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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

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Project Title: Project Title: Meizhou Landfills Gas Recovery and Utilization as Energy

PDD version change history:
PDD V.05, dated on 01/11/2005 which was registered at UNFCCC on date 03/03/2006
PDD V.06, updated version on 28/02/2012 to UNFCCC for renewal crediting period application.
PDD V.07 revised version on 10/07/2012 according to the validation findings.
PDD V.08 revised version on 29/11/2012 according to the comments from DOE.

A.2. Description of the project activity:

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Meizhou City is located in the northeast corner of Guangdong province in the People's Republic of China. The center of government for Meizhou is located in Meijiang District, together with seven counties of Fengshun, Meixian, Xingning, Wuhua, Jiaoling, Dapu and Pingyuan, with a total population of over 5 million people in the City. There is a big Longfeng landfill at Meijiang District, and there are other seven landfills in the counties of Meizhou, all of the above eight landfills were simply filled with bad pollution by nauseous odors gas emission before the implementation of the Meizhou Landfills as Recovery and Utilization as Energy Project (Brief as Meizhou LFG Project).

The Meizhou LFG Project was registered as CDM project on 03/03/2006. The eight landfills described above were packed in the CDM project. The total amount of CERs estimated in PDD is about 1,684,780 tCO_2 in this crediting period, and the emission reduction attributable to the displacement of grid electricity by the Project Activity was not claimed by the project developer in PDD for the first and second crediting periods.

The first stage work of Meizhou LFG project is the construction of Longfeng landfill gas recovery and power generation facilities which has put into operation since January 2006. There are new landfill gas wells developing each year as the landfill continues to be filled with MSW, while the 2x500kW LFG power generation system is under operation through local rural power distribution line due to the reason of non-availability of the formal LFG power transmission line which shall provided by the local Power Supply Bureau by Chinese relative regulation, the LFG power generation is required only for grid peak load period and shall be shutdown during maintenance period of the rural power distribution line. The excess LFG as well as all gas collected during periods when electricity is not generated will be flared.

The second stage construction work of Meizhou LFG Project includes seven landfills, Fengshun, Xingning, Meixian Qilongkeng, Pingyuan, Wuhua, Jiaoling as well as Dapu. The LFG collection and flaring system has been put into operation at Xingning site since 01/08/2009. The LFG collection and flaring system of Meixian Qilongkeng has been built but not operate now and 2x500kW LFG power generation system has been installed, and planned to generate in 2013, the construction delayed of Meixian Qilongkeng site with regard to plan because the landfill operation makes the LFG pipes can not connect to the gas wells and the generating procedures is complicated in local Power Supply Bureau. The LFG constructions for Wuhua and Fengshun start now, the LFG collection and flaring system are planned to complete in 2013, the other three small landfills at Pingyuan, Dapu and Jiaoling are still not started due to the inability of site conditions at present, and be planed to construct in year 2014, these five landfills delayed because the landfill operation party can not timely covering and sealing fields, which influence the LFG collection and construction.

In the second crediting period, there are total 4x500kW LFG generators in operation at Longfeng and Meixian Qilongkeng landfills with an annual estimated 3,919,500kWh electricity will be delivered to

the Southern China Power Grid by the Project Activity, and the excess LFG as well as all gas collected at other six landfill sites will be flared. It is estimated to realize an annual GHG emission reduction up to 240,683 tones CO_2 equivalent[1] by destroying the methane and substituting the fossil fuel power of the Southern China Power Grid with LFG electricity.

It is firmly evidenced that the Project Activity has been contributed to the sustainable development in the following aspects:

- The un-controlled release of landfill gas can impact negatively on the health of the local population by the nauseous odors from the site and lease to risks of flammable and explosive threat on the landfill site, those kinds of negative impact and risks has been greatly reduced by implementation of Project Activity.
- The local environment has been improved without harmful gases emission (including SO_2 and NO_x) by LFG flaring.
- The contaminated leachate water pollution has been reduced through recycling processing technology, which the harmless process of the landfill also has been accelerated.
- To create new jobs for local people, also to train more professional technicians in LFG recovery and power generation in China.

A.3. Project participants:

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Project participants and Parties involved are listed in table A-1.

Table A-1 Project Participants Information

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)
China	Shenzhen PhasCon Technologies Co., Ltd.	No
Austria	Kommunalkredit Public Consulting GmbH	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

- The developer, owner and operator of Meizhou Landfill Gas Recovery and Utilization as Energy Project is Shenzhen PhasCon Technologies Co., Ltd.. PhasCon is in charge of the project design, project financing and investment, project implementation, project management and operation.

- The owner of the landfill sites is Meizhou Environment and Sanitation Administration Bureau, Guangdong, China (MESAB). MESAB is in charge of city municipal solid waste collection, landfill disposal and daily operation. MESAB signed a contract in May and July of 2004 to entrust PhasCon for the collection and utilization of LFG from the eight landfills in Meizhou for 30 years.

- The Austria Kommunalkredit Public Consulting GmbH has signed the ERPA with PhasCon to purchase the Certified Emission Reduction Credits (CERs) from this project.

[1] Details as estimated in B.6

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

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The People's Republic of China

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

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Guangdong Province

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

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Meizhou City and other subsidiary seven counties, Fengshun, Wuhua, Xingning, Jiaoliong, Meixian, Pingyuan and Dapu.

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

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The Meizhou LFG project is located at Meizhou city, Guangdong Province of China, includes landfill gas recovery and flaring or utilization activity in the eight landfills which spread in the Longfeng landfill at Meijiang District of Meizhou city zone, as well as the landfills in the counties of Xingning, Meixian, Fengshun, Pingyuan, Jiaoling, Dapu, Wuhua respectively. The location of project activity is described in figure 1-3, and the detail geographic coordinates of the eight landfills are as the table A-2 below:

Table A-2. The geographic coordinates of the eight landfills included in the Meizhou LFG project.

Landfill	Location	Longitude	Latitude
Longfeng Landfill	Longfeng village, Meijiang district	116°07′59″E	24°18′21″N
Xingning Landfill	Xingpozhenxiansheng village	115°39′07″E	24°07′52″N
Meixian Qilongken Landfill	Xiyang town, Mei county	116°10′29″E	24°17′44″N
Fengshun Landfill	Tangken town, Fengshun county	116°09′54″E	23°43′41″N
Jiaoling Landfill	Sanzhen town, Jiaoling county	116°06′29″E	24°34′54″N
Dapu Landfill	Longgang town, Dapu county	116°39′32″E	24°21′19″N
Wuhua Landfill	Zhuanshui town, Wuhua county	115°44′58″E	23°58′41″N
Pingyuan Landfill	Datuo town, Pingyuan county	115°54′03″E	24°33′56″N

Figure1. Location of Guangdong Province in China

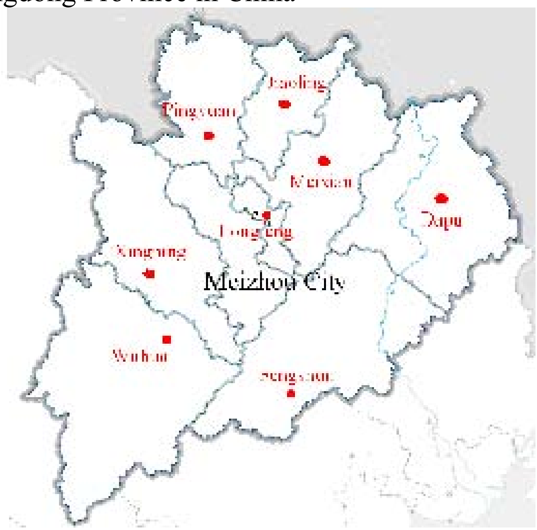

Figure 2 Meizhou City in Guangdong Figure 3. Location of Project Activity at Meizhou

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

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The Project Activity falls under Sectoral scope 13: waste handling and disposal, with applicable scopes of captured landfill gas is flared or used to produce energy.

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

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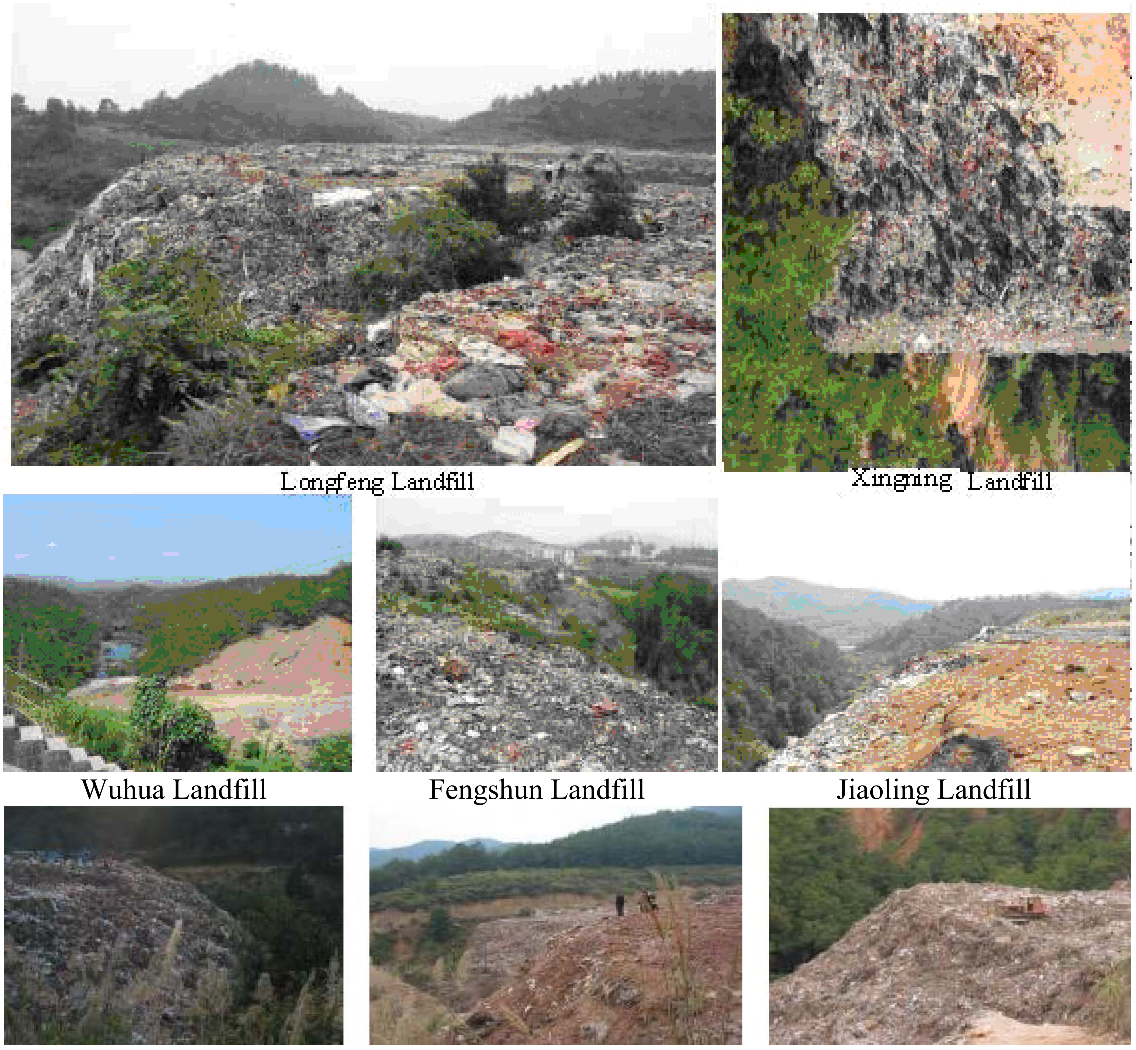
The main background and data for each landfill prior to the project activity is shown in figure below and listed in table A-3.



Longfeng Landfill   Xingning Landfill

Wuhua Landfill   Fengshun Landfill   Jiaoling Landfill

Meixian Qilongkeng Landfill   Dapu Landfill   Pingyuan Landfill

Figure 4. The Original Site Views of Eight Landfills in Meizhou at 2005

Table A-3 The data for eight landfills in Meizhou (updated on January, 2012)

Landfill Name	Start Fill Date	Waste Deposition Rate tonnes/day at 2011)	Waste in Place (x 10,000 tonnes at 2011)	Designed End Fill Date	Estimated Final Volume (x10,000 tonnes)	Actual depth/ designed depth (m)
Longfeng	1985	1056	549.5	2012	578.0	18/15
Xingning	1994	352	169.9	2026	397	17/19
Wuhua	1998	264	85.1	2020	199.7	15/23
Fengshun	2001	191.3	57.5	2031	328.2	12/19
Pingyuan	1995	152.6	69.8	2034	347.9	8/18
Jiaoling	2000	132	47.5	2026	138.2	16/25
Dapu	1993	124.6	55.6	2026	172.8	18/27
Meixian Qilongkeng	1995	520	83.2	2035	823.4	6/19

The landfills in Meizhou are all the municipal solid waste (MSW) which dumped in the mountains, there is no any landfill gas collection pipes and facilities onsite, all the gas just released to air through vertical rock cribs for safety consideration. This is the scenario existing prior to the start of the implementation of the project activity which is the same as baseline scenario, where the Greenhouse Gas of landfill gas (the main content is methane) generated from the landfills is released to air without

any recovery.

In the project activity, the landfill gas is extracted by the blower pump station from well sealed landfill, and delivered for flaring by a closed flare, or combusted by gas generators for power generation, as shown in figure 5, and the project sites of Longfeng and Xingning are shown in figure 6 and 7 below.

