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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Methane Recovery from Sludge Digester and Landfill to Generate Electricity
Document version: 1.1
Completion date: 21/2/2011

A.2. Description of the project activity:

Methane Recovery from Sludge Digester and Landfill to Generate Electricity project (hereinafter referred to as the "project") is located in Xiamen city, Fujian province, P. R. China and invested in by Xiamen Perfect New Energy Co., Ltd. The purpose of the project is to recover methane, which releases to the atmosphere directly without this project, to generate electricity.

In the project activities, methane is recovered from two sources, including anaerobic digester which is introduced at project site to treat sludge from seven wastewater treatment plants in Xiamen city, and Xiamen Eastern landfill which was put into operation in December 2008 without landfill gas ("LFG") recovery and utilization. The recovered biogas will be utilized to generate electricity by installing gas engine generators with a total capacity of 6MW. In addition, the electricity generated will be exported to the East China Power Grid ("ECPG").
Without the project activities, the sludge and MSW will continue to be disposed of at the landfill and consequently generate methane and other gases which release into the atmosphere directly without recovery and utilization. Besides, local electricity demand is supplied by the ECPG which is dominated by thermal power. By implementing the proposed project, landfill gas will be partially avoided to be generated and released to the atmosphere. Furthermore, the greenhouse gas ("GHG") emission reductions can also be achieved by the displacement of the electricity from fossil fuel-fired power plants connected to the ECPG. In the 10-year fixed crediting period, a total of 2,102,650 tCO_2e will be achieved by the project.

The proposed project will contribute to the sustainable development in local society on the following aspects:

- Prevent the generation and release of greenhouse gases by diverting the amount of waste and sludge that is to be disposed at landfill without biogas recovery.
- Supply clean electricity to the ECPG and reduce GHG and other environmental pollutants emissions.
- Support the local communities and increase local incomes.
- Create job opportunities over the project construction and operation period.

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)	Xiamen Perfect New Energy Co., Ltd. (Private entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Fujian Province

A.4.1.3. City/Town/Community etc:

Xiang'an District, Xiamen City

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

The proposed project is located in Xiang'an District, Xiamen City. It is situated at 118°16'52''East longitude and 24°43'19'' North latitude.
The detailed geographic location is shown in Fig.A.4.1.4.-1 below.

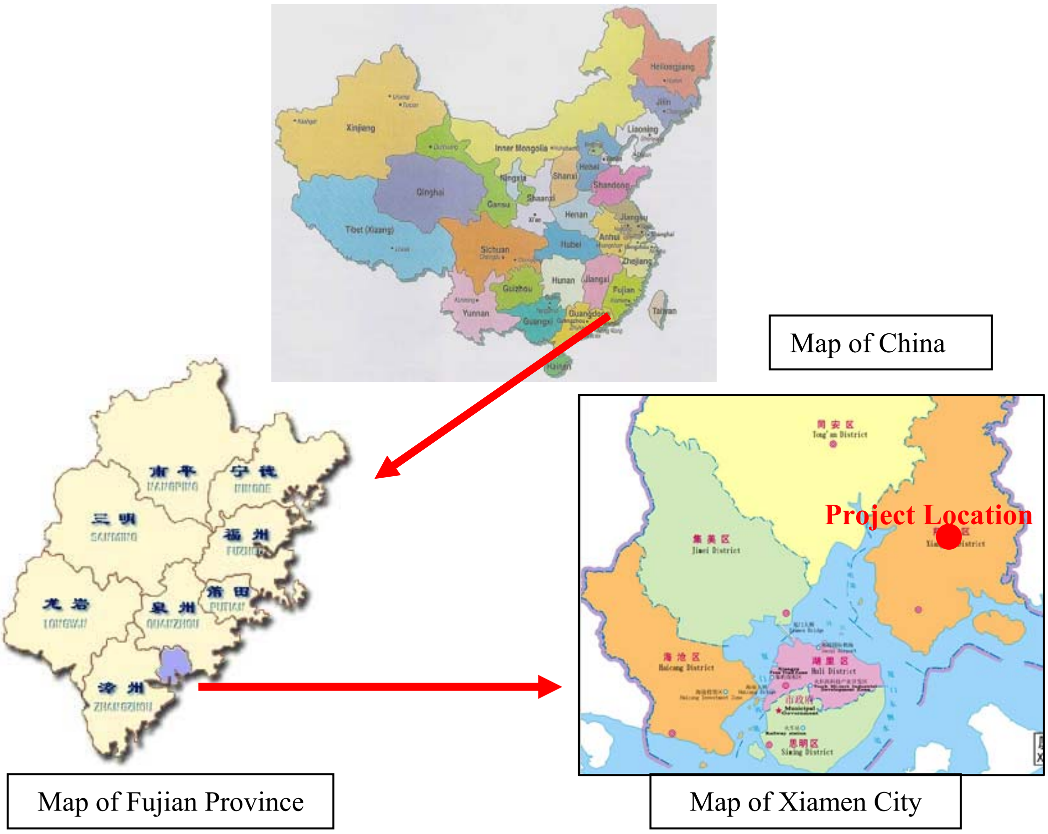

Fig.A.4.1.4.-1 Location of the Proposed Project

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

Sectoral scope 1: energy industries (renewable energy)
Sectoral scope 13: waste handling and disposal

- Type "I": Renewable Energy Project
  Category "D": Grid connected renewable electricity generation
- Type "III": Other Project Activities
  Category "H": Methane recovery in wastewater treatment

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

The proposed project introduces anaerobic digester for treatment of sludge from seven wastewater treatment plants in Xiamen city and installs biogas recovery systems to collect biogas from digester. In addition, landfill gas generated from Xiamen Eastern landfill is will be also recovered. Both recovered biogas will be utilized to produce electricity. Before entering the electricity generators, the recovered biogas and LFG will be pre-treated to remove impurities and moisture, etc., to ensure stable and normal operation of the generators. The project is designed to install electricity generator with a total installed capacity of 6MW. The electricity generated using biogas and LFG will be predominantly exported to the ECPG except small portion for on-site usage.

The details of seven wastewater treatment plants in Xiamen city are shown in the table below.

Table A.4.3.-2 Details of existing seven waste water treatment plants

Plant name	Beginning of service	Sewered population	Treatment method	Treatment capacity (design)	Sludge dewatering method	Sludge production (t/year)
Yundang	2006	900,000	Biofiltration method	300,000m^3/day	Deep dewatering, centrifugal dewatering	49,897
Shiweitou	2001	480,000	AO method	200,000m^3/day	Deep dewatering, centrifugal dewatering	31,786
Haicang	2000	700,000	Standard activated sludge method	100,000m^3/day	Belt press dewatering	19,170
Tongan	2005	140,000	OD method	100,000m^3/day	Centrifugal dewatering	12,041
Xiangan	2006	150,000	OD method	25,000 m^3/day	Centrifugal dewatering	342
Xinglin	2007	200,000	A20 method	60,000m^3/day	Deep dewatering	11,640
Jimei	2000	200,000	OD method	45,000m^3/day	Deep dewatering	9,384
Total	—	2,770,000	—	830,000m^3/day	—	134,260

The main technical parameters of introduced equipment are shown in the table below.

