MONITORING REPORT FORM (CDM-MR)
VERSION 01 - IN EFFECT AS OF: 28/09/2010

CONTENTS

MONITORING REPORT
Version 2.2, Date 20/10/2011

GUANGZHOU ZHUJIANG BEER METHANE RECOVERY PROJECT
CDM reference number: 2946 GS reference number: GS784
Monitoring period (20/12/2008 - 19/12/2009)

SECTION A. General description of the project activity

A.1. Brief description of the 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 5,000,000 m^3 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 wastewater 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 registered 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.

Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.).

The construction starting date of the project activity was on Nov. 28th, 2006, and commissioning was started in Jan. 2008. Continued operation started in May. 2008.

How emission reductions will be achieved

The project activity will lead to greenhouse 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. In this monitoring period (from Dec. 20th, 2008 to December 19th, 2009), the project activity achieved 14,550 tCO2e by capturing the biogas, and 3,105 tCO2e through displacement of electricity from the grid. The total amount of emission reductions is 17,656 tCO2e. Emission reductions from air conditioner are neglected for simplicity that is conservative.

A.2. 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**

A.3. Location of the project activity:

>>

Guangzhou City, Guangdong Province, P.R. China. (E113° 20'2'' and N 23° 06' 32'')

Figure 1. Location of the project activity

A.4. Technical description of the project

>>

Figure 2 shows the schematic diagram of the project. The registered 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 m^3/h to 700 m^3/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 registered 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.

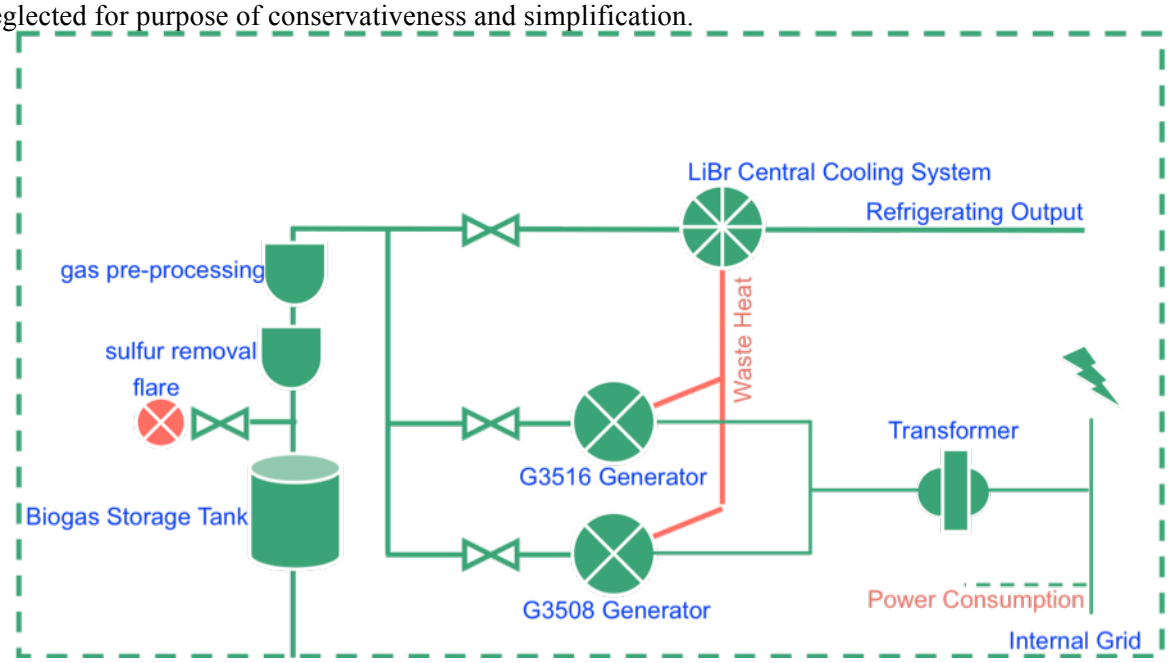

Figure 2. Schematic Diagram of the Project

A.5. Title, reference and version of the baseline and monitoring methodology applied to the 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

Include the complete reference of the methodology applied and tools whenever is applicable.

A.6. Registration date of the project activity:

CDM registration: Dec. 20th. 2009
Gold Standard registration: Aug. 2nd 2010

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

7 years (Pre-registration VER started from Dec. 20th, 2008, ended to Dec.19th . 2009)

A.8. Name of responsible person(s)/entity(ies):

>> Mr Sun Mingming, Ms Huang Da Fei and Mr Abhishek Bansal
Address: Unit 2506 A, China Central Building T3, Jianguo Road 77, Chaoyang District, 100025, Beijing
Telephone: +86 10 84549953
Email: m.sun@southpolecarbon.com

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

>>
Commissioning started in Jan. 2008. Continued operation started in May. 2008. There is no long-term overhaul and equipment exchange during the monitoring period.

B.2. Revision of the monitoring plan

>>
No revision of monitoring plan has been made.

B.3. Request for deviation applied to this monitoring period

>>
No request for deviation was applied for during this monitoring period.

B.4. Notification or request of approval of changes

>>
No notification or request of approval of changes has been made.