The main state-of-art technologies adopted in the Project including:

- Landfill sealing with soil and green plants, as well as the rain waterspout drainage system , so as to keep the whole landfill well sealed;
- Landfill gas vertical well constructed with PhasCon cone-sinking technology, the configuration of LFG well is shown in figure 5 below;
- Landfill gas horizontal piping with sink-well drainage technology;
- Gas/water separating and LFG drying technology with knock-out drum and cooling system;
- Blower station with multi-stage centrifuge pumps for LFG extraction from the landfill;
- Methane fraction and oxygen fraction online monitoring and safety control technology;
- LFG flaring technology with enclosed in flame flare torch;
- High voltage Self-ignition technology for flaring without auxiliary LPG fossil fuel.
- LFG purifying treatment technology;
- LFG power generation with gas generators;
- DC starter for gas generator starting without any fossil fuel diesel engine driven.
- LFG flow measurement and CDM data monitoring technology;
- Remote communication and management.

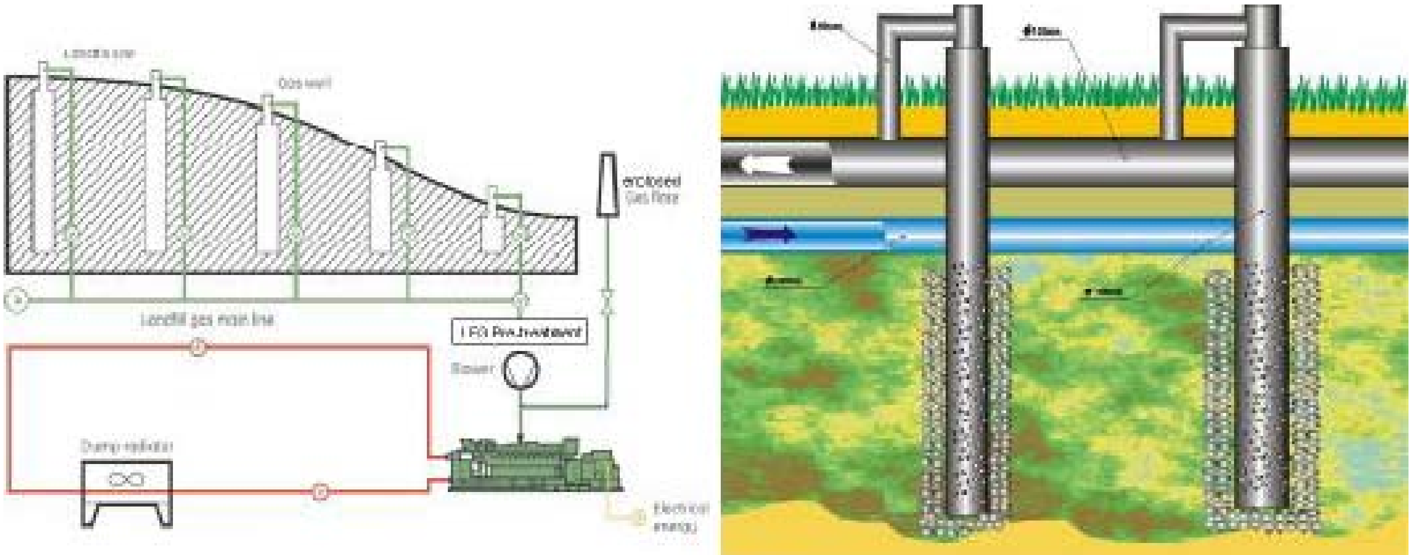


Figure 5. Configuration of LFG collection and utilization as well as vertical LFG well

Figure 6 the site of Longfeng LFG flaring and power generation station

Figure 7 the site of Xingning LFG Flaring station

The initial training is required for staff in charge of the operation and maintenance of the project before on the duty.

Table A-4. The main equipments and parameters for Longfeng with LFG power generation and Xingning with LFG flaring are shown below. Other project sites will be similar to those configurations.

ID	Contents	Units	Longfeng parameters	Xingning Parameters
	LFG Blower station, designed and manufactured by PhasCon Technologies			
1	LFG collection pipes	m	PVC, 8000m, PE,3000m	PVC, 3500m, PE, 1260m
2	Lockout drum for gas-water separation	m	D2×H5, stainless steel	D1.5×H5, stainless steel
3	blower pumps		-10kpa/20kpa, 3500m^3/h	-10kpa/20kpa, 1200m^3/h
LFG Flaring system, Designed and manufactured by Chengdu Zhaolong Electronic Co., Ltd.				
4	Flare Torch system	600-800℃, D2m×H10m, 3000m^3/h		
Gas generator station, manufactured by Shangdong Shengdong Co.,Ltd.				
5	Rated capacity	kW	2X500	N/A
6	generator rated voltage	V	400	N/A
7	Rated speed	Rpm	1000rpm	N/A
8	Transformer	KVA	1250	N/A
Monitoring and Control system, manufactured by Germany Schneider				
9	PLC controller	64 input/output		64 input/output
10	Variable frequency controller	380v/50kW		380v/30kW

In the proposed Project Activity, the key instruments in LFG recovery and power generation system are imported, including PLC and variable frequency controller from Germany, and the blowers from France etc., therefore, the implementation of the proposed Project Activity is benefit to the transfer of advance technologies.

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

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A renewable crediting period is applied to this project. The estimated amount of emission reductions for the second crediting period is shown in table below.

Table A-5 Estimation of emission reduction in the second crediting period

Years	Estimation of annual emission reductions in tonnes of $CO_{2\,e}$
01/09/2012-31/12/2012	70,718
2013	224,781
2014	237,416
2015	250,266
2016	258,551
2017	258,049
2018	236,728
01/01/2019-31/08/2019	148,271
Total estimated reductions (tones of CO_2e)	1,684,780
Total number of crediting years	7
Annual average over the second crediting period of estimated reductions (tones of CO_2e)	240,683

A.4.5. Public funding of the project activity:

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There is no public funding related to Annex 1 Countries in the 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 project activity:

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Revision to the approved consolidated methodology ACM0001 "Flaring or use of landfill gas", Version 12.0.0[2], Sectoral Scope 13, EB 65, is adopted for analysis of the proposed Project Activity.

The methodology also refers to the latest version of the following tools:

- Methodological tool "Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period", version 03.0.1, EB66.
- Methodological tool "Emissions from solid waste disposal sites", version 06.0.1, EB66.
- Methodological "Tool to determine project emissions from flaring gases containing methane" version 1, EB 28.
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 01, EB39.
- Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 02.0.0, EB61.
- Tool to determine the remaining lifetime of equipment, version 01, EB50.
- Tool to calculate the emission factor for an electricity system, version 2.2.1, EB 63.

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

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1. This methodology is applicable to project activities which:
   a) Install a new LFG capture system in a new or existing SWDS; or
   b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:
      (i) The captured LFG was only vented or flared and not used prior to the implementation of the project activity; and
      (ii) In the case of an existing active LFG capture system for which the amount of LFG can not be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.

      The project activity installs a new LFG capture system in an existing SWDS; there is no LFG capture system before the start of the project activity.

   c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:
      (i) Generating electricity;
      (ii) Generating heat in a boiler, air heater or kiln (brick firing only); and/or
      (iii) Supplying the LFG to consumers through a natural gas distribution network.

      The LFG shall be utilized for energy generation, and excess LFG shall be flared.

   d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.
      As the project activity is implemented on open landfills, which receive waste everyday, the project activity will not lead to a reduction in the amount of organic waste that would be recycled.

As previously described, this project is based on two complementary activities, i.e. to collect and flare the LFG, as well as to use the captured LFG for power generation. The project activity meets situation (a) (c) and (d) above.

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[2] http://cdm.unfccc.int/methodologies/DB/RNAKK7JRFWIKCFT3YSNKGPC1FR2DVA/view.html

2. ACM0001 (version 12.0.) is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:
   a) Partial or total release of the LFG from the SWDS; and
   b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heat or kiln;
      i. For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or
      ii. For heat generation: that heat would be generated using fossil fuels in on-site equipment.

   The baseline scenario is total release of the LFG from the SWDS. The project uses the captured LFG to generate electricity and the excess LFG will be flared, no heat will be generated. The emission reductions attributable to the displacement of grid electricity was not claimed for this crediting period

3. ACM0001 (version 12.0.0) is not applicable:
   a. In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln, where the purpose of the CDM project activity is to implement energy efficiency measures at the kiln;

   The project activity does not apply any methodologies in addition to ACM0001.

   b. If the management of the SWDS in the project activity is deliberately changed in order to increase methane generation compared to the situation prior to the implementation of the project activity (e.g. other to meet a technical or regulatory requirement). For example, this may apply to the addition of liquids to a SWDS, pre-treating waste to seed it with bacteria for the purpose of increasing the anaerobic degradation environment of the SWDS or changing the shape of the SWDS to increase the Methane Correction Factor.

   The management of the SWDS shall not be deliberately changed in order to increase methane generation.

In addition, as the residual gas stream to be flared in the proposed project activity contains no other combustible gases than methane which is obtained from decomposition of organic material through landfills, therefore, the project condition is applicable to the Methodological *tool to determine project emissions from flaring gases containing methane*; Also, as the eight solid waste disposal landfill sites at Meizhou where the waste dumped can be clearly identified, therefore, the project condition is applicable to *Methodological tool "Emissions from solid waste disposal sites"*. Of course, the project condition is also applicable to other general tools related to electricity consumption and emission factor listed above.

In conclusion, the project activity meets the situations and the tools described above, is therefore applicable to ACM0001.Version 12.0.0.

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

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The project boundary is the site of the project activity where the gas is captured and destroyed.

The Project Activity boundary consists of the whole LFG related system, including LFG collection, LFG flaring and LFG power generation system, auxiliary equipment, etc. The project baseline boundary includes all the facilities in the landfill except the LFG system, as well as all grid-connected power plants in Southern China Power Grid which provides the electricity to the landfill.

According to authoritative documents provided by China DNA[3], Southern China Power Grid consists of five provinces, i.e. Guangdong, Guangxi, Yunnan, Guizhou and Hainan. The project boundary is shown in figure below.

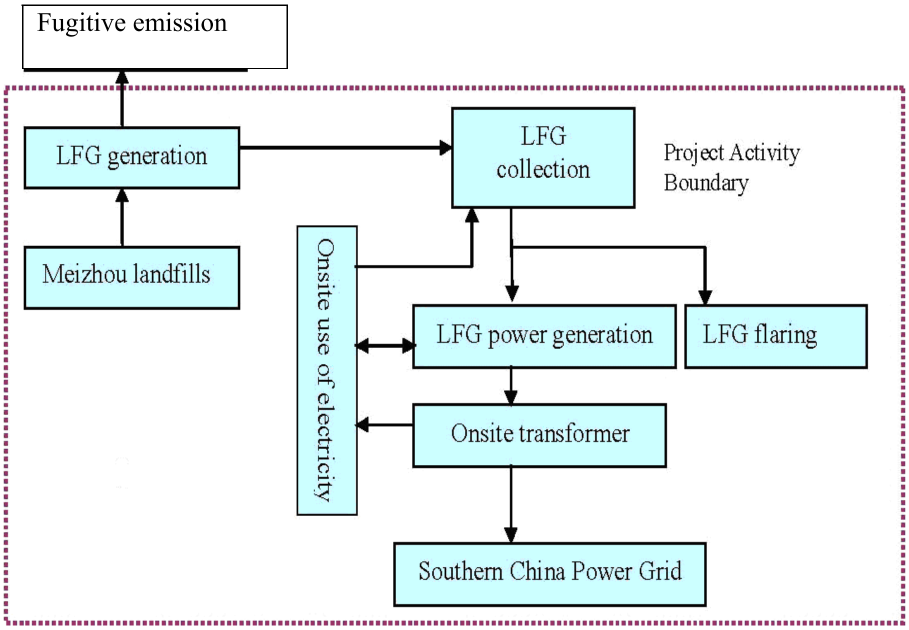

Figure 8. The diagram of Project boundary

The project sources and gases are listed in table B-1.

Table B-1 Summary of greenhouse gases and sources included in and excluded from the project boundary.

	Source	Gases	Included?	Justification/Explanation
Baseline	Emissions from the decomposition of waste at the SWDS site	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted since the CO_2 is also released under the project activity.
		CH_4	Yes	The main source of emission in baseline.
		N_2O	No	N_2O emission is small compared to CH_4 emission from SWDS. This is conservative.
	Emissions from electricity generation	CO_2	Yes	In the project activity, the emission reductions attributable to the displacement of grid electricity was not claimed for this crediting period, therefore, the project emission could be considered as zero if the total electricity generated by LFG is greater than the total electricity consumed by the project activity from the grid, otherwise, the project emission shall be considered. It is conservative.
		CH4	No	Excluded for simplification. This's conservative
		N_2O	No	Excluded for simplification. This's conservative

[3] http://cdm.ccchina.gov.cn/

	Emissions from heat generation	CO_2	No	Heat generation is not included in the project activity.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emission from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activity	Emissions from fossile fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	No	The fossil fuel consumption is not included in the Project Activity, not available
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from electricity consumption due to the project activity	CO_2	Yes	May be an important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

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

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As the project activity is approaching the renewal stage for the second crediting period, the *Methodological Tool "Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period"* version 03.0.1 shall be adopted for baseline analysis as follows:

Step 1: Assess the validity of the current baseline for the next crediting period

The "*Procedures for renewal of the crediting period of a registered CDM project activity",* version 06.0, EB63, requires assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline.

The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

1. The landfills in Meizhou in the project activity including Longfeng in city and other seven landfills in the seven counties started the construction at the time when *Technical code for municipal solid waste sanitary landfill (CJJ17-1988)*[4] was available. while there was no mandatory requirement on LFG utilization, and met the national and local standards and regulations during construction and has been in compliance since its operation, LFG from the landfills has directly released to the atmosphere through vertical rock-cribs to meet the landfill safety requirements before the implementation of project activity, which is also the traditional management and operation way of landfills in China. Furthermore this condition was confirmed by the audit team during onsite inspection and interviews. Hence, no flaring of LFG occurred at Meizhou landfills in the baseline scenario.

[4] Published by China Ministry of Construction dated on 15, February 1989.