Table A.4.3.-2 Main Technical Parameters of the core equipment for proposed project

Facility	Detail	Specification
LFG collection facility	LFG collection facility	LFG Collection well, pipe, and blower etc.
Sludge digester	Receive, Feeding equipment	250t/day (w80%)
	Digester tank	250t/day (w80%)
Gas pre-treatment facility	Dehumidify equipment	80,000m3/day
	De-sulfide equipment	80,000m3/day
	Gas holder	3,000m3
Dewater facility	Dewatering equipment	Filter press 175t/day(w80%)
Excess gas combustion facility	Flaring equipment	80,000m3/day
Electricity facility	Power generation equipment	Gas engine genset : 6MW
	Transformer	0.4kV→13.2kV
	Transmission line	2km
Civil	Office	300m2
Water treatment facility		87.5m3/day

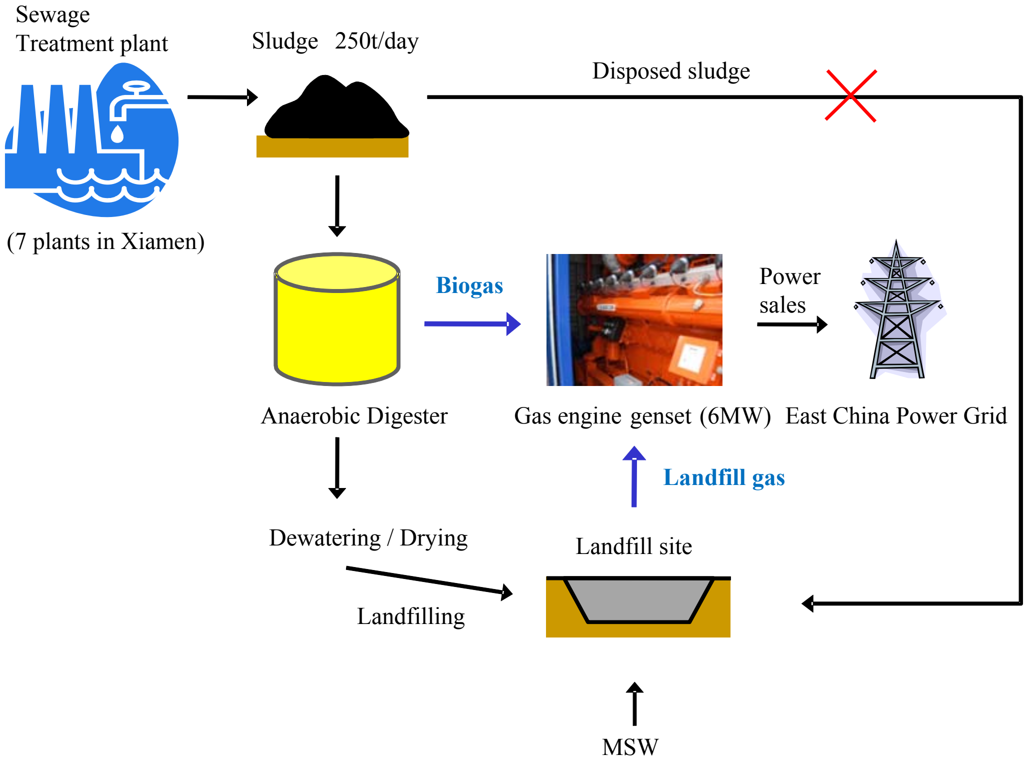

Fig.4.3.-1 Flow Diagram of the Proposed Project

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

The project applies a 10-year fixed crediting period. The crediting period is expected to start on 1st January 2013 till 31st December 2022. Emission reductions to be achieved by the proposed project during the first period are shown in the table below.

Table A.4.4.-1 Project Emission Reductions

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2013	284,972
2014	290,362
2015	296,688
2016	301,471
2017	305,598
2018	309,391
2019	312,926
2020	316,255
2021	319,418
2022	322,442
Total estimated reductions (tonnes of CO_2e)	3,059,523
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	305,952

A.4.5. Public funding of the project activity:

No public fund is involved in the proposed project.

SECTION B. Application of a baseline and monitoring methodology

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

- ACM0001 Consolidated baseline and monitoring methodology for landfill gas project activities(Version 11)
- AMS-III.H Methane recovery in wastewater treatment (Version 16)
- AMS I.D. Grid connected renewable electricity generation (version 16)
- Tool for the demonstration and assessment of additionality (Version 05.2)
- Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (Version 5)
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 1)
- Tool to determine project emissions from flaring gases containing methane
- Tool to calculate the emission factor for an electricity system (Version 2)
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2)

Above methodologies are available at
http://cdm.unfccc.int/methodologies/index.html

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

The proposed project involves:
a) Introduction of anaerobic digester to treat sludge and installation of biogas recovery systems for sludge digester.
b) Installation of gas recovery systems for Xiamen Eastern Landfill to recover LFG.
c) Installation of electricity generation system to utilize recovery gas to generate electricity.

ACM0001 is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas. The project activities include situations such as:
a) The captured gas is flared; and/or
b) The captured gas is used to produce energy (e.g. electricity/thermal energy). Emission reductions can be claimed for thermal energy generation, only if the LFG displaces use of fossil fuel either in a boiler or in an air heater. For claiming emission reductions for other thermal energy equipment (e.g. kiln), project proponents may submit a revision to this methodology;
c) The captured gas is used to supply consumers through a natural gas distribution network. If emission reductions are claimed for displacing natural gas, project activities may use approved methodologies AM0053.

As previously described, without the proposed project, Xiamen Eastern Landfill will continue to emit LFG directly into the atmosphere. The proposed project at the landfill has the purpose of electricity generation by recovered LFG and supply of electricity to the ECPG, thus, displacing a certain amount of fossil fuels used for electricity generation on the grid. In addition, the excess LFG or the collected LFG when the generators are under maintenance and inspection will be flared in an enclosed flare. Therefore, the project activity meets situations a) and b) (electricity energy) above and is therefore applicable to ACM0001.

The sludge treatment component of the proposed project uses methane recovered from the anaerobic sludge treatment facilities which are newly installed. The biogas sourcing from anaerobic digester is supplied to gas engine electricity generator to produce electricity along with LFG from Xiamen Eastern landfill and the applicable methodology is ACM0001. The total capacity of the proposed project will be 6MW. The power generated by the project will be exported to the ECPG. The sludge treatment and electricity generation parts of this project meet the applicable criteria of AMS III.H and AMS.I.D.as follows:

- It is a project with introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant. In this project, an anaerobic digester is introduced to treat sludge from seven wastewater treatment plants which have no sludge treatment facilities;
- The recovered methane is used for electricity generation and exported to the ECPG;
- The emission reductions from all type III components of the project activity are less than 60 ktCO_2 equivalents in any year of the crediting period.
- Its installed capacity is 1MW, and will remain during the entire crediting period.

The project will remain under the limits of small-scale project activity types during the crediting period. Therefore, the project applies the approved methodologies AMS.III.H. and AMS.I.D.

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

The project boundary encompasses the Xiamen Eastern landfill site where the LFG is captured and destroyed/used and the location where the sludge treatment takes place, as stated in the methodologies ACM0001 and AMS.III.H, respectively. Moreover, since the electricity generated by the captured gas from the sludge treatment system and Xiamen Eastern landfill will be delivered to the ECPG, the project boundary also includes all the power generation sources connected to the ECPG. The ECPG covers Shanghai, Jiangsu, Zhejiang, Anhui and Fujian provincial grids.

In addition, the ECPG also imports electricity from the Shan’xi Yangcheng Grid (SYG) which is a sub-grid of the North China Power Grid (NCPG) and from the Central China Power Grid (CCPG). Therefore, the SYG and the CCPG are also included in the project boundary.

The project boundary is shown as the figure below.

