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

CONTENTS

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

Luohe MSW Landfill Site LFG Recovery to Power Project

Version 01

Date: 09/12/2009

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

Luohe MSW Landfill Site LFG Recovery to Power Project (Hereinafter referred as the proposed project activity) aims to recover and destroy landfill gas (LFG) generated at the municipal solid waste (MSW) landfill site in Luohe city, Henan province, P.R. China. The collected LFG will be used for electricity production.

The Luohe city landfill area #1, where produced LFG will be used for the proposed project activity, started operation in 2004 and is expected to run for 15 years, with acceptance capacity of 2.4 million tonnes. Degassing pipelines have been installed on the landfill site only for safety reason, no LFG collection and/or destruction facilities have been installed prior to the proposed project activity. Therefore the whole LFG is being released into the atmosphere in the baseline scenario.

The proposed project activity will employ a gas collection system, a transmitting system, a pre-treatment system and gas engines with a capacity of 2 MW. The recovered LFG will be combusted in the gas engines to produce electricity which will be fed into the Central China Power Grid (CCPG) afterwards. In case the overall amount of collected LFG exceeds the gas consumption capacity of the 2 MW engines, an enclosed flare will be installed in the future to destroy the spare LFG. Emission reductions will be claimed from both methane recovery and electricity replacement.

It is estimated that the proposed project with 2MW engine capacity would destroy 14,499 tons[1] of methane and replace electricity 117,000 MWh in the 10 years crediting period, thus 404,253 tCO_2e emissions could be reduced.

Contribution to sustainable development

The proposed project activity not only reduces greenhouse gas emissions, but also brings the following environmental, social and financial benefits to the local community:

- Reducing the air pollution: The proposed project activity will destroy LFG which contains H_2S, resulting in unbearable odours, so that the living conditions of the neighbourhood are improved.
- Enhancing safety conditions of the landfill site: The proposed project activity could reduce potential dangers of fire and explosion on the landfill site by recovering the LFG.
- Promoting LFG recovery and utilization in China by providing a successful demonstration project.
- Increasing job opportunities for the local residences. The proposed project activity will create 15 new jobs for locals during construction and operation of the power plant.

[1] Rf. CER calculation sheet.

A.3. Project participants:

Name of Party involved(*) ((host)indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P. R. China (Host)	Shanghai BCCY New Power Industry Co., Ltd	NO
Germany	Umwelt Projekt Management 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.		

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

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

A.4.1.1. Host Party(ies):

People's Republic of China

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

Henan Province

A.4.1.3. City/Town/Community etc:

Luohe City

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

The plant site of the proposed project activity is located in the northeast area inside of Luohe City MSW landfill site, one kilometre south of Chengang village, Luohe City. The coordinate of the power plant is longitude 113°59′46″E and latitude 33°30′39″N, which is determined by mobile GPS device. The detailed location is shown in ***Figure1*** below:

Map of People's Republic of China

Map of Henan Province

The location of the project site

Figure 1: The location of the project

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

According to Appendix B to the simplified modalities and procedures for small-scale CDM project activities, the project falls into:

Type III- other project activities and category G- Landfill methane recovery; and

Type I- Renewable energy project and category D- Grid connected renewable electricity generation.

Technology applied in the proposed project

The technologies adopted in the proposed project include a gas collection system, a gas pre-treatment system, gas engines, a transmitting system, and if needed a flare system.

Gas collection system

The gas collection system consists of gas collecting wells, gas collecting sub-hoses and a main pipe. The numbers of gas wells will be increased as waste accumulating in the landfill area. All sub-hoses will be connected to the main pipe so that the recovered LFG from gas wells could be collected together for utilization. The operation pressure of the gas collection system is provided by draught fans.

Gas pre-treatment system

Prior to electricity generation and/or flaring, LFG will be pre-treated to remove its impurities, moistures etc, to prevent corrosion in the engines and/or the flare. The gas pre-treatment is composed of leachate condensation separation; filtration, dewatering, drying, pressurization and removing solid impurities.

Gas engines and transmitting system

The proposed project activity is planned to employ 4 sets of gas engines with capacities of 500kw each when the LFG generation hits the peak at the landfill site. The generated electricity will be exported to CCPG through the transmitting system. The engines are produced by a domestic engine company named Jinan Diesel Engine Co., Ltd. The specification of the gas engines is listed in Table 1.

To transform the voltage from 400V to 10kV, a transformer will be installed by the proposed project activity.

Table 1: The specification of the gas engines

Model	500GF-N1 (500GF-NK)
Rated power	500kW/625kVA
Rated voltage	400V
Frequency	50Hz
Rated speed	1,000r/min
Size	5,120*2,040*2,249mm

Flare

In case the total amount of collected LFG exceeds the gas consumption capacity of the 4 engines, an enclosed auto-ignition flare will be installed to destroy the residual LFG. The flare's detailed specifications are shown as follows:

Table 2: The specification of flare

Parameters	Unit	Value
Inlet pressure	kPa	5-20
Temperature	°C	650-850
Efficiency	%	>99%

Monitoring system

For the detailed information of the monitoring system, please refer to section B.7.

There is no technology transfer for the proposed project activity.

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

The proposed project activity adopts a fixed crediting period, i.e. 10 years; estimated emission reductions during each year are presented in the following table:

Year	Estimation of annual emission reductions in tonnes of CO_2e
01/05/2010-31/12/2010	18,891
2011	30,943
2012	33,561
2013	36,196
2014	38,854
2015	41,541
2016	44,260
2017	47,016
2018	49,816
2019	47,848
01/01/2020-30/04/2020	15,327
Total estimated reductions (tonnes of CO_2e)	404,253
Total number of crediting years	10
Annual average of the estimated reductions over the crediting years (tCO_2e)	40,425

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

There is no public funding from Annex I parties to the Convention involved in the proposed project.

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

The proposed project activity is not a de-bundled component of a large project activity, since there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity

- with the same project participants
- in the same project category and technology/measure
- registered within the previous 2 years and
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.[2]

[2] Simplified Modalities and Procedures for Small-Scale CDM project activities (http://cdm.unfccc.int/Reference/COPMOP/08a01.pdf)

SECTION B. Application of a baseline and monitoring methodology

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

Applied approved baseline and monitoring methodologies:

AMS-III.G. Landfill methane recovery (version 06)

AMS-I.D. Grid connected renewable electricity generation (version 15)

Used tools:

"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 04)

"Tool to calculate the emission factor for an electricity system" (version 01.1)[3]

"Tool to determine project emissions from flaring gases containing methane" (version 1)[4]

The above methodologies and tools are available at

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

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

General small scale requirement for chosen Type III component:[5]

The expected aggregate emission reductions of the proposed project activity from all type III components are less than 60kt CO_2 equivalent annually, the detailed figure please refer to section B.3.

General small scale requirement for chosen Type I component:[6]

The total capacity of the 4 installed engines for the proposed project activity is 2 MW, which is less than 15 MW. Together with the condition above, the conclusion can be drawn that the proposed project activity will remain under the limits of small scale project activity types during every year of the crediting period.

The methodologies AMS-III.G and AMS-I.D are applicable for the proposed small scale project activity, since the requirements of these methodologies are met, as summarized in the Table 3:

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[3] Version02 of the tool is the latest one, but due to the reason that crucial data for calculation of grid emission factor required by the tool are not public available , this PDD adopt the newest official figure provided by China DNA, which is calculated as reference to version 01.1 of the tool

[4] Tool version according to http://cdm.unfccc.int/Reference/tools/index.html

[5] Simplified Modalities and Procedures for Small-Scale CDM project activities (http://cdm.unfccc.int/Reference/COPMOP/08a01.pdf)

[6] Simplified Modalities and Procedures for Small-Scale CDM project activities (http://cdm.unfccc.int/Reference/COPMOP/08a01.pdf)

Table 3: Applicability comparison between methodology and the proposed project activity

Methodology applicability	The proposed project activity
AMS-III.G (version 06)	
1. This project category comprises measures to capture and combust methane from landfills (i.e., solid waste disposal sites) used for disposal of residues from human activities including municipal, industrial and other solid wastes containing biodegradable organic matter	*The proposed project activity will recover LFG generated from a municipal solid waste disposal site*
2. The recovered methane from the above measures may also be utilised for the following applications instead of flaring or combustion a) Thermal or electrical energy generation directly; or b) Thermal or electrical energy generation after bottling of upgraded biogas; or c) Thermal or electrical energy generation after upgrading and distribution using one of the following options: (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; or (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or d) Hydrogen production.	*The proposed project activity will utilize the recovered LFG to produce electrical energy directly, i.e. 2 (a)*
3. If the recovered methane is used for project activities covered under paragraph 2(a), that component of the project activity shall use a corresponding category under type I	*The electricity produced by the proposed project activity will be exported to the Grid, so AMS-I.D will be adopted.*
AMS-I.D (version 15)	
1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	*The proposed project activity will feed the electricity produced by LFG, one of the renewable energies, into the Central China Power Grid, which is connected to more than one fossil fuel fired generating unit.*
2. Combined heat and power (co-generation) systems are not eligible under this category.	*The proposed project activity doesn't apply co-generation system. Only electricity is being produced without any further heat utilization*

B.3. Description of the project boundary:

According the methodologies AMS-III.G and AMS-I.D, the project boundary includes Luohe City landfill site area #1, where the gas is recovered and destroyed/utilized, and all the power generation sources connected to the Central China Power Grid (CCPG), where the generated electricity will be exported. CCPG covers the grids in Henan province, Hubei province, Hunan province, Jiangxi province, Sichuan province as well as Chongqing municipality. The project boundary is illustrated in ***Figure 2***:

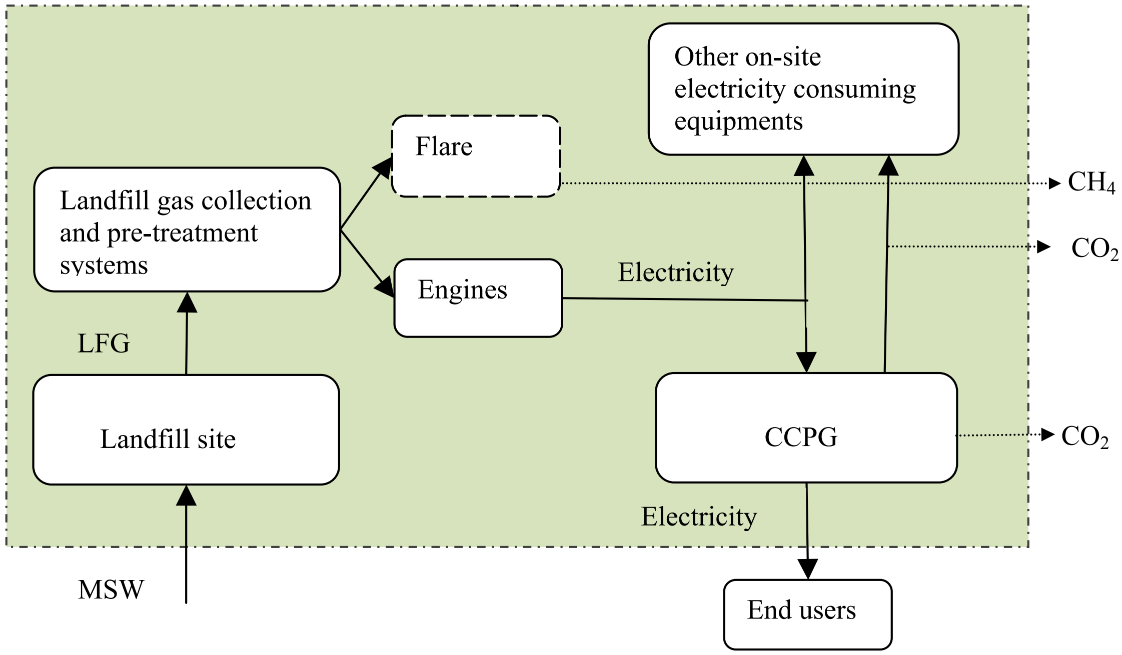

Figure 2: Project boundary

B.4. Description of baseline and its development:

According to AMS-III.G., the baseline scenario should be the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. Baseline emissions shall exclude methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations.

Currently China has regulations in place to deal with the management of landfills and to encourage utilization of LFG. Those regulations are "Standard for Pollution Control on the Landfill Site of Municipal Solid Waste" (GB 16889-2008) which became effective at July 2008, issued by the Environment Protection Administration and "Technical Code for Municipal Solid Waste Sanitary Landfill" (CJJ17-2004) which was issued by the Ministry of Construction.

The item 5.15 of GB 16889-2008 states that landfill sites with designed acceptance capacity larger than 2.5 million tonnes and depth higher than 20 meter should construct LFG utilization facilities or flare to destruct methane. Landfills, smaller than the defined size of landfill site mentioned above, should adopt landfilling technology which could effectively reduce production and emission of methane or install a flare to destruct methane in the LFG.

The item 8.0.1 of CJJ17-2004 states that landfill sites should have effective degassing facilities installed. If the LFG cannot be utilized, it should be flared.

The report of a programme in August 2005 jointly carried out by State Environmental Protection Administration, United Nations Development Program (UNDP), Global Environmental Facility (GEF) and United Nations Department of Economic and Social Affairs (UNDESA)[7] says:

"*At present, in China the municipal refuse is disposed using the technology of traditional landfill, without consideration of recovery and utilization of landfill methane. It is estimated that the annual quantity of municipal refuse filled is about 50 million tons. Almost all landfills have not equipped the system of landfill gas recovery, except several new built landfills, and the landfill methane is emitted to the atmosphere openly.*"

In Feb 2007, China Ministry of Construction issued a report which has similar findings saying that after the inspection of 372 landfill sites in 31 provinces, cities and autonomous regions in China; it was revealed that 92.76% of the landfills have no LFG recovery and utilization facilities.[8]

Therefore, it is a fact that prevailing LFG treatment in China is far behind the requirements of above mentioned regulations. With no exception to other landfill sites, the baseline scenario of the proposed project is that LFG released into the atmosphere directly without any recovery and utilization.

Besides, according to the methodology AMS-I.D, if the recovered methane from landfill gas is used for electricity generation, the baseline emissions are the electricity produced by the renewable generating unit multiplied by the emission factor for the grid systems. Since the electricity produced by the proposed project will be exported to CCPG which, is mainly based on thermal power plants using fossil fuels, the baseline scenario for electricity replacement is the emissions from the equivalent amount of electricity from CCPG.

Table 4: Baseline for the proposed project

Baseline	Description of situation
Landfill gas	The direct and open release of LFG into the atmosphere without recovery and flare
Electricity	The electricity is obtained from the Central China Power Grid (CCPG)

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

Attachment A to Appendix B of the Simplified Modalities and Procedures for Small-Scale Clean Development Mechanism Project Activities (decision 4/CMP.1, Annex II) should be used to determine whether the project is additional. Attachment A asks the project proponents to justify the additionality of the proposed project by showing that the project activity would not have occurred anyway due to at least one of the following barriers.

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements

[7] Section 2.4 National Action Plan for Recovery And Utilization of Landfill Gas (Revised Edition)

[8] Notification of Inspection Outcome on China National Sanitary Landfill Site, found on http://www.huanke.com.cn/08/article.asp?articleid=416, last visited on 09/12/09

would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The proposed project adopts technological barrier (option b) to demonstrate the additionality. The major factor underpinning this argumentation is the extremely low utilization rate of LFG in China.

As stated in the Guidelines for objective demonstration and assessment of barriers 9(EB 50, Annex 13), Guideline 3: In order to make an objective claim for a specific barrier, the PDD confirms the existence of the barrier by using evidence sources listed in the Tool for the demonstration and assessment of additionality1 and the Combined tool to identify the baseline scenario and demonstrate additionality,2 by demonstrating, for each of the barrier, that in similar circumstances (in similar industries/sectors, in companies of similar size and ownership structure, in similar projects) the barriers actually prevented the implementation of other project(s).

The Guideline 3 also provides an example: The existence of a technological barrier for high pressure steam technology is confirmed by showing evidence that the use of this technology in the considered sector is marginal e.g. below10%.

The China Ministry of Construction in February 2007 issued a report after the national inspection of operation status and harmless treatment level rating of landfill sites has been finished. The report said that among 372 landfill sites in 31 provinces, cities and autonomous regions in China, there are 156 landfill sites have leachate treatment system, taking up to 41.82% out of total landfill sites; 92.76% of the landfills have no LFG recovery and utilization facilities. As indicated in the report, the shortage of the public financial investment is the major reason to result in the low level of harmless treatment of sanitary landfill sites. The fact is over half of all the cities in China don't collect tipping fee, the main financial source for construction, operation and management of sanitary facilities, such as landfill site are from the incomes of public finance, which make it hard to guarantee the normal operation and constrained the development and application of new technology, new material and new technics.

The report clearly shows that the LFG utilization technology is implemented less than 10% in China. Apart from this, CDM has been seriously considered before the start date of the proposed project as can be seen in the timeline of major events during the project development listed below:

Date	Events	Supporting Documents[10]
21/09/2008	Board meeting with CDM/investment decision	Meeting Minute
16/03/2009	Environmental Impact Assessment (EIA) has been finished	EIA
02/04/2009	EIA is approved by Environmental Protection Bureau (EPB) of Henan province	EIA Approval
June 2009	Feasibility Study Report has been finished	FSR
31/07/2009	FSR is approved by Henan Development and Reform Commission	FSR Approval
07/09/2009	The construction of the proposed project started	Construction contract
23/09/2009	Stakeholder meeting was held	Records, attendance list, announcement

[9] http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid38.pdf

[10] These documents will be submitted to DOE for validation.

15/10/2009	ERPA was signed	ERPA

Conclusion

All in all, the proposed project faces a technological barrier of implementation in China and CDM has been considered seriously before the start date of the proposed project, therefore the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions

According to methodologies AMS-III.G and AMS-I.D, the baseline emissions of the proposed project activity are:

$$\mathbf{BE_{y} = BE_{CH4,y} - MD_{BL,y} + BE_{elec,y}} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year y, (tCO_2e)
$BE_{CH4,y}$	Methane emission during the year y from landfill site in the absence of the project activity, (tCO_2e)
$MD_{BL,y}$	Methane emission that would be captured and destroyed to comply with national or local safety requirement or legal regulations in the year y, (tCO_2e)
$BE_{elec,y}$	Baseline emissions due to the use of grid electricity in year y, (tCO_2e)

$$\mathbf{BE_{CH4} = MD_{project,y} * GWP_{CH4}} \quad \textbf{(2)}$$

Where:

$BE_{CH4,y}$	Methane emission during the year y from landfill site in the absence of the project activity, (tCO_2e)
$MD_{project,y}$	The amount of methane would have been destroyed at the project scenario in year y, in tonnes (t)
GWP_{CH4}	Global warming potential of CH_4 (IPCC 2006: 21t CO_2e/t CH_4)

$$\mathbf{MD_{BL,y} = MD_{project,y} * AF} \quad \textbf{(3)}$$

Where:

AF Adjustment Factor

As stated in section B.4., no methane recovery or destruction occurs in the baseline scenario, therefore AF is 0; nevertheless AF will be monitored during the whole crediting period.