2. Although China government encouraged the collection of LFG from waste dumps in the past few years, but the fact was still that most of the landfills just vent the gas to air without any exhaust and flaring system, even more than 90% of thousand landfills in China just simple "dumping" the waste without sanitation filling[5]. "*it is still a blank paper for landfill management to establish landfill gas recovery and utilization systems* "quoted from the China "National Action Plan for Recovery and Utilization of landfill Gas" which sponsored by China State Environment Protection Administration (SEPA) , together with UNDP and GEF. Also, in February 2007, the Ministry of Construction issued "Circular on the Outcome of Nationwide Inspection on Hazard-free Treatment of Domestic Waste Landfill Sites". As per this Circular, by the end of year 2005, there are 372 landfills across 31 provinces, autonomous regions and municipalities in China. 92.76% of 372 landfills have no landfill gas recovery and utilization facilities.[6] Only the landfills in CDM mode or few with investment from the government count with LFG flaring or utilization systems in operation. Therefore, it is considered that LFG gas flaring or utilization is still exceptional and that under common practice conditions the LFG is not flared in China in baseline conditions.

3. There were two national regulations[[7]][[8]]issued and taken into effective since July,2008, where the landfill gas recovery was required for those build landfill with capacity over 2.5 million tons and depth over 20 meters. Longfeng landfill and the other seven landfills in the counties have filled for MSW for many years and the depth is less than 20 meters or the capacity is less than 2.5 million tonnes[9], therefore the landfills in the proposed project are not belong to those landfills which enforced for landfill gas recovery by the new regulations.

CJJ17-2004 states that landfill site should install landfill gas venting system if the LFG cannot be utilized, it should be flared. However, the Meizhou landfills have been built before CJJ117-2004 was approved and on the basis of above evidence, it is justifiable to conclude that the specific requirements on methane recovery and utilization as prescribed in CJJ17-2004 have not been systematically enforced and that noncompliance with those requirements, namely uncontrolled emission of methane to the atmosphere without any recovery, has been and is still widespread in China.

Therefore, LFG collection and utilization is not enforced in China, the landfill operator of Meizhou Sanitation Administration Bureau and the sanitation departments in each county would continue release the LFG from the landfill sites directly to atmosphere without any collection, this is the cost-zero way for LFG treatment without economically attractive, also without obligatory restriction by the new issued regulations.

Therefore, on the basis of above evidences, the flaring and treatment of LFG in GB16889-1997, CJJ17-1988 and CJJ17-2004, have been systematically not enforced and non-compliance with those policies, namely uncontrolled emission of methane to the atmosphere without any recovery, has been and is still widespread in China, which have come into effect after the submission of the project activity for validation or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period. The LFG venting into atmosphere is the baseline scenario of the proposed project in the second crediting period, which is the same as the first crediting period.

Step 1.2: Assess the impact of circumstances

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[5] http://www.gzuda.gov.cn/news/view.asp?id=XW20030211552083224&fdID=CL20030211519245550&tbColor=D BE2FF&trColor=C7CFF3

[6] http://www.huanke.com.cn/08/article.asp?articleid=416

[7] The latest "Technical code for projects of landfill gas collection treatment and utilization" promulgated by China Ministry of housing and Urban-Rural Development on 09,Nov,2009 (CJJ133-2009)

[8] China Standard for pollution control on the landfill site of Municipal Solid Waste (GB16889-2008) on 02, April,2008

[9] The updated data for each landfill supplied by the local sanitation bureau available to DOE

As the LFG collection is in place for the Longfeng landfill which is the biggest one in near city, other seven landfills are located at the counties which are far away from the Meizhou city filled in a sanitated way for the new MSW area, there is no impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewable is requested.

As per *"Tool to determine the remaining lifetime of equipment" Version 01,* the Option (c) use default values for the technical lifetime and determine the remaining lifetime as the difference of the technical lifetime and the operational time.

This option can only be applied if:

(i) The project participants can demonstrate that the equipment has been operated and maintained according to the recommendations of the equipment supplier;

(ii) There are no periodic replacement schedules or scheduled replacement practices specific to the industrial facility, that require early replacement of equipment before the expiry of the technical lifetime; and

(iii) The equipment has no design fault or defect and did not have any industrial accident due to which the equipment can not operate at rated performance levels.

The first commissioning of equipments in the Meizhou landfills is in 2005, the information on the operational history of the equipments showed that the situation of the proposed project is applied for (i) (ii) and (iii) of this option.

The main equipment adopted in the project is described in table A-4, the design life time adopted the default value 25 years from "Tool to determine the remaining lifetime of equipment" including the PE/PVC plastic pipes in the landfill gas wells, the LFG blowers for deliver the LFG from gas wells to the collection stations, the stainless flare torches and resistant alloy material burning heads, the gas generator sets and power transformers, as well as the industrial level control devices. As the Meizhou project constructed and commissioned in 2005, the first crediting period of the project is 7 years, and the remaining technical lifetime of the equipments is 17 years, which exceeds the 2^{nd} crediting period.

Step 1.4: Assessment of the validity of the data and parameters

The IPCC default value Model correction factor is updated for the second crediting period as described in table B-3, which was only determined at the start of the crediting period and not monitored during the crediting period.

The emission reductions attributable to the displacement of grid electricity by the Project Activity were not claimed for the first crediting period. For simplicity in analysis and conservative approach in emission reduction, this displacement will be not claimed for the second crediting period, too.

For the values of W_{OM} and W_{BM} are revised at the renewal of the crediting period, the emission factor is updated in second crediting period.

As in Step 1.4 some data and parameters are not valid for the subsequent crediting period, then the baseline, data and parameters are updated for the second crediting period.

Step2. Update the current baseline and the data and parameters.
This step is applicable for the step 1.4 showed that the current baseline needs to be updated.

Step2.1 Update the current baseline
The current baseline emissions for the second crediting period are updated based on the latest ACM0001 version 12.0.0 applicable to the project activity.

Step2.2 Update the data and parameters

The default value for the model correction factor to account for model uncertainties(φ_y) and combined margin CO_2 emission factor for grid connect power generation are updated in the second crediting period in table B-3.

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

>>

According to the "*Procedures for renewal of the crediting period of a registered CDM project activity",* version 06.0, EB63, the assessment and demonstration of additionality is NOT required. Therefore, the assessment and demonstration of additionality in the registration CDM-PDD version 05 is not updated in the revised CDM-PDD version 08 for renewal application.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The Methodology of ACM0001 will be adopted for calculation of emission reduction.

1. Emission Reduction

>>

$ER_y = BE_y - PE_y$ **(1)**

Where,

ER_y is the emissions reductions of the Project Activity during the year y in tons of CO_2,
BE_y is the baseline emissions during the year y in tons of CO_2,
PE_y is the project emissions during the year y in tons of CO_2, and

2. Baseline Emissions

>>

According to ACM0001 version 12.0.0, baseline emissions are determined according to equation (2) and comprise the following sources:

(A) Methane emissions from the SWDS in the absence of the project activity;
(B)Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;
(C) Heat generation using fossil fuels in the absence of the project activity; and
(D) Natural gas used from the natural gas network in the absence of the project activity.

$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$ **(2)**

Where:
BE_y = Baseline emissions in year *y* (t CO_2e/yr)
$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)
$BE_{EC,y}$ = Baseline emissions associated with electricity generation in year *y* (t CO_2/yr)
$BE_{HG,y}$ = Baseline emissions associated with heat generation in year *y* (t CO_2/yr)
$BE_{NG,y}$ = Baseline emissions associated with natural gas use in year *y* (t CO_2/yr)

As the proposed project activity is only CASE A related, cases B, C and D are NOT applicable, therefore,
$BE_y = BE_{CH4,y}$ **(3)**

Step A: Baseline emissions of methane from the SWDS ($BE_{CH4,y}$)

Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account:
$BE_{CH4,y} = (1 - OX_{top\_layer}) \cdot (F_{CH4,PJ,y} - F_{CH4,BL,y}) \cdot GWP_{CH4}$ **(4)**
Where:
$BE_{CH4,y}$ = Baseline emissions of LFG from the SWDS in year *y* (t CO_2e/yr)
OX_{top_layer} = Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)
$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity

in year *y* (t CH_4/yr)

$F_{CH4,BL,y}$ = Amount of methane in the LFG that would be flared in the baseline in year *y* (t CH_4/yr)

GWP_{CH4} = Global warming potential of CH_4 (t CO_2e/t CH_4)

Step A.1: Ex post determination of $F_{CH4,PJ,y}$

During the crediting period, $F_{CH4,PJ,y}$ is determined as the sum of the quantities of methane flared and used in power plant(s), as there is no boiler(s), air heater(s), kiln(s) and natural gas distribution network application in the project activity, as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} \quad (5)$$

Where:

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (tCH_4/yr)

$F_{CH4,flared,y}$ = Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH_4/yr)

$F_{CH4,EL,y}$ = Amount of methane in the LFG which is used for electricity generation in year *y* (tCH_4/yr)

The working hours of the flare and power plant(s) should be monitored and no emission reduction should be claimed for methane destruction during non-working hours.

Amount of methane destroyed by flaring ($F_{CH4, flared, y}$)

$F_{CH4,flared,y}$ is determined as the difference between the amount of methane supplied to the flare(s) and any methane emissions from the flare(s), as follows:

$$F_{CH4, flared, y} = F_{CH4, sent flare, y} - \frac{PE_{flare, y}}{GWP_{CH4}} \quad (6)$$

Where:

$F_{CH4, flared, y}$ = Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH_4/yr)

$F_{CH4, sent\_flare, y}$ = Amount of methane in the LFG which is sent to the flare in year *y* (t CH_4/yr)

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year *y* (t CO_2e/yr)

GWP_{CH4} = Global warming potential of CH_4 (t CO_2e/t CH_4)

$F_{CH4,EL,y}$ and $F_{CH4,sent flare, y}$ are determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". The following requirements apply:

- The gaseous stream the tool shall be applied to is the LFG delivery pipeline to each item of electricity generation system. $F_{CH4, EL, y}$ is then calculated as the sum of mass flows to each item of electricity generation;
- CH_4 is the greenhouse gases for which the mass flow should be determined;
- The flow of the gaseous stream should be measured on continuous basis;
- The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 or 17 in the tool); and
- The mass flow should be summed to a yearly unit basis (t CH_4/yr).

The project participant intends to monitor the volumetric flow of the LFG and the volumetric fraction of CH_4 in the LFG, with both parameters monitored on a dry basis. Therefore, Option A of the tool shall be applied in the project activity.

Option A

Option A is applicable where the volumetric flow of the LFG is measured on a dry basis. In order to demonstrate that the LFG gaseous stream is dry, there are two ways to do this:

(a) Measure the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05kg H_2O/m^3 dry gas; or
(b) Demonstrate that the temperature of the gaseous stream (T_t) is less than 60℃ (333.15K) at the flow measurement point.

For the project activity, it has been selected to demonstrate it using (b).
The mass flow of greenhouse gas i($F_{i,t}$) is determined as follows:

$$F_{i,t}=V_{t,db}*v_{i,t,db}*\rho_{i,t} \quad \textbf{(7)}$$

With

$$\rho_{i,t}=\frac{P_t * MM_i}{R_u * T_t} \quad \textbf{(8)}$$

where
$F_{i,t}$= Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$= Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$v_{i,t,db}$= Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval t on a dry basis (m^3 gas i/m^3 dry gas)
$\rho_{i,t}$= Density of greenhouse gas *i* in the gaseous stream in time interval t (kg gas *i*/m^3 gas *i*)
P_t= Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i= Molecular mass of greenhouse gas *i* (kg/kmol)
R_u= Universal ideal gases constant (Pa.m^3/kmol.K)
T_t= Temperature of the gaseous stream in time interval *t* (K)

Note that calculating the mass flow of methane (CH_4), this is equivalent to $F_{i,t}=F_{CH4,t}$
In addition, Option B of the tool shall be applied when it cannot be demonstrated that the LFG is indeed dry, as per the requirement of the tool:

Option B
Option B shall be applied if in a particular time interval the temperature of the LFG exceeds 60°C and therefore it cannot be demonstrated that the volumetric flow of the LFG is monitored on a dry basis.

The mass flow of the CH_4 shall be determined using equations (7) and (8) above. The volumetric flow of the gaseous stream in time interval t on a dry basis ($V_{t,db}$) shall be determined by converting the measured volumetric flow from wet basis as follows:

☐□,□□=☐□,□□/(1+☐□2□,□□□) **(9)**

Where:
$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)
$V_{t,wb}$ = Volumetric flow of the gaseous stream in time interval *t* on a wet basis (m^3 wet gas/h)
$v_{H2O,t,bd}$= Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m^3 H_2O/m^3 dry gas)

The volumetric fraction of H_2O in time interval t on a dry basis ($V_{H2O,t,db}$) is estimated according to the following equation:

$$v_{H2O,t,db}=\frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}} \quad \textbf{(10)}$$

Where,
v_{H2O} = Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m^3 H_2O/M^3 dry gas)
$m_{H2O,t,db}$ =Absolute humidity in the gaseous stream in time interval *t* on a dry basis (kg H2O/kg dry gas)
$MM_{t,db}$ =Molecular mass of the gaseous stream in time interval *t* on a dry basis (kg dry gas/kmol dry gas)
MM_{H2O} =Molecular mass of H_2O (kg H_2O/kmol H_2O)

The absolute humidity of the gaseous stream ($m_{H2O,t,db}$) shall be determined by applying Option 2 as follows:
Option 2: Simplified calculation without measurement of the moisture content

As this parameter is used for the calculation of baseline emissions, it is therefore conservative to assume that the gaseous stream is saturated, and $m_{H2O,t,db,sat}$ is assumed to equal the saturation absolute humidity ($m_{H2O,t,db,sat}$) and calculated as follows:

$$m_{H2O,t,db,sat} = \frac{P_{H2O,t,Sat} * MM_{H2O}}{(P_t - P_{H2O,t,Sat}) * MM_{t,db}} \qquad \textbf{(11)}$$

Where,
$m_{H2O,t,db,sat}$ = Saturation absolute humidity in time interval t on a dry basis (kg H_2O/kg dry gas)
$P_{H2O,t,Sat}$ =Saturation pressure of H_2O at temperature Tt in time interval *t* (Pa)
Tt = Temperature of the gaseous stream in time interval *t* (k)
Pt =Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_{H2O} = Molecular mass of H_2O (kg H_2O/Kmol H_2O)
$MM_{t,db}$ = Molecular mass of the gaseous stream in a time interval t on a dry basis (kg dry gas/kmol dry gas)

The molecular mass of the gaseous stream ($MM_{t,db}$) shall be estimated as follows:
$MM_{t,db} = \Sigma k(v_{k,t,db} * MM_k)$
Where,
$MM_{t,db}$ =Molecular mass of the gaseous stream in time interval t on a dry basis (kg dry gas/kmol dry gas)
$v_{k,t,db}$ =Volumetric fraction of gas k in the gaseous stream in time interval t on a dry basis (m^3 gas k/m^3 dry gas)
MM_k =Molecular mass of gas k (kg/kmol)
k = All gases, except H_2O, contained in the gaseous stream (N_2, CH_4)

As a simplification, the project participant shall monitor only the volumetric fraction of CH_4, which is the only greenhouse gas in LFG that is considered in the emission reduction calculation by the underlying methodologies (ACM0001) and assume that the difference to 100% is pure nitrogen. This simplification is valid under ACM0001.

