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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

Title: Guangzhou Zhujiang Beer Methane Recovery Project
Version of PDD: Version 3.5
Date of document: 21/08/2009

Revision history of PDD:

Version	Date	Comments
Version 1.0	16th January 2008	PDD submitted to DOE for validation (start GSP)
Version 2.0	7th July 2008	PDD revised based on DOE's findings
Version 3.0	8th October 2008	Revised with new methodology version 9 for second global stakeholder consultation
Version 3.1	11th December 2008	Revised with new emission factor.
Version 3.2	21th January 2009	Revised in monitoring plan, 2nd-round local stakeholder consultation of Gold Standard, and PDD reference
Version 3.3	1st March 2009	PDD revised as per updated Table-3 (Validation Findings)
Version 3.4	29th May 2009	PDD revised as per updated Table-3 (Validation Findings)
Version 3.5	21st August 2009	PDD revised as per updated Table-3 (Validation Findings). Update the methodology from version 9 to version 13

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 and an air conditioning system in the existing wastewater treatment system at the beer brewery of Guangzhou Zhujiang Brewery Co., Ltd.. Guangzhou Zhujiang Brewery Co., Ltd. has a production capacity of 1.5 billion litres per year. The beer brewing process produces up to 5,000,000t of wastewater per year, which is sent to an anaerobic digester system, where the organic matter in the wastewater is converted into a methane rich biogas. After the anaerobic digesters the wastewater passes through an aerobic treatment stage before is discharged into the Zhujiang River on the north side of the plant. The current anaerobic wastewater treatment system reduces the COD concentration of the wastewater from 2,526 mg/l to less than 500 mg/l, and then, through another aerobic waste water treatment system, the COD concentration will be lowered to 80mg/l, which is below the prescribed discharge value of 110 mg/l (Guangdong provincial standard, which is stricter than the national standard of 150 mg/l).

The scenario existing prior to the start of the implementation of the project activity
Guangzhou Zhujiang Brewery Co., Ltd. has a wastewater treatment plant with annual capacity of 5,000,000 tonnes. Anaerobic digesters integrated generate 10,000~12,000 m^3 of biogas everyday. The existing wastewater treatment system at the beer brewery of Guangzhou Zhujiang Brewery Co., Ltd. has no biogas recovery devices and the methane-rich gas is released to the atmosphere.

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 and air conditioning. Power generation will be consumed on site in the beer factory. The project activity consists

of implementing a biogas recovery system, a biogas purification device, power generators and an air conditioner system to the existing wastewater treatment facility. The biogas purification through desulphurization devices is required for utilisation of the biogas as a fuel. Two methane combustion generators will be used in order to meet the various gas flows, which range from 150 m^3/h to 700 m^3/h. The minimum and maximum capacities of the power generators will be 490 kW (when one generator works) and 1,400 kW (when both generators work) accordingly. The project activity is expected to produce 7,623 MWh of electricity per year, displacing fossil fuel based electricity from the regional grid. The air conditioner system uses tail-gas from two generators and surplus biogas for generation of cool air. Power consumption of electricity-based air conditioner will be saved.
For more technical details, please refer to Section A.4.2 of this PDD.

Table A.1 Key parameters of Project (Generators)

Model	G3516	G3508
Manufacturer	CATERPILLAR	CATERPILLAR
Engine Speed	1500	1500
Application	50 Hz GENSET	50 Hz GENSET
Engine Power (KW, at 100% load)	1011	482
Generator Power (KW, at 100% load)	961	460
Fuel Consumption (nominal, MJ/bkW-hr)	10.76	10.58
Exhaust Stack Temperature (°C)	466	403
Combustion Efficiency	96.7%	96%

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 China Southern Power Grid. The project activity is expected to avoid 29,803 t CO2e per year by capturing the biogas and around 5,977 t CO2e per year through displacement of electricity from the grid. The total expected amount of emission reductions is 35,780 tCO2e. Emission reductions from air conditioner are neglected for simplicity which is conservative.

Information Regarding Technology Transfer and Knowledge Innovation
Implementation of the proposed project involves imports of advanced engines and equipments from United States, Japan and Europe. The manufacturers include Caterpillar, Emerson, WIKA and others. 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. This is the first time the concept of Clean Production Pattern and recycling economy being put into practice in brewery industry of China. Particularly, the combination of biogas-based generators and tail-gas based air conditioner system is quite novel in China.

Contribution to Sustainable Development of the Project

- Air quality (emissions other than GHG)
  By biogas desulfurization and recovery, air quality is improved substantially as compared to baseline scenario. Furthermore, SOx and NOx emissions of the biogas-fired power plant are significantly lower than the average (mainly coal fired) grid-connected power

plant in the baseline. Implementation of the proposed project consists of desulfurization facility, by which the toxic hydrogen sulphide (H_2S) will be removed.

- 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 18 working positions. Please see Table B.7 in Section B.7.2 for staff list and their responsibilities.
- Balance of payments (sustainability)
  In recent years China has been suffering abnormally rapid increase of foreign currency reserve due to its aggressive exports. Implementation of the project activity involves import of advanced engines and equipments from United States, Japan and European, which leads to payment in foreign currency equivalent to USD 1,632,000 according to Feasibility Study Report. This will slightly contribute in relief of trade surplus pressure of China.
- 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 United States, Japan and European. The project showcases an innovative way to use biogas from wastewater plant for power generation in brewery industry of China. This is the first CDM project in brewery industry of China 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)	**Guangzhou Zhujiang Brewery Co., Ltd**	**No**
Switzerland	**South Pole Carbon Asset Management 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 ofrequesting registration, the approval by the Party(ies) involved is required.		

Annex 1 lists the complete contact information on participants in the project activity.

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.:

Guangdong Province.

A.4.1.3. City/Town/Community etc:

Guangzhou

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 Guangzhou Municipality, Guangdong Province, People's Republic of China. The project is 7 km away from the city centre at the southern riverside of Zhujiang River. The project has geographical coordinates of E 113° 20'2'' and N 23° 06' 32''[1].

[1] Location of the powerhouse.

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:
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.D: Grid connected renewable electricity generation
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 sulfur removal unit and a gas processing unit), a power generation system (two units of generators) and a lithium bromide (LiBr) air conditioner system.
Two methane internal combustion engines and generators (G3516 and G3508) will be used in order to meet the various gas flows, which range from 150 m3/h to 700 m3/h. The minimum and maximum capacity of the power generators will be 490 kW (the small generator) and 1,400 kW (sum of two generators) accordingly.
Normally the air conditioner system recovers waste heat in tail gas of generators as energy source for air-cooling. In case of a biogas surplus, the cooling system will also combust biogas as fuel. The proposed project will only claim emission reductions from methane avoidance and power generation. Emission reductions from waste heat recovery and heat generation in the LiBr cooling system is neglected for purpose of conservativeness and simplification.

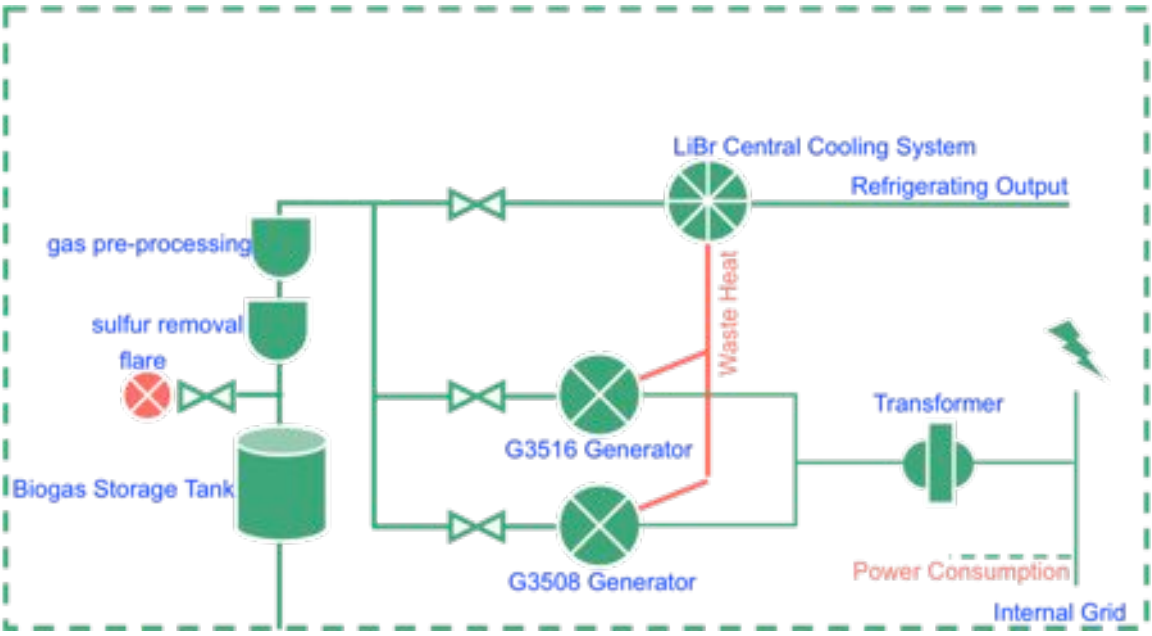

Figure 2. Schematic Diagram of the Project

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

Table A.2 Key parameters of Project (Generators)

Model	G3516	G3508
Manufacturer	CATERPILLAR	CATERPILLAR
Engine Speed	1500	1500
Application	50 Hz GENSET	50 Hz GENSET
Combustion	Low Emission	Low Emission
Engine Power (KW, at 100% load)	1011	482
Generator Power (KW, at 100% load)	961	460
Engine Efficiency (nominal, 100% load)	32.8%	33.4%
Thermal Efficiency (nominal, 100% load)	46.3%	43.6%
Total Efficiency (nominal, 100% load)	79.1%	76.8%
Fuel Consumption (nominal, MJ/bkW-hr)	10.76	10.58
Exhaust Stack Temperature (°C)	466	403
Combustion Efficiency	96.7%	96%

Table A.3 Key parameters of Project (Air Conditioner)

Name/ Type	Waste Heat Recovery Chiller (non-electric Steam/Hot water/Exhausted-fired chiller)
Manufacturer	BROAD Air Conditioning
Model	BZHE150IXD-403-88/98-d
Refrigerating Output	150×10^4 kcal/hr
Rated Life Time	25 Years
Fired Gas Temperature (°C, in, unit 1)	403
Fired Gas Temperature (°C, out, unit 1)	170

Fired Gas Temperature (°C, in, unit 2)	466
Fired Gas Temperature (°C, out, unit 2)	170
Fired Gas Flow kg/h	5874
Power Consumption (kW)	10.4
CO Emissions (%)	0.02
NOx Emissions (ppm, corr 5% O2)	46
Combustion Efficiency	93%

Environmentally safe and sound technology and know how
Design of the project was done by Guangzhou Engineering Design Co, Ltd. of Light Industry[2]. Founded in 1953, the company is an A Class large-scale designing entity. Design of the project (Chapter 10 of FSR) 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:

Table A.4 Estimation amount of emission reductions

Years	Estimation of annual emission reductions (tCO_2e)
2009 (from 1st October)	8,945
2010	35,780
2011	35,780
2012	35,780
2013	35,780
2014	35,780
2015	35,780
2016 (until 30th September)	26,835
Total estimated reductions (tonnes of CO_2 e)	**250,460**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**35,780**

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, Guangzhou Zhujiang Brewery Co., Ltd will fund the project by itself.