In order to conduct ex-ante estimation of the methane emission during the year y from landfill site in absence of the project activity ($BE_{CH4,y}$), "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 04) is used. At the same time, as indicated by the feasibility study report, it is estimated that only 60% of the LFG generated in the landfill can be captured and collected by the proposed project activity, thus baseline emission due to CH_4 can be ex-ante estimated as:

$$\mathbf{BE_{CH_4,\, y} = BE_{CH_4,\, SWDS,\, y} * 60\%} \quad \textbf{(4)}$$

$$\mathbf{BE_{CH_4,\, SWDS,\, y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,\, x} \cdot DOC_j \cdot e^{-kj \cdot (y-x)} \cdot (1-e^{-kj})} \quad \textbf{(5)}$$

Where:

$BE_{CH4,SWDS,y}$	The total methane emission from the landfill in the absence of the proposed project activity in year y, (tCO_2e)
φ	Model correction factor to account for model uncertainties (0.9)
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 oxidised 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 can decompose
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j
j	Waste type category (index)
k_j	Decay rate for the waste type j
x	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)
y	Year for which methane emissions are calculated

$$\mathbf{BE_{elec.y} = EL_{gird,\, y} * EF_{elec,\, BL,\, y}} \quad \textbf{(6)}$$

$BE_{elec,y}$	Baseline emissions due to the use of grid electricity in year y, (tCO_2e)
$EL_{grid,y}$	Net quantity of electricity that would be exported to the grid by the proposed project, which in absence of the project activity would have been produced by power plants connected to the grid during year y , (MWh)
$EF_{elec,BL,y}$	CO_2 emission factor of the gird that the propose project connects to in year y, (tCO_2e/MWh)

In accordance with the "Tool to calculate the emission factor for an electricity system (version 01.1)", the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system (**$EF_{elec,BL,y}$**), is determined by calculating the operating margin (OM) and build margin (BM) as well as the combined margin (CM)

This PDD refers to the Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor published by the Chinese DNA on 2nd July 2009, which is publicly available at this website: http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

The 6 steps of calculating the emission factor are stated as follows. All the data quoted in the calculation process are presented in Annex 3 of the PDD.

Step 1: Identify the relevant electric power system

The Chinese DNA has published a delineation of the project electricity system and connected electricity systems, according to the "Tool to calculate the emission factor for an electricity system", these delineations should be used. The electricity is purchased from the Central China Power Grid (CCPG) in the baseline scenario of the proposed project. The spatial extension of the (CCPG) comprises all power plants that are physically connected to it, which covers Henan province, Hubei province, Hunan province, Jiangxi province, Sichuan province and Chongqing municipality.

Step 2: Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

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

Any of the four methods can be used, the simple OM method (Option (a)) can only be used if low-cost/ must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Among the total electricity generations of the Central China Power Grid which the Project is connected to, the amount of low cost/must run resources accounts for 40.83% (2003), 44.78% (2004), 38.95% (2005), 35.12% (2006) and 35.46% (2007)[11], all less than 50%. Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin for the Project.

For the simple OM, the emissions factor is selected to be calculated using either of the data vintages between any of: ex ante option or ex post. For this PDD ex ante option is selected, which is a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 3: Calculate the operating margin emission factor according to the selected method

According to the Tool to calculate the emission factor for an electricity system, the simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2e/MWh) of all power plants serving the system, not including low cost / must run power plants / units. The three following options may be used to calculate the simple OM emission factor:

- Option A:

  Based on data on fuel consumption and net electricity generation of each power plant / unit

- Option B:

[11] China Electric Power Yearbook, 2004-2008

Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit

- Option C:

  Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system

According to the "Tool to calculate the emission factor for an electricity system" (version01.1), Option A should be preferred and must be used if fuel consumption data is available for each power plant / unit. However, due to the necessary data, including the fuel consumption and net electricity generation of each power plant, is not available in China, Option C is adopted. Accordingly only nuclear and renewable power generation are considered as low-cost/must-run power sources and data of the quantity of electricity supplied to the grid by these sources should be available for the calculation.

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

$$EF_{grid,OM,simple,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_y} \quad \textbf{(6.1)}$$

Where:

$EF_{grid,OM,simple,y}$	simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	the amount of fuel i (in a mass or volume unit) consumed by project electricity system in year(s) y
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	all fossil fuel types combusted in power sources in the project electricity system in year y
y	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option), following the guidance on data vintage in *step 2*

The simple OM is calculated with reference to the *Notification on Determining Baseline Emission Factor of China's Grid*[12] issued by the Chinese DNA.

Step 4: Identify the cohort of power units to be included in the build margin (BM)

The sample group of power units *m* used to calculate the build margin consists of either:

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

[12] Available at http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

In China, it is not possible to obtain the public data for non plant specific generation data. Taking notice of such situation, the Executive Board accepts the following deviation in methodology application:

1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity;
2) Use of weights estimated using installed capacity in place of annual electricity generation.

In terms of vintage of data, Option 1 described as following is chosen:

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

Step 5: Calculate the build margin emission factor

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

$$EM_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(6.2)}$$

Where:

$EM_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which power units included in the build margin

In accordance with the "Tool to calculate the emission factor for an electricity system", the CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance of options B1, B2 or B3 under Step 3(a) *Simple OM* , using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

On account of data availability, the following adapted calculation has been approved by the CDM EB. Using this modified method, newly-built capacity is weighted by the composition of power generation technologies, and then emission factors are calculated using the efficiencies of the best available technologies.

Because capacities of technologies using coal, oil and gas can't be separated from the total thermal power generation from available statistics, the following method is used for the calculation: First, use recent one year available energy balance data and calculate percentages of CO_2 emissions of power generation using solid, liquid and gas fuel in the total CO_2 emission. Second, calculate grid thermal power emission factor, using the percentages (as weights) and emission factors of technologies corresponding to best available

efficiencies. Lastly, the thermal power emission factor is multiplied by the percentage of thermal power in the newest 20% capacity in the grid, and the result is the Build Margin (BM) emission factor of the grid.

The equations are as follows:

1. Calculate percentage of CO_2 emission of power generation using solid, liquid and gas fuel in the total CO_2 emission..

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \textbf{(6.3)}$$

$$\lambda_{Coal,y} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \textbf{(6.4)}$$

$$\lambda_{Coal,y} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \textbf{(6.5)}$$

Where:

$F_{i,j,y}$	the fuel *i* consumed by the province *j* in the year y (in a mass or volume unit)
$EF_{CO2,i,j,y}$	the CO_2 emission coefficient (tCO_2e /MJ) of fuel *i*,
$NCV_{i,y}$	net calorific value of fuel i in year y (MJ/ a mass or volume unit）
	The feet *Coal, Oil* and *Gas* is for solid fuels, liquid fuels and gas fuels.

2. Calculate grid thermal power emission factor

$$EF_{Thermal} = \lambda_{Coal} \cdot EF_{Coal,Adv} + \lambda_{Oil} \cdot EF_{Oil,Adv} + \lambda_{Gas} \cdot EF_{Gas,Adv} \quad \textbf{(6.6)}$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, and $EF_{Gas,Adv}$ are emission factors corresponding to commercially optimal efficient power generation technology using coal, oil and gas.

3. Calculate BM emission factor

$$EF_{grid,BM,y} = \frac{CAP_{thermal,y}}{CAP_{total,y}} \times EF_{thermal,y} \quad \textbf{(6.7)}$$

Where:

$CAP_{thermal,y}$	the newly built thermal capacity at year *y*.
$CAP_{total,y}$	total newly built capacity at year *y*.

The build margin emissions factor ($EF_{grid,BM,y}$) is calculated with reference to the *Notification on Determining Baseline Emission Factor of China's Grid* issued by Chinese DNA[13]

Step 6: Calculate the combined margin (CM) emissions factor

The baseline emission factor is the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$):

$$EF_{grid,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y} \quad \textbf{(6.8)}$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

Where the weight w_{OM} and w_{BM} by default, are 50% for the first crediting period.

According to the emission factor value provided by Chinese DNA:

	$EF_{OM}(tCO_2/MWh)$	$EF_{BM}(tCO_2/MWh)$	$EF_{grid,y}$
CCPG	1.1255	0.5802	0.8529

Project Emission

In line with AMS-III.G, project activity emissions consist of CO_2 emissions related to the power used by the project activity facilities. Emission factors for electricity shall be calculated as described in category I.D.

$$PE_y = PE_{elec,y} + PE_{flare,y} \quad \textbf{(7)}$$

The electricity for on-sites equipments will be provided by the proposed project itself, in case all the engines stopped running, the electricity for must-using on-site equipments will be supplemented from CCPG. Meters which can measure both on-grid and off-grid electricity from CCPG is subject to install to monitor the electricity consumed by the on-site equipments and exported to CCPG, the data will be used for determine the net amount of electricity sent to the CCPG.

$$PE_y = EL_{onsite,y} * EF_{grid,y} \quad \textbf{(8)}$$

Where:

PE_y	Project emissions in the year y (tCO_2e)
$EL_{onsite,y}$	Quantity of electricity consumed by the project activity during the year y (MWh)
$EF_{grid,y}$	The emission factor of CCPG in year y (tCO_2e/MWh)

Since only the net amount of electricity exported to the CCPG would count for the source of baseline

[13] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

emission, project emissions of the proposed project due to the electricity consumption during the crediting period is 0.

Meanwhile, the proposed project plan to install flare only when the collected LFG amount exceeds the gas consumption capacity by 2MW engines in the future. Once the flare is installed, the project emission from the flare will be included in the monitoring report and calculated according to "Tool to determine project emissions from flaring gases containing methane[14]".

Project emissions from flaring of the residual gas stream are calculated based on the flare efficiency and the mass flow rate of methane in the residual gas stream that is flared. The proposed project will adopt default value for flare efficiency, that is 90%[15], to calculate the project emissions from flare, and compliance of manufacturer's specification of flare will be continuously monitored.

If there is no record of the temperature of the exhaust gas of the flare or if the record temperature is less than 500 ℃ for any particular hour, it shall be assumed that during that hour the flare efficiency is zero.

The following steps will be applied to calculate project emissions from flaring (**$PE_{flare,y}$**):

➢ ***Determination of methane mass flow rate in the residual gas on a dry basis***

$$\mathbf{TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n}} \quad \mathbf{(9.1)}$$

Where:

$TM_{RG,h}$	Mass flow rate of methane in the residual gas in hour *h* (kg/h)
$FV_{RG,h}$	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
$\rho_{CH4,n}$	Density of methane at normal conditions (0.716 kg/m^3)

It is necessary to refer both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) to the same reference condition that may be dry or wet basis. If the residual gas moisture is significant (temperature greater than 60 ℃), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis(i.e. water is removed before sample analysis).