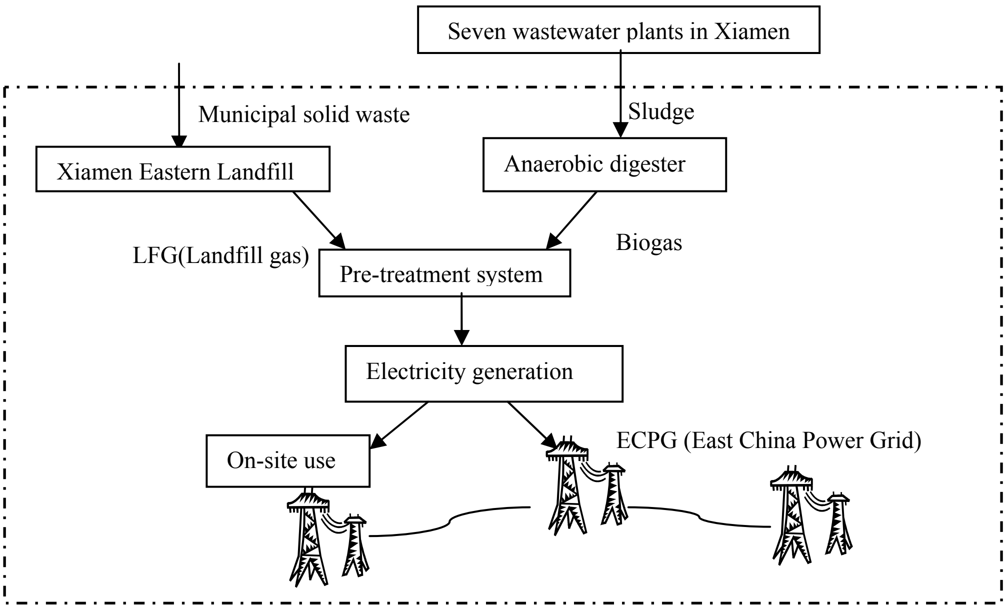

Fig.B.3.-1. Project boundary

Table B.3.-1 Sources and gases included in the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from decomposition of waste at the landfill site	CH_4	Yes	The major source of emissions in the baseline.
		N_2O	No	N_2O emissions are small compared to CH4 emissions from landfills. Exclusion of this gas is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted.
	Emissions from the sludge treatment systems affected by the project activity	CH_4	No	There is no sludge treatment system in the baseline scenario.
		N_2O	No	There is no sludge treatment system in the baseline scenario.
		CO_2	No	There is no sludge treatment system in the baseline scenario.
	Emissions from anaerobic decay of the final sludge	CH_4	Yes	The main source of emissions in the baseline.
		N_2O	No	Excluded for simplification. This is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted for.

	Electricity generation on ECPG	CO_2	Yes	Main emission sources
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project activity	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	No	The amount of fossil fuel to be consumed by the project activity is not available at this stage. Will be monitored and deducted from the ERs if any.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Methane emissions from anaerobic decay of the final sludge	CO_2	No	The sludge is disposed of at a landfill with biogas recovery in the project activity, the emission shall be neglected.
		CH_4	No	Neglected
		N_2O	No	Neglected
	Emissions from biogas release in capture systems	CO_2	No	Excluded for simplification. This emission source is assumed to be very small.
		CH_4	Yes	May be an important emission source
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from on-site electricity use	CO2	Yes	May be an important emission source when the project consumes the electricity from the grid when the equipment including generators shut down or are under regular maintenance. Otherwise, emissions due to consumption of the electricity derived from biogas are not accounted.
		CH4	No	Excluded for simplification. This emission source is assumed to be very small.
		N2O	No	Excluded for simplification. This emission source is assumed to be very small.

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

The proposed project involves:

a) Installation of gas recovery systems for Xiamen Eastern Landfill to recover LFG; (ACM0001)
b) Introduction of anaerobic digester to treat sludge and installation of gas recovery systems for sludge digester; (AMS-III.H)
c) Installation of electricity generation system to utilize recovery gas to generate electricity. (ACM0001 for electricity by using LFG and AMS-I.D for electricity by using digestion gas of the sludge)

According to the approved methodology ACM0001, AMS.III.H, and AMS.I.D, the baseline scenario of the project activities is defined as the following procedures.

STEP 1: Identification of alternative scenario

Alternatives for the treatment of biogas from sludge in the absence of the project activity to be analysed should include, *inter alia:*
B1. The project activity, capture of biogas from digester and its flaring and use, undertaken without being registered as a CDM project activity;
B2. Atmospheric release of the biogas from sludge disposal of at landfill.

Alternatives for the treatment of landfill gas in the absence of the project activity to be analysed should include, *inter alia:*
LFG1. The project activity, capture of landfill gas and its flaring and use, undertaken without being registered as a CDM project activity;
LFG2. Atmospheric release of the landfill gas.

The project activity also includes the production of electricity using captured landfill gas and biogas from sludge digester, and exporting the electricity to the ECPG. In this case, the realistic and credible alternatives of power generation in the absence of the project activity may include, *inter alia*:
P1. Power generated from landfill gas and biogas undertaken without being registered as CDM project activity;
P2. Existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant;
P3. Existing or construction of a new on-site or off-site renewable based cogeneration plant;
P4. Existing or construction of a new on-site or off-site fossil fuel fired captive power plant;
P5. Existing or construction of a new on-site or off-site renewable based captive power plant;
The project activities comprise of three components, sludge treatment, MSW treatment and electricity generation. Heat generation is not involved in the project. Therefore, the alternatives for the proposed project are listed below.
P6. Existing and/or new grid-connected power plants.

In accordance with *Urban Wastewater Treatment Plant Sludge Treatment and Pollution Prevention Technical Policy (2009)* which is available at present, anaerobic digestion of sludge with biogas recovery is proposed, but not mandatory. In China, Most of sludge is pretreated by simple dehydration and then disposed of at the landfill site, except a few of sludge is digested anaerobically, composted or incinerated. Thus, the alternatives about sludge treatment are in compliance with national laws and regulations.

Xiamen Eastern landfill was constructed and operating at the time the Technical code for municipal solid waste sanitary landfill (CJJ17-1988) was available. It has no mandatory requirement on LFG utilization. In China, almost all landfills release LFG directly into the atmosphere without any recovery and utilization, except some landfills which are undertaken as CDM projects install LFG recovery and utilization facilities. Therefore, the alternatives are in compliance with national laws and regulations.

The purpose of the proposed project is to recover LFG and biogas and utilize the recovered gas for electricity generation, without producing heat for on-site use or nearby facilities. Consequently, alternatives P2 and P3, cogeneration plant, are not providing the same service and output as the proposed project and therefore are not the baseline scenario. Therefore, they are eliminated from further consideration.

According to *Notice on strictly prohibiting the installation of the fuel-fired generators with the capacity of 135MW or below*[1] issued by State Council, 2002, thermal power plants of less than 135MW are prohibited for construction in the areas covered by regional grids. Therefore, Alternative P4 is not in compliance with Chinese regulations on construction of a thermal plant.

Therefore, only alternatives B1, B2, LFG1, LFG2, P1, P5 and P6 are in compliance with national laws and regulations.

STEP 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable.

Alternative P1 is to recover and utilize landfill gas and biogas to generate electricity and exported to the ECPG. According to the conservative estimation, 13,033,058 m^3 of methane will be collected annually to generate electricity. In addition, the excess methane in LFG and biogas will be flared in an enclosed flare. Therefore, there is no fuel supply constraint to the proposed project.

Alternative P5 is eliminated from further analysis. This is due to the lack of renewable energy resources at the project site available for the exploitation to produce renewable electricity. According to the China Electric Power Yearbook (2007), Fujian province had no renewable power sources other than hydro and wind power by the end of year 2006. But the project activity is located in a valley-type landfill site where no wind or hydropower is available.

Alternative P6 is to provide the same amount of electricity by the ECPG which is dominated by thermal power. The fuel consumption for electric power generation on the ECPG is shown in Annex 3. The fuels consumed by ECPG are conventional types and are available in abundance in the host country and there is no supply constraint.

STEP 3: Step 2 of the latest approved version of the Tool for demonstration and assessment of additionality shall be used to assess which of these alternatives should be excluded from further consideration.

Based on the financial analysis illustrated in the following Section B.5, without CER revenue being taken into account, the IRR of total investment of the project, including B1, LFG1 and P1, is -0.9% which is below the benchmark IRR of 8%. Therefore, if not implemented as a CDM project, the proposed project is not financially attractive and unlikely to proceed.

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[1] http://www.gov.cn/gongbao/content/2002/content_61480.htm.