SECTION C. Description of the monitoring system

>>

Data collection procedure

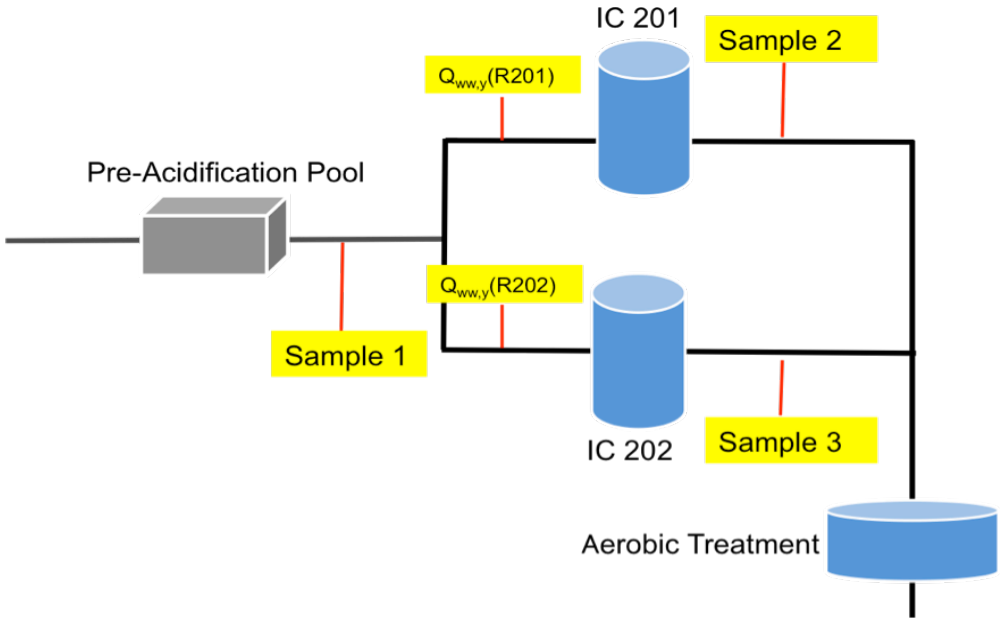

Figure 3 Schematic Diagram of wastewater flow

Data generation:
The project owner reads the power meters daily. Auto-electronic devices have been installed in the project site. As showed in Figure 3, two flow meters were installed at the location $Q_{ww,y}(201)$ and $Q_{ww,y}(202)$, the project owner reads the flow meter on daily based. The analysis of COD content before and after the IC reactors will be sampled and measured through lab test based on GB11914 (Monitoring and Analyzing of Water and Wastewater). Therefore, the data of COD removed will be the difference of these two values. Since there are two IC reactors involved in the project activity, the test will be done separately for the COD content after each IC reactor. Based on Figure 3 above, the wastewater from sample 1 will be the basis for testing the COD content of the wastewater before IC reactors; Sample 2 and 3 will be used for testing COD content of wastewater after IC 201 and IC 202.

Data recording:
Monitoring data is recorded by the qualified employees on-site using a designed form periodically. Data of power generation, biogas (flow, pressure, temperature, fraction of methane) is also stored in electronic form periodically.

Data aggregation:
Monitoring data is collected and aggregated by the each corresponding team leader every month and stored properly. The CDM project manager of Guangzhou Zhujiang Brewery Co. Ltd will recheck and collect the monitoring data from each operation team leaders and send them to South Pole Carbon Asset Co. Ltd.

Calculation:
Please see the details in section D.2 and section E.

Calibration and Accuracy of meters:
Please refer to Table 1 below.

Table 1: Detailed meter information

Meter Measuring	Meter Serial No.	Accuracy (%)	Calibration date	Valid until	Certificate No.
$Q_{ww,y\ (R201)}$	4500D691000 (R201)	1.0	01/12/2008	30/11/2010	Manufacturer's statement (01/12/2008)
$Q_{ww,y\ (R202)}$	4500D591000 (R202)	1.0	01/12/2008	30/11/2010	Manufacturer's statement (01/12/2008)
$Flow_{biogas,y}$	6083101	0.5	10/03/2008	09/03/2010	LL-080300424
$P_{biogas,y}$	4753475	0.5	10/03/2008	10/03/2010	LY-090100049
$T_{biogas,y}$	17	0.5	21/04/2008	20/04/2009	20081695
			22/04/2009	21/04/2010	20092046
$Fraction_{biogas,y}$	1090 9110 3061 8200 0029	1.0	30/10/2008 14/10/2009	29/10/2009 13/10/2010	2008110303 NH-200914152
$EG_{3508,y}$	164649890902	0.5	19/02/2009	18/02/2010	DN-20090107
$EG_{3516,y}$	148744260608	0.5	12/02/2009	11/02/2010	DN-2009008
$EG_{backup\ 3508}$	06012500	0.5	25/09/2007	24/09/2010	DN-20072166
$EG_{backup\ 3516}$	06012578	0.5	25/09/2007	24/09/2010	DN-20072161
$EC_{y,project}$	06012038	0.5	25/09/2007	24/09/2010	DN-20072145

Organizational Structures, Roles and responsibilities

An emission reductions manager has been appointed and trained to be responsible for the GS CER monitoring system. Monthly recording of relevant meters falls under the responsibility of the site.

Emergency procedures for the monitoring system

The site manager will notify the manufacturer and the equipment maintenance team in case there is doubt about the correct functioning of the meters mentioned in the monitoring plan. In that case, manufacturer or the maintenance team will check, repair and where necessary replace the meters. No GS CERs are claimed for the period during which the meters were not functioning correctly.

Location of meters and line diagram
Please refer to Table 2 for detailed location of the meters. Figure 4 illustrates for the electricity line connection and relevant monitoring of electricity generation. Figure 5 demonstrates the monitoring of biogas recovery.

Table 2: Monitored parameters and locations

Name	Name in Section B.7.1	Descriptions
E1	$EG_{3516,y}$	Power generation of No.3516 generator in year *y*.
E2	$EG_{3508,y}$	Power generation of No.3508 generator in year *y*.
E3	$EC_{project,y}$	Project electricity consumption in year *y*.
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. This meter is not yet installed and it is not required for the calculations of emission reduction.
E7, E8	/	Meters were installed at the coal power plant measuring the electricity imported from the grid and exported to the grid. Therefore, it is irrelevant for the ER calculations.
P	$P_{biogas,y}$	Pressure of biogas at entrance of generators and air conditioner.
T	$T_{biogas,y}$	Temperature of biogas at entrance of generators and air conditioner.
F	$F_{biogas,y}$	Flow of biogas at entrance of generators and air conditioner.
C	$C\%_{biogas,y}$	Fraction of methane in biogas recovered at entrance of generators and air conditioner.