➢ ***Determine of the hourly flare efficiency***

Since the proposed project will adopt enclosed flare and the default value for its efficiency, the flare efficiency in the hour *h* (η_{flare}) is:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C 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 °C 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 °C 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*.

[14] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf

[15] According to the Tool to determine project emissions from flaring gases containing methane

➢ ***Calculation of annual project emissions from flare***

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH_4}}{1000} \qquad (9.2)$$

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

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

η_{flare} Flare efficiency in hour *h*

GWP Global warming potential of methane valid for the commitment period (tCO_2e/tCH_4)

In the project design stage, the project emission from flare is assumed to be 0 for simplification.

Leakage

As stated in AMS-III.G, if the methane recovery technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered. Since the equipments for methane recovery is brand new and there is no plan to transfer the existing equipment to another activity for the proposed project, no leakage effects will be accounted. Nevertheless whether the existing equipment would be transferred to another activity will be monitored during the whole crediting period.

Emission Reductions

$$ER_y = BE_y - PE_y - Leakage \qquad (10)$$

ER_y Emission reduction in year y (tCO_2e)

BE_y Baseline emission in year y(tCO_2e)

PE_y Project emission in year y(tCO_2e)

Leakage Leakage in year y(tCO_2e)

As illustrated above, at the project design stage the PE_y=0 and Leakage=0

Thus: $\mathbf{ER_y = BE_y}$

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

Data / Parameter:	$\mathbf{W_{j,x}}$
Data unit:	tonne
Description:	Quantity of MSW tipped during 2004 to 2018
Source of data used:	FSR
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	All the data are listed at FSR
Any comment:	

Data / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid disposal site (version 04)
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.

Data / Parameter:	**OX**
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Luohe city landfill has regular soil cover, according to the "Tool to determine methane emissions avoided from disposal of waste at a solid disposal site (version 04)" Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost.
Any comment:	

Data / Parameter:	$\mathbf{DOC_f}$

Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
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 :	The project will choose the default value 0.5 from IPCC 2006 for DOC_f
Any comment:	

Data / 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 :	
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	21 for the first commitment period and will be updated according to any future COP/MOP decisions.
Any comment:	

Data / 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	Luohe landfill is an anaerobic managed solid waste disposal site with controlled placement of waste and covered with soil with each layer. According to the tool, the 1.0 value for MCF is chosen.

measurement methods and procedures actually applied :	
Any comment:	

Data / 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 (adapted from Volume 5, Tables 2.4 and 2.5
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	The total amount and the fraction of the waste are based on wet waste, so DOC_j (% wet waste) is chosen.
Any comment:	

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

Data / Parameter:	**k_j**
Data unit:	-
Description:	Decay rate for the waste type *j*
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value applied:	see table below

Waste type j		**Boral and Temperate (MAT< 20 ℃)**
		Wet (MAP/PET<1)
Slowly degrading	Pulp, paper cardboard (Other than sludge), textiles	0.04
	Wood, wood products and straw	0.02
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05
Rapidly degrading	Food, food waste, sewage sludge, beverages and	0.06

	tobacco
Justification of the choice of data or description of measurement methods and procedures actually applied :	MAP/PET <1, MAT<20 °C Since the climate data for Luohe landfill area are: Mean annual temperature (MAT): 14.6 °C Mean annual precipitation (MAP): 749.2～845.2 mm Potential evapotranspiration (PET): 900-1100 mm
Any comment:	

Data / Parameter:	**Efficiency of the collection system**
Data unit:	%
Description:	
Source of data used:	FSR
Value applied:	60
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is assumed that average 60% of the LFG can be collected by the collection system in FSR based on the expert's opinion and other landfill sites' experience.
Any comment:	

Data / Parameter:	**D_{CH4}**
Data unit:	tCH_4/m^3CH_4; kg/m^3
Description:	Methane density
Source of data used:	Tool to determine project emissions from flaring gases containing methane
Value applied:	0.0007168/0.716
Justification of the choice of data or description of measurement methods and procedures actually applied :	At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4
Any comment:	

Data / Parameter:	**$FC_{i,j,y}$**
Data unit:	t/m^3, t/t
Description:	the amount of fuel *i* (in a mass or volume unit) consumed by project electricity system in year *y*
Source of data used:	China Energy Statistic Yearbook (2006-2008)
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually	The detailed data of fuels consumed by power plant are unavailable publicly, so the aggregated data by fuel types are used instead.

applied :	
Any comment:	

Data / Parameter:	**NCV_i**
Data unit:	MJ/t, MJ/km^3
Description:	Net calorific value per mass or volume unit of a fuel *i*
Source of data used:	China Energy Statistic Yearbook (2006-2008)
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data come from an official statistic.
Any comment:	

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are based on IPCC default value because the national specific value is unavailable.
Any comment:	

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y*
Source of data used:	China Electric Power Yearbook (2006-2008)
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data come from an official statistic
Any comment:	

Data / Parameter:	**$F_{i,j,y}$**
Data unit:	t/m^3, t/t
Description:	the fuel *i* consumed by the province *j* in the year *y* (in a mass or volume unit)
Source of data used:	China Energy Statistic Yearbook (2006-2008)
Value applied:	Please refer to Annex 3

Justification of the choice of data or description of measurement methods and procedures actually applied :	The data come from the official statistic
Any comment:	

Data / Parameter:	***$GEN_{j,y}$***
Data unit:	MWh
Description:	The amount of electricity supplied by CCPG from year 2005 to 2007
Source of data used:	China Energy Statistic Yearbook (2006-2008)
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data come from the official statistic
Any comment:	

Data / Parameter:	***$GEN_{imported,y}$***
Data unit:	MWh
Description:	The amount of electricity imported from Northwest Power Grid to CCPG from year 2005 to 2007
Source of data used:	China Energy Statistic Yearbook (2006-2008)
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data come from the official statistic
Any comment:	

Data / Parameter:	$GENE_{best,coal}$
Data unit:	%
Description:	Efficiency of most advanced coal-fired power technology that is commercially available
Source of data used:	Notice on the Determination of Emission Factors of Regional Power Grids by Chinese CDM DNA
Value applied:	38.10%
Justification of the choice of data or description of measurement methods and procedures actually applied :	National Default Value

Any comment:	

Data / Parameter:	*$GENE_{best,oil/gas}$*
Data unit:	
Description:	%
Source of data used:	Efficiency of the most advanced oil-fired/gas-fired power technology that is commercially available
Value applied:	Notice on the Determination of Emission Factors of Regional Power Grids by Chinese CDM DNA
Justification of the choice of data or description of measurement methods and procedures actually applied :	49.99%
Any comment:	National Default Value

Data / Parameter:	**Internal power consumption rate of power plant**
Data unit:	%
Description:	The internal power consumption rate of power plant in each province connected to CCPG from year 2005 to 2007
Source of data used:	China Energy Statistic Yearbook (2006-2008)
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data come from the official statistic
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Based on the formulas stated in the B.6.2., the emission reductions from the project are calculated as follows:

$$\mathbf{BE_{CH_4,\,y} = BE_{CH_4,\,SWDS,\,y} * 60\%} \qquad (1)$$

$$\mathbf{BE_{CH_4,\,SWDS,\,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,\,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1-e^{-k_j})} \qquad (2)$$

Where:

Parameter	Description	Value
$BE_{CH4,SWDS,y}$	The total methane emission from the landfill in the absence of the proposed project activity in year y, (tCO_2e)	
φ	Model correction factor to account for model uncertainties	0.9
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	0

OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)	0.1
F	Fraction of methane in the SWDS gas (volume fraction)	0.5
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose	0.5
MCF	Methane correction factor	1.0
$W_{j,x}$	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)	See Annex 3
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j	See section B.6.2
j	Waste type category (index)	
k_j	Decay rate for the waste type j	See section B.6.2
x	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)	
y	Year for which methane emissions are calculated	

Baseline emission due to the released methane in the atmosphere:

	$BE_{CH4,SWDS,y}$ (tCO_2e)	**Collection rate (60%)**	**$BE_{CH4,y}$ (tCO_2e)**
	A	**B**	**C=A*B**
01/05/2010-31/12/2010	20,398	0.6	12,239
2011	34,941	0.6	20,964
2012	39,304	0.6	23,582
2013	43,696	0.6	26,218
2014	48,127	0.6	28,876
2015	52,605	0.6	31,563
2016	57,135	0.6	34,281
2017	61,730	0.6	37,038
2018	66,396	0.6	39,837
2019	63,116	0.6	37,870
01/01/2020-30/04/2020	20,002	0.6	12,001

$$EL_{grid} = (EL_{LFG} - EL_{onsite})$$

$$= (1\text{-}10\%)*CA_{install}*h \quad (3)$$

$$= (1\text{-} 10\%)*2MW*6{,}500h = 11{,}700\ MWh$$

$$\mathbf{BE_{elec} = EF_{grid,y} * EL_{grid}} \quad \mathbf{(4)}$$

$= 0.8529\ tCO_2e/MWh*11,700\ MWh=9,978\ tCO_2e$

Baseline emission due to the electricity replacement:

	Net electricity supply to the CCPG (EL_{LFG}) (MWh)	**$EF_{grid,y}$ (tCO_2e/MWh)**	**BE_{elec} (tCO_2e)**
	A	**B**	**C=A*B**
01/05/2010-31/12/2010	7,799	0.8529	6,652
2011	11,700	0.8529	9,978
2012	11,700	0.8529	9,978
2013	11,700	0.8529	9,978
2014	11,700	0.8529	9,978
2015	11,700	0.8529	9,978
2016	11,700	0.8529	9,978
2017	11,700	0.8529	9,978
2018	11,700	0.8529	9,978
2019	11,700	0.8529	9,978
01/01/2020-30/04/2020	3,901	0.8529	3,326

Please note that the engine capacity will change according to the LFG amount that will be collected by the proposed project during the implementation. The above estimation assumes that the engine capacity is 2 MW during the whole crediting period, which is the maximum capacity according to the Feasibility Study of the proposed project, and the electricity consumed by all the on-site equipment accounts for 10 % of the total amount electricity produced by the proposed project. The real engine capacity and the emission reduction from the electricity replacement will be monitored and calculated based on the reality once the proposed project is registered.

$$\mathbf{BE = BE_{CH_4} + BE_{elec}} \quad \mathbf{(5)}$$

$$\mathbf{ER_y = BE_y - PE_y - Leakage} \quad \mathbf{(6)}$$

ER_y	Emission reduction in year y (tCO_2e)
BE_y	Baseline emission in year y (tCO_2e)
PE_y	Project emission in year y (tCO_2e)
$Leakage_y$	Leakage in year y (tCO_2e)

At the project design stage the PE_y=0 and $Leakage_y$=0; $\mathbf{ER_y = BE_y}$

The emission reduction:

	BE_{CH4} (tCO_2e)	BE_{elec} (tCO_2e)	ER=BE (tCO_2e)
	A	B	C=A+B
01/05/2010-31/12/2010	12,239	6,652	18,891
2011	20,964	9,978	30,943
2012	23,582	9,978	33,561
2013	26,218	9,978	36,196
2014	28,876	9,978	38,854
2015	31,563	9,978	41,541
2016	34,281	9,978	44,260
2017	37,038	9,978	47,016
2018	39,837	9,978	49,816
2019	37,870	9,978	47,848
01/01/2020-30/04/2020	12,001	3,326	15,327
Total	304,469	99,783	404,253
Average	30,447	9,978	40,425

For detailed calculation please refer to the Excel file of the emission reduction.