Step 4 in the methodology is not necessary because only one credible and plausible alternative for sludge treatment, LFG treatment and electricity generation respectively remains as demonstrated in above Step1~Step 3.

It is concluded that the baseline scenario of the project activities is only the combination of alternatives B2, LFG2 and P2.

Table B.4.-1 Combination of baseline options and scenarios applicable to the methodology

Baseline	Biogas from sludge	LFG from MSW	Electricity
Description	Atmospheric release of biogas from sludge disposal of at landfill	Atmospheric release of landfill gas from MSW	The electricity is obtained from the ECPG.

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

The following steps from the *Tool for the demonstration and assessment of additionality* are taken to demonstrate the additionality of the project.

Considering CDM prior to starting project activity

The shareholders of the Xiamen Perfect New Energy Co., Ltd. who will be the project owner, signed a Memorandum of Understanding (MOU) on July 6th, 2010 for submission of the proposal to Global Environment Centre Foundation, Japan (GEC) who is an agency of the Government of Japan for subsidization of feasibility study, and to conduct a feasibility study on the Project under a cooperation program of GEC, Kyoto Mechanisms Promotion Program CDM/JI Feasibility Study 2010. And then, the feasibility study for this project as CDM project was done in 2010 to 2011 collaborated with Xiamen Perfect New Energy Co., Ltd. Thus, it is evident that the project was intended to be undertaken as a CDM project from the very beginning.

The main events of the implementation of the project are shown in table below.

July 6, 2010	MOU signing among the shareholders of the Xiamen Perfect New Energy Co., Ltd.
July 14, 2010	Submission of the project proposal for feasibility study to GEC as CDM project
August 3, 2010	Approval of the project proposal for feasibility study by GEC as CDM project
September 13 to 17, 2010	1st visit for the feasibility study
December 6 to 9, 2010	2nd visit for the feasibility study

Additionality

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

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

The project activities comprise of three components, Sludge treatment, LFG treatment and electricity generation. Heat generation is not involved in the project. Therefore, the alternatives for the proposed project are listed below.

Alternatives for the treatment of biogas from sludge in the absence of the project activity to be analysed should include, inter alia:
B1. The project activity, capture of biogas from digester and its flaring and use, undertaken without being registered as a CDM project activity;
B2. Atmospheric release of the biogas from sludge disposal of at landfill.

Alternatives for the treatment of landfill gas in the absence of the project activity to be analysed should include, inter alia:
LFG1. The project activity, capture of landfill gas and its flaring and use, undertaken without being registered as a CDM project activity;
LFG2. Atmospheric release of the landfill gas.

The project activity also includes producing the electricity using captured gas, and exporting the electricity to the ECPG. In this case, the realistic and credible alternatives of power generation in the absence of the project activity may include, inter alia:
P1. Power generated from landfill gas undertaken without being registered as a CDM project activity;
P2. Existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant;
P3. Existing or construction of a new on-site or off-site renewable based cogeneration plant;
P4. Existing or construction of a new on-site or off-site fossil fuel fired captive power plant;
P5. Existing or construction of a new on-site or off-site renewable based captive power plant;
P6. Existing and/or new grid-connected power plants.

The purpose of the proposed project is to recover and utilize the biogas and LFG for electricity generation, without producing heat for on-site use or nearby facilities. Consequently, alternatives P2 and P3, cogeneration plant, are not providing the same service and output as the proposed project and therefore are eliminated from further consideration.

Alternative P5 is eliminated from further analysis. This is due to the lack of renewable energy resources available at the project site for exploitation to produce renewable electricity. According to the China Electric Power Yearbook (2007), Fujian province had no renewable power sources other than hydro and wind power by the end of year 2006. But the project activity is located in a valley-type landfill site where no wind or hydropower is available.

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

Referring to *Urban wastewater treatment plant sludge treatment and pollution prevention technical policy（2009）*which is available at present, anaerobic digestion of sludge with biogas recovery is proposed, but not mandatory. In China, Most of sludge is pretreated by simple dehydration and then disposed of at the landfill site, except a few of sludge is digested anaerobically, composted or incinerated. Thus, the alternatives about sludge treatment are in compliance with national laws and regulations.

Xiamen Eastern landfill was constructed and operating at the time the Technical code for municipal solid waste sanitary landfill (CJJ17-1988) was available. It has no mandatory requirements for LFG utilization. In China, almost all landfills release LFG directly into the atmosphere without any recovery and utilization activities, except that some landfills which are undertaken as CDM projects install LFG recovery and utilization facilities. Therefore, the alternatives about LFG treatment are incompliance with national laws and regulations.

According to *Notice on strictly prohibiting the installation of the fuel-fired generators with the capacity of 135MW or below*[2] issued by State Council, 2002, thermal power plants of less than 135MW are prohibited for construction in the areas covered by regional grids. Therefore, Alternative P4 is not in compliance with Chinese regulations on construction of a thermal plant.

Alternative P6, providing the same amount of electricity by the ECPG, is in line with Chinese laws and regulations, and is feasible in terms of the financial situation. Therefore, it is the baseline scenario to the project.

Therefore, the alternatives that are in compliance with national laws and regulations are B1, B2 and LFG1, LFG2, P1 and P6. The baseline scenario includes alternatives B2, LFG2 and P6 as analyzed in section B.4, and the project activities include B1, LFG1 and P1.

Step 2: Investment analysis

Sub-step 2a. Determine appropriate analysis method

The project will receive proceeds from power sales as well as from emission reduction credits, so Option I - Simple Cost Analysis stated in the Tool for the Demonstration and Assessment of Additionality is not applicable.

Since the alternatives (B2 & LFG2 & P6) to the proposed project (B1&LFG1 & P1) are identified as the baseline scenario, accordingly, the baseline scenario, which is the continuing atmospheric release of biogas and LFG and providing electricity by existing grid-connected power plants, is not a specific investment project. Therefore, Option II – Investment Comparison Analysis is not applicable, because the alternative to the investment is not identified.

As a result, Option III – Benchmark Analysis must be used, where the project IRR of total investment is compared to benchmark IRR of total investment applicable to the power industry sector in China. Here, the benchmark analysis is selected.

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

With reference to the*"Economic Assessment Method and Parameters for Construction Project" (version 3)"* issued jointly by NDRC and Ministry of Construction in 2006, the financial benchmark for the project internal rate of return after tax for the landfill to power project is 8%. Therefore, we choose 8% as the benchmark.

[2] http://www.gov.cn/gongbao/content/2002/content_61480.htm.

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

The following parameters and values are applied for calculation and comparison of financial indicator, IRR, with and without CDM.

Assuming that the unit price of CER is US$10, the result of financial analysis for the proposed project is shown in the table below. The calculated IRR value of the project without CERs would be -0.9%, below the benchmark rate 8%. Thus without CER revenue, it is evident that the project faces substantial financial hurdles and would not be implemented.

Table B.5.-2 Project IRRs (after tax)

	IRR (%)
Without CERs	-0.9
With CERs	19.5

Sub-step 2d. Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters: electricity sales, electricity tariff, investment and operation and maintenance costs. These parameters were selected as being the most likely to fluctuate over time. A financial analysis was performed by altering each of these parameters by 10%, and by assessing what the impact on the project IRR would be, as shown in the figure below.

Alternatively, when the project IRR is equal to the benchmark, the resultant changes to the critical parameters can be seen in the table below.