[2] http://www.gdicn.com

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 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 13) 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.D "Grid connected renewable electricity generation" (Version 13) 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 01.1) is used.

For more information, please refer to the link:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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.D is applicable to the project activity due to following reasons:

- 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 beer factory, which imports electricity from the China Southern 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 China Southern Power Grid, therefore all power plants connected physically to the China Southern Power Grid are also part of of the project boundary. The reasons for defining the China Southern Power Grid as project boundary for the electricity generation component of the project are as follows:

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 Guangdong Grid via local grid network, and thus finally to the China Southern Power Grid. The China Southern Power Grid is a large regional grid, which consists of four sub-grids: Guangdong Grid, Guangxi Grid, Yunnan Grid and Guizhou Grid.
3. There is substantial inter-grid power exchange among the above-mentioned sub-grids of the China Southern Power Grid.
4. The China Southern Power Grid can be clearly identified as regional grid and information on the characteristics of this grid is publicly available.
5. There is a 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	CH4	Included	The major source of emissions in the baseline from wastewater plant
		N2O	Excluded	Excluded for simplification. This is conservative.
		CO2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted for
	Electricity consumption/ generation	CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
		CO2	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.

	Thermal energy generation	CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
		CO2	Excluded	Excluded for simplification. This is conservative.
Project Activity	Wastewater treatment	CH4	Included	As the wastewater treatment plant remains unchanged, only installed methane emissions from flaring will betaken into account.
		N2O	Excluded	Not required by AMS.III.H
		CO2	Excluded	CO2 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.

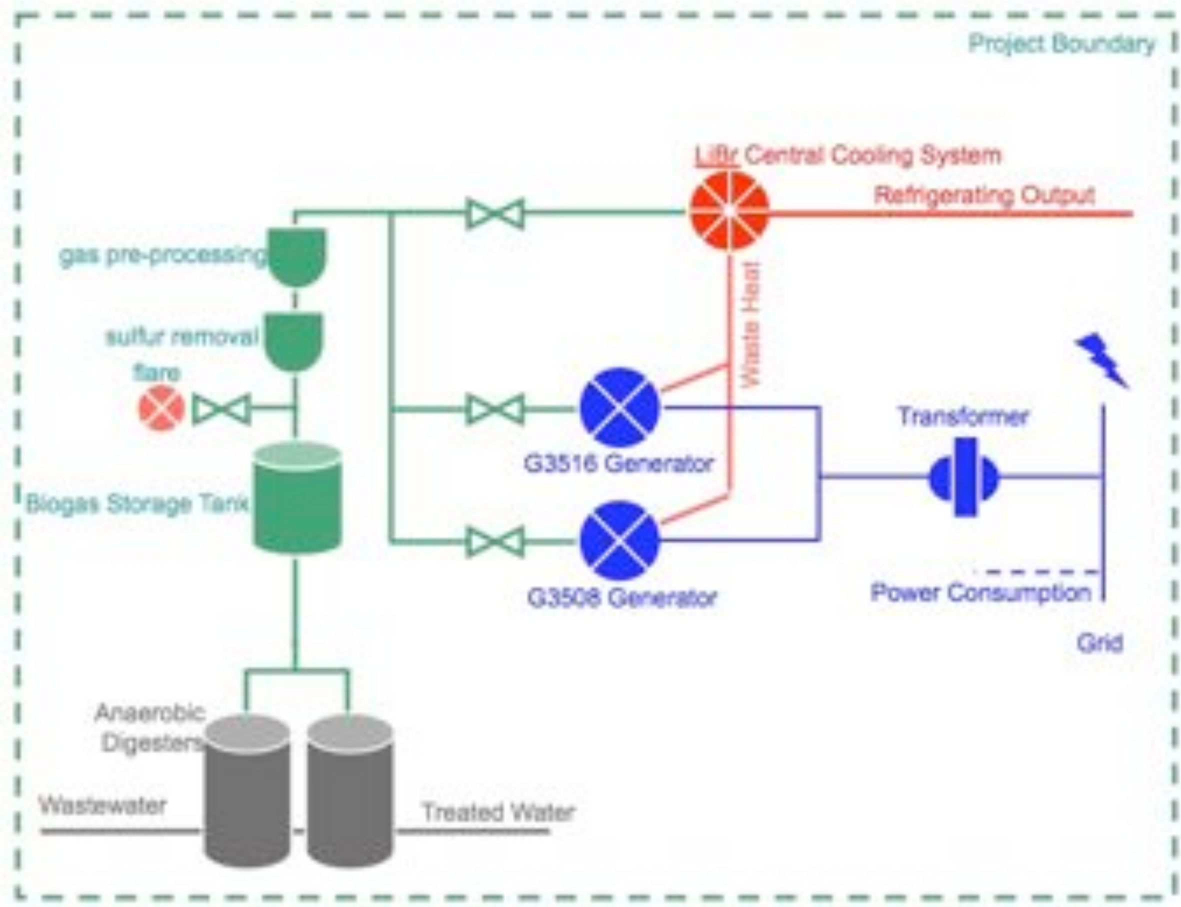

Figure 3. Project Boundary

B.4. Description of baseline and its development:

Methane avoidance component:
Following alternative scenarios have been identified as plausible and realistic alternatives for providing outputs or services comparable to the proposed project activity:

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)

These alternatives are discussed as follows:

Scenario M1: This scenario is in compliance with current laws and regulations of China. However, comparing with continuation of current situation, biogas capture and flaring without carbon revenues needs additional investment for the capture system, purification system, desulphurization system and electricity generation system. With only revenue from electricity generation, the internal rate of return (IRR) of this scenario is merely 6.1%, calculated based on data from the Feasibility Study Report (FSR).

Thus, this scenario is not financially attractive and does not represent a plausible and realistic baseline scenario. Please see Section B.5 for more information.

Scenario M2: Biogas capturing and flaring without electricity generation is only attractive as a CDM project because flaring is not mandated by law and there are no revenues from electricity. Such a scenario would represent an alternative CDM project and not a baseline scenario. It is therefore excluded as potential baseline scenario.

Scenario M3: This scenario does not imply any additional investments or costs for the project owner. Further, current laws and regulations in China do not impose flaring of biogas at wastewater treatment facilities. Thus, in absence of the project activity, the project owner would continue releasing biogas to the atmosphere, which makes this scenario a plausible and realistic baseline scenario.

Electricity generation component:

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

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 grid.

These alternatives are discussed as below:

Scenario E1: This scenario is in compliance with current laws and regulations of China. However, according to the investment analysis in section B.5, the Project's internal rate of return (IRR) without consideration of CDM revenues is lower than the financial benchmark IRR (8%), which represents a severe investment barrier to the Project. Thus, Scenario 1 cannot be considered as the baseline scenario.

Scenario E2: According to current regulations in China, thermal power plants of less than 135 MW are prohibited for construction in areas covered by the large electricity grids such as provincial grids[3]. At the same time, the construction of fossil fuel-fired thermal power plants with an installed capacity of less than 100 MW is strictly controlled by the authority[4]. Therefore, this scenario does not comply with Chinese relevant laws and regulations and cannot be considered a feasible alternative to the Project.

Scenario E3: This baseline scenario option is in compliance with Chinese relevant laws and regulations. It faces neither finance nor other barriers.

Conclusion:
From the above analysis it can be concluded that the Scenarios M3 and E3, say "direct release biogas to atmosphere" and "equivalent amount of electricity is supplied by the grid", are 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 China Southern Power Grid.

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[3] 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.

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

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

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 (8th June 2006).

As per the "Guidelines on the demonstration and assessment of prior consideration of the CDM" (version 02)[5], 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 2005 and are described in the table below. The decision to develop the proposed Project was taken during a board meeting held in March 2006 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. The first contact with a CDM consultant is dated from end 2006 and the first contract with a CDM service provider and buyer of CERs in early 2007.

[5] http://cdm.unfccc.int/UserManagement/FileStorage/MB6XIY1TWLS7KQO25EFDA98VPC3J0H

Table B.2. Brief history of the project

Event	Date	Type of event	Description
The first wastewater treatment plant of Guangzhou Zhujiang Brewery Co., Ltd. started operation	1985		Host company of proposed project, Guangzhou Zhujiang Brewery Co., Ltd. started operation since 1985 with the first wastewater treatment plant. The first wastewater treatment plant adopted "Two-Stage Activated Sludge" process. It copied a similar process at Stella Artois, a Belgian brewery company, as part of technology transfer from the Belgian company. Wastewater Discharge Standard of Guangzhou (DB4437-90) was achieved. The wastewater plant was operated until 2002, when the second wastewater plant was built.
The second wastewater treatment plant was designed and construction started	2001		Amid expansion of production capacity, the second wastewater treatment plant was designed by Guangzhou Engineering Design Co, Ltd. of Light Industry in 2001 and started operation to replace the first one in October of 2002. The second wastewater treatment plant integrated in Internal Circulation (IC) Anaerobic Treatment system from PAQUES, a Dutch company in wastewater treatment industry. The second wastewater treatment is an anaerobic-aerobic two-staged process. It is also the base of proposed project. This plant treated wastewater of 25,000 tonnes daily with COD out less than 60 mg/l.[6]
Biogas recovery for energy generation assessed	2001		Biogas recovery for energy generation was proposed and assessed during design of the second wastewater plant. It was excluded due to the fact it is not financially attractive, concluded from a financial analysis. The only incentive for building a wastewater plant is to meet the wastewater discharge standards; biogas recovery is not mandatory. As a result, a wastewater treatment plant without biogas recovery was built, which asked for minimal investment and achieved environmental standards required at same time.
FSR Draft	September 2005		A first draft FSR was finished in September 2005 based on a 0.5 RMB/kWh electricity tariff and no CDM. The IRR of the project in the draft FSR from 2005 is below the relevant IRR benchmark for the investment decision, representing a prohibitive investment barrier. Aware of the fact, that the project was financially not feasible based on the expected 0.5 RMB/kWh electricity tariff, the project owner decided to reevaluate the project through a group of local experts.

[6] Please feasibility study report of the wastewater treatment plant made in 1999, in which biogas is directly vented into atmosphere.