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

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
01/05/2010-31/12/2010	0	18,891	0	18,891
2011	0	30,943	0	30,943
2012	0	33,561	0	33,561
2013	0	36,196	0	36,196
2014	0	38,854	0	38,854
2015	0	41,541	0	41,541
2016	0	44,260	0	44,260
2017	0	47,016	0	47,016

2018	0	49,816	0	49,816
2019	0	47,848	0	47,848
01/01/2020-30/04/2020	0	15,327	0	15,327
Total (tonnes of CO_2e)	**0**	**404,253**	**0**	**404,253**

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

B.7.1 Data and parameters monitored:

Parameter:	**LFG$_{total,y}$**
Data unit:	m^3/y
Description:	Total amount of landfill gas captured at Normal Temperature and Pressure
Source of data to be used:	Records of flow meter from project participants
Value of data	Not Applied. As the ex-ante estimation, the amount of methane that will be captured was calculated by the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 04), which provides the directly ex-ante estimation for methane amount.
Description of measurement methods and procedures to be applied:	Measured by a continuous flow meter and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**LFG$_{engines,y}$**
Data unit:	m^3/y
Description:	Amount of landfill gas combusted in engines at Normal Temperature and pressure
Source of data to be used:	Records of flow meter from project participants
Value of data	Not Applied. As the ex-ante estimation, the amount of methane that will be destroyed/combusted was calculated by the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 04), which provides the directly ex-ante estimation for methane amount.
Description of measurement methods and procedures to be	Measured by a continuous flow meter and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.

applied:	
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**$W_{CH4,y}$**
Data unit:	%
Description:	Methane fraction in the landfill gas
Source of data to be used:	Records of gas quality analyser from project participants
Value of data	"50%" is used for ex-ante estimation of emission reduction at section B.5.
Description of measurement methods and procedures to be applied:	Measured by a continuous gas quality analyser and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	The gas quality analyser will be subject to a regular maintenance, testing regime and calibration in accordance with the manufacturer's specifications to ensure measurement accuracy.
Any comment:	

Parameter:	**T**
Data unit:	℃
Description:	Temperature of the landfill gas
Source of data to be used:	N/A
Value of data	Not Applied. As the ex-ante estimation, the amount of methane that will be destroyed /combusted was calculated by the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 04).
Description of measurement methods and procedures to be applied:	The flow meters installed will automatically measure temperature and pressure, expressing landfill gas volumes in normalized cubic meters. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	The flow meters will be subject to a regular maintenance and testing regime, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the landfill gas
Source of data to be used:	Records of flow meter from project participants
Value of data	Not Applied. As the ex-ante estimation, the amount of methane that will be destroyed /combusted was calculated by the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 04).

Description of measurement methods and procedures to be applied:	The flow meters installed will automatically measure temperature and pressure, expressing landfill gas volumes in normalized cubic meters. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	The flow meters will be subject to a regular maintenance and testing regime, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**$EL_{LFG,y}$**
Data unit:	MWh
Description:	Total amount of electricity produced by all the engines of the proposed project in year *y*
Source of data to be used:	Records of electricity meter from project participants
Value of data	"13,000" is used for ex-ante estimation of emission reduction at section B.6.
Description of measurement methods and procedures to be applied:	Measured by continuous electricity meter and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Flow meter will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**$EL_{onsite,y}$**
Data unit:	MWh
Description:	The amount of electricity consumed by the project activity in year *y*
Source of data to be used:	Records of electricity meter from project participants
Value of data	10% of the total amount of electricity produced by the proposed project is used for ex-ante estimation of emission reduction.
Description of measurement methods and procedures to be applied:	Measured by continuous electricity meter and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**$EL_{grid,y}$**
Data unit:	MWh
Description:	Net amount of electricity exported to CCPG by the proposed project in year *y*
Source of data to be used:	Records of electricity meter from project participants
Value of data	11,700 MWh/a is used for ex-ante estimation of emission reduction at section B.6.

Description of measurement methods and procedures to be applied:	Measured by continuous electricity meter and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after. The monthly or/and yearly data could be cross-checked by electricity sales receipt.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	

Parameter:	**Operation hours of the generators**
Data unit:	Hours
Description:	Operation hours of the generators in year *y*
Source of data to be used:	Record from project participants
Value of data	"6,500" is used for ex-ante estimation of emission reduction at section B.6.
Description of measurement methods and procedures to be applied:	The data are measured and archived electronically and recorded annually. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	
Any comment:	The parameter is monitored to ensure methane destruction is only claimed when generators are operating.

Parameter:	$\mathbf{LFG}_{flare,y}$
Data unit:	m^3/y
Description:	Amount of landfill gas destructed in flare at Normal Temperature and pressure
Source of data to be used:	Records of flow meter from project participants
Value of data	Not Applied. As the ex-ante estimation, there is no landfill gas will be destructed in the flare
Description of measurement methods and procedures to be applied:	Measured by a continuous flow meter and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Flow meter will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	The proposed project will install flare only when the amount of the collected landfill gas exceeds gas consumption capacity of 4*500 kw engines, but a flow meters to monitor the gas amount that is beyond to combusted in the engines will be set up at the very beginning of the proposed project, please refer to section B.7.2 for detailed explanation.

Parameter:	$\mathbf{FV}_{RG,h}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal condition in the hour *h*

Source of data to be used:	Measurements by project participants using a flow meter
Value of data	Not Applied. As the ex-ante estimation, there is no landfill gas will be destructed in the flare
Description of measurement methods and procedures to be applied:	Measured by a continuous flow meter, values to be averaged hourly or at a shorter time interval and the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Flow meter will be subject to a regular maintenance, testing regime and calibration, in accordance with the manufacturer's specifications, to ensure measurement accuracy.
Any comment:	The parameter is 0 before the installation of the flare, once flare is installed, it will be monitored continuously.

Parameter:	$\mathbf{fv}_{i,h}$
Data unit:	-
Description:	Volumetric fraction of methane in the residual gas in the hour *h*
Source of data to be used:	Measurements of continuous gas analyser from project participants
Value of data	Not Applied. As the ex-ante estimation, there is no landfill gas will be destructed in the flare
Description of measurement methods and procedures to be applied:	The data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Analyser will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard gas sample.
Any comment:	The parameter is 0 before the installation of the flare, once flare is installed, it will be monitored continuously.

Parameter:	$\mathbf{T}_{flare}$
Data unit:	℃
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Measurement from project participants
Value of data	Not Applied. As the ex-ante estimation, no landfill gas will be destructed in the flare
Description of measurement methods and procedures to be applied:	Measure the temperature of the exhaust gas stream in the flare by a type N thermocouple. And the data will be aggregated monthly and yearly. Archived data will be kept during the crediting period and two years after.
QA/QC procedures to be applied:	Thermocouple should be replaced or calibrated every year
Any comment:	The parameter is 0 before the installation of the flare, once flare is installed, it will be monitored continuously.

B.7.2 Description of the monitoring plan:

The monitoring plan is drawn up based on the methodologies AMS-III.G (version 06) and AMS-I.D (Version 15) providing the methods to measure and record all the variables and factors needed for ex-post assessment of emission reductions achieved by the proposed project.

The following parameters are subject to continuous measurement in the monitoring plan:

- Quantity of methane actually captured ($MD_{proejct,\ y}$)
- Quantity of methane used to generate electricity ($MD_{elec,y}$)
- Quantity of electricity consumed by the project activity
- Quantity of electricity exported to the CCPG

Once the LFG amount exceeds the gas consumption capacity of maximum number of engines, yet is still not enough to add another engine, the project owner plans to install a flare to destroy the abundant methane. In this case the quantity of flared methane as well as the flare efficiency will also be continuously monitored, according to the procedures described in the methodological "Tool to determine project emissions from flaring gases containing methane".

Shanghai BCCY New Power Industry Co., Ltd as the project owner will conduct the monitoring procedures and will be responsible for data recording and archiving.

Meters and Data

The meters will be installed at the locations indicated at ***Figure 4***, the corresponding data will be collected and documented.