Regarding $PE_{flare,y}$

$PE_{flare,y}$ shall be determined using the "*Tool to determine project emissions from flaring gases containing methane*". If LFG is flared through more than one flare, then $PE_{flare,y}$ is the sum of the emissions for each flare determined separately.

As the project will utilize an enclosed flare, the residual gas stream to be flared is obtained from decomposition of organic material through landfills which contains no other combustible gases than methane and carbon monoxide.

For enclosed flares, the temperature T_{flare} in the exhaust gas of the flare is measured to determine whether the flare is operating or not. The normal operation temperature of the flare exhaust gas is among 600℃to 800℃ as defined by the flare manufacture. And, either of the following two options can be used to determine the flare efficiency $\eta_{flare,h}$:

Option (a) to use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.

Option (b) continuous monitoring of the methane destruction efficiency of the flare.

Option (a) the default value for the flare efficiency is adopted for the proposed project, where the flare efficiency in the hour h ($\eta_{flare,h}$) is:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 ℃ for more than 20 minutes during the hour h .
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 ℃ for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h.
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 ℃ for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.

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

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH4}}{1000} \qquad \textbf{(12)}$$

And $$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{ch4,n} \qquad \textbf{(13)}$$

Where,

$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h	kg/h
$\eta_{flare,h}$	Flare efficiency in hour h	-
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period	tCO_2e/tCH_4
$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h	m^3/h
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h	-
$\rho_{CH4,h}$	Density of methane at normal conditions (0.716)	kg/m^3

Step A.1.1: Ex ante estimation of $F_{CH4,PJ,y}$

An *ex ante* estimate of $FC_{H4,PJ,y}$ is required to estimate baseline emission of methane from the SWDS in order to estimate the emission reductions of the proposed project activity in the CDM-PDD. It is determined as follows:

$$F_{CH4,PJ,y} = \eta_{PJ} \cdot BE_{CH4,SWDS,y} / GWP_{CH4} \qquad \textbf{(14)}$$

Where:

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)

$BE_{CH4,SWDS,y}$ = Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (t CO_2e/yr)

η_{PJ} = Efficiency of the LFG capture system that will be installed in the project activity

GWP_{CH4} = Global warming potential of CH_4 (t CO_2e/t CH_4)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool "Emissions from solid waste disposal sites".

The following guidance should be taken into account when applying the tool:

- *fy* in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation 2 of this methodology;

- In the tool, x begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and

- Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

Step A.2: Determination of $F_{CH4,BL,y}$

This step provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, or to address safety and odour concerns (collectively referred to as *requirement* in this step). The four cases in Table B-2 are distinguished. The appropriate case should be identified and the corresponding instructions followed.

TableB-2: Cases for determining methane captured and destroyed in the baseline

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture system
Case 1	No	No
Case 2	Yes	No
Case 3	No	Yes
Case 4	Yes	Yes

Case 1: No requirement to destroy methane exists and no existing LFG capture system

In this situation: $F_{CH4,BL,y} = 0$ **(15)**

Step B: Baseline emissions associated with electricity generation ($BE_{EC,y}$)

The baseline emissions associated with electricity generation in year *y* ($BE_{EC,y}$) shall be calculated using the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*". When applying the tool:

- The electricity sources *k* in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and

- $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year *y*.

As the emission reduction attributable to the displacement of grid electricity by the Project Activity was not claimed for the first crediting period, and for simplicity in analysis and conservative approach in emission reduction, this displacement is not claimed for the second crediting period, too. Therefore, Step B could be skipped.

Project emissions

Project emissions are calculated as follows:

$PE_y = PE_{EC,y} + PE_{FC,y}$ **(16)**

Where:
PE_y =Project emissions in year *y* (t CO_2/yr)
$PE_{EC,y}$ =Emissions from consumption of electricity due to the project activity in year *y*(t CO_2/yr)
$PE_{FC,y}$ =Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (t CO_2/yr)

The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) shall be calculated using the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*". When applying the tool:

- Electricity sources *j* in the tool corresponds to the sources of electricity consumed due to the project activity. This shall include, where applicable, electricity consumed for the operation of the LFG capture system, for any processing and upgrading of the LFG, for transportation of the LFG to the flare or other applications (boilers, power generators), for the compression of the LFG into the natural gas network, etc.;

- If in the baseline a proportion of LFG is destroyed ($F_{CH4,BL,y} > 0$), then the electricity consumption in the tool ($EC_{PJ,j,y}$) should refer to the net quantity of electricity consumption (i.e. the increase due to the project activity). The determination of the amount of electricity consumed in the baseline shall be transparently documented in the CDM-PDD.

There is no fossil fuel combustion for purposes of project activity, therefore $PE_{FC,y}$=0

As the emission reduction attributable to the displacement of grid electricity by the Project Activity was not claimed for the first and second crediting periods. Therefore, the project emission could be considered as zero if the total electricity generated by LFG is greater than the total electricity consumed by the project activity from grid. Otherwise, the project emission shall be used to determined as per the "*Tool to calculate baseline, project and/or leakage emission from electricity consumption*"

$PEy=PE_{EC,y}=\sum_j EC_{PJ,j,y}*FE_{EL,j,y}*(1+TDL_{j,y})$ **(17)**

Where,

PE_y	Project emission in year *y* (tCO_2e)
$PE_{EC,y}$	Project emissions from electricity consumption in year y (tCO_2e/yr);
$EC_{PJ,j,y}$	Quantity of electricity consumed by the project activity during the year y (MWh/yr)
$FE_{EL,J,,y}$	Emission factor for electricity generation for source j in year y (tCO_2/MWh)
$TDL_{j,y}$	Average technical transmission and distribution losses for proving electricity to source j in year y.
j	Source of electricity consumption in the project

In the project design stage or for ex-ante calculation, $EC_{PJ,y}$ = 0 and will be monitored during the crediting period.

Project emission from flaring is already considered in the formula of $FE_{flare,y}$ of equation (12).

As there is no onsite diesel generator used for emergency cases in the proposed project activity, there is grid supplied electricity for project activity, also the gas generator will be driven by DC-Motor-Starter for starting. In addition, there is a high voltage Self-ignition technology for flaring without auxiliary LPG fossil fuel. Therefore, there is no fossil fuel consumption in the proposed project activity.

The *ex ante* estimate of emissions reductions is available for DOE which is the future GHG emissions of the SWDS for the calculation of baseline emissions.

Ex-ante estimation of total amount of methane generated and captured
The amount of methane that would in the absence of the project activity be generated from disposal of waste at the solid waste disposal site ($BE_{CH4,SWDS,y}$) is estimated with the latest version of the approved *"Emission from solid waste disposal sites"* based on the first order decay (FOD) model.

According to the tool, the FOD model differentiates between the different types of waste *j* with respectively different decay rates *kj* and different fractions of degradable organic carbon (DOC_j). The model calculates the methane generation based on the actual waste streams $W_{j,x}$ disposed in each year *x*, starting with the first year after the start of the project activity until the end of the year *y*, for which baseline emissions are calculated (years *x* with x = 1 to x = y) by formula below:

$$BE_{CH4,SWDS,y}=\varphi_y \cdot (1-f_y) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)$$

(18)

Where,

$BE_{CH4,SWDS,y}$	Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year *y* (tCO_2e/yr)
φ	Model correction factor to account for model uncertainties (0.75)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS.
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type *j* disposed or prevented from disposal in the SWDS in the year *x*(tons)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type *j*
kj	Decay rate for the waste type *j*
j	Type of residual waste or types of waste in the MSW
x	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x=1) to year y (x=y)
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)

Emission Factor Calculations
To calculate the CO_2 Emission Factor of the baseline source of electricity displaced by the project activity, *"Tool for calculation of emission factor for electricity systems"* should be adopted as required by ACM0001.

According to *2011 Baseline Emission Factors for Regional Power Grids in China* issued by China

DNA[10], in the Southern China Grid where the project activity located,

$EF_{grid,OM,y}$= 0.9489 (tCO_2/MWh), $EF_{grid,BM,y}$= 0.3157 (tCO_2/MWh)

$$EF_{grid,CM,y} = W_{OM} * EF_{OM,y} + W_{BM} * EF_{BM,y} = W_{OM} * EF_{grid,OM,y} + W_{BM} * EF_{grid,BM,y}$$

Where,

$EF_{CM,y}$	Combined margin CO_2 emission factor in year y	tCO_2/MWh
$EF_{grid,OM,y}$	Operation margin CO_2 emission factor in year y	tCO_2/MWh
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y	tCO_2/MWh
W_{OM}	Weight of operation margin emission factor	%
W_{BM}	Weight of build margin emissions factor	%

The default values used for W_{OM} and W_{BM} following the latest version of the *Tool to calculate the emission factor for an electricity system*:
The projects except wind and solar power generation project activities: W_{OM}=0.25 and W_{BM}=0.75 for the second cretingd period.

Therefore, the emission factor $EF_{grid,,CM,y}$=0.9489x0.25+0.3157x0.75= 0.474 (tCO_2/MWh)

4. Leakage emission:
According to the ACM0001, the leakage is not considered, therefore LE_y is zero.

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

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According to the calculation process above, some information on the data and parameters that are not monitored throughout the crediting period but those are determined only once and thus remain fixed throughout the crediting period and that are available when validation is undertaken.

Table B-3 Data and parameters those are available at validation.

Data / Parameter:	**$OX_{top\ layer}$ (OX)**
Data unit:	Dimensionless
Description:	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data used:	*Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites"*
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the Approved consolidated methodology ACM0001 "Flaring or use of landfill gas"
Any comment:	Applicable to Step A of approved methodology ACM0001 ver.12.0.0, ex ante estimation of $BE_{CH4,SWDS,y}$ in accordance with *"emissions from solid waste disposal sites"*.

Date / Parameter:	**GWP_{CH4}**
Data unit:	t CO_2e/t CH_4
Description:	Global warming potential of CH_4
Source of data:	IPCC

[10] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf

Value applied:	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value
Any comment:	

Data/Parameter:	η_{PJ}
Data unit:	Dimensionless
Description:	Efficiency of the LFG capture system that will be installed in the project activity
Source of data used:	Default value as per the Approved consolidated methodology ACM0001"Flaring or use of landfill gas"
Value applied:	50%.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value
Any comment:	Applicable to Step A.1.1 of approved methodology ACM0001 ver.12.0.0.

Data / Parameter:	**EF**
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year y ($EF_{grid,CM,y}$), calculated using the latest version of the tool "Tool to calculate the emission factor for an electricity system."
Source of data used:	Calculated as per the "Tool to calculate the emission factor for an electricity system"
Value applied:	0.474
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to calculate the emission factor for an electricity system", the calculation procedures are as Annex3 of PDD.
Any comment:	

Data / Parameter:	$\eta_{flare,h}$
Data unit:	--
Description:	efficiency of the flaring system in hour *h*
Source of data used:	Default value of option (a) according to "Tool to determine project emissions from flaring gases containing Methane"
Value applied:	90% /50% /0%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Online monitoring the exhaust temperature of the flare in operation
Any comment:	

Parameter:	$\rho_{CH4,n}$

Data unit:	kg CH_4/Nm^3 CH_4
Description:	Methane Density
Source of data used:	"Tool to determine project emissions from flaring gases containing methane"
Value applied:	0.716
Justification of the choice of data or description of measurement methods and procedures actually applied :	Methane density at normal temperature and pressure
Any comment:	

Parameter:	**φ ($\varphi_{default}$)**
Data unit:	-
Description:	Default value for the model correction factor to account for model uncertainties
Source of data used:	"Emission value from solid waste disposal sites", version6.0.0
Value applied:	0.75
Justification of the choice of data or description of measurement methods and procedures actually applied :	For baseline emissions, the project activity fall under Application A of the tool, 0.75 is the appropriate default value for $\varphi_{default}$
Any comment:	

Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value to determined by the methodological tool "*Emission from solid waste disposal sites*" ver.6.0.1
Any comment:	

Parameter:	**DOC_f**
Data unit:	Weight fraction
Description:	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per "Emission from solid waste disposal sites" (version 6.0.1), the default value shall be applied to Application A and is therefore applicable to the project activity.
Any comment:	

Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories

Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the tool, for Application A: MCF_y=$MCF_{default}$ The proposed project is an anaerobic managed solid waste disposal sites
Any comment:	

Parameter:	**$W_{j,x}$**
Data unit:	tons
Description:	Amount of organic waste type *j* disposed in the SWDS in the year x
Source of data used:	Calculated based on (1) the total amount of waste prevented from disposal in year x and (2) the fraction of waste type *j* in the deposited waste
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	The total amount of waste prevented from disposal in year x and the fraction of waste type *j* in the deposited waste are from the eight landfill information tables issued by related county or city sanitation bureau.
Any comment:	The detailed $W_{j,x}$ of eight landfills are showed in the ER emission reduction spreadsheet respectively.