Expert meeting	27/10/2005	CDM awareness proof	The expert meeting was held about one month after completion of the initial draft FSR on 27/10/05. The experts discussed the Project and suggested to register the project as CDM activity in order to improve the financial viability of the project. Major outcome of the expert meeting was that the project would be viable assuming an electricity tariff of roughly 0.8 RMB/kWh instead of 0.5 RMB/kWh. The experts concluded that CDM revenues, which are proportional to the amount of electricity generated by the project, would allow the project owner to close the gap between 0.5 RMB/kWh and 0.8 RMB/kWh.
Financial Reassessment Study	15/01/2006	CDM awareness proof	After the expert meeting, the po decided to ask the guangzhou engineering design co. to conduct a financial reassessment of the proposed project taking cdm revenues into consideration, which became the foundation for the internal investment decision by the project owner. in a report dated 15/01/2006 guangzhou engineering design co. concluded that the proposed project would be only financially feasible with revenues from emission reduction credits.[7]
Board decision of project with CDM	20/03/2006	Prior consideration of the CDM	Based on the Financial Reassessment Study and conclusion that project will be only viable with CDM revenues taken into account, board of Zhujiang Brewery Co., Ltd. decided to construct the biogas recovery for energy generation project and apply for a CDM project. The return rate of 10-year national debt is 4.41% and 15-year debt is 4.45%, which is the expected return rate of a project without risk. With uncertainty in biogas amount and electricity production, a higher benchmark of 8% was used by Zhujiang Brewery Co., Ltd. in decision making, which is in accordance with "*The Economic Assessment Method and Parameters for Construction Projects (version 03)*" and also in accordance with "*Interim Method of Economic Assessment for Retrofitting Power Generation Project (2003)*".
Equipments purchasing	08/06/06 -	Project start date	First purchasing contract with equipment integrator and suppliers signed in June

[7] Please see Financial Analysis for Biogas Recovery Project as a CDM Project made by Guangzhou Engineering Design Co, Ltd. of Light Industry in January of 2006.

contract signed and Project construction started	28/11/06		2006. Construction started in November of 2006[8]. (It is normal that construction of a project started with some informal approval of go-ahead before the formal notification of approval.)
PIN is drafted. Carbon funds and consultants are contacted.	Autumn 2006	Proof of real actions to secure CDM status	On behalf of the PO, a NGO called Global Environment institute offers the project to CDM consultants.
Approval of the project FSR	17/01/2007		Notification of Approval of the project by Economic and Trade Commission of Guangdong Province dated 17/1/07. According to this approval, construction of the project could start after May 2006.
The project is introduced by GEI to South Pole	8/02/2007	Proof of real actions to secure CDM status	The NGO GEI introduced South Pole to Zhujiang Brewery Co., Ltd.
Exclusivity agreement between South Pole and Guangzhou Zhujiang Brewery Co., Ltd.	23/05/2007	Proof of real actions to secure CDM status	
ERPA between South Pole and Guangzhou Zhujiang Brewery Co., Ltd.	15/11/07	Proof of real actions to secure CDM status	
Commissioning of Project started	January 2008		With all equipments installed and monitors calibrated, project commissioning started.
1st round of the Gold Standard Local stakeholders' consultation	15/01/2008	Implementation of project under CDM	
Official Start of CDM Validation	22/01/2008	Implementation of project under CDM	PDD is submitted for Global Stakeholder Consultation on UNFCCC website on 22/01/2008 (see http://cdm.unfccc.int/Projects/Validation/DB/A4HNFFBJ4OB9TM93CNGM6E1YULKQLH/view.html).
LoA Switzerland is issued	03/04/2008	Implementation of project under CDM	

[8] Construction Start Report dated on 25th November 2006.

Gold Standard pre-fasibility assessment report is issued	27/11/2008	Implementation of project under CDM	
LoA China is issued	22/12/2008	Implementation of the CDM	
2nd round of the Gold Standard Local stakeholders' consultation	26/12/2008	Implementation of the CDM	

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 5.02)*.
The only incentive for building a wastewater treatment plant is environmental laws and regulations, which do not require biogas recovery activities. Access to electricity supply is available for the plant, and moreover, Zhujiang Brewery Co., Ltd. already had a captive power plant with a capacity of 2×12 MW. 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 25th November 2006, 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 China Southern Power Grid.

Sub-step 1b. Consistency with mandatory laws and regulations:
All baseline alternatives are in compliance with the laws and regulations except **E2**, as discussed in previous section B.4 baseline development.

Outcome of Step 1b
From the analysis in Section B.4 it can be conclude that the **combination of M3 and E3**, say "direct release biogas to atmosphere" and "equivalent amount of electricity is supplied by China Southern 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. Biogas used in proposed project was directly released into atmosphere in absence of the project. Hence Project is regarded as a waste-to-energy activity. According to *"The Economic Assessment Method and Parameters for Construction Projects (version 03)*[9]", the benchmark equity IRR is 8% for waste-to-energy projects (scope 0815) and 10% for power generation projects (scope 0811). In "*Interim Method of Economic Assessment for Retrofitting Power Generation Project (2003)*", it's 8%. To be conservative, 8% is applie.

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 4.2%, lower than the benchmark IRR. While considering CERs revenue, the IRR of the proposed project is 12.1%, higher than the benchmark of 8%.

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

Parameter	Unit	Value	Source
Installed capacity	MW	1.4	FSR[10] and Nameplate
Estimated annual electricity output	MWh/yr	7,623	FSR
Electricity saving from air conditioning system	MWh/yr	4,633	FSR
Revenue from sulphur	CNY/yr	3,730	FSR
Project lifetime (FSR)	Yr	15	FSR
Total investment	Million CNY	31.3	FSR and approval
Expected electricity tariff	CNY/kWh	0.5	Electricity Tariff used in decision making
Actual electricity tariff[11]	CNY/kWh	0.484	Average of 2004 - 2006

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

[10] Feasibility Study Report of the project, made by Guangzhou Engineering Design Co, Ltd. of Light Industry in December of 2006.

Equity/debt ratio	-	100%	FSR
VAT rate	%	17%	National Tax Policies
Income tax	%	33%	National Tax Policies
Annual Cost (Depreciation included)	Million CNY	3.9	FSR
O&M Cost (Depreciation excluded), of which	Million CNY	1.93	FSR
Salary	Million CNY	0.3	FSR
Maintenance Costs	Million CNY	0.31	FSR
Materials	Million CNY	1.32	FSR
IRR Benchmark	%	8	Benchmark of electricity industry

Add explanation about electricity tariff. Why is it relevant (no independent connection to the grid). Which evidence have used.

Using the values above, the IRR of the Project is only 4.2% without consideration of CERs sales revenues, which is considered to be economically not attractive. Therefore, the Project faces severe investment barriers and fulfils the requirement of additionality.

Table B.4. IRR with and without CER revenue

IRR without CER revenue	4.2%
IRR with CER revenue	12.1%

Sensitivity Analysis

Sensitivity analysis of the project mainly considers fluctuations in power/heat generation, O&M costs, total investment and electricity tariff. Fluctuation range of ±10% is applied to this analysis. The figure below shows when these four key parameters change within ±10%, IRR of the project is always lower than 8%.

[11] This is the average of actual electricity tariff of power selling. It's CNY 0.381 in 2004, CNY 0.435 in 2005 and 0.427 in 2006, with invoices as evidence. 0.414 RMB/kWh is the price with VAT excluded, equivalent to 0.484 RMB/kWh.

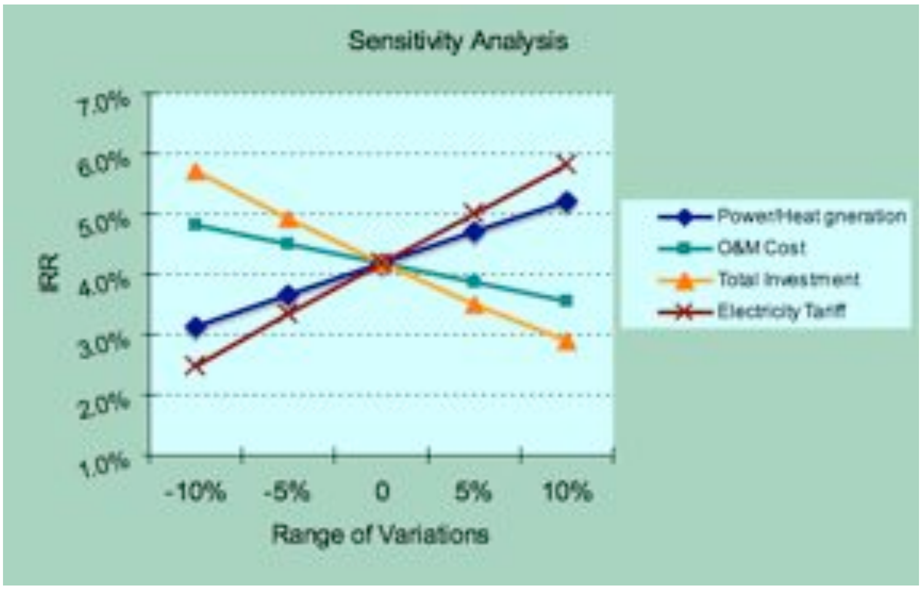

Figure 5 Sensitivity Analysis: Power/Heat Generation

Power/heat generation estimation in FSR is based on 330 days of operation at 100% load. 10% higher in power/heat generation would lead to operation days of 365 days, a whole year. Space of higher power/heat generation is little.
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 ±10% in O&M cost is conservative.
Generally, difference between actual total investment and total investment in FSR is limited within ±10% in China.

As can be seen from investment analysis above, proposed project is not financially attractive without benefits from CERs. Current situation (M3+E3) is a financially more viable alternative to the project activity.

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 8%. 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 South China Power Grid supplies equivalent amount of electricity. This would lead to more greenhouse gas emissions than project activity.

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 13. 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 13, 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.D (Version 13).

I) Emission reductions due to methane avoidance

I.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 13, baseline emissions are calculated as follows:

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

Where:

$BE_{methane,y}$ Baseline emissions due to methane avoidance in year y (tCO_2e)

$BE_{power,y}$ Baseline emissions from electricity or fuel consumption in year y (tCO_2e)

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

$BE_{s,treatment,y}$ Baseline emissions of the sludge treatment systems affected by the project activity in year y (tCO_2e)

$BE_{ww,discharge,y}$ Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (tCO_2e).

$BE_{s,final,y}$ Baseline methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected.

For this project activity, $BE_{s,treatment,y}$, and $BE_{s,final}$ are not applicable, as sludge produced by the wastewater treatment will be collected by Bureau of City Appearance Environmental and Sanitation of Guangzhou Municipality for treatment, resulting in no methane emissions. For the sake of conservativeness, baseline emissions from the sludge treatment are excluded. The proposed project will report final disposal of sludge for DOE validation and verification. Furthermore, according to paragraph 14 of AMS.III.H, Version 13, $BE_{power,y}$ *and* $BE_{ww,discharge,y}$ can also be neglected as the project activity will not have impacts on these two factors. The power consumption of the wastewater treatment system, as well as wastewater discharge remains unchanged both in the baseline scenario and project activity, The wastewater treatment system is still the same as in the baseline scenario.