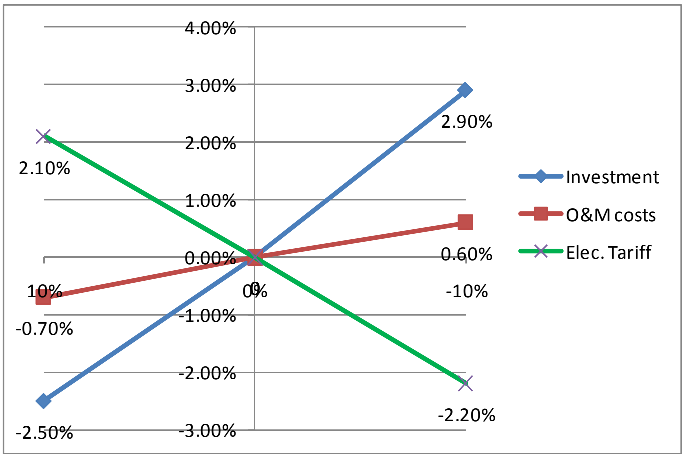

Fig.B.5.-1 Project Sensitivity Analysis

Fig.B.5.-1 shows that if there is an increase in the electricity tariff or a decrease in the investment and operation and maintenance costs by 10%, respectively, the project IRR would still be far below the benchmark rate of 8%.

Alternatively, when the project IRR is equal to the benchmark, the resultant changes to the critical parameters can be seen in the table below.

Table B.5.-3 Parameter changes when project IRR is equal to the benchmark

Change of parameters	Investment	O&M costs	Elec. Tariff
Project IRR = Benchmark	-39%	-106 %	+30%

The above sensitivity analysis provides a valid argument that the financial attractiveness of the proposed project is robust to reasonable variations in the critical assumptions, and supports that without CER revenue the proposed project is not financially attractive.

Step 4. Common Practise Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

According to the additionality tool, the common practice shall provide an analysis of any other activities that are similar to the project. Based on this guidance, the common practice analysis is limited to the provincial level as the investment environment for each province differs (e.g. with regards to investment costs and electricity tariff).

Till now, there are only several landfill sites where the LFG is recovered to produce electricity in Fujian province. However, no biogas recovery from sludge digester is utilized for electricity generation.

Table B.5.-3 Similar activities in Fujian province.

Name of Project name	Waste Disposal Amount (metric tons per day)	Current status
Hongmiaoling Landfill Gas to energy project, Fuzhou city	2,000	Registered as a CDM project with LFG recovery and utilization.
Dongfu Landfill Gas to energy project, Xiamen city	1,268	Registered as a CDM project with LFG recovery and utilization.

Sub-step 4b. Discuss any similar options that are occurring:

As shown in the table above, Hongmiaoling Landfill Gas to energy project and Dongfu Landfill Gas to energy project have been registered as CDM project. Besides, both of them just utilize LFG to generate electricity, while the proposed project activities recover biogas from sludge and LFG. In conclusion, similar activities are not widely observed and commonly carried out. The project activity is not common practice.

In sum, based on above analysis, it is concluded that the proposed project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The emission reductions will be calculated in accordance with the steps in ACM0001 and AMS.III.H:

1. Project emissions (PE_y)

1.1 Project emissions from sludge treatment

The project emissions from sludge treatment consist of:

$$PE_{sluge,y} = PE_{power,y} + PE_{s,treatment,y} + PE_{s,final,y} + PE_{fugitive,y} \quad (1)$$

Where,

$PE_{power,y}$	Emissions from electricity or fuel consumption in the year *y* (tCO_2e);
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO2e);
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e);
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year *y* (tCO_2e).

The project will use the recovered methane to produce the electricity, for on-site use and export to the public grid as well. Hence, there is no CO_2 emission on account of grid electricity used by the project activity facilities, PEpower,y = 0.

$$PE_{s,treatment,y} = \sum_l S_{l,PJ,y} * MCF_{s,treatment,l} * DOC_s * UF_{PJ} * DOC_F * F * \frac{16}{12} * GWP_{CH4}$$

(2)

Where,

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system l in the project scenario in year y;
DOC_s	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis). Default values of 0.5 for domestic sludge and 0.257 for industrial sludge shall be used;
$MCF_{s,treatment,l}$	Methane correction factor for the project sludge treatment system l (MCF values as per Table III.H.1);
UF_{PJ}	Model correction factor to account for model uncertainties (1.12);
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5);
F	Fraction of CH4 in biogas (IPCC default of 0.5).

$$PE_{s,final,y} = S_{final,PJ,y} * DOC_s * UF_{PJ} * MCF_{s,PJ,final} * DOC_F * F * \frac{16}{12} * GWP_{CH4} \quad (3)$$

Where：

$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year *y* (t);
$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.

This project will introduce the anaerobic digester with biogas recovery to treat sludge, and the residual sludge will be landfilled in Xiamen Eastern landfill with capture system. No sludge treatment systems affected by the project activity, and not equipped with biogas recovery exists in this project. In accordance with the methodology, if the sludge is disposed in a landfill with biogas recovery, emissions from anaerobic decay of the final sludge are neglected. Therefore, $PE_{s,treatment,y} = 0$, and $PE_{s,final,y} = 0$.

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y} \quad (4)$$

$$PE_{fugitive,s,y} = (1 - CEF_s) * MEP_{s,treatment,y} * GWP_{CH4} \quad (5)$$

$$MEP_{s,treatment,y} = \sum_l (S_{l,PJ,y} * MCF_{s,treatment,PJ,l}) * DOC_s * UF_{PJ} * DOC_F * DOC_F * F * \frac{16}{12} \quad (6)$$

Where,

$PE_{fugitive,ww,y}$	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO2e);
$PE_{fugitive,s,y}$	Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y (tCO2e). Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems are not accounted as the wastewater treatment will not be affected by this project;
CEF_s	Capture efficiency of the biogas recovery equipment in the sludge treatment systems (a default value of 0.9 shall be used);
$MEP_{s,treatment,y}$	Methane emission potential of the sludge treatment systems equipped with a biogas recovery system in year y (t);
$S_{l,PJ,y}$	Amount of sludge treated in the project sludge treatment system l equipped with a biogas recovery system (on a dry basis) in year y (t);
$MCF_{s,treatment,PJ,l}$	Methane correction factor for the sludge treatment system equipped with biogas recovery equipment (MCF values as per Table III.H.1);
UF_{PJ}	Model correction factor to account for model uncertainties (1.12).

1.2 Project emissions from LFG treatment

Considering that electricity generators will be under regular maintenance and sometimes shut down, electricity will be purchased from the ECPG during this period of time. Therefore, there will be project emissions from MSW treatment, which can be calculated following the latest version of the *Tool to calculate baseline, project and/or leakage emissions from electricity consumption.*

$$PE_{MSW,y} = PE_{EC,y} = EC_{PJ,y} * CEF_{elec,BL,y} * (1+TDL_y) \quad (7)$$

Where,

$PE_{EC,y}$	Project emissions from consumption of electricity by MSW treatment project activity during the year y (tCO_2e/yr);
$EC_{PJ,y}$	Quantity of electricity consumed by MSW treatment project activity during the year y (MWh);
TDL_y	Average technical transmission and distribution losses in the ECPG in year y for the voltage level at which electricity is obtained from the grid at the project site.

In the project design stage, $EC_{PJ,y} = 0$ and will be monitored during the crediting period.

2. Baseline emissions (BE_y)

2.1 Baseline emissions about sludge treatment

$$BE_{sludge,y} = BE_{power,y} + BE_{s,treatment,y} + BE_{s,final,y} \quad (8)$$

Where,

BE_y: Baseline emissions about sludge treatment in year y (tCO_2e);

$BE_{power,y}$: Baseline emissions from electricity or fuel consumption in year y (tCO2e);

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

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

$$\mathbf{BE_{y,power} = EGP_{J,y} * CEF_{y,grid}} \qquad \textbf{(9)}$$

Where,

$EG_{PJ,y}$ Electricity exported to the grid by the project activity in year "y" (MWh);

$CEF_{y,grid}$ Emission factor of the connected grid by the project activity in year "y" (tCO_2e/MWh)

$$BE_{s,treatment,y} = \sum_j S_{j,BL,y} * MCF_{s,treatment,BL,j} * DOC_s * UF_{BL} * DOC_F * F * \frac{16}{12} * GWP_{CH4} \qquad \textbf{(10)}$$

Where,

$S_{j,BL,y}$ Amount of dry matter in the sludge that would have been treated by the sludge treatment system j in the baseline scenario (t);

j Index for baseline sludge treatment system;

DOC_s Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis);

$MCF_{s,treatment,BL,j}$ Default values of 0.5 for domestic sludge and 0.257 for industrial sludge8 shall be used Methane correction factor for the baseline sludge treatment system j (MCF values as per Table III.H.1);

UF_{BL} Model correction factor to account for model uncertainties (0.89);

DOC_F Fraction of DOC dissimilated to biogas (IPCC default value of 0.5);

F Fraction of CH4 in biogas (IPCC default of 0.5).