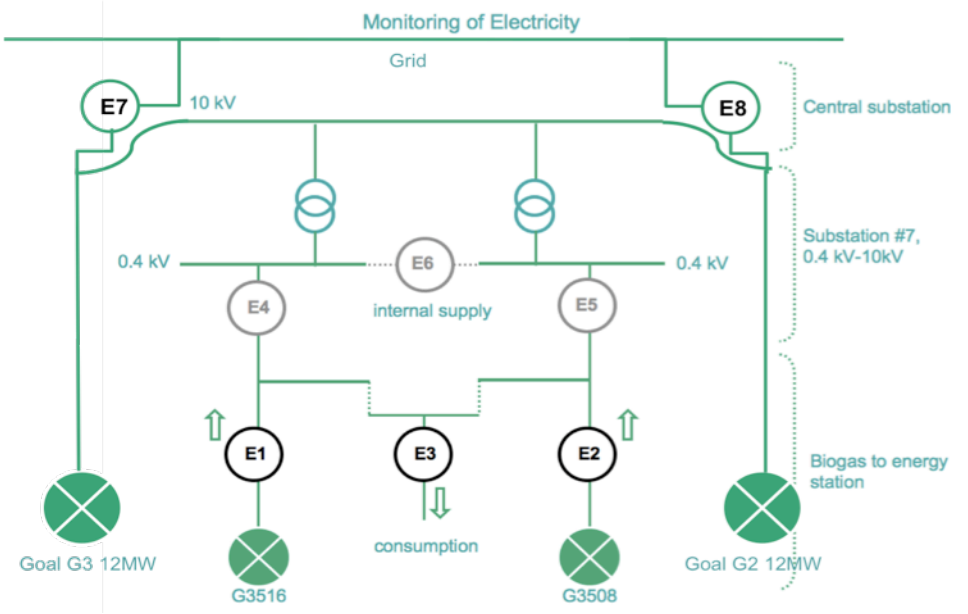

Figure 4. Line Connection Diagram

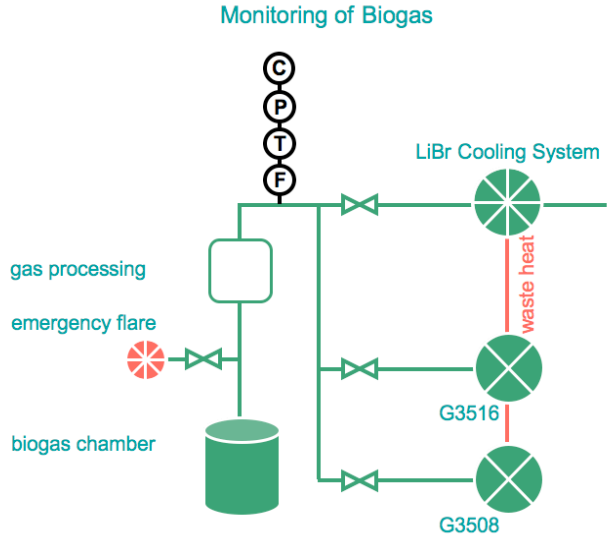

Figure 5 Monitor of biogas recovery and their installation positions

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emissions.
Any comment:	As per AMS.III.H Version 13, the IPCC default value of 0.25 kg CH_4/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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emissions.
Any comment:	

Data / Parameter:	$MCF_{ww,treatment,BL}$
Data unit:	Fraction
Description:	Methane correction factor for the wastewater treatment system that will be equipped with methane recovery and combustion
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 5, Chapter 6), value for anaerobic reactors
Value applied:	$MCF_{ww,treatment,PJ,}$ = 0.8 (for calculation of project emissions) $MCF_{ww,treatment,BL}$ =0.8 (for calculation of baseline emissions)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	IPCC default value
Any comment:	As per AMS.III.H Version 13, the higher IPCC value is used for calculation of project emissions and the lower value for baseline emissions as a conservative measure.

Data / Parameter:	UF_{BL}
Data unit:	Factor
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS III.H/ Version 13
Value applied:	0.94
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	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 III.H Version 13
Value applied:	0.9
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emissions.
Any comment:	

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions.
Any comment:	Based on combined margin calculation of OM and BM of China Southern Power Grid. Weighting of OM and BM are both 50%.

D.2. Data and parameters monitored

1) Methane avoidance component:

Data / Parameter:	$Q_{ww,y}$
Data unit:	m^3/year
Description:	Volume of wastewater treated in the year "y"
Measured /Calculated /Default:	Measured.
Source of data:	Flow meter records/operation logbook
Value(s) of monitored parameter:	m^3(this is the sum of daily records of two anaerobic ER calculations will be based on daily records. See the f ER calculation).
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.

Unit: m^3/year	R201	R202
2008	13,773.00	63,569.42
2009	1,395,765.00	1,520,604.00
Sub-total	1,409,538.00	1,584,173.42

<table>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>
<table>
<tr><td>Type</td><td colspan="2">Flow meter (R201)</td></tr>
<tr><td>Serial no.</td><td colspan="2">4500D69100</td></tr>
<tr><td>Accuracy</td><td colspan="2">1%</td></tr>
<tr><td>Calibration Standard</td><td colspan="2">JJG1033-2007</td></tr>
<tr><td>Calibration frequency</td><td colspan="2">2 year</td></tr>
<tr><td>Previous calibration</td><td>Calibration date</td><td>Valid until</td></tr>
<tr><td>First time</td><td>01/12/2008</td><td>30/11/2010</td></tr>
</table>
<table>
<tr><td>Type</td><td colspan="2">Flow meter (R202)</td></tr>
<tr><td>Serial no.</td><td colspan="2">4500D59100</td></tr>
<tr><td>Accuracy</td><td colspan="2">1%</td></tr>
<tr><td>Calibration Standard</td><td colspan="2">JJG1033-2007</td></tr>
<tr><td>Calibration frequency</td><td colspan="2">2 year</td></tr>
<tr><td>Previous calibration</td><td>Calibration date</td><td>Valid until</td></tr>
<tr><td>First time</td><td>01/12/2008</td><td>30/11/2010</td></tr>
</table>
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Monitored continuously, read and recorded on daily based.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>$Q_{ww,y} = Q_{ww,y}$ (R201) + $Q_{ww,y}$ (R202)</td></tr>
<tr><td>QA/QC procedures applied:</td><td>▪ Trained and qualified staff is responsible for recording data from the meter
▪ Meter will be calibrated periodically according to relevant national standards</td></tr>
</table>