Therefore,

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

According to paragraph 20, in AMS.III.H version 13, 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 0.21 kg CH_4/kg COD)[6]
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

I.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 13):

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

Where:

$PE_{methane,y}$	Project activity emissions due to methane avoidance in the year "*y*" (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year *y* (tCO_2e). 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_2e).
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e).
$PE_{ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year *y* (tCO_2e).
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e).
$PE_{fugitivie,y}$	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_2e)

$PE_{flaring,y}$ Methane emissions due to incomplete flaring in year *y* as per the "Tool to determine project emissions from flaring gases containing methane"(tCOe)

In terms of ***$PE_{power,y}$*** as the wastewater treatment plant remains unchanged, only electricity consumption from the new equipment installed for biogas capture and utilisation 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 based on the net electricity exported to the grid multiplied by emission factor. Therefore, $PE_{power,y}$ 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 13, ***$PE_{ww,treatment,y}$, $PE_{ww,discharge,y}$*** and ***$PE_{biomass,y}$*** remain unchanged as the wastewater treatment system remains unchanged, and only methane capture system is installed. As per AMS.III.H, ***$PE_{s,treatment,y}$*** represents methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e). After implementation of the project activity, the same situation as in the baseline will prevail: the sludge produced by the wastewater treatment will be collected by Bureau of City Appearance Environmental and Sanitation of Guangzhou Municipality[12] for treatment. Since the project activity does not affect the sludge treatment system, ***$PE_{s,treatment,y}$*** can be neglected. According to paragraph 26 of AMS.III.H, Version 13, ***$PE_{s.final,y}$*** can also be neglected if the sludge is combusted in a controlled manner, disposed in a landfill with methane recovery or used for soil application. The proposed project will report final disposal of sludge for DOE during the verification of emission reductions, demonstrating that the final sludge disposal does not generate methane emissions.

Hence,

$PE_{methane,y} = PE_{fugitivie,y} + PE_{flaring,y}$ 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 (tCO_2e)

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$$ 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:

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[12] http://www.gzsrhw.gov.cn/

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

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

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} \cdot MCF_{ww,treatment,PJ,k}$$ (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 0.21 kg CH/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 (1.06)

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" (tCO_2e). The project owner has installed an 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:

$$PE_{flare,y} = \sum_{i=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000}$$ Equation 2.3

Where:

$PE_{flare,y}$: Project emissions from flaring of the residual gas stream in a year *y*; tCO_2e

$TM_{RG,h}$ Mass flow rate of methane in the residual gas in the hour *h*; kg/h

$\eta_{flare,}$ Flare efficiency in hour *h;* h

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

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n}$$ 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

$fv_{CH4,RG,h}$ Volumetric fraction of methane in the residual gas on dry basis in hour *h*;

$\rho_{CH4,n}$ Density of methane at normal conditions (0.7168). Kg/Nm^3

I.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:

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

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):

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

Where:

$ER_{y,ex\ ante}$ *Ex ante* emission reduction in year *y* due to the methane avoidance (tCO_2e)
$LE_{y,ex\ ante}$ *Ex ante* leakage emissions in year *y* due to methane avoidance (tCO_2e)
$PE_{y,ex\ ante}$ *Ex ante* project emissions in year *y* due to methane avoidance (tCO_2e)
$BE_{y,ex\ ante}$ *Ex ante* baseline emissions in year *y* due to methane avoidance (tCO_2e)

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:

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

Where:

$ER_{y,ex\ post}$ Emission reductions achieved by methane avoidance based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\ post}$ Baseline emissions due to methane avoidance calculated as per paragraph 16 using *ex post* monitored values (tCO_2e)
$PE_{y,ex\ post}$ Project emissions due to methane avoidance calculated as per paragraph 26 using *ex post* monitored values (tCO_2e)
$MD_{methane,y}$ Methane captured and destroyed/gainfully due to methane avoidance in the year *y* (tCO_2e)

$$MD_{methane,y} = BG_{burnt,y} * W_{CH4} * D_{CH_4} * FE * GWP_{CH_4} \qquad \text{Equation (4.1.1)}$$

Where:

$BG_{burnt,y}$ Biogas flared/combusted in year *y* (m^3)
$w_{CH4,y}$ Methane content[12] in the biogas in the year *y* (mass fraction)

D_{CH4} Density of methane at the temperature and pressure of the biogas in the year *y* (tonnes/m^3)
FE Flare efficiency in year *y* (fraction)

II) Emission reductions due to electricity displacement

As per AMS.I.D version 13,

$ER_{electricity,y} = BE_{electricity,y} - PE_{electricity,y} - Lekage_{electricity,y}$ Equation (5)

Where:

$ER_{electricity,y}$ Emission reductions due to electricity generation in year "y", tCO2e
$BE_{electricity,y}$ Baseline emissions due to electricity generation in year "y", tCO2e
$PE_{electricity,y}$ Project emissions due to electricity generation in year "y", tCO2e
$Leakage_{electricity,y}$ Leakage emissions due to electricity generation in year "y", tCO2e

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.D Version 13, 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,
$ER_{electricity,y}=BE_{electricity,y}$

As per AMS I D version 13 paragraph 9: For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner as:

(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,

$$BE_{electricity,y} = ER_{electricity,y} = EG_y * EF_y$$ Equation (5.1)

Where:

EG_y Net electricity supplied to the grid in year "y", Mwh
EF_y The grid CO2 emission factor in year "y", tCO2e/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 beer production facility imports also electricity from the grid to a certain extent, especially during shut downs of the coal fired captive plant. The biogas plant is connected to the internal company grid, which has both an import and export connection to the grid. From a baseline perspective the biogas plant would be either replacing electricity from the captive coal-fired power plant or displacing electricity from the Southern Chinese grid due to electricity exports to the grid. As grid emission factor, the PPs can therefore consider the 3 following options:

1. The emission factor is the one from the Southern Chinese 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 Southern Chinese grid.

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

- As the captive coal-fired cogeneration power plant is driven by heat demand and heat demand is not affected by the project activity, it can be assumed that electricity production by the captive coal fired power plant remains unchanged. Under this condition, the combined electricity output of the coal fired plant and the biogas plant increases by the output of the biogas plant, meaning that there is more surplus electricity to be exported. Under this assumption, electricity produced by the biogas reactor would displace electricity from the grid.
- In reality, the electricity baseline would be a mix of electricity from the grid and captive coal fired electricity. However, it is not possible to measure exactly how much electricity produced by biogas plant is consumed internally and how much is exported, because the electricity produced by the biogas plant is mixed with the electricity from the captive coal fired plant within the internal company grid prior to reaching the electricity export connection to the grid.
- Given the difficulty to establish a clear baseline scenario among a distinct set of options, the most conservative scenario should be selected. Since the emission factor from the coal fired captive plant is higher than the emission factor from the Southern Chinese grid, the selection of the grid emission factor for baseline calculations (Option 1) is the most conservative choice and the one to be followed hereafter.

a) Calculation of Baseline Emission Factor from the Southern Chinese grid

The baseline emission factor is calculated according to method (a) selected from the methodology AMS-I.D (Version 13) 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 1.1). 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 electric power system

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 *China Southern Power Grid*. The Project's electricity generation unit is connected to the *Guangdong Grid* via local grid network, and thus finally to the *China Southern Power Grid*. The *China Southern Power Grid* is a large regional grid, which consists of four sub-grids: *Guangdong Grid, Guangxi Grid, Yunnan Grid* and *Guizhou Grid*. There is substantial inter-grid power exchange among the above-mentioned sub-grids of the *China*

Southern Power Grid. The *China Southern Power Grid* can be clearly identified as regional grid and information on the characteristics of this grid is publicly available. [14]
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 CO_2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from a connected electricity system within the same host country(ies).

Step 2. Select an operating margin (OM) method

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

(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 1.1), 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 2005, according to gross annual power generation statistics for the China Southern Power Grid, the ratio of power generated by hydro-power and other low cost/compulsory resources was: 35.99% in 2002, 33.53% in 2003, 29.95% in 2004, 30.42% in 2005 and 31.25% in 2006 respectively, significantly lower than 50%.[15]
The simple OM of the grid for the proposed project is calculated using the Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 3. 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 1), it may be calculated:

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

Since neither the data of fuel consumption nor the net electricity generation for every single electricity generation plant/unit is publicly available for China Southern Power Grid, the proposed project uses

[14] 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.

[15] *China Energy Year Book, 2003-2007*

Option C for simple OM calculation. The calculation is based on the total net electricity generation and the fuel types and total fuel consumption of each provincial sub-grid of China Southern Power Grid. Electricity importation from Central China Grid is also counted. A three-year average, based on the most recent fuel consumption statistics available at the time of PDD submission, is used ("ex-ante" approach). The calculation equation of the Simple OM is as follows:

$$EF_{Grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \bullet EF_{CO2,i,y}}{\sum_{m} EG_{m,y}} \qquad \text{Equation (5.1.1)}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO2 emission factor in year *y* (tCO2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power plant/unit m 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)
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power plant/unit *m* in year *y* (MWh)
m	All power plants/units serving the grid in year *y* except low-cost/must-run power plants/units [16]
i	All fossil fuel types combusted in power plant / unit m in year y
y	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

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 1.06080 tCO_2e/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 4. Identify the cohort 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:

(a) The set of five power units that have been built most recently, or

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

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

[16] Here the proposed project uses each provincial sub-grid as an electricity plant/unit in this equation, since total electricity generation and fuels consumption is available for each sub-grid. Electricity imports from a connected electricity system should be considered as one power source j.

generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts[17] 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 5. 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 CO_2 emissions produced by solid, liquid, and gas fuel consumption for power generation; than 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.

17 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 using methodology ACM0002 so far.

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

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

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

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

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 CO_2 emission coefficient of fuel i (tCO_2e/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.

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

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

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \cdot EF_{Thermal}$$ 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 0.68155 tCO_2e/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 2004 to 2006
   Source: *China Electric Power Yearbook* (2005-2007)
2. Fuel consumption and the net caloric value of thermal power plants the years 2004 to 2006
   Source: *China Energy Statistics Yearbook* (figures are for 2005-2007)
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 6. 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.

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

The operating margin emission factor ($EF_{grid,OM,y}$) of China Southern Power Grid is 1.06080 tCO_2e/MWh and the build margin emission factor ($EF_{grid,BM,y}$) is 0.68155 tCO_2e/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 0.87118 tCO_2e/MWh.

III. Total emission reductions

Overall,

$$\mathbf{ER_{total,y}=ER_{methane,y}+ER_{electricity,y}}$$ 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

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:	0.21 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 13, the IPCC default value of 0.25 kg CH4/kg COD was corrected to take into account the uncertainties.

Data / Parameter:	GWP_{CH4}
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:	$MCF_{ww,treatment,PJ,k}$ = 0.8 (for calculation of project emissions) $MCF_{ww,treatment,BL,j}$ = 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:	The IPCC value is derived from Table III.H.I under paragraph 21 of AMS.III.H, Version 13.