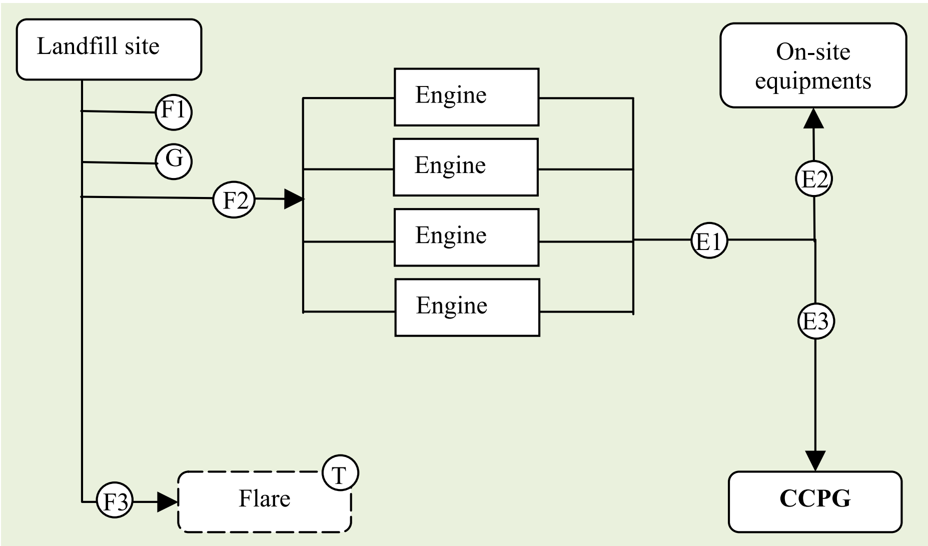

Figure 3: Chart of the monitoring meters

Legend:

F1	Flow meter to continuously measure the flow of total collected LFG, which can automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
F2	Flow meter to continuously measure the flow of LFG fed into the engines, which can automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
F3	Flow meter to continuously measure the flow of LFG fed into flare once it got installed, which can automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.

E1	Electricity meter to continuously measure the electricity produced by all the engines.
E2	Electricity meter to continuously measure the electricity consumed by all the on-site equipments.
E3	Electricity meter to continuously measure the electricity exported to the CCPG. Both on-grid and off-gird electricity data could be measured by the meter.
G	Gas analyzer to continuously measure methane fraction in collected LFG after pre-treatment.
T	Thermocouple to measure temperature in the exhaust gas of the flare

Monitoring Management

General Manager: He/she is in charge of and manages the issues related to CDM project monitoring.

CDM Manager: He/she will be responsible for meter calibration, checking the daily operation, and archiving emergency situation reports. He/she will report monthly to the General Manager (GM) of the project developer about the project performance and monitored data. In case non-conformances are identified, in terms of performance during the production and/or problems in the performance of the monitoring equipments (e.g. flow meters are not working, data are not correct, etc), the CDM manager will inform the GM about the irregular situation and the measures that will be taken to fix the problems.

The CDM manager will also be responsible for aggregating the monitoring data monthly and annually and for archiving and keeping it during the crediting period and tow year after.

Operators: Operators will take turns to work in the control room 24 hours a day. They will take charge of data supervision, filling in operation report forms as well as checking and inspecting the control system.

Training

A training plan will be carried out for all employees involved in the proposed CDM project, which aims to provide both the basic CDM knowledge in terms of monitoring and know-how on operating the monitoring equipments.

Quality Control and Quality Assurance procedures

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

- Provide routine and consistent checks to ensure data integrity, correctness and completeness;
- Identify and address errors and omissions;
- Document and archive inventory material and record all QC activities.

Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Reviews, preferably conducted by independent third parties, should be performed upon a finalised inventory following the implementation of QC procedures. Reviews verify that data quality objectives were met, ensure that the inventory represents the best possible estimation of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the QC programme.

The QC and QA measures which will be adopted by the proposed project include:

Data recording: Daily readings of all field meters will be documented in electronic worksheets. In addition, all data collected will be recorded in electronic files which are regularly backed up.

Periodic control of the LFG field monitoring records will be carried out to check any deviations from the estimated ERs and to evaluate the project performance. Any divergence will be investigated and dealt by the GM and recorded for future reference.

Equipment calibration and maintenance: Flow meters, gas analyzers, other critical CDM project equipments will be subject to regular maintenance and testing according to technical specifications from the manufactures to ensure accuracy and good performance. Equipment calibration will be conducted periodically according to their technical specifications.

Corrective actions: The QC/QA procedures include the handling and correction of nonconformities in the implementation of the project or the monitoring plan. In case such nonconformities are observed:

- An analysis of the nonconformity and its causes shall be conducted immediately by the CDM manager.
- The corrective action plan should be developed and followed actions should be implemented to eliminate the nonconformity.
- The result of the actions should be reported to the CDM Manager as well as the GM.
- Relative information will be included in the monitoring report and reported to DOE during the verification.

Emergency procedures for unintended emissions: In case of equipment malfunction or breakdown, corrective actions will be carried out to minimize the unintended emissions.

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

Completion date of the baseline and monitoring study and their applications: 03 Nov. 2009

Name of the responsible company and person:

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Oasis Science and Technology Development Beijing Co., Ltd is not 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:

07/09/2009 when the construction contract was signed

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

15 years 0 months

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

C.2.1. Renewable crediting period

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/05/2010 or the day after registration, whichever is later

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The environmental impact assessment (EIA) of the proposed project was done by Henan Zhengda environmental science and technology engineering consulting Co., Ltd. and was approved by the Environmental Protection Bureau of Henan province in April 2009. The expected environmental impacts are summarized below:

Environmental impacts during the construction period

1. Wastewater

   Wastewater during the construction period will mainly comprise sewage produced by civil workers. This wastewater will be treated in a septic-tank first then send to other local treatment facilities for further treatment.

2. Dust pollution

   The dust is mainly from earthwork during the construction. Measures like frequently watering on transportation road and construction site, covering earthwork with canvas when there is heavy wind and covering raw material transport vehicles with canvas will be implemented to reduce the dust pollution.

3. Noise

   Noise sources are from noisy construction equipments such as excavator, bulldozer and shovel loader, their acoustic sound source level is 80～95dB(A). To follow the national standard of "Noise Limits at Construction Site Boundary" (GB12523-90), the proposed project will try to use low sound level equipments as much as possible and limit the speed of the vehicles. The construction period of the proposed project is short, so the noise during the period will not have significant impact on the neighbourhood.

4. Solid waste

   Construction debris includes broken bricks, foundation soil, concrete and so on. Construction solid waste will be recycled and sorted to future treatment. The domestic solid waste produced by the civil workers will be disposed in the Luohe municipal solid waste landfill site.

Expected environmental impacts during operation

1. Air quality

   The proposed project used LFG to produce electricity at Luohe municipal solid waste landfill site, through which uncontrolled LFG release is avoided. It reduces the emission of methane, one of the greenhouse gases as a major constituent of LFG and would benefit the local air quality in this regard.

2. Wastewater

   During operation, wastewater consist condensed water from the LFG collection system, sewage produced by employee and wastewater from circulating cooling systems of pre-treatment equipment and engines. The condensed water and sewage will be sent to Luohe municipal wastewater treatment plant by tank car, and it will be treated in the landfill site's own wastewater treatment plant, once it got built. The wastewater from cooling system will be recovered and used for watering trees, washing cars, etc.

3. Noise

   Noise sources are from noisy equipments such as Roots blower, cooling tower, generators etc., their acoustic sound source level is 75～95dB (A). Since the equipments that will be installed are on low sound level and together with the measures of sound insulation and shock absorption, the proposed project could meet the category II of national standard of "Emission standard for industrial enterprises noise at boundary" (GB12348-2008).

4. Solid waste

   Solid wastes mainly include particulate matter from the filter system, spent desulfurizer as well as domestic waste from office workers. The proposed project is located inside of the Luohe municipal solid waste landfill site area, so the solid waste generated by the project activity would be treated in the landfill directly.

All in all, as stated in the EIA, the proposed project won't have serious negative impact on the local environment.

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

As discussed in above section, the environmental impacts of the proposed project are not considered significant by the authorities of the host party country. Recovery and utilization of the landfill gas for electricity production is an approach to reduce greenhouse emission and to provide clean energy as well.

SECTION E. Stakeholders' comments

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

At 12th, September 2009, the project owner placed the notice of holding stakeholder consulting meeting on Luohe Daily, in order to invite and collect local stakeholder comments. The stakeholder consulting meeting was held at the conference room of Luohe Sanitation Department at 23rd, September 2009. The 20 questionnaires with brief introduction on the project were filled during and after the meeting by the farmers nearby. The questions and the analysis of the questionnaires are listed in section E.2.

The main topics of the stakeholder consulting meeting were as listed below:

1. Mr. Huang, Secretary of Luohe Sanitation Department, gave the speech on the general situation and backgrounds of the proposed project.
2. Mr. Xu, Project Manager with Shanghai BCCY New Power Industry Co., Ltd, gave an introduction on the technical design and potential environmental impacts of the proposed project.
3. Ms. Shen, CDM Project Manager with OASIS, gave an introduction on clean development mechanism.
4. Free discussion among the attendees and fill-in of the questionnaires.

E.2. Summary of the comments received:

The survey covered people of varying ages and educational background, who live within 5 km of the project site. The results can reflect the general opinions or objections towards the proposed project by the local farmers who would be possibly affected by it.

The questionnaires focused on the following issues:

1. Whether the stakeholders know the proposed project;
2. Whether the stakeholders have concerns about the proposed project on any aspects such as socially and/or environmentally;
3. Whether the stakeholders have any questions on CDM issue;
4. Whether the stakeholders have any ideas and suggestions to improve the proposed project.