Data / Parameter:	$COD_{removed,y}$
Data unit:	tonnes/m^3 (or mg/l)
Description:	Chemical oxygen demand removed in the wastewater through the anaerobic treatment reactor/system with methane capture in the year "*y*"
Measured /Calculated /Default:	Calculated
Source of data:	Operation records of lab test
Value(s) of monitored parameter:	Please refer to the calculations of the ER as the values of this parameter on daily based.
Indicate what the data are used for (Baseline/ Project/ Leakage emission	Baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Laboratory test. The Chemical Oxygen Demand (COD) test uses a strong chemical oxidant ($K_2Cr_2O_7$ or $Mn_2(SO_4)_3$) in an acid solution and heat to oxidize organic carbon to CO_2 and H_2O. By definition, chemical oxygen demand is "a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant. Oxygen demand is determined by measuring the amount of oxidant consumed using titrimetric or

	photometric methods. Measured and recorded on a daily basis by monitoring personnel.
Measuring/ Reading/ Recording frequency:	Daily based.
Calculation method (if applicable):	A lab system which is in line with national standard will be applied to measure the values of COD content before and after the anaerobic tank on daily based, and the difference between this two values will be applied on the calculation of emission reductions.
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data from the meter

Data / Parameter:	$P_{biogas,y}$		
Data unit:	kPa		
Description:	Pressure of biogas at entrance of power/heat generation system in the year "y"		
Measured /Calculated /Default:	Measured by meter.		
Source of data:	Operation records.		
Value(s) of monitored parameter:	Please refer to the calculations of the emission reductions as the values of this parameter are being monitored continuously.		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type	Pressure transmitter	
	Serial no.	4753475	
	Accuracy	0.5%	
	Calibration frequency	2 years	
	Calibration standard	JJG882-2004	
	Previous calibrations	Calibration date	Valid until
	First time	10/03/2008	10/03/2010
Measuring/ Reading/ Recording frequency:	Continuously.		
Calculation method (if applicable):	N/A.		
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards		

Data / Parameter:	$T_{biogas,y}$
Data unit:	°C
Description:	Temperature of methane at entrance of power/heat generation system in the year "y"
Measured /Calculated /Default:	Measured by Thermometer.

Source of data:	Operation records.
Value(s) of monitored parameter:	Please refer to the calculations of the emission reductions as the values of this parameter are being monitored continuously.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Thermometer Serial no.: 17 Accuracy: 0.5% Calibration Standard: JJG617-96 Calibration frequency: 1 year Previous calibration: First time — Calibration date: 21/04/2008 — Valid until: 20/04/2009 Previous calibration: Second time — Calibration date: 22/04/2009 — Valid until: 21/04/2010
Measuring/ Reading/ Recording frequency:	Continuously.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards

Data / Parameter:	$Flow_{biogas,y}$
Data unit:	m^3/year
Description:	Amount of methane recovered, fuelled or flared in the year "y"
Measured /Calculated /Default:	Measured by flow meters corrected with temperature and pressure.
Source of data:	Operation records.
Value(s) of monitored parameter:	**Unit: m^3/year** — $Flow_{biogas,y}$ **2008**: 133,819 **2009**: 2,446,352 **Sub-total**: 2,580,171
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Gas flow meter Serial no.: 6083101 Accuracy: 0.5% Calibration Standard: JJG640-1994 Calibration frequency: 4 years Previous calibration: First time — Calibration date: 10/03/2008 — Validate until: 09/03/2010
Measuring/ Reading/ Recording frequency:	Continuously.
Calculation method (if	N/A.

applicable):	
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards

Data / Parameter:	$Fraction_{biogas,y}$
Data unit:	% volume
Description:	Fraction of methane in biogas in year "*y*"
Measured /Calculated /Default:	Measured by gas analyser.
Source of data:	Operation records.
Value(s) of monitored parameter:	Range from 79.8% to 89%. Please refer to the calculations of the emission reductions as the values of this parameter are being monitored continuously.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Gas analyser Serial no.: 10909110306182000029 Accuracy: 1.0% Calibration standard: JJG365-2008 Calibration frequency: 1 year Previous calibration: Calibration date: 30/10/2008; Validate until: 29/10/2009 Second time: 14/10/2009; 13/10/2010
Measuring/ Reading/ Recording frequency:	Continuously.
Calculation method (if applicable):	N/A.
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data from the meter ▪ Meter will be calibrated periodically according to relevant national standards

Data / Parameter:	**Time for Flaring**
Data unit:	
Description:	Amount of minutes per hour where a flame has a higher temperature than 500°C, whenever biogas is sent to the flare.
Measured /Calculated /Default:	Measured by online timekeeper.
Source of data:	Operation records.
Value(s) of monitored parameter:	The dates that the flare was on: (total 3 days in 2009). 2008: Covered 20/12/2008 – 2009: 01/01/2009 –

	period: 31/12/2008 – 31/12/2009; No. of days: 0 – 3
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	On-line timekeeper and operation records.
Measuring/ Reading/ Recording frequency:	Continuously.
Calculation method (if applicable):	N/A.
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data from the meter

Data / Parameter:	***Final disposal of sludge***
Data unit:	
Description:	For the registered project, the final sludge will be transported outside of the project site and put into controlled landfills as in the baseline scenario.
Measured /Calculated /Default:	Measured on site by receipt.
Source of data:	Operation records.
Value(s) of monitored parameter:	N/A.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A.
Measuring/ Reading/ Recording frequency:	N/A.
Calculation method (if applicable):	N/A.
QA/QC procedures applied:	▪ Trained and qualified staff is responsible for recording data and archiving data.