Data / Parameter:	UF_{BL}
Data unit:	Factor
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS III.H/ Version 13
Value applied:	0.94

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

Data / Parameter:	$\mathbf{UF_{PJ}}$
Data unit:	Factor
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS III.H/ Version 13
Value applied:	1.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the AMS IIIH, 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 IIIH Version 13 – page 12
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:	tCO2/MWh
Description:	Combined margin CO2 emission factor of China Southern Power Grid in year *y*
Source of data used:	*China Electric Power Yearbook 2005-2007, China Energy Statistics Yearbook 2007, 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	0.87118
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 China Southern 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:	$EF_{grid,OMsimple,y}$
Data unit:	tCO2/MWh
Description:	Simple operating margin CO2 emission factor of China Southern Power Grid in year *y*
Source of data used:	*China Electric Power Yearbook 2005-2007, China Energy Statistics Yearbook 2007, 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	1.06080
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:	tCO2/MWh
Description:	Build margin of China Southern Power Grid in year *y*
Source of data used:	*China Electric Power Yearbook 2005-2007, China Energy Statistics Yearbook 2007, 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	0.68155
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 *m* in (years) *y* (2004-2006, China Southern Power Grid)
Source of data used:	*China Electric Power Yearbook 2005-2007*
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:	*Electricity Imports from Connected Electricity Systems to* China Southern Power Grid
Data unit:	MWh

Description:	Electricity Imports from Connected Electricity Systems to China Southern Power Grid in (years) y (2004-2006)
Source of data used:	*China Electric Power Yearbook 2005-2007*
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:	10^4t/10^8m^3
Description:	Amount of fuel *i* consumed by relevant power sources *m* in (years) *y* (2004-2006, China Southern Power Grid)
Source of data used:	*China Energy Statistics Yearbook 2005-2007*
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:	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
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:	tCO2/TJ
Description:	CO2 emission factor per energy unit of fuel i
Source of data used:	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
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:	*Efficiency level of best technology commercially available in China for coal-fired power generation*

Data unit:	%
Description:	Efficiency level of best technology commercially available in China for coal-fired power generation
Source of data used:	*China DNA: Notification on Determining the Regional Grid Emission Factors of China*
Value applied:	37.28%
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:	*Efficiency level of best technology commercially available in China for oil and gas-fired power generation*
Data unit:	%
Description:	Efficiency level of best technology commercially available in China for oil and gas-fired power generation
Source of data used:	*China DNA: Notification on Determining the Regional Grid Emission Factors of China*
Value applied:	48.81%
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 (2004-2006, China Southern Power Grid)
Source of data used:	*China Electric Power Yearbook 2005-2007*
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
I). Emission reduciton due to methane avoidance	***ER methane,y***	***29,803***	tCO2e/yr	Equation 4

I.1) Baseline emissions due to methane avoidance	$BE_{methane,y}$	33,591	tCO2e/yr	
Volume of treated wastewater	Qww,y	5,000,000	m3/yr	Equation 1.2
COD of removed by the anaerobic reactor	CODremoved,y	0.0020258	t/m3	
Methane producing capacity of wastewater	Bo,ww	0.21	t CH4/t COD	
Methane correction factor for wastewater treatment system	MCFww,treatment,BL	0.8	-	
Model correction factor to account for model uncertainties	UF_{BL}	0.94		
Global warming potential of methane	GWP CH4	21	-	Equation 1.2
I.1) Baseline emissions methane	**BE methane,y**	**33,591**	**tCO2e/yr**	
-	-	-	-	
I.2) Project emissions due to methane avoidance	**PE methane,y**	**3,788**	**tCO2e/yr**	
-	-	-	-	
Volume of treated wastewater	Qww,y	5,000,000	m3/yr	Equation 2.2.2
COD removedby the anaerobic reactor	CODy,ww,removed,PJ,k,y	0.0020258	t/m3	
Methane producing capacity of wastewater	Bo,ww	0.21	t CH4/t COD	
Methane correction factor for wastewater treatment system	MCFww,treatment,PJ,k	0.8	-	
Model correction factor to account for model uncertainties	Ufpj	1.06		
Methaneemission potential of wastewater treatment systems equipped with biogas recovery system	*MEPww,treatment,y*	*1,804*	*t CH4/yr*	
Capture efficiency of the biogas recovery equipment in the wastewater treatment systems	CFEww	0.9	-	Equation 2.2.1
Methane emission potential of wastewater treatment plant	MEPww,treatment,y	1,804	t CH4/yr	
Global warming potential of methane	GWP CH4	21	-	
a) Fugitive project emissions	***PEy,fugitive,ww***	***3,788***	***tCO2e/yr***	
-	-	-	-	
b) Project emissions due to incomplete flaring	***PEflaring,y***	**0**	***tCO2e/yr***	Equation 2.3
Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h	***FVRG,h***	**0**	***Nm3/h***	Equation2.3.1
Volumetric fraction of methane in the residual gas on dry basis in hour	***fvCH4,RG,h***	**0**		
Density of methane at normal conditions	***ρCH4,n***	**0.7168**	***Kg/Nm3***	
Mass flow rate of methane in the residual gas in the hour h	***TMRG,h***	**0**	***kg/h***	Equation 2.3.1
Flare efficiency in hour h	***ηflare,***	**50%**		
Global warming potential of methane	***GWP***	**21**		Equation 2.3
I.3) Leakage		**0**	**tCO2e/yr**	
Emissions due to leakage effects	**Leakage y,ww**	**0**	**tCO2e/yr**	Euqation 3
-	-	-	-	
I.4) Emission reductions due to methane avoidance	-	-	-	

Emission Reductions due to methane avoidance	***ER methane,y***	***29,803***	***tCO2e/yr***	Equation 4
II) Emission reductions due to electricity displacement	***ER electricity,y***	5,977	***tCO2e/yr***	Euquation 5
Grid Emission Factor Calculation 2008				
-				
Operating Margin emission factor of regional grid	EFOM	1.06080	tCO2e/MWh	
Build Margin emission factor of regional grid	EFBM	0.68155	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	0.87118	tCO2e/MWh	
Net Electricity supplied to the grid	EGy	6,861	Mwh/yr	
Combined margin emission factor of China Southern Power Grid 2008	Efcm	0.87118	tCO2e/MWh	
1.2) Baseline emissions due to electricity displacement	**BE electricity,y**	**5,977**	**tCO2e/yr**	Equation 5.1
III)Total emission reductions	**ER total ,y**	35,780	**tCO2/yr**	Equation 6

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

Year	Estimations of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimations of leakage (tCO_2e)	Estimations of overall emission reductions (tCO_2e)
2009 (since 01-10-2009)	1,113	10,058	0	8,945
2010	4,452	40,232	0	35,780
2011	4,452	40,232	0	35,780
2012	4,452	40,232	0	35,780
2013	4,452	40,232	0	35,780
2014	4,452	40,232	0	35,780
2015	4,452	40,232	0	35,780
2016 (until 30-09-2016)	3,339	30,174	0	26,835
Total (tonnes of CO2e)	**31,164**	**281,624**	0	**250,460**

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:	$\boldsymbol{Q_{ww,y}}$
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 5,000,000 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:	▪ Trained and qualified staff is responsible for recording data from the flow meter ▪ Meter will be calibrated periodically according to relevant national standards ▪ Data measured by meters will be crosschecked with beer production data as per brewery log books
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:	$\boldsymbol{COD_{removed,y}}$
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 *Methods of Monitoring and Analyzing of Water and Wastewater (Version 4) (GB11914).* The $\boldsymbol{COD_{removed,y}}$ value is based on two COD measurements, one before the anaerobic reactor and one after the reactor. The difference between these two values at a given time period delivers the $\boldsymbol{COD_{removed,y}}$ value.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected COD value removed through the anaerobic reactor is 0.0020258 t/m3, which is equivalent to a COD reduction from 2,026 mg/l (prior to the anaerobic reactor) to 500 mg/l (after the anaerobic reactor) per cubic meter of treated effluent.

Description of measurement methods and procedures to be applied:	The Chemical Oxygen Demand (COD) test uses a strong chemical oxidant (K2Cr2O7 or Mn2(SO4)3) in an acid solution and heat to oxidize organic carbon to CO2 and H2O. 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:	▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards
Any comment:	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 biogas flow measurement point 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	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:	▪ 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:	Flow meters will be installed at the output of the anaerobic digestor, at the entrance of the electricity generators, at the entrance of the air conditioner system and at entrance of the flare system. Temperature and pressure of the gas are required to determine the density of methane combusted.

Data / Parameter:	$T_{biogas,y}$
Data unit:	°C
Description:	Temperature of methane at biogas flow measurement point in the year "y"
Source of data to be used:	Measured by a temperature meter
Value of data applied for the purpose of calculating expected emission reductions in	Biogas temperature is monitored and used for ex-post calculation of biogas density. Typical temperature is 25 °C.

section B.5	
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:	▪ 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:	Flow meters will be installed at the output of the anaerobic digestor, at the entrance of the electricity generators, at the entrance of the air conditioner system and at entrance of the flare system. Temperature and pressure of the gas are required to determine the density of methane combusted.

Data / Parameter:	***$Flow_{biogas,y}$***
Data unit:	m^3/yr
Description:	Amount of methane recovered and fuelled in the year "y"
Source of data to be used:	Measured by flow meters 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 3,000,000 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:	▪ 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:	Flow meters will be installed at the output of the anaerobic reactor, at the entrance of the electricity generators, at the entrance of the air conditioner system and at entrance of the flare system. Temperature and pressure of the gas are required to determine the density of methane combusted.

Data / Parameter:	$fv_{CH4,RG,h}$
Data unit:	% volume
Description:	Volumetric fraction of methane in biogas in year "*y*"
Source of data to be used:	Measured with a gas analyser
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:	▪ 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:	Amount of minutes per hour where a flame has a higher temperature then 500°C, whenever biogas is sent to the flare. 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%. Otherwise flare efficiency is assumed to be 50%.
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:	The flame detection period shall be compared to the period of biogas being sent to the flare. The flare efficiency is determined based on the ratio of these two values.
QA/QC procedures to be applied:	The meter shall be subject to at least once in three-year calibration according to the equipment's specifications and applicable industrial standards.
Any comment:	The online temperature gauge is not available yet,

Data / Parameter:	***Final disposal of sludge***
Data unit:	-
Description:	For the proposed project, the final sludge will be used for brick-making
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	Used as raw materials for brick-making after being dried
Description of	Zhujiang Beer is not capable of sludge treatment. With daily capacity of 9,000

measurement methods and procedures to be applied:	tonnes, Guangzhou Mingde (Jinsheng) is the only centralized sludge treatment plant in Guangzhou. Before the plant starts in 2003, sludge from several major wastewater treatment plants were dumped into the sea directly. Since the sludge treatment plant is out of the project boundary and Project owner is not able to monitor final disposal of sludge. While Project participants will provide receipts of sludge treatment (Zhujiang Beer is paying for sludge treatment everyday) and Guangzhou EPA's Environmental Certification issued to Guangzhou Zhujiang Beer regarding sludge disposal and proper handling.
QA/QC procedures to be applied:	▪
Any comment:	

2) Electricity generation component:

Data / Parameter:	$EG_{3508,y}$, $EG_{3516,y}$
Data unit:	*MWh*
Description:	Power generation by "3508" and "3516" generator in the year *y*
Source of data to be used:	Measured by electricity meter with serial No. 80000048 (3508 generator) and No. 80000047 (3516 generator).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The annual total power generation by these two generators is expected to be 7,623 MWh/year.
Description of measurement methods and procedures to be applied:	Measured continuously by two kilowatt meters and recorded on a monthly basis by monitoring personnel.
QA/QC procedures to be applied:	▪ Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; ▪ Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter ; ▪ Meters will be calibrated periodically according to relevant national standards. For last calibration information please refer to Annex IV.
Any comment:	▪ Only the net electricity export to the grid shall be taken into account in ER calculation. This means that the monitoring measurement method shall exclude electricity imported from the grid by the project activity.