The feedback from the questionnaire survey is summarised in the following table:

Table 5 Summary of questionnaire results

Questions	Options	Votes	Questions	Options	Votes
Age	20-29	7	**Education**	Primary school	3
	30-39	6		Junior high	4
	40-49	6		Senior high	11

	above 50	1		above senior high	2
Occupation	Farmer	18	**The distance between the project site and where you live**	within 2 km	8
	Others	2		between 2 to 5 km	10
				beyond 5 km	
1. What do you think about your surrounding environment?	A. Good	8	**2. Is the electricity off frequently in your house?**	A. Often	
	B. Bad			B. Occasionally	19
	C. Acceptable	12		C. Never	1
3. Do you expect a landfill-gas-to-power plant could be built nearby your house?	A. Yes	18	**4. Do you have any information that a landfill-gas-to-power plant would be built nearby the place you live?**	A. Yes, I know this very well	2
	B. No			B. Yes, I Know a little	16
	C. Doesn't matter	2		C. Never heard of that	2
5. What are the possible positive impacts that you think the project could bring after its construction? (multiple choice)	A. Reduce the air pollution	20	**6. What are the possible negative impacts that you think the project could bring after its construction? (multiple choice)**	A. Noises	4
	B. Reduce the situation of off-electricity	17		B. Land occupation	10
	C. Create more job opportunities	15		C. Disturb the TV or/and cell-phone signals	
	D. Reduce the incomes			D. Destroy natural environment	
	E. Benefit the local tourism	7		E. Discharge more amount of wastewater during the construction period of the plant	5
	F. Reduce the electricity fee	9		F. Domestic waste due to the employees during the operation of the plant	3
	G. Increase the incomes	9		G. Others	
	H. Others				
7. What's your idea towards the project?	A. The advantages outweigh the disadvantages	20	**8. Do you support the project?**	A. Yes, strongly	5
	B. The disadvantages outweigh the advantages			B. Yes	15
	C. I don't know			C. No	
				D. No, I object it strongly	
				E. Doesn't matter to me	

9. What are the measures you think could reduce the above negative impacts brought by the project?

1) Please pay attention to the environment during the construction period

2) Improve the equipments of the plant

3) Construct the project abiding by the regulations

4) Install the sound-proof equipments to reduce noises

10. Do you have any other opinions and ideas on the project?

1) Hopefully the project could create more job opportunities for the villagers

2) Hopefully the project wouldn't bring bad impacts on our lives

3) Reduce the pollution

Summary according to the above table:

- 16 respondents out of 20 claimed that they know a little about the project;
- In terms of the possible positive impacts that could be supplied by the proposed project with multiply choices, all 20 respondents think it could reduce the air pollution, 17 reckon a reduction of electricity shut-offs which happen sometimes in the village is feasible, 15 think the project activity aids creating more job opportunities and 9 voted for both reducing electricity fee and increasing the incomes.
- As to the possible negative impacts that could be brought by the proposed project with multiply choices, 10 respondents out of 20 vote for land occupation, 5 for discharging more amount of wastewater during the construction period, 4 have concerns on noise and 3 on daily pollution due to the employees during the project operation.
- All 20 respondents think the advantages of implementing the proposed project outweigh its disadvantages and support the establishment of the proposed project.

By means of holding the public stakeholder consulting meeting and handing out questionnaires, the relevant stakeholders had the better understanding on ideas of the proposed project and CDM.

During the stakeholder consulting meeting, participants expressed their idea openly and freely on the proposed project. By the survey's results the conclusion can be made that the majority of related stakeholders have a positive attitude towards the project, with the expectation that it could improve the local environment and bring social benefit to the local community.

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

The opinions collected from the stakeholders will be seriously considered by the project participants, as illustrated in the section D.1. The questions from the stakeholders are answered as below:

As concerns the issues raised in the questionnaires:

- As to the noise issue, sound insulation and shock absorption measures will be introduced to reduce noise and vibration for the proposed project;
- As to land occupation, the cooperation agreement of Luohe landfill gas comprehensive utilization signed between the project owner and Luohe Environmental Sanitation Management Office (LESMO) who is in charge of landfill management, states that LESMO will provide land for the future power plant inside the landfill area. So the proposed project will have sufficient land and there will be no need to acquire additional farmland.
- As to waste water, during the operation, wastewater of the proposed project consists of condensed water from the LFG collection system, sewage produced by the employees and wastewater from circulating cooling systems of pre-treatment equipment and engines. The condensed water and sewage will be sent to Luohe municipal wastewater treatment plant by tank car, and it will be treated in the landfill site's own wastewater treatment plant, once it has been built. The wastewater from the cooling systems will be recovered and used for watering trees, washing cars, etc. So the wastewater generated by the proposed project will be treated properly.
- As to domestic waste, the proposed project is located inside of the Luohe municipal solid waste landfill site area, so the solid waste generated by the project activity will be treated in the landfill directly.

For other concerns raised by the stakeholders:

- The proposed project will adopt domestic state-of-the-art engines, the construction and installation will be conducted strictly according to the relevant regulations;

- The proposed project will be constructed according to the national regulations and industrial standards;
- The proposed project will create 15 new job opportunities for the power plant as well as other temporary jobs for tasks such as construction and maintenance of the gas collection system.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I countries is involved in the proposed project.

Annex 3

BASELINE INFORMATION

➢ **Municipal Solid Waste Received from 2004 to 2020**

Year	Quantity (ton/a)	Source
2004	127,800	FSR
2005	132900	FSR
2006	138200	FSR
2007	143700	FSR
2008	149400	FSR
2009	155400	FSR
2010	161,600	FSR
2011	168,100	FSR
2012	174,800	FSR
2013	181,800	FSR
2014	189,100	FSR
2015	196,700	FSR
2016	204,500	FSR
2017	212,700	FSR
2018	221,200	FSR
2019	Closed	FSR
2020		

➢ **The components of the MSW of Luohe landfill**

Components	Weight content (% wet waste)	Source
Wood	3	FSR
Paper	7	FSR
Kitchen waste	35	FSR
Textile	4	FSR
Garden waste	14	FSR
Glass, metal	37	FSR

➢ **Emission factor calculation for the Central China Power Grid**

According to Chinese DNA's document[16], the calculation and the data is presented as following:

(i) EF_{OM} calculation for the Central China Power Grid (CCPG)

[16] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm, last visited on 09/12/2009

Calculation of CO_2 Emission of Central China Power Grid in 2005

Fuel Types	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	Default Carbon content (tc/TJ)	Carbon oxidation rate (%)	Emission factor of the fuel ($kgCO_2/TJ$)	NCV (MJ/ t,m3)	CO_2 eimssions (tCO_2e) L=G×J×K/100000 (mass)
		A	B	C	D	E	F	G= A+B+C +D+E+F	H	I	J	K	L=G×J×K/10000 (volume)
Raw coal	10^4t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	87,300	20,908	325,404,287
Clean Coal	10^4t	0.02						**0.02**	25.8	100	87,300	26,344	460
Other washed coal	10^4t		138.12			89.99		**228.11**	25.8	100	87,300	8,363	1,665,408
Coke	10^4t		25.95		105			**130.95**	29.2	100	95,700	28,435	3,563,450
Coke oven gas	10^8m^3			1.15		0.36		**1.51**	12.1	100	37,300	16,726	94,206
Other coal gas	10^8m^3		10.2			3.12		**13.32**	12.1	100	37,300	5,227	259,696
Crude oil	10^4t		0.82	0.36				**1.18**	20	100	71,100	41,816	35,083
Gasoline	10^4t		0.02			0.02		**0.04**	18.9	100	67,500	43,070	1,163
Diesel oil	10^4t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	72,600	42,652	293,861
Fuel oil	10^4t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	75,500	41,816	280,035
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.71	3.41	1.76	0.78			**6.66**	15.7	100	48,200	46,055	147,842
Natural gas	10^8m^3						3	**3**	15.3	100	54,300	38,931	634,186
Other petroleum production	10^4t							**0**	20	100	75,500	41,816	0
Other coke production	10^4t				1.5			**1.5**	25.8	100	95,700	28,435	40,818
Other fuel	10^4t		2.88		1.74	32.8		**37.42**	0	0	0	0	0
												Sum	**332,420,496**

China Energy Statistical Yearbook 2006

The thermal power generation of the CCPG in 2005

Provinces	Electricity generation （10^8kWh)	Electricity generation （MWh)	Self-consumption by the gird （%）	Electricity supply of the Grid （MWh)
Jiangxi	300	30,000,000	6.48	28,056,000
Henan	1315.9	131,590,000	7.32	121,957,612
Hubei	477	47,700,000	2.51	46,502,730
Hunan	399	39,900,000	5	37,905,000
Chongqing	175.84	17,584,000	8.05	16,168,488
Sichuan	372.02	37,202,000	4.27	35,613,475
Total				**286,203,305**

China Energy Statistic Yearbook 2006

China Electricity Yearbook 2006

OM of Central China Power Grid in 2005

Emission of Central China Power Grid (tCO_2)	C	332,420,496
Total electricity supply of Central China Power Grid	D	286,203,305
$EF_{OM,2005}$ (tCO_2/MWh)	E=C/D	**1.16148**

Calculation of CO_2 Emission of Central China Power Grid in 2006

Fuel Types	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	Default Carbon content (tc/TJ)	Carbon oxidation rate (%)	Emission factor of the fuel ($kgCO_2/TJ$)	NCV (MJ/ t,m3)	CO_2 eimssions (tCO_2e) L=G×J×K/10 0000 (mass)
		A	B	C	D	E	F	G= A+B+C +D+E+F	H	I	J	K	L=G×J×K/10 000 (volume)
Raw coal	10^4t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	**20127.82**	25.8	100	87,300	20,908	367,386,738
Clean Coal	10^4t					5.79		**5.79**	25.8	100	87,300	26,344	133,160
Other washed coal	10^4t	4.51	104.12		8.59	79.21		**196.43**	25.8	100	87,300	8,363	1,434,116
Moulded coal	10^4t						0.01	**0.01**	26.6	100	87,300	20,908	183
Coke	10^4t		17.23		0.32			**17.55**	29.2	100	95,700	28,435	477,576
Coke oven gas	10^8m^3		0.52	1.07	4.24	0.38	0.01	**6.22**	12.1	100	37,300	16,726	388,053
Other coal gas	10^8m^3	12.69	3.95		1.7	4.36	0.01	**22.71**	12.1	100	37,300	5,227	442,770
Crude oil	10^4t		0.49					**0.49**	20	100	71,100	41,816	14,568
Gasoline	10^4t		0.01					**0.01**	18.9	100	67,500	43,070	291
Diesel oil	10^4t	0.91	2.23	1.41	1.78	0.96		**7.29**	20.2	100	72,600	42,652	225,737
Fuel oil	10^4t	0.51	1.26	1.31	0.8	0.57	3.49	**7.94**	21.1	100	75,500	41,816	250,674
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.86	8.1	1	0.97			**10.93**	15.7	100	48,200	46,055	242,630
Natural gas	10^8m^3			0.28		0.16	18.63	**19.07**	15.3	100	54,300	38,931	4,031,309
Other petroleum production	10^4t							**0**	20	100	75,500	41,816	0
Other coke production	10^4t						0.01	**0.01**	25.8	100	95,700	28,435	272
Other fuel	10^4t	17.45	37.36	31.55	18.29	29.35		**134**	0	0	0	0	0
												Sum	**375,028,077**