Data / Parameter:	**$TDL_{j,y}$**
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data used:	.As the scenario C, case.Ⅲ in *Tool to calculate baseline, project and/or leakage emissions from electricity consumption* default values of 20% are chosen as more conservative
Value applied:	20
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value by the tool issued by UNFCCC
Any comment:	

Parameter:	**DOC_j**
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the waste type *j*
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories

Value applied:	Apply the following values for the different waste types *j*:

Waste type *j*	DOC_j (% wet waste)
Wood and wood products	43
Pulp, paper and cardboard(other than sludge)	40
Food, food waste, beverages and tobacco(other than sludge)	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

Justification of the choice of data or description of measurement methods and procedures actually applied :	If a waste type can not clearly be attributed to one of the waste types in the table above, it should choose among the waste types that have similar characteristics that waste type where the values of DOC_j and k_j result in a conservative estimate (lowest emissions)
Any comment:	

Parameter:	K_j
Data unit:	1/yr
Description:	Decay rate for the waste type *j*
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	apply the following default values for the different waste types *j*

Waste type j		Boreal and temperate(MAT<20℃)		Tropical (MAT>20℃)	
		Dry (MAP/PET<1)	Wet (MAP/PET>1)	Dry (MAP< 1000mm)	Wet (MAP> 1000mm)
Slowly degrading	Pulp, paper, cardboard(other than sludge), textile	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.025	0.035
Moderately degrading	Other(non-food)organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

NB: MAT –mean annual temperature, MAP –Mean annual precipitation, PET –potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.

Justification of the choice of data or description of measurement methods and procedures actually applied :	Meizhou's annual average climate temperature is about 21.7 ℃, and annual average rain fall 1500-2000mm, with annual vapor amount 1000-1200mm, therefore, MAT > 20 ℃ and MAP > 1000mm is adopted for the proposed project.
m	

Data / Parameter:	R_u
Data unit:	Pa.m3/kmol.K
Description:	Universal ideal gases constant
Source of data used:	"Tool to determined the mass flow of a greenhouse gas stream" (ver 02.0.0), "Tool to determine project emissions from flaring gases containing methane"
Value applied:	8,314.472
Justification of the choice of data or description of measurement methods and procedures actually applied :	The tool to determine the mass flow of a greenhouse gas in a gaseous stream (ver 02.0.0) provides a value of 8,314, while the "Tool to determine project emission from flaring gases containing methane" provides a value of 8,314.472. The latter value shall be applied in this project activity, as it will lead to a lower density of the LFG (and as a result smaller mass quantities) and therefore to a more conservative estimation of emission reductions.
Any comment:	It is used for Option A of "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

Data / Parameter:	MM_i (MM_{CH4})
Data unit:	Kg/kmol
Description:	Molecular mass of greenhouse gas i (CH_4)
Source of data used:	"Tool to determined the mass flow of a greenhouse gas stream" (ver 02.0.0)
Value applied:	16.04
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the value in methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Any comment:	It is used for Option A of "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

Data / Parameter:	MM_k (MM_{N2})
Data unit:	Kg/kmol
Description:	Molecular mass of gas k
Source of data used:	"Tool to determine the mass flow of a greenhouse gas stream" (ver 02.0.0), "Tool to determine project emissions from flaring gases containing methane"
Value applied:	Compound / Structure / Molecular mass Nitrogen / N_2 / 28.01
Justification of the choice of data or description of measurement methods and procedures actually applied :	The tool to determine the mass flow of a greenhouse gas in a gaseous stream (ver 02.0.0) provides a value of 28.01, while the "Tool to determine project emission from flaring gases containing methane" provides a value of 28.02. The value 28.01 shall be applied in this project activity, as it will lead to a lower density of the LFG (and as a result smaller mass quantities) and therefore to a more conservative estimation of emission reductions.

Any comment:	As a simplification, the project participants shall monitor only the volumetric fraction of CH_4, which is the only greenhouse gas in LFG that is considered in the emission reduction calculation by the underlying methodology (ACM0001) and assume that the difference to 100% is pure nitrogen. This simplification is valid under ACM0001.

Data / Parameter:	MM_{H2O}
Data unit:	kg/kmol
Description:	Molecular mass of water
Source of data used:	“Tool to determine the mass flow of a greenhouse gas in gaseous stream” (ver.02.0.0)
Value applied:	18.0152
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”
Any comment:	It is used for Option B of “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”

Data / Parameter:	P_n
Data unit:	Pa
Description:	Total pressure at normal conditions
Source of data used:	“Tool to determined the mass flow of a greenhouse gas stream” (ver 02.0.0), “Tool to determine project emissions from flaring gases containing methane”
Value applied:	101,325
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”
Any comment:	

Data / Parameter:	T_n
Data unit:	K
Description:	Temperature at normal conditions
Source of data used:	“Tool to determine the mass flow of a greenhouse gas stream” (ver 02.0.0), “Tool to determine project emissions from flaring gases containing methane”
Value applied:	273.15
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”
Any comment:	

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

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Baseline Emission:

$BE_y=BE_{CH4,y}$

Where:

BE_y	Baseline emission in year y	tCO_2/yr
$BE_{CH4,y}$	Baseline emission from the SWDS in year y	tCO_2/yr

Year	$BE_{CH4,y}$	BE_y
2012(9-12)	70,718	70,718
2013	224,781	224,781
2014	237,416	237,416
2015	250,266	250,266
2016	258,551	258,551
2017	258,049	258,049
2018	236,728	236,728
2019(1-8)	148,271	148,271

$BE_{CH4,y}=(1-OX_{top\_layer})*(F_{CH4,PJ,y}-F_{CH4,BL,y})*GWP_{CH4}$

Where:

$BE_{CH4,y}$	Baseline emissions of LFG from the SWDS in year *y*	t CO_2e/yr
OX_{top_layer}	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)	
$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)	t CH_4/yr
$F_{CH4,BL,y}$	Amount of methane in the LFG that would be flared in the baseline in year *y*	t CH_4/yr
GWP_{CH4}	Global warming potential of CH_4	t CO_2e/t CH_4

Year	$1-OX_{top\_layer}$	$F_{CH4,PJ,y}$	$F_{CH4,BL,y}$	GWP_{CH4}	$BE_{CH4,y}$
2012(9-12)	0.9	3,742	0	21	70,718
2013	0.9	11,893	0	21	224,781
2014	0.9	12,562	0	21	237,416
2015	0.9	13,242	0	21	250,266
2016	0.9	13,680	0	21	258,551
2017	0.9	13,653	0	21	258,049
2018	0.9	12,525	0	21	236,728
2019(1-8)	0.9	7,845	0	21	148,271

As per ACM0001, $F_{CH4,PJ,y}$ is estimated as follows:

$F_{CH4,PJ,y}=\eta_{PJ}*BE_{CH4,SWDS,y}/GWP_{CH4}$

Where:

$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year y	t CH_4/yr
η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity	t CO_2e/yr
$BE_{CH4,SWDS,y}$	Amount of methane in the LFG that is generated from the SWDS in	-

	the baseline scenario in year y	
GWP_{CH4}	Global warming potential of CH_4	t CO_2e/t CH_4

Year	η_{PJ}	$BE_{CH4,SWDS,y}$	GWP_{CH4}	$F_{CH4,PJ,y}$
2012(9-12)	50%	157,150	21	3,742
2013	50%	499,513	21	11,893
2014	50%	527,590	21	12,562
2015	50%	556,147	21	13,242
2016	50%	574,557	21	13,680
2017	50%	573,443	21	13,653
2018	50%	526,063	21	12,525
2019(1-8)	50%	329,492	21	7,845

$$BE_{CH4,SWDS,y} = \varphi_y \cdot (1-f_y) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)$$

Where,

φ_y	Model correction factor to account for model uncertainties for year y	-
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emission of methane to the atmosphere in year y	-
GWP_{CH4}	Global Warming Potential of methane	t CO_2e/yr
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	-
F	Fraction of methane in the SWDS gas (volume fraction)	-
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS in year y (weight fraction)	--
MCF	Methane correction factor for year y	-
$W_{j,x}$	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x	t
DOC_j	Fraction of degradable organic carbon in the waste type j (weight fraction)	-
kj	Decay rate for waste type j	1/yr
j	Type of residual waste or types of waste in the MSW	-
x	As per ACM0001 ver 12.0.0, x begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation). x runs from the first year of landfill operation (x=1) to the year for which emission are calculated (x=y)	-
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)	-

Year	2012(9-12)	2013	2014	2015	2016	2017	2018	2019(1-8)
$BE_{CH4,SWDS,y}$	157,150	499,513	527,590	556,147	574,557	573,443	526,063	329,492

According to *IPCC 2006 Guidelines for National Greenhouse Gas Inventories,* corresponding tools and by consulting the experts and absorbing similar experiences, the main variables used to predict the landfill's methane production for the proposed project activity are assumed in table below:

Table B-4, main assumption for LFG prediction

<table>
<tr><th>variables</th><th>assumption</th><th>sources</th></tr>
<tr><td>F</td><td>0.5</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories, also in tool “Emission value from solid waste disposal sites”, version6.0.0</td></tr>
<tr><td>φ</td><td>0.75</td><td>Emission value from solid waste disposal sites”, version6.0.0</td></tr>
<tr><td>OX</td><td>0.1</td><td>Emission value from solid waste disposal sites”, version6.0.0</td></tr>
<tr><td>DOC_f</td><td>0.5</td><td>Emission value from solid waste disposal sites”, version6.0.0</td></tr>
<tr><td>MCF</td><td>1.0</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories, also in tool</td></tr>
<tr><td>GWP_{CH4}</td><td>21</td><td>By methodology</td></tr>
<tr><td>f</td><td>0</td><td>By methodology</td></tr>
<tr><td>DOC_j</td><td colspan="2">Apply the values listed in table B-7 for the different waste type j, in case of wet waste, i.e.
<table>
<tr><th>Waste type j</th><th>DOC_j
(% wet waste)</th></tr>
<tr><td>Wood and wood products</td><td>43</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge)</td><td>40</td></tr>
<tr><td>Food, food waste, beverages and tobacco(other than sludge)</td><td>15</td></tr>
<tr><td>Textiles</td><td>24</td></tr>
<tr><td>Garden, yard and park waste</td><td>20</td></tr>
<tr><td>Glass, plastic, metal other inert waste</td><td>0</td></tr>
</table></td></tr>
<tr><td>Kj</td><td colspan="2">apply the default values in table B-7 for the different waste types *j,* in case of MAT＞20℃， wet, i.e.
<table>
<tr><th colspan="2" rowspan="2">Waste type j</th><th>Tropical(MAT>20℃)</th></tr>
<tr><th>Wet(MAP>1000mm)</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textile</td><td>0.07</td></tr>
<tr><td>Wood, wood</td><td>0.035</td></tr>
</table></td></tr>
</table>

		products and straw	
	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.17
	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.40

The model is considered applicable to the project context due to comparable waste composition and climatic conditions. The model includes a fine division of precipitation classes (also in comparison of IPCC 2006).

The detail calculation of the amount landfill gas and methane generated and captured is listed in the *Meizhou Emission Reduction Calculation Spreadsheet* submitted to DOE during the validation.

Table B-5 the estimation of emission reduction during the second crediting period

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2012 (9-12)	0	70,718	0	70,718
2013	0	224,781	0	224,781
2014	0	237,416	0	237,416
2015	0	250,266	0	250,266
2016	0	258,551	0	258,551
2017	0	258,049	0	258,049
2018	0	236,728	0	236,728
2019（1-8）	0	148,271	0	148,271
Sum for the second crediting period (tonnes of CO_2e)				1,684,780

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

B.7.1 Data and parameters monitored:

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As there is no thermal and municipal gas pipeline application in the project activity, the data and parameters to be monitored for the proposed project activity are listed in table B-6 below.

Table B-6 the parameters to be monitored in the Project Activity

Data / Parameter:	Operation of the energy plant
Data unit:	hr
Description:	Operation of the energy plant
Source of data to be used:	Electricity of the energy plant
Value of data applied for the purpose of calculation expected emission reductions in section B.6	5,000
Description of measurement methods and procedures to be applied:	Hourly
QA/QC procedures:	
Any comment:	Applicable to Step A.1 of ACM0001 ver 12.0.0.This is monitored to ensure methane destruction is claimed for methane used in electricity plant when it is operational

Data / Parameter:	$BE_{CH4,SWDS,y}$
Data unit:	tCO_2e
Description:	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in the year *y*
Source of data used:	Calculated as per the "Emission from solid waste disposal sitese"
Value of data applied for the purpose of calculation expected emission reductions in section B.6	Details as list in the excel file of *Meizhou Emission Reduction Calculation Spreadsheet,* submitted to DOE
Description of measurement methods and procedures to be applied:	As per the calculation formula of "Emission from solid waste disposal sitese"
QA/QC procedures:	
Any comment:	Used for *ex ante* estimation of the amount of methane that would have been destroyed/combusted during the year

Data / Parameter:	$V_{t,db}$ /$V_{t,wb}$
Data unit:	m^3 dry gas/h
Description:	Volumetric flow of the gaseous stream in hour h (time interval t) on a dry basis
Source of data to be used:	Onsite records of the flow meter accumulator
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Shall be monitored separately for the LFG gaseous stream delivered to electricity generation and LFG delivery pipeline to the flare (s).