Without the project activities, the sludge from wastewater treatment plants treated by the project will be disposed of at the landfill and consequently generate methane and other gases which release into the atmosphere directly. During the process, no sludge treatment system exists in the baseline scenario. Thus, the value of the term $\mathbf{BE_{s,treatment,y}}$ is zero.

$$BE_{s,final,y} = S_{final,BL,y} * DOC_s * UF_{BL} * MCF_{s,BL,final} * DOC_F * F * \frac{16}{12} * GWP_{CH4} \qquad \textbf{(11)}$$

Where,

$S_{final,BL,y}$ Amount of dry matter in the final sludge generated by the baseline wastewater treatment system systems in the year(y);

$MCF_{s,BL,final}$ Methane correction factor of the disposal site that receives the final sludge in the

	baseline situation, estimated as per the procedures described in the —"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site";
UF_{BL}	Model correction factor to account for model uncertainties (0.89).

2.2 Baeline emissions about MSW treatment

$$BE_{MSW,y} = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} \quad (12)$$

Where,

BE_y	Baseline emissions in year y (tCO_2e);
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario;
$MD_{BL,y}$	The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tones of methane (tCH_4);
GWP_{CH4}	Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4。

The methane that would be destroyed in baseline is calculated as follows.

$$MD_{BL,y} = MD_{project,y} * AF \quad (13)$$

Where,

AF Adjustment Factor

ACM0001 provides the guidance on how to estimate AF. AF should be considered in cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements or is undertaken for other reasons, the ratio of the destruction efficiency of the baseline system to the destruction efficiency of the system used in the project activity shall be used. For the proposed project, there is neither contractual requirement nor local and national mandatory regulations that are applicable for the destruction of certain amounts of methane from landfills, therefore AF is zero and will be monitored during the crediting period.

Some LFG captured will be flared and most LFG will be used to generate electricity. Thus, the following equation is used to calculate the project emission reductions.

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} \quad (14)$$

$$MD_{flared,y} = (LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4}) \quad (15)$$

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4} \quad (16)$$

Where,

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH_4);
$LFG_{flare,y}$	Quantity of LFG fed to the flare during year y measured in cubic meters (m^3);
$w_{CH4,y}$	Average methane fraction of the LFG as measured during year y and expressed as a fraction (in m^3CH_4/m^3LFG);
D_{CH4}	Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH4);
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y

	(tCO_2e)determined following the procedure described in the *Tool to determine project emissions from flaring gases containing Methane;*
$MD_{electricity,y}$	Quantity of methane destroyed by generation of electricity (tCH_4);
$LFG_{electricity,y}$	Quantity of LFG fed into electricity generator (m^3).

Determination of LFG generation

ACM0001 requires that a project proponent provides an ex ante estimate of emissions reductions. According to the *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, the amount of methane produced in the year y ($BE_{CH4,SWDS,y}$) is calculated using first order decay (FOD) model as follows:

$MB_y = BE_{CH4,SWDS,y}$ =

$$\varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot (1-e^{-k_j}) \qquad \textbf{(17)}$$

Where,

$BE_{CH4,SWDS,y}$	is the methane generation from the landfill in the absence of the project activity in year y (tCO2e)
φ	is model correction factor to account for model uncertainties (0.9)
f	Average methane fraction of the LFG as measured during year y and expressed as a fraction (in m^3CH_4/m^3LFG);
GWP_{CH4}	is fraction of methane captured at the landfill and flared, combusted or used in another manner
OX	is oxidation factor reflecting the amount of methane from the landfill that is oxidized in the soil or other material covering the waste. Using 2006 IPCC Guidelines for default values
F	is fraction of methane in the landfill gas (volume fraction) (0.5)
DOC_f	is fraction degradable organic carbon (DOC) that can decompose. Using 2006 IPCC Guidelines for default values
MCF	is methane correction factor. Using 2006 IPCC Guidelines for default values
$W_{j,x}$	is amount of organic waste type j prevented from disposal in the landfill in the year x (tons)
DOC_j	is fraction of degradable organic carbon (by weight) in the waste type j. Using 2006 IPCC Guidelines for default values
k_j	is decay rate for the waste type j. Using 2006 IPCC Guidelines for default values
j	is waste type category (index)
x	is 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	is year for which methane emissions are calculated

Where different waste types j are prevented from disposal, determine the amount of different waste types ($W_{j,x}$) through sampling and calculate the mean from the samples, as follows:

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^{z} P_{n,j,x}}{z} \qquad \textbf{(18)}$$

Where,

$W_{j,x}$	is amount of organic waste type j prevented from disposal in the landfill in the year y (tons);
W_x	is total amount of organic waste prevented from disposal in year x (tons);
$P_{n,j,x}$	is weight fraction of the waste type j in the sample n collected during the year x;
z	is number of samples collected during the year x.

2.3 Baseline emissions for electricity generation from LFG

$$BE_{EN,y} = BE_{elec,y} = EG_{d,y} * CEF_d \qquad \textbf{(19)}$$

Where,

$BE_{elec,y}$	is the baseline emissions from electricity generated utilizing the combustion heat from incineration in the project activity and exported to the grid (tCO_2e);
$EG_{d,y}$	is the amount of electricity generated utilizing the combustion heat from incineration in the project activity and exported to the grid during the year y (MWh);
CEF_d	is the carbon emissions factor for the displaced electricity source in the project scenario (tCO_2e/MWh).

In case the generated electricity from LFG displaces electricity that would have been generated by other power plants in the grid in the baseline, CEF_d is calculated according to *Tool to calculate the emission factor for an electricity system*. The calculation steps are as follows.

- **Calculating emission factor of East China Power Grid in the baseline scenario**

The electricity generated by the project activity will be delivered to the ECPG. The total generation capacity installed will be 6MW throughout the first crediting period. The project electricity system will be connected with the ECPG. From the China Electric Power Yearbook and China Energy Statistical Yearbook data are public available to calculate the Emission Factor of the ECPG. The default values for the calculation of calorific values for fuel types came from the China Energy Statistical Yearbook 2009, the potential emission factor and fuel oxidation came from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Moreover, the Chinese DNA published emission factor of ECPG on its website[3] which is also available.

- **Step 1. Identify the relevant electric power system**

The electricity generated by the project will be delivered to the ECPG, which covers Shanghai, Zhejiang, Jiangsu, Anhui and Fujian provincial grids. Therefore, ECPG is the relevant electric power system to the proposed project.

- **Step 2. Select an operating margin (OM) method**

For recent years (2003-2007) where data are available, the low-cost/must run resources constituted less

[3] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

than 50% of total power generation of the ECPG and the relevant ratios are respectively 11.0%, 9.75%, 11.9%, 11.4% and 10.9% for year 2003, 2004, 2005, 2006 and 2007[4]. Therefore, the simple OM method is applicable to the project.

A 3-year generation-weighted average OM, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

- **Step 3. Calculate the operating margin emission factor according to the selected method**

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2e/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. It may be calculated:

- Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit, or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The project selects Option B based on the following two reasons:

- The data required in Option A belong to commercial secret and not publicly available in China;
- The power resources of the low-cost/must-run power plants/units serving the ECPG are nuclear and renewable resources, and the data of electricity sales of these resources are publicly available.