2) Electricity generation component:

Data / Parameter:	$EG_{3508,y}$, $EG_{3516,y}$

<table>
<tr><td>Data unit:</td><td>MWh</td></tr>
<tr><td>Description:</td><td>Power generation by “3508” and “3516” generator in the year y</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured by electricity meter.</td></tr>
<tr><td>Source of data:</td><td>Operation records.</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>3,581.98MWh (this is the sum of daily records, ER calculations will be based on daily records, see the spreadsheet of ER calculation).

<table>
<tr><td>Unit: MWh</td><td>3508</td><td>3516</td></tr>
<tr><td>2008</td><td>0.00</td><td>0.00</td></tr>
<tr><td>2009</td><td>1,332.72</td><td>2,237.81</td></tr>
<tr><td>Sub-total</td><td>1,332.72</td><td>2,237.81</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline and project emission calculations.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>
<table>
<tr><td>Type</td><td colspan="4">Electricity meter</td></tr>
<tr><td></td><td>EG3508</td><td>EG backup 3508</td><td>EG3516</td><td>EG backup 3516</td></tr>
<tr><td>Serial no.</td><td>164649890902</td><td>06012500</td><td>148744260608</td><td>06012578</td></tr>
<tr><td>Calibration Standard</td><td>JJG780-1992</td><td>JJG596-1999</td><td>JJG780-1992</td><td>JJG596-1999</td></tr>
<tr><td>Accuracy</td><td>0.5%</td><td>0.2%</td><td>0.5%</td><td>0.2%</td></tr>
<tr><td>Calibration frequency</td><td>3 year</td><td>5year</td><td>3year</td><td>5years</td></tr>
<tr><td>Previous calibration</td><td colspan="4">First time</td></tr>
<tr><td>Calibration date</td><td>19/02/2009</td><td>25/09/2007</td><td>12/02/2009</td><td>25/09/2007</td></tr>
<tr><td>Validate until</td><td>18/02/2010</td><td>24/09/2010</td><td>11/02/2010</td><td>24/09/2010</td></tr>
</table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Monitored continuously, read and recorded on daily based.</td></tr>
<tr><td>Calculation method (if applicable):</td><td></td></tr>
<tr><td>QA/QC procedures applied:</td><td>▪ Trained and qualified staff is responsible for recording data from the meter
▪ Meter will be calibrated periodically according to relevant national standards</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>ECy,project</td></tr>
<tr><td>Data unit:</td><td>MWh/yr</td></tr>
<tr><td>Description:</td><td>Amount of electricity consumed by the equipment installed in addition to the existing wastewater treatment facility.</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured by electricity meter.</td></tr>
<tr><td>Source of data:</td><td>Operation records.</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>6.66MWh (this is the sum of daily records, ER calculations will be based on daily records, see the spreadsheet of ER calculation).
<table>
<tr><th>Unit</th><th>MWh</th></tr>
<tr><td>2008</td><td>0.00</td></tr>
<tr><td>2009</td><td>6.15</td></tr>
<tr><td>Total</td><td>6.15</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline and project emission calculations.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>
<table>
<tr><td>Type</td><td colspan="2">Electricity meter</td></tr>
<tr><td>Serial no.</td><td colspan="2">06012038</td></tr>
<tr><td>Accuracy</td><td colspan="2">0.2%</td></tr>
<tr><td>Calibration standard</td><td colspan="2">JJG596-1999</td></tr>
<tr><td>Calibration frequency</td><td colspan="2">5 years</td></tr>
<tr><td>Previous calibration</td><td>Calibration date</td><td>Valid until</td></tr>
<tr><td>First time</td><td>25/09/2007</td><td>24/09/2010</td></tr>
</table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Monitored continuously, read and recorded on daily based.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>N/A.</td></tr>
<tr><td>QA/QC procedures applied:</td><td>▪ Trained and qualified staff is responsible for recording data from the meter
▪ Meter will be calibrated periodically according to relevant national standards</td></tr>
</table>

3) Gold Standard component:

No	1
Indicator	Air quality during operation
Mitigation measure	N/A
Repeat for each parameter	
Chosen parameter	Hours of normal operations of the desulfurization and purification system
Situation of parameter before	N/A

Future target for parameter		The normal operation hours of the desulphurization and purification system should match the operation hours of generators (to ensure the gas treatment for the generators is supported by effective desulfurization and purification system)
Description of monitored parameter:		
Way of monitoring	How	The normal operation hours of the desulphurization and purification system will be recorded with PH value of washing liquid, matching the operation hours of generators. According to the PDD, pH value of washing liquid is between 7 to 9, desulfurization and purification system is under normal operation.
	When	Continuously
	By who	Plant operator

Monitored values of indicator 1:

Monitoring period: Dec. 20th. 2008 to Dec. 19th. 2009

	Operation hours	**Hours for maintenance**
G3508	4213	32
G3516	3878	56
Total	8091	
Desulphurization system	7968	24

The normal operation hours of the desulphurization and purification system match the operation hours of the generators. Two generators, G3508 and G3516, were installed to meet the fluctuations of biogas generated among the seasons. Therefore, for most of the time, the two generators could not operate simultaneously. In this monitoring period, the two generators were operated simultaneously only for 123 hours. This has been presented in the original operation records/logbooks.

No		2
Indicator		Air quality (emission of NOx)
Mitigation measure		N/A
Repeat for each parameter		
Chosen parameter		NOx emission (mg/m^3)
Situation of parameter before		N/A
Future target for parameter		Less than or equal to 400 mg/m^3
Description of monitored parameter:		
Way of monitoring	How	The Local Environmental Agency authorized by the national Environmental authorities will be assigned for the monitoring activity.
	When	Once a year.
	By who	The Local Environmental Agency authorized by the national Environmental authorities.

Monitored values of indicator 2:

		First time	Second time	Third time
		23/05/2008	31/08/2009	27/08/2010
Emission of NO_x (mg/m^3)	G3508	297	162	169.3
	G3516	175	226	221

No		3
Indicator		Biogas flaring
Mitigation measure		N/A
Repeat for each parameter		
Chosen parameter		Time of biogas flared
Situation of parameter before		N/A
Future target for parameter		Methane utilization ratio > 65%
Description of monitored parameter:		
Way of monitoring	How	An on-line monitoring system has been installed to continuously monitor the time of flaring.
	When	Continuously
	By who	Plant operator

Monitored values of indicator 3:

Flare was only on 3 days during this monitoring period, which only covered about 1% of the total operation time.