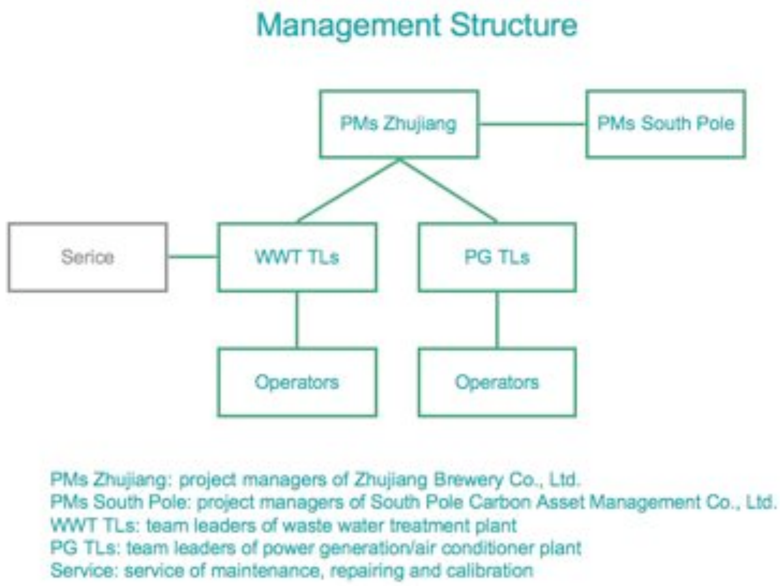
Data / Parameter:	$EC_{y,project}$
Data unit:	MWh/yr
Description:	Amount of electricity consumed by the equipment installed in addition to the existing wastewater treatment facility
Source of data to be used:	Measured by an electricity meter with serial No. "06012038"
Value of data applied for the purpose of	762 MWh/year for power generation unit and 762 MWh/year for heat generation (air conditioning system). Auxiliary power consumption in total

calculating expected emission reductions in section B.5	accounts for 20% of power generation.
Description of measurement methods and procedures to be applied:	Measured continuously by an electricity meter and recorded on a monthly basis by monitoring personnel
QA/QC procedures to be applied:	▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards. The latest calibration was done by Guangzhou Institute of Measurement and Testing Technology. See Annex IV for more details.
Any comment:	In absence of monitoring data it shall be assumed that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum.

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 managers of Zhujiang Brewery Co., Ltd. regarding monitoring requirements of CDM. Project managers directly lead two teams, e.g. wastewater treatment plant team and power generation/air conditioner 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.



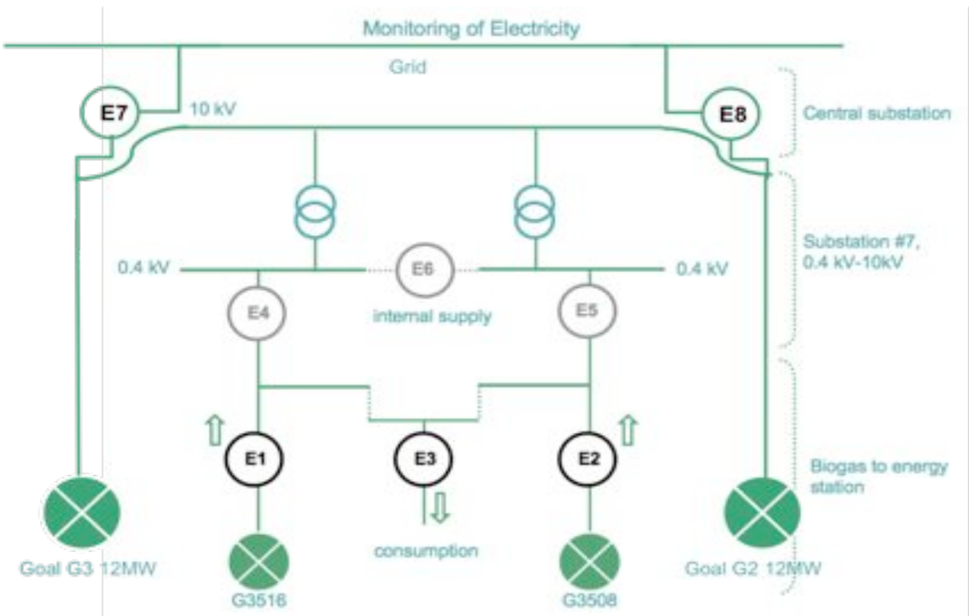
2. Monitors and Installation Positions

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	Descriptions

	Section B.7.1	
E1	$EG_{3516,y}$	Power generation of No.3516 generator in year y. See Section B.7.1 for detail.
E2	$EG_{3508,y}$	Power generation of No.3508 generator in year y. See Section B.7.1 for detail.
E3	$EC_{project,y}$	Project electricity consumption in year y. See Section B.7.1 for detail.
E4	/	Backup meter for power generation E1.
E5	/	Backup meter for power generation E2.
E6	/	Meter for monitoring of internal power supply between two generators. According to plant owner, the “bridge” in between is never connected.
E7, E8	/	Meters for electricity exported to the grid
P	$P_{biogas,y}$	Pressure of biogas at entrance of generators and air conditioner. See Section B.7.1 for details.
T	$T_{biogas,y}$	Temperature of biogas at entrance of generators and air conditioner. See Section B.7.1 for details.
F	$F_{biogas,y}$	Flow of biogas at entrance of generators and air conditioner. See Section B.7.1 for detail.
C	$C\%_{biogas,y}$	Fraction of methane in biogas recovered at entrance of generators and air conditioner. See Section B.7.1 for detail.



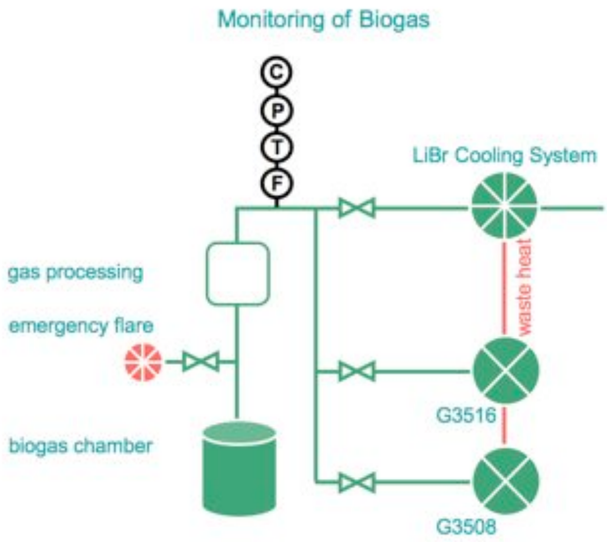


Figure 7 Monitors and their installation positions

3. Quality Assurance, Quality Control
The plantt has published "*Regulations of Operation for Biogas-to-energy Plant*" (internal file code: ZP-EHS-W-RDGC-023) and "*Operation Manual for Biogas-to-energy Plant*" (internal file code: ZP-EHS-W-RDGC-023) 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 and air conditioner, 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.

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:

Mr. Patrick Bürgi, South Pole Carbon Asset Management Ltd.
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m.hirsbrunner@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 completion of baseline study and monitoring plan: 16th January 2008
Date of final revision of baseline study and monitoring plan: 9th July 2009

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:

The starting date of the project activity is 08/06/2006 (the date of the first equipment purchasing contract).

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:

01/10/2009 or date of registration, whichever comes later.

C.2.1.2. Length of the first crediting period:

7 years 0 month

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

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 2nd November 2005, which has been approved by the National EPA on 12th January 2006, approved by Guangdong Provincial EPA on 8th March 2006 and approved by Guangzhou Municipal EPA on 21st February 2006. 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 NOx. 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 NOx≤400mg/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. Zhujiang Beer plants will remain green area of more than 30%. Therefore, the project has little impact on the local eco-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:

Some questionnaires were distributed to residents who may be impacted by the project and 7 investigational questionnaires have been returned. 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.
In order to ensure that the potential stakeholders receive information concerning the meeting, Zhujiang Beer Co., Ltd. posted a notification of the meeting on 25th December 2007. In the notification, the company invited the potential stakeholders to get to know detailed information about the project. The stakeholder consultation meeting for the parties interested in the project was organized on 14:30 on 15th January 2008 at the meeting room of Zhujiang Brewery Co., Ltd.
Project participants also uploaded the project documents to the Internet to invite comments from global stakeholder. The web address is:
http://www.southpolecarbon.com/goldstandard_consultations.htm

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:

Some residents who may be impacted by the project were investigated and 7 investigation questionnaires returned to the project owner. The interviewed people were all villagers, of whom 14.3% are women, 100% have graduated from senior high school or an inferior school, 100% are elder than twenty years old, and the investigation results are the following:

- 100% of the investigated residents are aware of lack of electricity and climate change.
- 100% of the investigated residents think that the project will not bring negative impacts on their lives.
- 100% of the investigated residents think that the project will bring benefits to city environments, such as improving air conditions, improving water quality of Zhujiang River.
- 100% of the investigated residents think that the project will not bring negative impacts on the ecological environment.
- 100% of the investigated residents agree with the construction of the project.

There were 7 local residents and governmental representatives attending the Stakeholder Consultancy Meeting. The conclusions of the meeting are as follows:

- All stakeholders consider the proposed project to be a renewable energy, which will cause no negative impacts on the environment.
- The project will only lead to noise pollution in a limited period. The project will improve air quality in a long term.
- The project will not cause negative impacts on Zhujiang River, on the contrary the project will improve water quality of Zhujiang River by encouraging more plants pay more attention to water discharged to Zhujiang River.
- The project will also help to increase the local employment opportunities, and improve life quality of local residents by increasing incomes.

