=0.85714 tCO₂/MWh

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} = 0.8825 \text{ tCO}_2/\text{MWh}$$

Table 5 - Calculation of Ratio of Solid, Liquid and Gas fuel in total CO₂ Emission

| | | Shanghai | Zhejiang | Jiangsu | Anhui | Fujian | Total | NCV | Emission factor | OXID | Emission(tCO ₂) |
|--------------------------|--------------------------|----------|----------|---------|---------|----------|-----------|--------|-----------------|------|-----------------------------|
| Fuels | Units | A | B | C | D | E | G=A+...+F | H | I | J | K=G×H×I×J/100,000 |
| Raw coal | 10000t | 2,754.04 | 11,060.8 | 7,350 | 3,929.9 | 3,097.87 | 28,192.59 | 20,908 | 87,300 | 1 | 514,590,436 |
| Washed coal | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 26,344 | 87,300 | 1 | 0 |
| Other washed coal | 10000t | 0 | 459.17 | 0 | 29.32 | 0 | 488.49 | 8,363 | 87,300 | 1 | 3,566,416 |
| Bquette coal | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 20,908 | 87,300 | 1 | 0 |
| coke | 10000t | 0 | 0 | 35.06 | 0 | 0 | 35.06 | 28,435 | 95,700 | 1 | 954,063 |
| Other coke products | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 28,435 | 95,700 | 1 | 0 |
| Total | | | | | | | | | | | 519,110,916 |
| Crude oil | 10000t | 0 | 0 | 15.35 | 0 | 0 | 15.35 | 41,816 | 71,100 | 1 | 450,427 |
| Gasoline | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 43,070 | 67,500 | 1 | 0 |
| Diesel | 10000t | 1.23 | 5.37 | 2.76 | 0 | 1.01 | 10.37 | 42,652 | 72,600 | 1 | 321,111 |
| Fuel oil | 10000t | 40.76 | 1.55 | 29.52 | 0 | 2.04 | 73.87 | 41,816 | 75,500 | 1 | 2,332,156 |
| Other petroleum products | 10000t | 20.39 | 2.78 | 0 | 0 | 0 | 23.17 | 41,816 | 75,500 | 1 | 731,502 |
| Total | | | | | | | | | | | 3,835,196 |
| Natural gas | 0.1billionm ³ | 46.1 | 191.7 | 110.1 | 0 | 0 | 347.9 | 38,931 | 54,300 | 1 | 7,354,444 |
| Coke oven gas | 0.1billionm ³ | 8.9 | 97.3 | 2.2 | 15.6 | 7.5 | 131.5 | 16,726 | 37,300 | 1 | 820,402 |
| Other gas | 0.1billionm ³ | 989.2 | 704.5 | 34.1 | 363 | 17.1 | 2,107.9 | 5,227 | 37,300 | 1 | 4,109,712 |
| LPG | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 50,179 | 61,600 | 1 | 0 |
| Refinery gas | 10000t | 0.2 | 0.63 | 0 | 2.55 | 0 | 3.38 | 46,055 | 48,200 | 1 | 75,031 |
| Total | | | | | | | | | | | 12,359,588 |
| Total | | | | | | | | | | | 535,305,699 |



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

$$= 0.8129 \text{ tCO}_2/\text{MWh}$$

Table6–The Calculation of BM Emission Factor for the East China Power Grid

| | Installed capacity in 2005 | Installed capacity in 2006 | Installed capacity in 2007 | Newly added installed capacity 2005-2007 | Proportion against newly added installed capacity |
|----------------------------------|----------------------------|----------------------------|----------------------------|--|---|
| | A | B | C | D=C-A | |
| Thermal power | 104,076.6 | 128,828 | 138,650 | 34,573.4 | 83.97% |
| Hydro-power | 16,069.4 | 18,463 | 19,970 | 3,900.6 | 9.47% |
| Nuclear power | 3,066 | 3,066 | 5,070 | 2,004 | 4.87% |
| Wind power | 401.3 | 547 | 1,095.6 | 694.3 | 1.69% |
| Total | 123,613.3 | 150,904 | 164,785.6 | 41,172.3 | 100.00% |
| Share in 2007 installed capacity | 75.01% | 91.58% | 100% | | |

$$EF_{BM,y} = 0.8129 \times 83.97\% =$$

0.6826 tCO₂/MWh

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y} = 0.5 \cdot 0.8825 + 0.5 \cdot 0.6826 = 0.78255 \text{ tCO}_2/\text{MWh}$$

Annex 4

MONITORING INFORMATION

4. Monitoring interface of power/heat generation system (original screen printing, in Chinese). Gui Chang Sci&Tech is the system integrator. The following interface is for monitoring and operating of biogas recovering system and power/heat generation system.
5. Monitoring interface of anaerobic treatment of the wastewater treatment system. The following interface is for monitoring and operating of the wastewater treatment plant and the flare.
6. Indicators and parameters controlled for normal operation power generation system. Online monitored/controlled parameters indicate a normal running state when their values stay within the “Target Values” or limits.
7. Calibration and Testing of Electricity Meters
8. For more information please refer to section B.7 of this PDD.