Date	**Duration of flaring opened**	**Reasons of flaring opened**
02/08/2009	2'43''	Biogas over-supply
03/09/2009	1'20''	Biogas over-supply
01/11/2009	36'5''	Pipes of running water were broke down, and Generators and Desulphurization system were stopped.

NOTES: Flaring system was automatically controlled by the fluid position of biogas in pressure tank. Whenever the fluid position of biogas reach or beyond the maximum position, flaring system will be automatically opened till the fluid position goes done to normal position.

No		4
Indicator		Employment
Mitigation measure		N/A
Repeat for each parameter		
Chosen parameter		Implementations of safety manual
Situation of parameter before		N/A
Future target for parameter		Safety manual has been provided to staff.
Description of monitored parameter:		
Way of monitoring	How	The monitoring report of the implementations of safety manual has been provided.
	When	Once a year.
	By who	Plant manager

Monitored values of indicator 4:

It has been recorded in the operation reports that the safety manual has been provided. The safety departments designed a checklist derived from safety manual, and the implementations of the safety manual have to be checked once a month according to the checklist. If incipient faults were found, corrective actions are forced to take. The checklist contains 19 items covers almost all the safety elements, and the samples of the original checklist were provided for DOE.

In this monitoring period, there was no single safety misadventure happened. All corrective actions founded in this monitoring period were properly addressed. Incipient faults were removed.

No		5
Indicator		Noise
Mitigation measure		N/A
Repeat for each parameter		
Chosen parameter		Noise (dB(a))
Situation of parameter before		N/A
Future target for parameter		Day time: less than or equal to 60dB(A), Night time: less than or equal to 55dB(A) GB12348-2008 class II.IV
Description of monitored parameter:		
Way of monitoring	How	Monitoring Centre of Guangdong Prevention and Treatment Centre for Occupational Disease was assigned to monitoring the level of noise. Report would be provided.
	When	Once a year.
	By who	The Local Environmental Agency authorized by the national Environmental authorities.

Monitored values of indicator 5:

	First time		Second time	
Date of monitoring report	10/08/2009		20/07/2010	
	Day	Night	Day	Night
Noise [Leq dB(A)]	53.5		53.7	53.5

No		6
Indicator		Employment
Mitigation measure		N/A
Repeat for each parameter		
Chosen parameter		Number of employed staff
Situation of parameter before		N/A
Future target for parameter		Job creation > 0
Description of monitored parameter:		
Way of monitoring	How	Number of employees will be recorded through salary payment records.
	When	Monthly
	By who	The plant management.
Chosen parameter		Level of income
Situation of parameter before		N/A
Future target for parameter		Each job created should receive reasonable level of income
Description of monitored parameter:		
Way of monitoring	How	The level of income generation will be recorded through salary payment records.
	When	Monthly
	By who	The plant management.

Monitored values of indicator 6:

	2009	2010	2011 (first quarter)
Number of jobs	18	18	18
Average annual income (RMB/person)	42,431	43,033	52,320

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

>> 1) Methane recovery component

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

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 registered 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,

$BE_{methane,y} = BE_{ww,treatment,y}$ 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)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

The actual values used in the calculations are summarized in the tables below. Please refer to the ER calculation spreadsheet for further details.

Baseline emissions of methane recovery component 2008 ($BE_{methane,y}$)

Parameter	Value	Unit	Data source
$Qww,i,2008$	77,342	m^3	Operation recrods
$COD_{removed,i,y}$	Daily based	mg/l	Operation recrods
$MCF_{ww,treatment,BL,i}$	0.8	n/a	Default value, PDD
$Bo,_{ww}$	0.21	n/a	Default value, PDD
UF_{BL}	0.94	n/a	Default value, PDD
GWP_{CH4}	21	n/a	Default value, PDD
BEmethane,2008	376	tCO_2e	Calculated as per Equation (1) (1.1) and (1.2), refer to spreadsheet for details

Baseline emissions of methane recovery component 2009 ($BE_{methane,y}$)

Parameter	Value	Unit	Data source
$Q_{ww,i,2009}$	2,916,369	m^3	Operation recrods
$COD_{removed,i,y}$	Daily based	mg/l	Operation recrods
$MCF_{ww,treatment,BL,i}$	0.8	n/a	Default value, PDD

$Bo_{,ww}$	0.21	n/a	Default value, PDD
UF_{BL}	0.94	n/a	Default value, PDD
GWP_{CH4}	21	n/a	Default value, PDD
$BE_{methane,2009}$	16,090	tCO_2e	Calculated as per Equation (1) (1.1) and (1.2), refer to spreadsheet for details

2) Electricity displacement component

$$BE_{electricity,y} = ER_{electricity,y} = EG_y * EF_y \quad \text{Equation (2)}$$

Where:

EG_y Net electricity supplied to the grid in year "y", MWh
EF_y The grid CO_2 emission factor in year "y", tCO_2e/MWh

The actual values used in the calculations are summarized in the tables below. Please refer to the ER calculation spreadsheet for further details.

Baseline emissions of electricity displacement component 2008 ($BE_{electricity,y}$)

Parameter	Value	Unit	Data source
EG_{2008}	**0.00**	**MWh**	**Operation records**
EC_{2008}	**0.00**	**MWh**	**Operation records**
EFy(	**0.87118**	**tCO2e/MWh**	**Default value, PDD**
$BE_{electricity,2008}$	**0**	**tCO2e**	**Calculated as per Equation (2)**

Baseline emissions of electricity displacement component 2009 ($BE_{electricity,y}$)

Parameter	Value	Unit	Data source
EG_{y2009}	3,570.53	MWh	Operation records
EC_{2009}	6.15	MWh	Operation records
$EF_{y(}$	0.87118	tCO_2e/MWh	Default value, PDD
$BE_{electricity,2009}$	3,105	tCO_2e	Calculated as per Equation (2)

E.2. Project emissions calculation

>>

1) Methane component

The project activity emissions due to methane avoidance are calculated as follows (Paragraph 26 of ASM III.H Version 13):

$$PE_{methane,y} = PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \quad \text{Equation (3)}$$

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"(tCO_2e)

In terms of $\boldsymbol{PE_{power,y}}$ 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.