According to Option B, the simple OM emission factor is calculated using following equation:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad \textbf{(20)}$$

Where,

$EF_{grid,OMsimple,y}$	Simple operating margin CO2 emission factor in year y (tCO2e/MWh);
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit). Using country specific data from China Energy Statistical Yearbook 2009;
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit). Using country specific data from China Energy Statistical Yearbook 2007-2009;
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel type i in year y (tCO2/GJ). Using 2006 IPCC Guidelines for default values;
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	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).

4 China Electric Power Yearbook (2004~2008)

According to the above steps and the emission factor of ECPG published by Chinese DNA on its website, a 3-year average Simple OM Emission Factor of the ECPG is:
$EF_{grid,OM,y}$ = 0.8592 tCO_2e/MW

The detailed calculation is shown in Annex 3.

- **Step 4. Identify the cohort of power units to be included in the build margin**

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

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

Project participants should use the set of power units that comprise the larger annual generation.

Referring to the description in *Tool to calculate the emission factor for an electricity system*, there are two options for calculating BM. The project selects the ***Option 1*** – For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to 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 emission factor is the generation-weighted average emission factor (tCO_2e/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(21)}$$

Where:

$EF_{grid,BM,y}$	Build margin CO2 emission factor in year y (tCO2e/MWh);
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh);
$FE_{EL,m,y}$	CO2 emission factor of power unit m in year y (tCO2e/MWh);
m	Power units included in the build margin;
y	Most recent historical year for which power generation data is available.

In China, data on either the five power plants that have been built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation are classified as business confidential and are not publicly available. Therefore, EB accepted the following deviations[5]:

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

EB also suggests using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

According to the data published by Chinese DNA, the subcritical generating system with a capacity of 600MW represents the most advanced technology commercially used in domestic coal-fired plants. The combined cycle technology with a capacity of 200MW stands for the most advanced technology used in thermal plants fired by gas or oil in China. Therefore, the BM emission factor of the ECPG is calculated using the data from 2006~2008, based on the above best technology commercially available at the time of this PDD submission. The calculation procedures are shown below.

$$\lambda_{coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \quad \textbf{(22)}$$

$$\lambda_{oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \quad \textbf{(23)}$$

$$\lambda_{gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \quad \textbf{(24)}$$

Where,

λ_{coal}, λ_{oil} and λ_{gas} represent the proportion of CO_2 emission of the solid, liquid and gas fuel in the total emission, respectively.

$F_{i,j,y}$ is the amount of fuel i consumed by relevant power sources j in year y (mass or volume).

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/mass or volume), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year y.

COAL, OIL and GAS are the mark aggregation of solid fuel, liquid fuel and gas fuel, respectively.

λ_{coal}, λ_{oil} and λ_{gas}	represent the proportion of CO2 emission of the solid, liquid and gas fuel in the total emission, respectively;
$F_{i,j,y}$	is the amount of fuel i consumed by relevant power sources j in year y (mass or volume);
$COEF_{i,j,y}$	is the CO2 emission coefficient of fuel i (tCO2/mass or volume), taking into account the carbon content of the fuels used by relevant power sources j and the

[5] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

	percent oxidation of the fuel in year y;
COAL, OIL and GAS	are the mark aggregation of solid fuel, liquid fuel and gas fuel, respectively.

$$\mathbf{EF_{thermal} = \lambda_{coal} * EF_{coal,Adv} + \lambda_{oil} * EF_{oil,Adv} + \lambda_{gas} * EF_{gas,Adv}} \quad \textbf{(25)}$$

$EF_{thermal}$ is the emission factor of thermal power plant. $EF_{coal,Adv}$, $EF_{oil,Adv}$ and $EF_{gas,Adv}$ represent the CO_2 emission factor of the most advanced technology commercially used in coal-, oil- and gas-fired plants in China, respectively.

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad \textbf{(26)}$$

CAP_{Total}	is the total newly capacity addition on different power sources connected to the ECPG;
$CAP_{Thermal}$	is the newly capacity addition on thermal power sources connected to the ECPG.

According to the above steps and the emission factor of ECPG published by Chinese DNA on its website, the BM emission factor of the ECPG is:

$EF_{grid,BM,y}$ = 0.6789tCO_2e/MWh

The detailed calculation is shown in Annex 3.

- **Step 6. Calculate the combined margin emissions factor**

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

$$\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}} \quad \textbf{(27)}$$

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are calculated as described in above Steps and are expressed in tCO_2e/MWh.

The baseline emission factor is:

$CEF_d = EF_{grid,CM,y}$ = 0.5×0.8592+0.5×0.6789= **0.76905 tCO_2e/MWh**

3. Leakage (L_y)

Referring to the ACM0001 and AMS III.H, no leakage effects need to be accounted.

4. Emission reduction (ER_y)

According to the above analysis, the emission reduction of the project activity is calculated as follows. Please see Annex 3 for more details.

$$ER_y = BE_y - PE_y \quad (28)$$

Where,
ER_y is the emission reductions in year y (tCO_2e)
BE_y is the emissions in the baseline scenario in year y (tCO_2e)
PE_y is the emissions in the project scenario in year y (tCO_2e)

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

Data / Parameter:	DOC_S
Data unit:	-
Description:	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis).
Source of data used:	AMS-III.H
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default values of 0.5 for domestic sludge and 0.257 for industrial sludge shall be used according to the methodology.
Any comment:	-

Data / Parameter:	$MCF_{s,BL,final}$
Data unit:	-
Description:	Methane correction factor of the disposal site that receives the final sludge in the baseline situation.
Source of data used:	The data will be estimated as per the procedures described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The placement of waste at the landfill is controlled, including the following activities: (i) cover material; (ii) mechanical compacting; (iii) levelling of the waste. Therefore, 1.0 for anaerobic managed solid waste disposal sites is recommended by 2006 IPCC Guidelines.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	UF_{BL}
Data unit:	-

Description:	Model correction factor to account for model uncertainties.
Source of data used:	AMS-III.H
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using FCCC/SBSTA/2003/10/Add.2 for default value
Any comment:	

Data / Parameter:	**DOC_F**
Data unit:	-
Description:	Fraction of DOC dissimilated to biogas.
Source of data used:	2006 IPCC Guidelines
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using 2006 IPCC Guidelines for default value.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of CH_4 in biogas.
Source of data used:	2006 IPCC Guidelines
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using 2006 IPCC Guidelines for default value.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	GWP_{CH4}
Data unit:	- tCO_2e/tCH_4
Description:	Global Warming Potential for methane.
Source of data used:	Decisions under UNFCCC and the Kyoto Protocol.
Value applied:	21
Justification of the choice of data or description of measurement methods	This value of 21 is to be applied for the first commitment period of the Kyoto Protocol.

and procedures actually applied :	
Any comment:	

Data / Parameter:	CFE_s
Data unit:	
Description:	Capture efficiency of the biogas recovery equipment in the sludge treatment systems.
Source of data used:	AMS-III.H
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$MCF_{s,treatment,PJ,l}$
Data unit:	
Description:	Methane correction factor for the sludge treatment system equipped with biogas recovery equipment (MCF values as per Table III.H.1).
Source of data used:	As per Table III.H.1 in the methodology AMS-III.H.
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Table III.H.1 provides 0.8 as the default value for anaerobic digester for sludge.
Any comment:	

Data / Parameter:	UF_{PJ}
Data unit:	
Description:	Model correction factor to account for model uncertainties.
Source of data used:	AMS-III.H
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	φ

Data unit:	-
Description:	Model correction factor to account for the model uncertainties.
Source of data used:	Default value from *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site* .
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	According to 2006 IPCC, in developing countries such as China with less elaborate management practices, the average value is probably closer to zero. For the conservativeness, 0.1 is used for this project.

Data / Parameter:	**OX**
Data unit:	
Description:	Oxidation factor (reflecting the amount of methane from the landfill that is oxidized in the soil or other material covering the waste).
Source of data used:	2006 IPCC 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 :	Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Xiamen Eastern landfill has daily soil cover, thus OX = 0.1.
Any comment:	According to 2006 IPCC, in developing countries such as China with less elaborate management practices, the average value is probably closer to zero. For the conservativeness, 0.1 is used for this project.