China Energy Statistical Yearbook 2007

The thermal power generation of the CCPG in 2006

Provinces	Electricity generation （10^8kWh)	Electricity generation （MWh)	Self-consumption by the gird （%）	Electricity supply of the Grid （MWh)
Jiangxi	344.49	34,449,000	6.17	32,323,497
Henan	1512.35	151,235,000	7.06	140,557,809
Hubei	548.41	54,841,000	2.75	53,332,873
Hunan	464.08	46,408,000	4.95	44,110,804
Chongqing	234.87	23,487,000	8.45	21,502,349
Sichuan	441.93	44,193,000	4.51	42,199,896
Total				**334,027,226**

China Energy Statistic Yearbook 2007

China Electricity Yearbook 2007

OM of Central China Power Grid in 2006

Electricity imported from Northwest Power Grid (MWh)	A	3,028,950
OM of Northwest Power Grid	B	0.99148
Emission of Central China Power Grid (tCO_2)	C=375,028,077+A*B	378,031,235
Total electricity supply of Central China Power Grid	D=334,027,226+3,028,950	337,056,176
$EF_{OM,2006}$ (tCO_2/MWh)	E=C/D	**1.12157**

Calculation of CO2 Emission of Central China Power Grid in 2007

Fuel Types	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	Default Carbon content （tc/TJ）	Carbon oxidation rate （%）	Emission factor of the fuel (kgCO_2/TJ)	NCV （MJ/ t,m3）	CO_2 eimssions （tCO_2e） L=G×J×K/10 0000 （mass）
		A	B	C	D	E	F	G= A+B+C +D+E+F	H	I	J	K	L=G×J×K/10 000 (volume)
Raw coal	10^4t	2200.57	9357	3479.81	2683.81	1547.7	3239	**22507.89**	25.8	100	87,300	20,908	410,829,404
Clean Coal	10^4t		3.07			3.8		**6.87**	25.8	100	87,300	26,344	157,998
Other washed coal	10^4t	0.04	87.16		2.06	96.42		**185.68**	25.8	100	87,300	8,363	1,355,631
Moulded coal	10^4t						0.01	**0.01**	26.6	100	87,300	20,908	183
Coke	10^4t							**0**	29.2	100	95,700	28,435	0
Coke oven gas	10^8m^3	0.08	2.61	0.25	0.31	0.91		**4.16**	12.1	100	37,300	16,726	259,534
Other coal gas	10^8m^3	29.17	25.79		24.69		23.98	**103.63**	12.1	100	37,300	5,227	2,020,444
Crude oil	10^4t		0.43					**0.43**	20	100	71,100	41,816	12,784
Gasoline	10^4t				0.04	0.01		**0.05**	18.9	100	67,500	43,070	1,454
Diesel oil	10^4t	0.98	3.21	2.51	2.83	1.93		**11.46**	20.2	100	72,600	42,652	354,863
Fuel oil	10^4t	0.42	1.25	1.33	0.63	0.64	1.74	**6.01**	21.1	100	75,500	41,816	189,742
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	1.43	10.01	0.97	0.7			**13.11**	15.7	100	48,200	46,055	291,022
Natural gas	10^8m^3		0.12	0.18		0.2	1.87	**2.37**	15.3	100	54,300	38,931	501,007
Other petroleum production	10^4t							**0**	20	100	75,500	41,816	0
Other coke production	10^4t							**0**	25.8	100	95,700	28,435	0
Other fuel	10^4t	23.43	63.65	35.95	29.46	23.21		**175.7**	0	0	0	0	0
												Sum	**415,974,066**

China Energy Statistical Yearbook 2008

The thermal power generation of the CCPG in 2007

Provinces	Electricity generation (10^8 kWh)	Electricity generation (MWh)	Self-consumption by the gird (%)	Electricity supply of the Grid (MWh)
Jiangxi	421	42,100,000	7.72	38,849,880
Henan	1773	177,300,000	7.55	163,913,850
Hubei	609	60,900,000	6.69	56,825,790
Hunan	542	54,200,000	7.18	50,308,440
Chongqing	288	28,800,000	9.2	26,150,400
Sichuan	451	45,100,000	8.68	41,185,320
Total				**377,233,680**

China Energy Statistic Yearbook 2008

China Electricity Yearbook 2008

OM of Central China Power Grid in 2007

Electricity imported from Northwest Power Grid (MWh)	A	3,005,400
OM of Northwest Power Grid	B	1.01129
Emission of Central China Power Grid (tCO_2)	C=415,974,066+A*B	419,013,395
Total electricity supply of Central China Power Grid	D=377,233,680+3,005,400	380,239,080
$EF_{OM,2007}$ (tCO_2/MWh)	E=C/D	**1.10197**

Three years weighted average EF_{OM} from 2005 to 2007:

$EF_{OM,CCPG}$ = 1.12553

(ii) EF_{BM} calculations for the Central China Power Grid

Fuel type	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Sum G=A+…+F	Heat value H	Emission factor I	Oxidation rate J	Emissions K=G×H×I×J/100,000
Raw coal	10^4t	2,200.57	9,357	3,479.81	2,683.81	1,547.7	3,239	22,507.89	20,908	87,300	1	410,829,404
Clean coal	10^4t	0	3.07	0	0	3.8	0	6.87	26,344	87,300	1	157,998
Other washed coal	10^4t	0.04	87.16	0	2.06	96.42	0	185.68	8,363	87,300	1	1,355,631
Moulded coal	10^4t	0	0	0	0	0	0.01	0.01	20,908	87,300	1	183
Coke	10^4t	0	0	0	0	0	0	0	28,435	95,700	1	0
Other coke product	10^4t	0	0	0	0	0	0	0	28,435	95,700	1	0
Total												**412,343,216**
Crude oil	10^4t	0	0.43	0	0	0	0	0.43	41,816	71,100	1	12,784
Gasoline	10^4t	0	0	0	0.04	0.01	0	0.05	43,070	67,500	1	1,454
Diesel oil	10^4t	0.98	3.21	2.51	2.83	1.93	0	11.46	42,652	72,600	1	354,863
Fuel oil	10^4t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	41,816	75,500	1	189,742
Other petroleum product	10^4t	0	0	0	0	0	0	0	41,816	75,500	1	0
Total												**558,843**
Natural gas	10^7m^3	0	1.2	1.8	0	2	18.7	23.7	38,931	54,300	1	501,007
Coke oven gas	10^7m^3	0.8	26.1	2.5	3.1	9.1	0	41.6	16,726	37,300	1	259,534
Other coal gas	10^7m^3	291.7	257.9	0	246.9	0	239.8	1,036.3	5,227	37,300	1	2,020,444
LPG	10^4t	0	0	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10^4t	1.43	10.01	0.97	0.7	0	0	13.11	46,055	48,200	1	291,022
Total												**3,072,007**
Sum												**415,974,066**

China Energy Statistical Yearbook 2008

Thus $\lambda_{Coal,y}$ =99.13%，$\lambda_{Oil,y}$ =0.13%，$\lambda_{Gas,y}$ =0.74%

Emission factor of best efficiency technology commercially used in domestic power plants in China

		Efficiency of power supply	Emission factor of fuel ($kgCO_2/TJ$)	Oxidation rate	Emission factor (tCO2/MWh)
		A	B	C	D=3.6/A/1000000*B*C
Coal-fired power plant	**$EF_{coal,adv}$**	38.10	87,300	1	0.8249
Oil-fired power plant	**$EF_{oil,adv}$**	49.99	75,500	1	0.5437
Gas-fired power plant	**$EF_{gas,adv}$**	49.99	54,300	1	0.3910

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.8213\ tCO_2/MWh$$

Installed capacity of CCPG in 2007

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power	MW	9,270	38,540	13,040	13,360	6,370	12,000	92,580
Hydro power	MW	3,570	2,740	24,020	9,220	2,240	19,860	61,650
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and others	MW	0	0	10	17	24	0	51
Total	MW	12,840	41,280	37,070	22,597	8,634	31,860	154,281

China Electricity Yearbook 2008

Installed capacity of CCPG in 2006

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power	MW	6,568	32,603	11,623	10,715	5,594	9,555	76,658
Hydro power	MW	3,288	2,553	18,320	8,648	1,979	17,730	52,518
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and others	MW	0	0	0	17	24	0	41
Total	MW	9,856	35,156	29,943	19,380	7,597	27,285	129,217

China Electricity Yearbook 2007

Installed capacity of CCPG in 2005

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power	MW	5,906	26,267.8	9,526.3	7,211.6	3,759.5	7,496	60,167.2
Hydro power	MW	3,019	2,539.9	17,888.9	7,905.1	1,892.7	14,959.6	48,205.2
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and others	MW	0	0	0	0	24	0	24
Total	MW	8,925	28,807.7	27,415.2	15,116.7	5,676.2	22,455.6	108,396.4

China Electricity Yearbook 2006

$EF_{BM,\ CCPG}$ Calculation

	2005 installed capacity	2006 installed capacity	2007 installed capacity	2005-2007 increased capacity	The percentage of increased capacity against total increased capacity of all power type
	A	B	C	D=C-A	
Thermal power	60,167.2	76,658	92,580	32,412.8	70.64%
Hydro power	48,205.2	52,518	61,650	13,444.8	29.30%
Nuclear power	0	0	0	0	0.00%
Wind power and others	24	41	51	27	0.06%
Total	**108,396.4**	**129,217**	**154,281**	**45,884.6**	**100.00%**
Percentage against 2007’s installed capacity	70.26%	83.75%	100%		

$\mathbf{EF_{BM,y}=0.8213\times70.64\%=0.5802\ tCO_2/MWh}$

Annex 4

MONITORING INFORMATION

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