$\boldsymbol{PE_{ww,treatment,y}}$, $\boldsymbol{PE_{s,treatment,y}}$, $\boldsymbol{PE_{ww,discharge,y}}$, $\boldsymbol{PE_{s.final,y}}$, $\boldsymbol{PE_{biomass,y}}$ are all not applicable. According to paragraph 14, AMS.III.H Version 13, $\boldsymbol{PE_{ww,treatment,y}}$, $\boldsymbol{PE_{ww,discharge,y}}$ and $\boldsymbol{PE_{biomass,y}}$ remain unchanged as the wastewater treatment system remains unchanged, and only methane capture system is installed. As per AMS.III.H, $\boldsymbol{PE_{s,treatment,y}}$ 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 for treatment. Since the project activity does not affect the sludge treatment system, $\boldsymbol{PE_{s,treatment,y}}$ can be neglected. According to paragraph 26 of AMS.III.H, Version 13, $\boldsymbol{PE_{s.final,y}}$ 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 registered 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,

$$PE_{methane,\,y} = PE_{fugitivie,y} + PE_{flaring,y} \qquad \text{Equation (3.1)}$$

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)

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y} \qquad \text{Equation (3.2)}$$

Where:

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

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

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

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

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4} \quad \text{Equation (3.2.1)}$$

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:

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_{K} COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} \quad \text{Equation (3.2.2)}$$

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/m_3)

$MCF_{ww,treatment,PJ,k,y}$ 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) $PE_{flaring,y}$

Whenever the flare starts working, the working time is logged as a part of the operation records. According to the PDD, the emission reductions will be calculated as zero during this period. To enhance conservativeness, the emission reductions of the day during which the flare is on would be accounted as project emissions.

The actual values used in the project emissions calculations are summarized in the tables below. Please refer to the ER calculation spreadsheet for further details.

Project activity emissions due to methane avoidance in 2008 ($PE_{methane,y}$)

Parameter	Value	Unit	Comments/source
$PE_{power,2008}$	0	tCO_2e	Justified in the PDD
$PE_{ww,treatment,2008}$	0	tCO_2e	Justified in the PDD
$PE_{s,treatment,2008}$	0	tCO_2e	Justified in the PDD
$PE_{ww,discharge,2008}$	0	tCO_2e	Justified in the PDD
$PE_{s,final,2008}$	0	tCO_2e	Justified in the PDD

$PE_{fugitive,2008}$	42	tCO_2e	See calculation below
$PE_{biomass,2008}$	0	tCO_2e	Justified in the PDD
$PE_{flaring,2008}$	0	tCO_2e	See calculation below
$PE_{methane,2008}$	42	tCO_2e	Calculated as per Equation (3)

$PE_{fugitive,y}$

Parameter	Value	Unit	Data source
CFE_{ww}	*0.9*		Default value, PDD
$Qww,i,2008$	77,342	m^3	Monitored data, logbook
$COD_{removed,i,y}$	Daily based		
$MCF_{ww,treatment,BL,i}$	0.8		Operation records
$Bo_{,ww}$	0.21		Default value, PDD
UF_{PJ}	1.06		Default value, PDD
GWP_{CH4}	21		IPCC default value, PDD
$PE_{fugitive,2008}$	42	tCO_2e	Calculated as per Equation (3.2), (3.2.1) and (3.2.2), refer to spreadsheet for details

$PE_{flaring,y}$

Parameter	Value	Unit	Data source
$PE_{flaring,2008}$	0	tCO_2e	Monitored data, log book

Project activity emissions due to methane avoidance in 2009 (*$PE_{methane,y}$*)

Parameter	Value	Unit	Comments/source
$PE_{power,2009}$	0	tCO_2e	Justified in the PDD
$PE_{ww,treatment,2009}$	0	tCO_2e	Justified in the PDD
$PE_{s,treatment,2009}$	0	tCO_2e	Justified in the PDD
$PE_{ww,discharge,2009}$	0	tCO_2e	Justified in the PDD
$PE_{s,final,2009}$	0	tCO_2e	Justified in the PDD
$PE_{fugitive,2009}$	1,814	tCO_2e	See calculation below
$PE_{biomass,2009}$	0	tCO_2e	Justified in the PDD
$PE_{flaring,2009}$	59	tCO_2e	See calculation below
$PE_{methane,2009}$	1,873	tCO_2e	Calculated as per Equation (3)

$PE_{fugitive,y}$

Parameter	Value	Unit	Data source
CFE_{ww}	*0.9*		Default value, PDD
$Q_{ww,i,2009}$	2,916,369	m^3	Monitored data, log book
$COD_{removed,i,y}$	Daily based		Operation records
$MCF_{ww,treatment,BL,i}$	0.8		Operation records
$Bo,_{ww}$	0.21		Default value, PDD
UF_{PJ}	1.06		Default value, PDD
GWP_{CH4}	21		IPCC default value, PDD
$PE_{fugitive,y}$	1,814	tCO_2e	Calculated as per Equation (3.2), (3.2.1) and (3.2.2), refer to spreadsheet for details

$PE_{flaring,y}$

Parameter	Value	Unit	Data source

$PE_{flaring,2009}$	58.74	tCO2e	Monitored data, log book

E.3. Leakage calculation

>>

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

$$Leakage = 0 \qquad \text{Equation (4)}$$

E.4. Emission reductions calculation / table

>>

1). Emission reductions of methane recovery component

The emission reductions related to methane avoidance in the wastewater treatment process are calculated as the difference between the baseline emissions and the sum of the project emissions and leakage:

$$ER_{methane,y,exante} = BE_{methane,y,exante} - (PE_{methane,y,exante} + LE_{mehane,y,exante}) \qquad \text{Equation (5)}$$