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

Given the generally positive (or neutral) nature of the comments received, no action has been taken to address the comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Owner

Organization:	Guangzhou Zhujiang Brewery Co., Ltd.
Street/P.O.Box:	
Building:	Mo Die Sha, Xin Gang East Rd.
City:	Guangzhou City
State/Region:	Guangdong Province
Postfix/ZIP:	510308
Country:	P. R. China
Telephone:	84206636
FAX:	84202502
E-Mail:	
URL:	
Represented by:	Jianming Lin
Title:	Senior Engineer
Salutation:	Manager of Production Department
Last Name:	Lin
Middle Name:	
First Name:	Jianming
Department:	Production Department
Mobile:	13826256685
Direct FAX:	84202541
Direct tel:	84288570
Personal E-Mail:	1973ljm@vip.sina.com

The CER Purchase Facility Manager:

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State/Region:	Zurich
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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 Type	Emission Factor tc/TJ c E	Oxidation Rate % c F	NCV MJ/t,km3 c G
Coal	25.8	100	20908
Cleaned coal	25.8	100	26344
Other washed coa	25.8	100	8363
Briquettes	26.6	100	20908
Coke	29.2	100	28435
Coke oven gas	12.1	100	16726
Other coal gas	12.1	100	5227
Crude oil	20	100	41816
Gasoline	18.9	100	43070
Diesel	20.2	100	42652
Fuel oil	21.1	100	41816
LPG	17.2	100	50179
Refinery gas	15.7	100	46055
Natural gas	15.3	100	38931
Other petroleum p	20	100	38369
Other coke produ	25.8	100	28435
Other energy	0	100	0

1) 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy
2) <China Energy Statistical Yearbook 2007>

Table 2–OM Emission Factor of China Southern Power Grid in 2004

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	Potential emission factor	OXID	NCV	Emission(tCO2e)
							tc/TJ c	% c	MJ/t,km3 c	I=G*H*F*E*44/12/10000 in mass c
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/1000 (in volume)
Raw coal	10000tones	6017.7	1305	2643.9	1751.28	**11717.88**	25.8	100	20908	231,767,574
Washed coal	10000tones	0.21				**0.21**	25.8	100	26344	5,233
other washed coal	10000tones					**0**	25.8	100	8363	0
coke	10000tones					**0**	29.2	100	28435	0
coke oven gas	0.1billion m3					**0**	12.1	100	16726	0
other gas	0.1billion m3	2.58				**2.58**	12.1	100	5227	59,831
crude oil	10000tones	16.89				**16.89**	20	100	41816	517,933
Gasoline	10000tones					**0**	18.9	100	43070	0
Diesel	10000tones	48.88			1.83	**50.71**	20.2	100	42652	1,601,975
Fuel oil	10000tones	957.71				**957.71**	21.1	100	41816	30,983,494
LPG	10000tones					**0**	17.2	100	50179	0
Refinery gas	10000tones	2.86				**2.86**	15.7	100	46055	75,825
Natural gas	0.1billion m3	0.48				**0.48**	15.3	100	38931	104,833
other petroleum products	10000tones	1.66				**1.66**	20	100	38369	46,708
other coking products	10000tones					**0**	25.8	100	28435	0
other energy	10000tCe	79.42				**79.42**	0	100	0	0
									Total	265,163,407

China Energy Statistical Yearbook 2005

Thermal Power Generation within CCPG in 2004

province	Power Generation (10^8 kWh)	Power Generation MWh)	Auxiliary Power Consumption % c	Power Delivered to the Grid MWh)
Guangdong	1693.89	169389000	5.42	160,208,116
Guangxi	201.43	20143000	8.33	18,465,088
Guizhou	497.2	49720000	7.06	46,209,768
Yunnan	243.22	24322000	7.56	22,483,257
Total				247,366,229

China Electric Power Yearbook 2005

Net Import from CCPG (MWh)	10,951,240
Average EF of CCPG (tCO2/MW	0.827319
Total Emissioı	**274,223,576**
Total Power S	**258,317,469**
OM	**1.061576**

Table 3- OM Emission Factor of China Southern Power Grid in 2005

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	ential emission fa	OXID	NCV	Emission(tCO2e)
							tc/TJ c	% c	MJ/t,km 3 c	I=G*H*F*E*44/12/10000 in mass c
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/1000 (in volume)
Raw coal	10000tones	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	20908	263,442,602
Washed coal	10000tones				0.15	**0.15**	25.8	100	26344	3,738
other washed coal	10000tones			10.39	33.88	**44.27**	25.8	100	8363	350,238
coke	10000tones	4.79			8.05	**12.84**	29.2	100	28435	390,906
coke oven gas	0.1billion m3				0.79	**0.79**	12.1	100	16726	58,624
other gas	0.1billion m3	1.87			15.96	**17.83**	12.1	100	5227	413,486
crude oil	10000tones	10.91				**10.91**	20	100	41816	334,556
Gasoline	10000tones	0.68				**0.68**	18.9	100	43070	20,296
Diesel	10000tones	31.96	2.02		1.81	**35.79**	20.2	100	42652	1,130,639
Fuel oil	10000tones	887.21				**887.21**	21.1	100	41816	28,702,703
LPG	10000tones					**0**	17.2	100	50179	0
Refinery gas	10000tones	4.92				**4.92**	15.7	100	46055	130,441
Natural gas	0.1billion m3	0.93				**0.93**	15.3	100	38931	203,115
other petroleum products	10000tones	1.7				**1.7**	20	100	38369	47,833
other coking products	10000tones					**0**	25.8	100	28435	0
other energy	10000tCe	104.66	133.15		59.72	**297.53**	0	100	0	0
									Total	295,229,177

China Energy Statistical Yearbook 2006

Thermal Power Generation within CCPG in 2005

province	**Power Generation**	**Power Generation**	**Auxiliary Power Consumption**	**Power Delivered to the Grid**
	10^8 kWh)	**MWh)**	**% c**	**MWh)**
Guangdong	1764.53	176453000	5.58	166,606,923
Guangxi	250.23	25023000	7.95	23,033,672
Guizhou	584.3	58430000	7.34	54,141,238
Yunnan	272.81	27281000	6.94	25,387,699
Total				269,169,531

China Electric Power Yearbook 2006

Net Import from CCPG (MWh)	20,264,000
Average EF of CCPG (tCO2/MV	0.772159
Total Emissioı	**310,876,215**
Total Power S	**289,433,531**
OM	**1.074085**

Table 4- OM Emission Factor of China Southern Power Grid in 2006

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	Potential emission factor	OXID	NCV	Emission(tCO2e)
							tc/TJ c	% c	MJ/t,km3 c	I=G*H*F*E*44/12/10000 in mass c
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/1000 (in volume)
Raw coal	10000tones	7303.19	1490.01	4001.54	2735.88	**15530.62**	25.8	100	20908	307,179,636
Washed coal	10000tones					**0**	25.8	100	26344	0
other washed coal	10000tones			19.53	45.8	**65.33**	25.8	100	8363	516,852
briquette coal	10000tones	133.75				**133.75**	26.6	100	20908	2,727,466
coke	10000tones				1.31	**1.31**	29.2	100	28435	39,882
coke oven gas	0.1billion m3		0.84		2.06	**2.9**	12.1	100	16726	215,202
other gas	0.1billion m3	0.89			19.15	**20.04**	12.1	100	5227	464,737
crude oil	10000tones	0.87				**0.87**	20	100	41816	26,679
Gasoline	10000tones					**0**	18.9	100	43070	0
Diesel	10000tones	29.92	1.26		3	**34.18**	20.2	100	42652	1,079,777
Fuel oil	10000tones	685.85	0.09			**685.94**	21.1	100	41816	22,191,288
LPG	10000tones					**0**	17.2	100	50179	0
Refinery gas	10000tones	0				**0**	15.7	100	46055	0
Natural gas	0.1billion m3	7.92				**7.92**	15.3	100	38931	1,729,751
other petroleum products	10000tones	0.67				**0.67**	20	100	38369	18,852
other coking products	10000tones					**0**	25.8	100	28435	0
other energy	10000tCe	93.54	189.68		20.29	**303.51**	0	100	0	0
									Total	336,190,122

China Energy Statistical Yearbook 2007

Thermal Power Generation within CCPG in 2006

province	Power Generation 10^8 kWh)	Power Generation MWh)	Auxiliary Power Consumption % c	Power Delivered to the Grid MWh)
Guangdong	1884.29	188429000	5.27	178,498,792
Guangxi	279.67	27967000	4.45	26,722,469
Guizhou	760.39	76039000	6.06	71,431,037
Yunnan	397.91	39791000	4.12	38,151,611
Total				314,803,908

China Electric Power Yearbook 2007

	Net Import from CCPG (MWh)	21,730,840
	Average EF of CCPG (tCO2/MV	0.771336
	Total Emissio	**352,951,910**
	Total Power S	**336,534,748**
2006	OM	**1.048783**

Table 5 - Calculation of Ratio of Solid, Liquid and Gas fuel in total CO_2 Emission

	Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	NCV (kJ/kg, kJ/m3)	Emission factor	OXID	Emission (tCO2e)	Portion
			A	B	C	D	E=A+B+C+D	F	G	H	I=E*F*G*H*44/12/100	
Solid	Raw coal	10000t	7303.19	1490.01	4001.54	2735.88	15530.62	20,908	25.8	1	307,179,636	-
	Washed coal	10000t	0	0	0	0	0	26,344	25.8	1	0	-
	Other washed coal	10000t	0	0	19.53	45.8	65.33	8,363	25.8	1	516,852	-
	Biquette coal	10000t	133.75	0	0	0	133.75	20,908	26.6	1	2,727,466	
	cole	10000t	0	0	0	1.31	1.31	28,435	29.2	1	39,882	-
	total	-	-	-	-	-	0	-	-	-	310,463,836	92.35%
Liquid	cruede oil	10000t	0.87	0	0	0	0.87	41,816	20	1	26,679	-
	Gasoline	10000t	0	0	0	0	0	43,070	18.9	1	0	-
	Kerosene oil	10000t	0	0	0	0	0	43,070	19.6	1	0	-
	Diesel	10000t	29.92	1.26	0	3	34.18	42,652	20.2	1	1,079,777	-
	Fuel oil	10000t	685.85	0.09	0	0	685.94	41,816	21.1	1	22,191,288	-
	other petroleum products	10000t	0.67	0	0	0	0.67	38,369	20	1	18,852	-
	other coke products	10000t	0	0	0	0	0	28,435	25.8	1	0	
	Total	-	-	-	-	-	0	-	-		23,316,596	6.94%
Gas	Natural gas	0.1billion m3	79.2	0	0	0	79.2	38,931	15.3	1	1,729,751	-
	Coke oven gas	0.1billion m3	0	8.4	0	20.6	29	16,726	12.1	1	215,202	-
	othe gas	0.1billion m3	8.9	0	0	191.5	200.4	5,227	12.1	1	464,737	-
	LPG	10000t	0	0	0	0	0	50,179	17.2	1	0	-
	Refinery gas	10000t	0	0	0	0	0	46,055	15.7	1	0	-
	Total	-	-	-	-	-	0	-	-	-	2,409,690	0.72%
Total		-	-	-	-	-		-	-	-	336,190,122	100%

Table 6 –Calculation of the Emission Factor for Coal-fired, oil-fired and Gas-fired Power

Type of power plant	Variables	Power supply efficiency	Emission factor of fuels(tc/TJ)	Oxidation rate	Emission factor(tCO2e)
		A	B	C	D=3.6/A/1000×B×C ×44/12
Coal fire power plant	$EF_{Coal,Adv}$	37.28%	25.8	1	0.91352
Gas fired power plant	$EF_{Gas,Adv}$	48.81%	15.3	1	0.41377
Oil fired power plant	$EF_{Oil,Adv}$	48.81%	21.1	1	0.57062