	Continuous online measured by flow meters that automatically normalize the data to m^3 taking into account the actual pressure and temperature of the LFG, data to be recorded hourly.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The installed equipment shall be calibrated against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications.
Any comment:	From the temperature of the LFG in the first crediting period, the project activity applies Option A of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" to monitor the volumetric flow of the LFG on a dry basis. If ,however, for a particular time interval the temperature of the LFG shall be above 60℃, the LFG shall be assumed to be on a wet basis and shall therefore be converted to dry basis in accordance with Option B of the "*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*". The parameter used for calculation of $F_{CH4,EL,y}$ and $F_{CH4,flare,y}$

Data / parameter:	$\mathbf{v_{i,t,db}}$
Data unit:	m^3 CH_4/m^3 dry gas
Description:	Volumetric fraction of CH_4 in the LFG in hour h (time interval t) on a dry basis
Source of data to be used:	Onsite records of a gas analyzer operating in dry-basis
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Continuous online measured by methane fraction analyzer, data to be recorded hourly.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The methane fraction analyzer should be subject to a regular maintenance and testing regime to ensure accuracy. The equipment shall be periodically calibrated according to the manufacturer's recommendation calibration shall include zero verification with an inert gas and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases shall have a certificate provided by the manufacturer and shall be under their validity period.
Any comment:	The volumetric fraction of CH_4 in LFG on a dry basis is monitored in the project activity. As a simplification, the remainder of the gas shall be assumed to nitrogen (N_2)

Data / parameter:	$v_{k,t,db}$
Data unit:	m^3 gas k/ m^3 dry gas
Description:	Volumetric fraction of gas k in the gaseous stream in time interval *t* on a dry basis.
Source of data to be used:	

Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Continuous gas analyzer operating in dry-basis
Monitoring frequency:	Continuous if not specified in the underlying methodology.
QA/QC procedures to be applied:	As a simplification, the project participants shall monitor only the volumetric fraction of CH_4, which is the only greenhouse gas in LFG that is considered in the emission reduction calculation by the underlying methodology (ACM0001) and assume that the difference to 100% is pure nitrogen. This simplification is valid under ACM0001.
Any comment:	It is used for Option B of "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

Data / parameter:	**T_t**
Data unit:	K
Description:	Temperature of the gaseous stream in time interval t
Source of data to be used:	Onsite records of the thermocouples.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Monitored continously
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration shall be in accordance with manufacturer's specifications.
Any comment:	Used for the flow meter in expressing LFG volume in normalized cubic meters. According to the temperature of the LFG in the first crediting period are all below 60℃, the LFG is dry.

Data / parameter:	**P_t**
Data unit:	Pa
Description:	Pressure of the gaseous stream in time interval *t*
Source of data to be used:	Onsite records of the pressure transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Continuous, data be automatically compensated in pressure by the accumulator of the flow meter

Monitoring frequency:	Continuously
QA/QC procedures to be applied:	Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transmitter (either capacitive or resistive) must be calibrated monthly.
Any comment:	Used for the flow meter in expressing LFG volume in normalized cubic meters. This parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency)

Data / parameter:	$\mathbf{P_{H2O,t,Sat}}$
Data unit:	Pa
Description:	Saturation pressure of H_2O at temperature T_t in time interval *t*
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	This parameter is solely a function of the gaseous stream temperature T_t, and can be found in the above data source of a total pressure equal to 101,325Pa.
Monitoring frequency:	
QA/QC procedures to be applied:	
Any comment:	Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4^{o} Edition 1994, John Wiley& Sons,Inc.

Data / parameter:	$\mathbf{T_{flare,y}}$
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Measurements of the thermocouple by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Normal operation range 500℃-800℃ Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500℃ indicates that a significant amount of gases are still being burnt and that the flare is operating.
Description of measurement methods and procedures to be applied:	Continuous online measured, data be recorded hourly.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	Thermocouples will be calibrated and checked annually by a qualified third party for accuracy according to the manufacture's specification
Any comment:	An excessively high temperature at the sampling point (above

	700 ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.

Data / parameter:	**$EC_{BL,k,y}$**
Data unit:	MWh
Description:	Net amount of electricity generated using LFG in year y .
Source of data to be used:	Onsite records of the dual direction function kWh meter , or the tariff sheet by local Power Supply Bureau
Value of data applied for the purpose of calculating expected emission reductions in section B.6	3,919.5
Description of measurement methods and procedures to be applied:	Continuous online measure, data will be recorded daily.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	Electricity meter will be calibrated and checked annually by a qualified third party for accuracy according to the manufacture's specification
Any comment:	The project emission reduction attributable to the displacement of grid electricity by the project activity will not claimed for this crediting period.

Data / parameter:	**$EC_{PJ,j,y}$**
Data unit:	MWh
Description:	Quantity of electricity consumed from external by the project electricity consumption source *j* in year *y*
Source of data to be used:	Onsite records of the dual direction function kWh meter, or the tariff sheet by local Power Supply Bureau
Value of data applied for the purpose of calculating expected emission reductions in section B.6	202.18
Description of measurement methods and procedures to be applied:	Continuous online measure, data will be recorded daily.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	Electricity meter will be calibrated and checked annually by a qualified third party for accuracy according to the manufacture's specification
Any comment:	The project emission reduction attributable to the displacement of grid electricity by the project activity will not claimed for this crediting period. Therefore, the project emission could be considered as zero if the total electricity generated by LFG is greater than the total electricity consumed by the project activity from grid.

Data / parameter:	**$Fv_{RG,h}$**
Data unit:	m^3/h

Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*
Source of data to be used:	Measurements by project participants using a flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ($fv_{i,h}$) when the residual gas temperature exceeds 60 ℃
Monitoring frequency:	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures to be applied:	Flow meters are to be periodically calibrated according to the manufacturer's recommendation.
Any comment:	

Data / parameter:	$fv_{CH4,RG,h}$
Data unit:	mg^3/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h*
Source of data to be used:	Measurements by project participants using a continuous gas analyser
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A
Description of measurement methods and procedures to be applied:	Extractive sampling analyzers with water and particulates removal devices or in situ analyser for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). An excessively high temperature at the sampling point (above 700 ^{o}C) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.
Monitoring frequency:	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures to be applied:	The analyzers will be periodically calibrated according to manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard gas.
Any comment:	Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency. Measurement instruments may read ppmv or % values. To convert from ppmv to mg/m3 simply multiply by 0.716. 1% equals 10 000 ppmv.

Data / parameter:	**Other flare operation parameters**
Data unit:	-
Description:	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications including a flame detector in case of open flares.
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Normal flare exhaust air temperature is among 600℃-800 ℃
Description of measurement methods and procedures to be applied:	Continuous online measure, data be recorded daily
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	
Any comment:	Only applicable in case of use of a default value

B.7.2. Description of the monitoring plan:

>>

In order to assure the correctness and integrity of the Project monitoring plan, the Project participant will establish a system consisting of monitoring and verifying as well as CDM management and QC/QA, including,

1. Operation and Management Organization for the Monitoring Plan

A CDM management team will be formed to manage all the CDM related business in the Project Activity. The Manager of Shenzhen PhasCon Meizhou Branch will be in charged of the overall management of the monitoring plan.

The configuration of the CDM team is described below, a CDM engineer position is specially assigned for daily monitoring of CDM business, including daily reporting, meter calibration, CDM data security and all QA/QC related management.

A *CDM management manual* will be edited by professional consultant at PhasCon headquarter according to the spirits of this PDD, as a guideline to manage and monitor the Project during the lifetime of the proposed Project Activity, a series of trainings shall be arranged to all staff involved in this project activity. The CDM team members as well as the operation and maintenance personnel shall be trained with this manual before to the position of duty[12].

The staff training records will be available for DOE during validation period.

[12] The staff training records will be available for DOE during validation period.

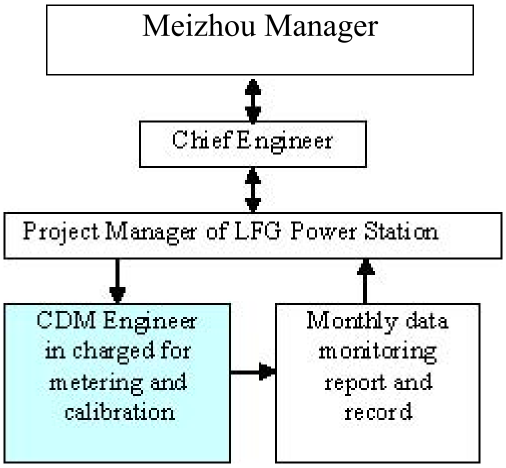

Figure 9 Configuration of the CDM management Team

2. Monitoring Data

According to the monitoring methodology of ACM0001, the parameters to be monitored are listed in section B.7.1, mainly including the LFG flow in main pipe as well as the flows in the sub-pipes to flare and to power generation, methane fraction in main LFG flow, residual methane fraction in flue gas after flaring, and the electricity supplied (net generation) by the Project Activity.

3. Installation of the Monitoring Meters

• Monitoring the methane recovered and destroyed in the Project Activity

It is based on direct measurement of the amount of landfill gas captured and destroyed at the flare and the electricity generating to determine the quantities as shown below. Three continuous flow meters will be installed on the recovery system: one at the blower, one at the flare and the other one at the LFG power generation station. The data of the flow meters shall be online compensated by the parameters of pressure and temperature.

A gas analyzer will also be installed at the blower location, in order to measure the methane fraction of the LFG (% CH_4 v/v) on a dry basis. There is a temperature transmitter will be installed at the top sector of flare to determine if the flare is under operation normal by measuring the temperature of the flue gas after flaring.

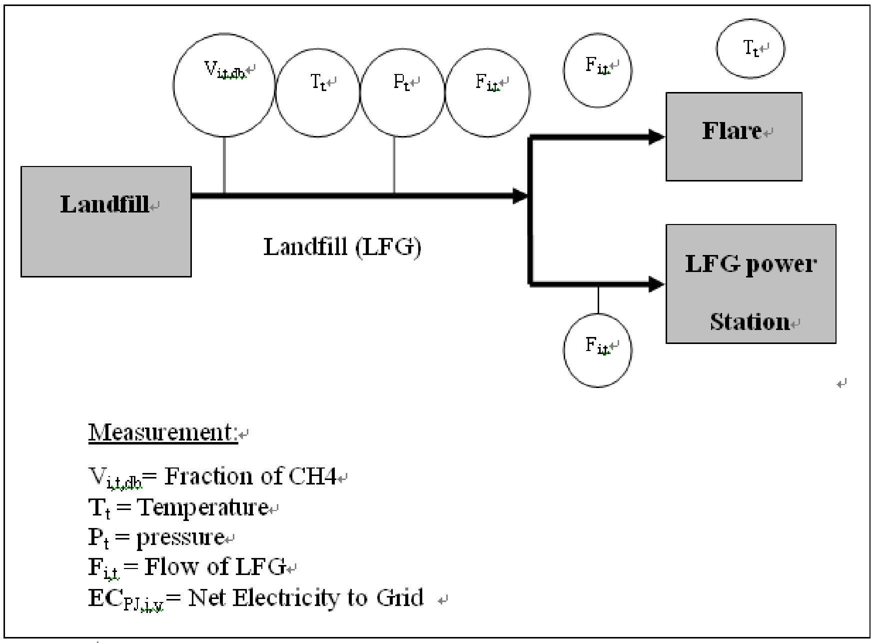

Figure 10. Installation of the CDM monitoring meters for LFG project with power generation

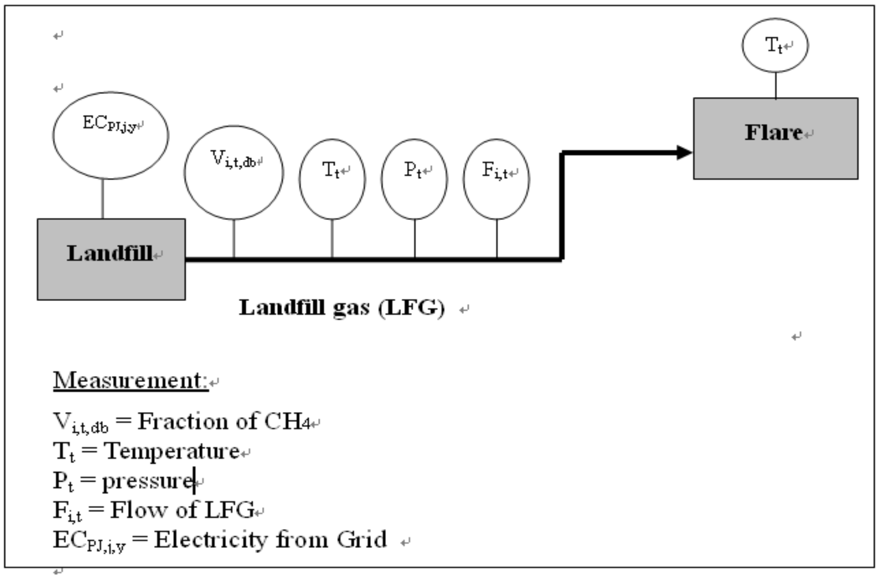

Figure 11 Installation of the CDM monitoring meters for LFG flaring project

• Monitoring the Electricity Generated by LFG in the Project Activity

The electrical supply and distribution diagram of the Project Entity is shown in figure 12 below. There are four 10KV/400V transformers with capacity of 630KVA for each to deliver the LFG electricity to the grid, and also deliver electricity to the project activity.

There is a monitoring kWh meter, M_{LFGP}, for measuring of electricity supplied to the Southern China Power Grid by the Project Activity, also the electricity from grid to the Project Activity, dual direction measurement function is required. The monitoring kWh meter is installed, monitored by local Power Supply Bureau.

Also, there are kWh meters, MG_1 to MG_2 at the terminal of each gas generator which installed and supplied by the manufacture for measuring the electricity generated by the generator, which could be considered as back-up meters for the main monitoring kWh meter M_{LFGP}.