Where:

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

$$ER_{y,expost} = \min(BE_{mathane,y,expost} - PE_{methane,y,expost} - LE_{methane,y,ex\square post}), \\ (MD_{methane,y} - PE_{methane,y,expost} - LE_{methane,y,expost}) \qquad \text{Equation (5.1)}$$

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)

$$MD_{methane,y} = BG_{burnt,y} * W_{CH4} * D_{CH4} * FE * GWP_{CH4} \qquad \text{Equation (5.1.1)}$$

Where:

$BG_{burnt,y}$ Biogas flared/combusted in year *y* (m^3)
$w_{CH4,y}$ Methane content in the biogas in the year *y* (mass fraction)
D_{CH4} Density of methane at the temperature and pressure of the biogas in the year *y* (tonnes/m^3)
FE Flare efficiency in year *y* (fraction)

The actual values used in the calculations are summarized in the tables below. Please refer to the ER calculation spreadsheet for further details.

Emission reductions of methane recovery component 2008 ($ER_{methane,2008}$)

Parameter	Value	Unit	Data source
$BE_{methane,2008}$	376	tCO_2e	See Section E.1
$PE_{methane,2008}$	42	tCO_2e	See Section E.2
$LE_{mehane,2008}$	0	tCO_2e	See Section E.3
$ER_{methane,2008}$	334	tCO_2e	Calculated as per Equation (5)

$MD_{methane,2008}$

Parameter	Value	Unit	Data source
$BG_{burnt,2008}$	133,819	m^3	Calculated as per operation records
W_{CH4}	79-89%		Monitored data, log book
D_{CH4}	0.00075-0.00078	t/m^3	Calculated, refer to spreadsheet for details
FE	100%		
$PE_{methane,2008}$	42	tCO_2e	See Section E.2.
$LE_{mehane,2008}$	0	tCO_2e	See Section E.3.
$MD_{methane,2008}$	1,410	tCO_2e	Calculated as per Equation (5.1.1), refer to spreadsheet for details

$ER_{methane,2008}$

Parameter	Value	Unit	Data source
$ER_{methane,2008}$	334	tCO_2e	Calculaetd as per Equation (5.1)

Emission reductions of methane recovery component 2009 ($ER_{methane,2009}$)

Parameter	Value	Unit	Data source
$BE_{methane,2009}$	16,090	tCO_2e	See Section E.1
$PE_{methane,2009}$	1,873	tCO_2e	See Section E.2
$LE_{mehane,2009}$	0	tCO_2e	See Section E.3
$ER_{methane,2009}$	14,217	tCO_2e	Calculated as per Equation (5)

$MD_{methane,2009}$

Parameter	Value	Unit	Data source
BGburnt,2009	2,446,352	m^3	Calculated as per operation records
WCH4	79-89%		Monitored data, log book
DCH4	0.00075-0.00078	t/m^3	Calculated, refer to spreadsheet for details
FE	100%		
PEmethane,2009	1,873	tCO_2e	See Section E.2.
LEmehane,2009	0	tCO_2e	See Section E.3.
MDmethane,2009	25,714	tCO_2e	Calculated as per Equation (5.1.1), refer to spreadsheet for details

$ER_{methane, 2009}$

Parameter	Value	Unit	Data source
$ER_{methane,2009}$	14,217	tCO_2e	Calculated as per Equation (5.1)

2) ***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 (5.2)

Where:

$ER_{electricity,y}$ Emission reductions due to electricity generation in year "y", tCO_2e
$BE_{electricity,y}$ Baseline emissions due to electricity generation in year "y", tCO_2e
$PE_{electricity,y}$ Project emissions due to electricity generation in year "y", tCO_2e
$Leakage_{electricity,y}$ Leakage emissions due to electricity generation in year "y", tCO_2e

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 registered 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 CO_2e/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 CO_2e/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 The grid CO2 emission factor in year "y", tCO_2e/MWh

The actual values used in the calculations are summarized in the tables below. Please refer to the ER calculation spreadsheet for further details.

Emission reductions of electricity displacement 2008 ($ER_{electricity,2008}$)

Parameter	Value	Unit	Data source
$BE_{electricity,2008}$	0	tCO_2e	Calculated as per Equation (2)
$PE_{electricity,2008}$	0	tCO_2e	Justified in PDD
$Leakage_{electricity,2008}$	0	tCO_2e	Justified in PDD
$ER_{electricity,2008}$	0	tCO2e	Calculated as per Equation (5.1) and (5.2)

Emission reductions of electricity displacement 2009 ($ER_{electricity,2009}$)

Parameter	Value	Unit	Data source
EG_{2009}	3,571	MWh	Calculated as per operation records
EC_{2009}	6.15	MWh	Operation records
EFy	0.87118	tCO_2e/MWh	PDD
$ER_{electricity,y}$	3, 105	tCO_2e	

Total emission reductions

Parameter	Methane recovery	Electricity	Total emission reductions
Emission reduction in 2008 (tCO2e)	**334**	**0**	**334**
Emission reduction in 2009 (tCO2e)	**14,216.8**	**3,105.2**	**17,322**
Total of the monitoring period (tCO2e)	**14,550.4**	**3,105.2**	**17,656**

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

>>

This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
2008 emission reductions (tCO_2e) (20/12/2008-31/12/2008)	**1,176**	**334**
2019 emission reductions (tCO_2e) (01/01/2009-19/12/2009)	**35,780**	**17,322**

The actual emission reductions are only 49% of the emission reductions estimated in the PDD.

E.6. Remarks on difference from estimated value in the PDD

Compared with estimated value in the PDD, the actual emission reductions are significantly lower. The reason is that the beer production dropped dramatically (about 33% compared with the production of 2007) during the economic downtime, and the implementation of cleaner production caused a reduction of waster consumption about 10% compared with 2007. The two reasons lead to a reduction of volumes

of wastewater treated by 35% during this monitoring period. The volume of wastewater is critical for biogas generation, hence this caused around 51% less on the emission reduction than estimated.

- - - - -

History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		