$EF_{thermal,y}$ 0.88616 *tCO2/MWh*

Table7–The Calculation of BM Emission Factor for the China Southern Power Grid

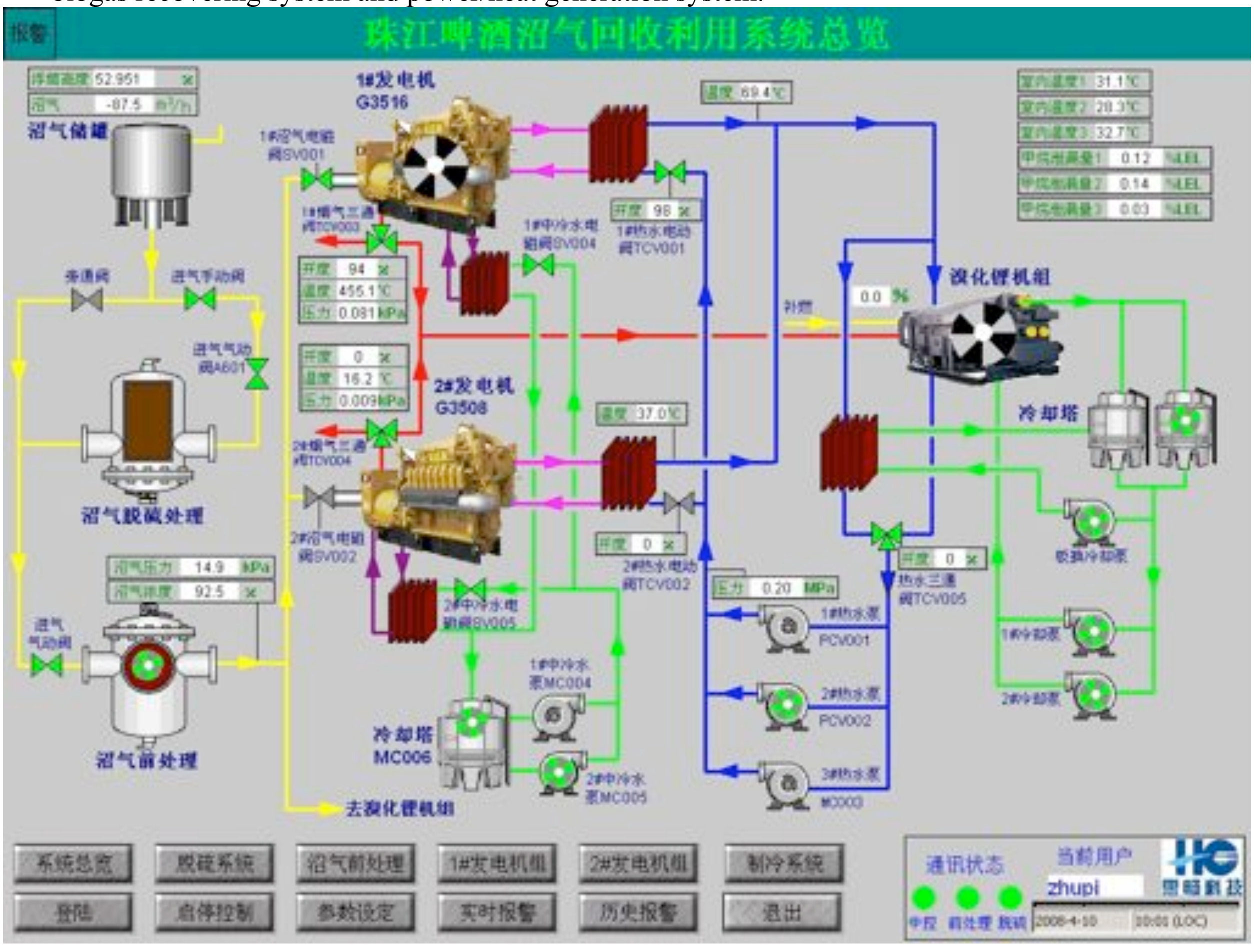
	Installed capacity in 2004	Installed capacity in 2005	Installed capacity in 2006	Newly added installed capacity from 2004 till 2006	Proportion against newly added installed capacity
	A	B	C	D=C-B	
Thermal power	46659.7	54507	68963	14456	78.63%
Hydro-power	27580.1	30347.1	34176	3828.9	20.83%
Nuclear power	3780	3780	3780	0	0.00%
Wind power	83.4	83.4	183	99.6	0.54%
Total	78103.2	88717.5	107102	18384.5	100.00%
share in 2006 installed capacity	74.04%	82.83%	100%		

$EF_{grid,BM,y}$ 0.69680 *tCO2/Mwh*

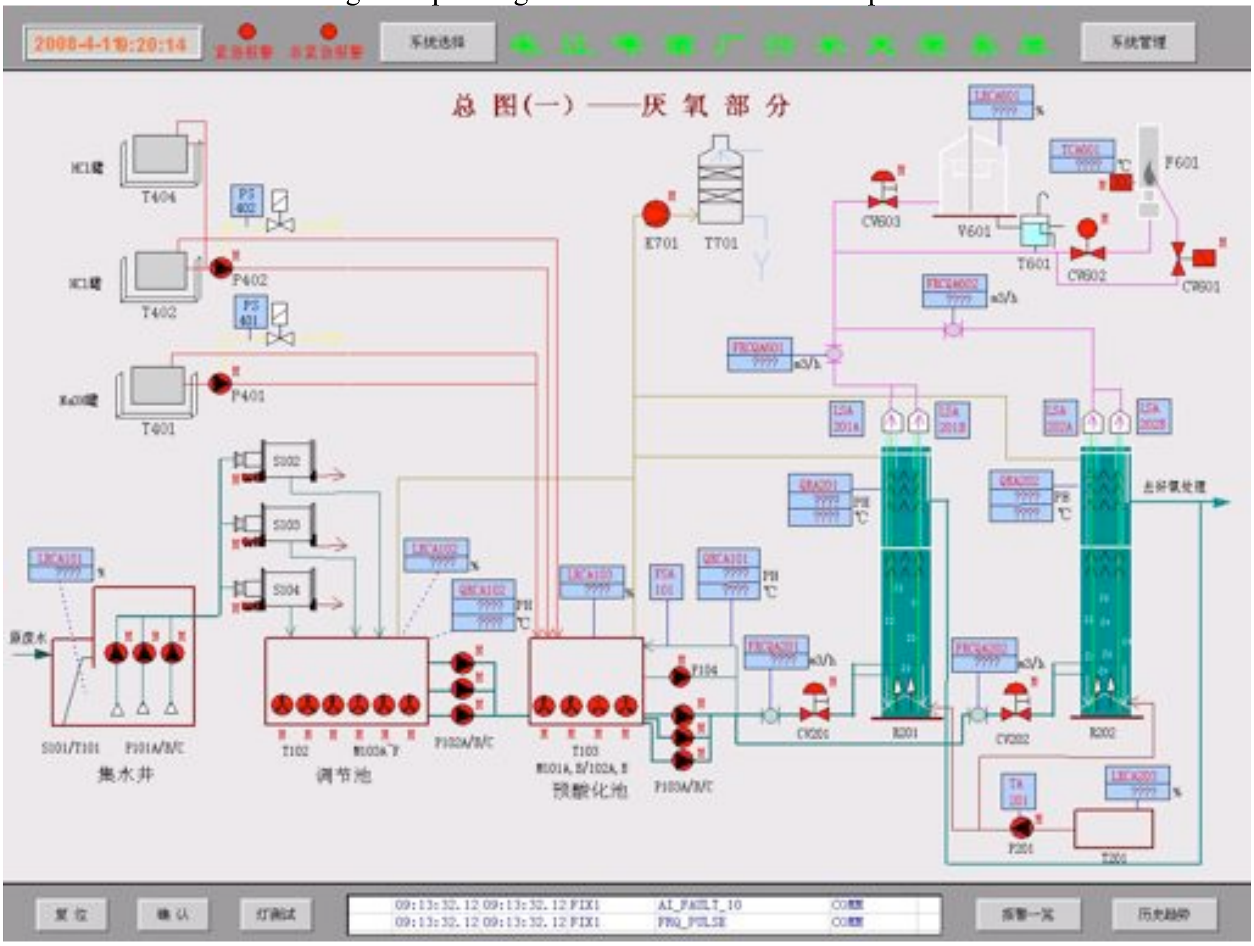
Annex 4

MONITORING INFORMATION

1. 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.



2. 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.



3. Indicators and parameters controlled for normal opertion power generation system. Online monitored/controlled parameters indicate a normal running state when their values stay within the “Target Values” or limits.

Indicators Monitored and Controlled for Power Generation

Equipments	Indicators	Unit	Target Value
De-sulfur Unit	pH		7.9-8.9
	Electrical Conductivity	ms/cm	40-60
	Oxidation-reduction Potential	mv	-300 ~ -410
	Temperature	℃	25-40
	Precepitation	g/l	5-15
	H2S Fraction	ppm	< 200
Pre-processing Unit	Inlet Pressure	kpa	3-5
	Outlet Temperature	℃	10-60
	Outlet Pressure	kpa	10-35
	Outlet Humidity		40%-60%
	Outlet Oxygen Concentration		≤1%
	CH4 Fraction		≥60%
	Pressure Diff. of Filter	kpa	< 5
Caterpilar Generators	Cell Voltage	V	≥24
	Mixture Gas Temperature	℃	≤68
	Pressure of Lubricating Oil	kpa	350–600
	Temperature of Lubricating Oil	℃	82/104(Max)
	Pressure Diff. of Oil Filter	kpa	≤103
	Temperature of Venting Gas	℃	≤554
	Temperature of Cylinder Vent	℃	≤670
	Gap of Electrodes	mm	0.35±0.03
	Frequency	HZ	50±0.5
	Voltage	V	400
	Speed	rpm	1500/1800(Off)
	Efficiency Factor	COSθ	≥0.8
	Water Temp. of Cylinder Sleev – Out	℃	≤123
	Water Temp. of Cylinder Sleev – In	℃	≤110
	Temperature of Reer Cooler	℃	54-60

4. Calibration and Testing of Electricity Meters

Parameters Monitored	$EG_{3508,y}$	$EG_{3516,y}$	$EC_{project,y}$
Verified by	Guangzhou Institute of Measurement and Testing Technology		
Certificate No.	DN-20080625	DN-20080626	DN-20072145
Client	Guangzhou meter factory Co., Ltd.		Guangzhou Zhujiang Brewery Co., Ltd.
Measurement Instruments	Three-phase Multi-functional Power Meter		
Model/Type	DTSD4000 3×220/380V 3×1.5 (6)A		
Manufacture	Guangzhou Institute of Measurement and Testing Technology		
Serial No.	80000048	80000047	06012038
Conclusion	Active Power: 0.5S Reactive Power: 2.0	Active Power: 0.5S Reactive Power: 2.0	Class 1
Verification/Due Date	14/4/2008-13/4/2011	14/4/2008-13/4/2011	25/9/2007-24/9/2010

5.

For more information please refer to section B.7. of this PDD.