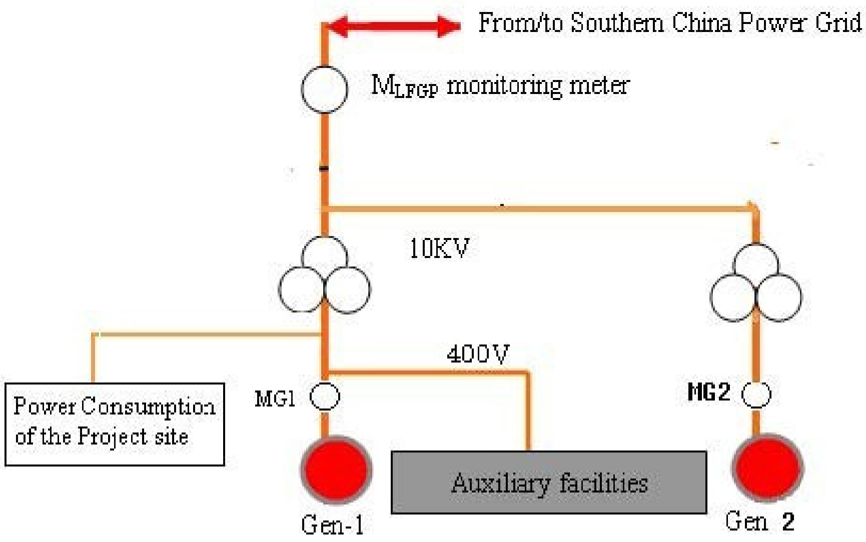

Figure 12 Installation position for monitoring meter in LFG power generation and distribution system

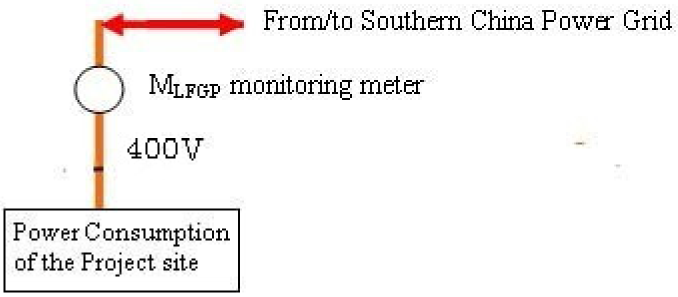

Figure 13 Installation position for monitoring meter in LFG flaring system

4. Data Reporting

As all the monitoring meter on site are intelligent ones, the operation data could be recorded and saved automatically, the data could be exchanged with upper monitoring computer(s), and the data could be viewed and saved by the monitoring computer(s).

The CDM engineer is in charge of daily, weekly and monthly management of the monitoring data, and submits a monthly monitoring report to CDM management team.

5. QC/QA Quality Control and Quality Assurance

The accuracy of the flow meter, the electricity and methane fraction measuring meters are the key factors of monitoring quality.

There is a specific national regulation [11] regarding kWh meter measurement, named as *kWh metering device technical management regulation DL/T 448-2000,* the precision requirements for kWh meter in this regulation for those generators with unit capacity under 100MW are: active power kWh meter is 1.0 grade, passive power kWh meter is 2.0 grade, PT is 0.5 grade and CT is 0.5s grade.

There is a national standard [12] named *V.R. of Vortex-shedding Flow meter JJG 1029-2007*, where the accuracy requirement for the flow meter is 1.0 grade and the temperature and pressure compensation function shall be taken, the thermometer shall meet the standard of IEC-751.

For methane fraction measurement, there is a technical requirement for the infrared ray gas analyzer with standard JB/T9359.1-1999, where the accuracy requirement for the measurement is 2.0 grade.

The reliability of monitoring system is determined by precision and quality of measuring meters, all the meters shall be purchased from professional manufacturers with national metering certificates and QA qualified pass, the meter shall be periodically calibrated according to manufacturer's recommendation by qualified metering instrument institutions, so as to assure the precision and steadiness of the metering results.

The general manager shall be in responsible for review and checking previous monitoring data, once there is any unusual, shall form an investigation team immediately to find the solution.

All the monitoring data shall be filed in CD quarterly, and keep for at least two years after the crediting period.

[11] http://wenku.baidu.com/view/5182050c581b6bd97f19ea6b.html
[12] http://www.gfjl.org/thread-14734-1-1.html

6. Measuring instrument fault/ emergency treatment procedures
Once a meter in fault, it shall be replaced immediately with another calibrated meter by a professional engineer, the LFG or electricity generated during the period of erroneous measurement and replacement of the fault meter shall not be accounted for conservative consideration. The fault meter shall be repaired and calibrated only by national designated institutions with metering certificate.

7. Monitoring Report
An annual or a periodic operation result and emission reduction result shall be summarized into a monitoring report, including all the data required in the monitoring plan as well as the records of calibration and maintenance of the meters, and a verification application shall be submitted to a DOE for CERs certification.

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

>>
Completion date of the application of Baseline and Monitoring Methodology was 28/02/2012.
Members of the Methodology and Application Research team are:

Prof./Dr. Yu Yuan Qi, President
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Shenzhen PhasCon Technologies is the CDM consultant and also the project participant.
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Shenzhen PhasCon Technologies is the CDM consultant and also the project participant.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

18/10/2004, the starting date for project detailed engineering and construction.

C.1.2. Expected operational lifetime of the project activity:

>>

At least 21 years. The left operational lifetime is 14 years.

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

C.2.1. Renewable crediting period:

>>

7 years×3 renewable crediting period is chosen. The first crediting period is from 01 Sep 2005 to 31 Aug 2012, the second crediting period is from 1 Sep 2012 to 31 Aug 2019.

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

>>

01/09/2012,

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

>>

N/A

C.2.2.1. Starting date:

>>

N/A

C.2.2.2. Length:

>>

N/A

SECTION D. Environmental impacts

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

Two Environmental Impact Assessments (EIA) reports[13] of this project had been completed by Meizhou Environment Science Research Institute, the one on 31/12/2004 is for Longfeng landfill LFG project, another one on 12/05/2005 for the seven landfills in the counties respectively, which have been ratified by Meizhou Environment Protection Bureau (EPB)[14] in 20/02/2005 and 25/05/2005 respectively.

According to the EIA report, the environmental impacts, measures taken and conclusions of the Project Activity will be given emphasis discussion as follows:

- **Impact on Air**
  Although the majority of landfill gas emissions are quickly diluted in the atmosphere, in confined spaces there is a risk of asphyxiation and/or toxic effects if landfill gas is present at high concentrations. Landfill gas also contains over 150 trace components that can cause both local and global environmental effects such as odor nuisances, stratospheric ozone layer depletion, and ground-level ozone creation.

  Through appropriate management of the proposed project activity at Meizhou landfill sites, landfill gas will be captured, flared and combusted, removing the risks of toxic effects on the nearby community and local and global environment.

  It could be controlled by flaring or combusting of the captured LFG of the Project Activity, and meet the second grade Chinese standard GB 14554-93 of *emission standard for odor nuisance.*

- **Sanitation Pollution**
  In absence of the Project Activity, there would be considerable amount of sanitation pollution in the vicinity due to the un-sealed landfill waste with disease diffusing by fly and mosquito and toxic smell. The Project Activity seals the landfill with soil and grass, and thereby greatly reduces sanitation pollution.

- **Noise Generation**
  There will be some increase in noise up to 90 dB[A] from the site associated with blower pump or gas generator for energy recovery, although the engines will be housed or in container to reduce noise lower to 35 Db[A], which will meet I-level standard GB 12348-90 of *China Industry Enterprise Noise Emission Standard.*

- **Impact on Water Environment**
  Groundwater and surface water can be contaminated by untreated leachate from landfill sites. Leachate may cause serious water pollution if not properly managed. Surface water runoff from a landfill site can also cause unacceptable sediment loads in receiving waters, while uncontrolled surface water run-off can lead to excessive generation of leachate and migration of contaminated waters off-site. With Project entity providing appropriate management on the site and recycling of the collected leachate, these potential problems should be avoided. Also there is few water impacts associated with landfill gas electricity generation plants. Unlike other power plants that rely upon water for cooling, landfill gas power plants are usually very small, use air-cooling, and therefore pollution discharges into local lakes or streams are typically non-existent.

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[13] EIA is available for DOE for validation
[14] Ratification documents available at DOE validation

- **Solid Waste Management**

A LFG based power station would not have any significant solid waste generated.

Where methane is used for electricity generation, operational practices at the landfill are improved thus contributing to sustainable development. Specifically for landfill, sustainable means accelerating waste stabilization such that the landfill harmless processes can be said to be largely complete within one generation. This ensures that both leachate and methane are more carefully managed and controlled, and the degradation processes are accelerated.

Other potential hazards and amenity impacts minimized by appropriate management of the proposed project activity at Meizhou landfill sites include the risks of fire or explosions, landfill gas migration, dust, odor, pests, vermin, unsightliness and litter, each of which may occur on-site or off-site. Thus, these kinds of hazards could be effectively reduced or avoided by the implementation of the proposed Project Activity.

There is no transboundary impact of the project activity.

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:

>>

As discussed above, the Project Activity would not have any adverse environmental impacts; on the contrary, the project will upgrade the local waste management practice to a higher standard and will lead to a significant reduction in local pollution along with a significant reduction in GHG emissions as described above, so it was approved by the supervision departments of China government.

SECTION E. Stakeholders' comments

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

>>

Figure 14. Technical Feasibility Study Meeting for Meizhou LFG Recovery Project

An Environmental Assessment (EA) has been conducted as a requirement to obtain the environmental licenses to operate the new landfill gas recovery projects. This EA was submitted to a prolonged stakeholder consultation process, which began with meetings with public officials and the Local EPB officer, including the vice-Mayor of Meizhou in May 2004 and continued with a meeting in Shenzhen in early June. A number of further meetings were conducted in July, September and October of 2004 and March in 2005 to present the design details of the Project and further make stakeholders familiar with the Project activities and plans. Continuing contact with area residents is taking place as project activities occur. The concerns of stakeholders are noted in the official minutes of these meetings and additional public meetings were held.

PhasCon responded to the concerns of the stakeholders with an agreement to address the environmental issues raised and commitment to resolve the problems identified by this process. The documentation of the meetings and the Environmental Assessment and Approval will be available to the OE conducting the Validation.

Brief description how comments by local stakeholders have been invited and compiled

Brief description of the process on how comments by (local) stakeholders have been invited and compiled.	For the environmental licenses and operational permits, local Government Bureaus conducted a public hearing in 2004, which focused on the waste disposal and management facilities in the Meizhou landfill gas recovery proposals. All comments are incorporated into the executive project. The documentation will be available to the public on request. The local television station showed the presentation on project details for 3 days and invited queries from the public. In addition, the local Meizhou newspaper covered the public meetings and detailed planned project activities. The target groups were divided into 5 interest groups. (i) public sector representatives of Government (ii) non-governmental organizations, including relevant local and national organizations specializing on climate change; (iii)

E.2. Summary of the comments received:

>>

Summary of the stakeholder comments received	Up to present date, all organizations have agreed with the project concept and most of them emphasized the environmental importance of the landfill when considering the precarious waste disposal situation in China. Most interesting is that many of the contacted stakeholders recognize the project's contribution to the mitigation of the global warming impacts. Another striking comment is that these improvements, especially capturing the landfill gas and recycling the leachate need to be done for the “benefit of our children”.

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

>>

Report on how due account was taken of any comments received	All comments received by now in the context of the environmental licensing and Operation permits process were positive. After meeting with the local villager group, a formal contact was established with a representative-Mr. Zhong Wei Xiang, who is kept informed of project progress and is to pass any comments or concerns on to PhasCon. PhasCon also hired a full time local employee to co-coordinate all project activities at the request of MESAB. The documentation will be available to the public on request.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The developer, owner and operator of Meizhou LFG recovery and Utilization Project

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State/Region:	Guangdong
Postfix/ZIP:	518063
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Telephone:	86 755 26993489
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E-Mail:	shenzhen@phascon.com
URL:	www.phascon.com
Represented by:	Yu Yuan Qi
Title:	Legal Person
Salutation:	Dr.
Last Name:	Yu
Middle Name:	
First Name:	Yuan Qi
Department:	Administration
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CERs Purchaser

Organization:	"Kommunalkredit Public Consulting GmbH (representing the Republic of Austria, Federal Minister of Agriculture, Forestry, Environment and Water Management)"
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City:	Vienna
State/Region:	
Postfix/ZIP:	A-1092
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URL:	http://www.ji-cdm-austria.at, http://www.publicconsulting.at
Represented by:	Alexandra Amerstorfer
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding related to Annex 1 Countries in the Project Activity.

Annex 3

BASELINE INFORMATION

1. Operating Margin Calculations

Table A3-1-1 Low Calorific Values, Emissions and Oxidation Factors of Fuels

Fuel	Unit	Low Calorific Value	EF for fuels ($kgCO_2/TJ$)	Oxidation Factor
Raw Coal	kJ/kg	20,908	87,300	100.00%
Cleaned Coal	kJ/kg	26,344	87,300	100.00%
Moule Coal	kJ/kg	20,908	87,300	100.00%
Other Washed Coal	kJ/kg	8,363	87,300	100.00%
Coke	kJ/kg	28,435	95,700	100.00%
Crude Oil	kJ/kg	41,816	71,100	100.00%
Gasoline	kJ/kg	43,070	67,500	100.00%
Diesel Oil	kJ/kg	42,652	72,600	100.00%
Fuel Oil	kJ/kg	41,816	75,500	100.00%
Other Oil Products	kJ/kg	41,816	72,200	100.00%
Natural Gas	kJ/m^3	38,931	54,300	100.00%
Coke Oven Gas	kJ/m^3	16,726	37,300	100.00%
Other Gas	kJ/m^3	5,227	37,300	100.00%
LPG	kJ/m^3	50,179	61,600	100.00%
Refinery Gas	kJ/m^3	46,055	48,200	100.00%

Table A3-1-2 Simple OM Emission Factors Calculation for CSPG 2007

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	EF (tC/TJ)	Oxidation (%)	EF of Fuel (kg CO2/TJ)	NCV (MJ/tkm3)	CO2 Emission(tCO2e)
		A	B	C	D	G=A+B+C+D	H	I	J	K	L=G*J*K/100000(for mass unit) L=G*J*K/10000 (for volume unit)
Raw Coal	10^4 t	8214.78	1750.63	4298.8	3170.79	17435	25.8	100	87,300	20,908	318,235,546
Cleaned Coal	10^4 t	3.46				3.46	25.8	100	87,300	26,344	79,574
Other Washed Coal	10^4 t		0.65	21.58	14.64	36.87	25.8	100	87,300	8,363	269,184
Moule Coal	10^4 t	271.25				271.25	26.6	100	87,300	20,908	4,951,041
Coke	10^4 t	0.04	1.69		2.15	3.88	29.2	100	95,700	28,435	105,584
Coke Oven gas	10^8 m^3		0.96	3.19	1.8	5.95	12.1	100	37,300	16,726	371,208
Other Gas	10^8 m^3		30.77		21.63	52.4	12.1	100	37,300	5,227	1,021,628
Crude Oil	10^4 t					0	20	100	71,100	41,816	0
Gasoline	10^4 t					0	18.9	100	67,500	43,070	0
Diesel Oil	10^4 t	21.37	2.13		2.29	25.79	20.2	100	72,600	42,652	798,596
Fuel Oil	10^4 t	467.97	0.41			468.38	21.1	100	75,500	41,816	14,787,262
LPG	10^4 t					0	17.2	100	61,600	50,179	0
Refinery Gas	10^4 t	0.37				0.37	15.7	100	48,200	46,055	8,213
Natural Gas	10^8 m^3	32.17				32.17	15.3	100	54,300	38,931	6,800,588
Other Oil Products	10^4 t	8.47				8.47	20	100	75,500	41,816	255,719
Other Oven Products	10^4 t					0	25.8	100	95,700	28,435	0
Other Energy	10^4 t	118.04	81.89	44.1	50.3	294.33	0	100	0	0	0
Import from CCPG							1.10197	100			26,708,796
Total											**374,392,939.81**

Table A3-1-3 Fuel-fired Electricity Generation of CSPG 2007

Province	Electricity Generated (MWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Guangdong	215,700,000	6.01	202,736,430
Guangxi	36,100,000	7.42	33,421,380
Guizhou	84,300,000	6.62	78,719,340
Yunnan	47,400,000	7.23	43,972,980
Import from CCPG			24,237,240
Total			**383,087,370.00**

Table A3-1-4 Simple OM Emission Factors Calculation for CSPG 2008

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	EF (tC/TJ)	Oxidation (%)	EF of Fuel (kg CO2/TJ)	NCV (MJ/tkm3)	CO2 Emission(tCO2e)
		A	B	C	D	G=A+B+C+D	H	I	J	K	L=G*J*K/100000(for mass unit) L=G*J*K/10000 (for volume unit)
Raw Coal	10^4 t	8001.54	1513.1	4117.45	2766.85	16398.94	25.8	100	87,300	20,908	299,324,670
Cleaned Coal	10^4 t	2.31				2.31	25.8	100	87,300	26,344	53,126
Other Washed Coal	10^4 t		0.08	13.38	57.11	70.57	25.8	100	87,300	8,363	515,224
Moule Coal	10^4 t	297.43				297.43	26.6	100	87,300	20,908	5,428,896
Coke	10^4 t	3.24	1.73		2.74	7.71	29.2	100	95,700	28,435	209,807
Coke Oven gas	10^8 m^3		1.55	3.92	2.17	7.64	12.1	100	37,300	16,726	476,644
Other Gas	10^8 m^3	1.09	29.6		35.71	66.4	12.1	100	37,300	5,227	1,294,582
Crude Oil	10^4 t					0	20	100	71,100	41,816	0
Gasoline	10^4 t	0.01				0.01	18.9	100	67,500	43,070	291
Diesel Oil	10^4 t	10.46	0.97		2.28	13.71	20.2	100	72,600	42,652	424,535
Fuel Oil	10^4 t	344.59	0.24			344.83	21.1	100	75,500	41,816	10,886,656
LPG	10^4 t					0	17.2	100	61,600	50,179	0
Refinery Gas	10^4 t	0.76				0.76	15.7	100	48,200	46,055	16,871
Natural Gas	10^8 m^3	35.6				35.6	15.3	100	54,300	38,931	7,525,674
Other Oil Products	10^4 t	7.3				7.3	20	100	72,200	41,816	220,395
Other Oven Products	10^4 t					**0**	25.8	100	95,700	28,435	0
Other Energy	10^4 t	120.17	103.26	89.44	42.63	355.5	0	0	0	0	0
Import from CCSPG							1.04205				23,281,534.58
Total											349,658,904.43

Table A3-1-5 Fuel-fired Electricity Generation of CSPG 2008

Province	Electricity Generated (MWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Guangdong	210,700,000	6.18	197,678,740
Guangxi	34,200,000	7.14	31,758,120
Guizhou	81,300,000	7.04	75,576,480
Yunnan	41,800,000	7.29	38,752,780
Import from CCPG			22,342,090
Total			**366108,210**

Table A3-1-6 Simple OM Emission Factors Calculation for CSPG 2009

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Hannan	Total	EF (tC/TJ)	Oxidation (%)	EF of Fuel (kg CO2/TJ)	NCV (MJ/tkm3)	CO2 Emission(tCO2e)
		A	B	C	D	E	G=A+B+ C+ D+E	H	I	J	K	L=G*J*K/100000(for mass unit) L=G*J*K/10000 (for volume unit)
Raw Coal	10^4 t	8011.98	1815.41	4925.23	3311.44	376.59	18440.65	25.8	100	87,300	20,908	336,591,357
Cleaned Coal	10^4 t	1.8					1.8	25.8	100	87,300	26,344	41,397
Other Washed Coal	10^4 t			11.67	44.92		56.59	25.8	100	87,300	8,363	413,158
Moule Coal	10^4 t	195.86					195.86	26.6	100	87,300	20,908	3,574,971
Coke	10^4 t	4.9	1.6		1.63		8.13	29.2	100	95,700	28,435	221,236
Coke Oven gas	10^8 m^3		2.89	2.02	2.48		7.39	12.1	100	37,300	16,726	461,047
Other Gas	10^8 m^3	1.11	20.88		48.61		70.6	12.1	100	37,300	5,227	1,376,468
Crude Oil	10^4 t						0	20	100	71,100	41,816	0
Gasoline	10^4 t						0	18.9	100	67,500	43,070	0
Diesel Oil	10^4 t	6.46	0.52		0.49	0.12	7.59	20.2	100	72,600	42,652	235,027
Fuel Oil	10^4 t	157.37	0.09				157.46	21.1	100	75,500	41,816	4,971,182
LPG	10^4 t						0	17.2	100	61,600	50,179	0
Refinery Gas	10^4 t	0.51					0.51	15.7	100	48,200	46,055	11,321
Natural Gas	10^8 m^3	47.21				6.19	53.4	15.3	100	54,300	38,931	11,288,511
Other Oil Products	10^4 t	45.31				0.83	46.14	20	100	72,200	41,816	1,393,020
Other Oven Products	10^4 t						0	25.8	100	95,700	28,435	0
Other Energy	10^4 t	152.99	98.56	23.01	49.01	20	343.57	0	0	0	0	0
Import from CCPG								0.95455tCO2e/ MWh				20,859,189.65
Total												**381,437,884.13**

Table A3-1-7 Fuel-fired Electricity Generation of CSPG 2009

Province	**Electricity Generated (MWh)**	**Auxiliary Power Ratio (%)**	**Supplied Electricity (MWh)**
Guangdong	214,300,000	6.16	201,099,120
Guangxi	42,800,000	6.69	39,936,680
Guizhou	97,800,000	6.68	91,266,960
Yunnan	54,800,000	6.52	51,227,040
Hainan	11,400,000	8.17	10,468,620
Import from CCPG			21,852,270
Total			**415,850,690**

Table A3-1-8 Calculation of OM

	2007	**2008**	**2009**	**Sum**
Emissions (t CO_2e)	374,392,939.81	349,658,904.43	381,437,884.13	1,105,489,728.37
Electricity Supplied to CSPG (MWh)	383,087,370.00	366,108,210.00	415,850,690.00	1,165,046,270.00
Emission Factor (t CO_2e / MWh)	**0.97730**	**0.95507**	**0.91725**	**0.94888**

2. Build Margin Calculations

Table A3-2-1 The portion of CO_2 emission of the solid, liquid and gaseous fuels in total emissions respectively

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Hainan	Total	EF (tC/TJ)	EF of Fuel (kg CO2/TJ)	Oxidation (%)	CO2 Emission(tCO2e)
		A	B	C	D	E	G=A+B+C+D+E	H	J	I	L=G*H*J*I/100000(for mass unit) L=G*H*J*I/10000 (for volume unit)
Raw Coal	10^4 t	8,011.98	1,815.41	4,925.23	3,311.44	376.59	18,440.65	20,908	87,300	1	336,591,357
Cleaned Coal	10^4 t	1.8	0	0	0	0	1.8	26,344	87,300	1	41,397
Other Washed Coal	10^4 t	0	0	11.67	44.92	0	56.59	8,363	87,300	1	413,158
Moule Coal	10^4 t	195.86	0	0	0	0	195.86	20,908	87,300	1	3,574,971
Coke	10^4 t	4.9	1.6	0	1.63	0	**8.13**	28,435	95,700	1	221,236
Other Coke Chemicals	10^4 t	0	0	0	0	0	0.00	28,435	95,700	1	0
Crude Oil	10^4 t	0	0	0	0	0	0	41,816	71,100	1	0
Gasoline	10^4 t	0	0	0	0	0	0	43,070	67,500	1	0
Diesel Oil	10^4 t	6.46	0.52	0	0.49	0.12	7.59	42,652	72,600	1	235,027
Fuel Oil	10^4 t	157.37	0.09	0	0	0	157.46	41,816	75,500	1	4,971,182
Other Oil Product	10^4 t	45.31	0	0	0	0.83	46.14	41,816	72,200	1	1,393,020
Natural Gas	10^8 m^3	472.1	0	0	0	61.9	534	38,931	54,300	1	11,288,511
Coke Oven Gas	10^8 m^3	0	28.9	20.2	24.8	0	73.9	16,726	37,300	1	461,047
Other Gas	10^8 m^3	11.1	208.8	0	486.1	0	706	5,227	37,300	1	1,376,468
LPG	10^4 t	0	0	0	0	0	0	50,179	61,600	1	0
Refinery Dry Gas	10^4 t	0.51	0	0	0	0	0.51	46,055	48,200	1	11,321
Total											**360,578,694**

According to the above, $\lambda_{Coal,y}$=94.53%%， $\lambda_{Oil,y}$=1.83%， $\lambda_{Gas,y}$=3.64%.

Table A3-2-2 Parameters used to calculate fuel-fired emissions factor

	Parameter	Efficiency of Power Supply	Emission factor of Fuel (tc/TJ)	Oxidation Factor	Emission factor (t CO_2e / MWh)
		A	B	C	D=3.6/A/10000*B*C*
Coal fired Power Plant	$EF_{Coal, Adv}$	39.45	87,300	1	0.7967
Gas Fired Power Plant	$EF_{Gas, Adv}$	51.77	75,500	1	0.5250
Oil Fired Power Plant	$EF_{Oil, Adv}$	51.77	54,300	1	0.3776

Therefore, $EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Gas, Adv,y} + \lambda_{Gas,y} \times EF_{Oil, Adv,y} = 0.7765$

Table A3-2-3 Installed Capacity of the CSPG in 2007

	Guangdong	Guangxi	Yunnan	Guizhou	Hainan	Total
Fossil fuel fired(MW)	44,710	9,310	10,630	15,960	2,400	83,010
Hydro (MW)	10,110	10,440	11,580	8,210	590	40,930
Nuclear (MW)	3,780	0	0	0	0	3,780
Others (MW)	250	0	0	0	24.0	274
Total	58,850	19,750	22,210	24,170	3,014	127,994

Table A3-2-4 Installed Capacity of the CSPG in 2008

	Guangdong	Guangxi	Yunnan	Guizhou	Hainan	Total
Fossil fuel fired(MW)	45,730	10,270	10,030	17,170	2,370	85,570
Hydro (MW)	10,280	13,970	15,740	9,470	410	49,870
Nuclear (MW)	3,780	0	0	0	0	3,780
Others (MW)	290	0	80	0	10	380
Total	60,080	24,240	25,850	26,640	2,790	139,600

Table A3-2-5 Installed Capacity of the CSPG in 2009

	Guangdong	Guangxi	Yunnan	Guizhou	Hainan	Total
Fossil fuel fired(MW)	48,300	10,770	10,710	17,310	3,090	90,180
Hydro (MW)	11,260	14,750	20,900	13,610	700	61,220
Nuclear (MW)	3,950	0	0	0	0	3,950
Wind & Others (MW)	560	0	80	0	60	700
Total	64,070	25,520	31,690	30,920	3,850	156,050

Table A3-2-6 New Capacity added to the CSPG during 2007-2009

	2007	2008	2009	Added 2007-2009[15]	Newly Added Capacity
	A	B	C	D	
Fossil fuel fired (MW)	83,010	85,570	90,180	14,446.9	40.66%
Hydro (MW)	40,930	49,870	61,220	20,487.9	57.66%
Nuclear (MW)	3,780	3,780	3,950	170	0.48%
Others (MW)	274	380	700	426	1.20%
Total	127,994	139,600	156,050	35,531	100.00%
% of 2009 installed Capacity				22.77%	

$EF_{BM,y}$ = 0.7765 x 40.66% = 0.3157 tCO_2/MWh

3. Combined Margin Calculations for CSPG

	OM (t CO_2e /MWh	BM (t CO_2e /MWh	CM (t CO_2e / MWh
			C=0.25×A+0.75×B
CSPG	0.9489	0.3157	0.474

[15] This added value includes consideration of capacity about shut-down sets and pumped storage.