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the landfill gas (volume fraction).
Source of data used:	2006 IPCC 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 :	Using 2006 IPCC Guidelines for default value.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	**DOC_f**
Data unit:	
Description:	Fraction of degradable organic carbon that can decompose.

Source of data used:	2006 IPCC 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 :	2006 IPCC Guidelines provide 0.5 as the default value for DOC_f.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	**DOC_j**
Data unit:	
Description:	Fraction of degradable organic carbon (by weight) in the waste type j.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and 2.5).
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using 2006 IPCC default values.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	**MCF**
Data unit:	
Description:	Methane Correction Factor.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Xiamen Eastern landfill is a managed category of landfill. Therefore, MCF is 1.0 in accordance with 2006 IPCC Guideline.
Any comment:	The value should be updated as per the latest version IPCC Guidelines for National Greenhouse Gas Inventories when the crediting period is updated.

Data / Parameter:	**k_j**
Data unit:	
Description:	Decay rate for the waste type j.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, adapted from Volume 5, Table 3.3.
Value applied:	See Annex 3
Justification of the	Climate data for the location of Xiamen Eastern landfill:

choice of data or description of measurement methods and procedures actually applied :	Mean Annual Temperature: 20.9 degree Celsius Mean Annual Precipitation: 1143.6 mm According to the climate data, Xiamen eastern landfill is in tropical and wet zone, with MAT>20□, MAP >1000mm.
Any comment:	Climate data are available on website.

Data / Parameter:	**$FC_{i,y}$**
Data unit:	mass or volume
Description:	Amount of each fossil fuel consumed by each power source/plant to the ECPG.
Source of data used:	China Energy Statistical Yearbook 2007~2009
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Energy Statistical Yearbook is an official and authoritative publication.
Any comment:	

Data / Parameter:	**NCV_i**
Data unit:	TJ/mass or TJ/volume
Description:	Net calorific value (energy content) per mass or volume unit of fuel i.
Source of data used:	China Energy Statistical Yearbook 2009
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using China's specific values.
Any comment:	

Data / Parameter:	**$EF_{CO2,i}$**
Data unit:	tC/TJ
Description:	CO_2 emission factor per unit of energy of fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using 2006 IPCC default values
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using 2006 IPCC default values
Any comment:	

Data / Parameter:	EG_y
Data unit:	MWh/a
Description:	Electricity generation of each power source/ plant j connected to the ECPG.
Source of data used:	China Electric Power Yearbook 2007~2009
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Electric Power Yearbook is an official and authoritative publication.
Any comment:	

Data / Parameter:	$GENE_{best,coal}$
Data unit:	%
Description:	Best power supply efficiency by the most advanced technology commercially used in coal-fired plants in China.
Source of data used:	Bulletin on Baseline Emission Factors of the China's Regional Grids- the calculation of baseline Build Margin emission factor for the China's Regional Grids. http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf
Value applied:	39.08%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official data from Chinese DNA.
Any comment:	-

Data / Parameter:	$GENE_{best,oil,gas}$
Data unit:	%
Description:	Best power supply efficiency by the most advanced technology commercially used in oil- and gas-fired plants in China.
Source of data used:	Bulletin on Baseline Emission Factors of the China's Regional Grids- the

	calculation of baseline Build Margin emission factor for the China's Regional Grids. http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf
Value applied:	51.46%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official data from Chinese DNA.
Any comment:	-

Data / Parameter:	**$CAP_{j,y}$**
Data unit:	MW
Description:	Capacity installation on different power sources connected to the ECPG.
Source of data used:	China Electric Power Yearbook 2007~2009
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Electric Power Yearbook is an authoritative publication.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

Please see Annex 3 for details of the calculation of baseline emissions, project emissions and leakage emissions.
According to Formula (1)~(28) in Section B.6.1, the baseline emissions and the emission reductions from the project are shown below.

Baseline emissions and project emissions from sludge digester

Table B.6.3.-1 Baseline emissions and project emissions from sludge digester (tCO_2e)

Year	Baseline emissions from electricity displacement (tCO_2e)	Baseline methane emissions from anaerobic decay of the final sludge(tCO_2e)	Total baseline emissions from sludge digester(tCO_2e)	Project emissions from sludge digester(tCO_2e)
	A	B	C=A+ B	D
2013	5,260	56,849	62,109	6,397
2014	5,260	56,849	62,109	6,397
2015	5,260	56,849	62,109	6,397
2016	5,260	56,849	62,109	6,397
2017	5,260	56,849	62,109	6,397

2018	5,260	56,849	62,109	6,397
2019	5,260	56,849	62,109	6,397
2020	5,260	56,849	62,109	6,397
2021	5,260	56,849	62,109	6,397
2022	5,260	56,849	62,109	6,397
Total	**52,600**	**568,490**	**621,090**	**63,970**

Baseline emissions from landfill

Table B.6.3.-1 Methane collected at landfill

Year	Methane generated from landfill (tCH_4)	Collection efficiency (%)	Collected methane from landfill (tCH_4)
	E	F	G=E* F
2013	16,514	60	9,909
2014	16,903	60	10,142
2015	17,358	60	10,415
2016	17,761	60	10,657
2017	18,125	60	10,875
2018	18,460	60	11,076
2019	18,771	60	11,263
2020	19,065	60	11,439
2021	19,344	60	11,606
2022	19,610	60	11,766
Total	**181,912**		**109,147**

Table B.6.3.-2 Methane destroyed at landfill

Year	Methane combustion by elec. generators (ton CH_4)	Methane combustion by flare (ton CH_4)	Methane destroyed (ton CH_4)	Direct emission by methane combustion (tCO_2e)
	H	I	J=H+I	K=J*21
2013	8,136	1,595	9,731	204,358
2014	8,327	1,633	9,960	209,163
2015	8,552	1,677	10,229	214,801
2016	8,593	1,857	10,450	219,457
2017	8,593	2,054	10,647	223,585
2018	8,593	2,235	10,828	227,378
2019	8,593	2,403	10,996	230,912
2020	8,593	2,561	11,154	234,242
2021	8,593	2,712	11,305	237,404
2022	8,593	2,856	11,449	240,428
Total	**85,166**	**21,583**	**106,749**	**2,241,728**

It is assumed that the generators will operate for 7,200 hours per year, and the generation efficiency is 30%. 5% of electricity generated by the project is for on-site use, e.g. by the landfill gas extraction system (pumps) and the generation system itself. The remaining 95% of electricity will be delivered to the ECPG. The emission factor of the ECPG is calculated as 0.76905 tCO_2e/MWh.

Table B.6.3.-2 Baseline emission by displacing equivalent electricity from ECPG

Year	Power from LFG supplied to the grid (MWh)	Grid electricity displacement emission (tCO_2e)
	L	M=J* $CEF_{elec,BL,y}$
2013	32,381	24,902
2014	33,142	25,488
2015	34,035	26,175
2016	34,200	26,302
2017	34,200	26,302
2018	34,200	26,302
2019	34,200	26,302
2020	34,200	26,302
2021	34,200	26,302
2022	34,200	26,302
Total	**338,958**	**260,676**

Referring to the AMS III.H and ACM0001, no leakage effects need to be accounted, that is L_y=0.

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

Based on Section B.6.3, the emission reductions of the project activity are summarized in the table below.

Table B.6.4.-1 Ex-ante estimation of Emission Reductions (tCO_2e)

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of over all emission reductions (tCO_2e)
2013	6,397	291,369	0	284,972
2014	6,397	296,759	0	290,362
2015	6,397	303,085	0	296,688
2016	6,397	307,868	0	301,471
2017	6,397	311,995	0	305,598
2018	6,397	315,788	0	309,391
2019	6,397	319,323	0	312,926
2020	6,397	322,652	0	316,255
2021	6,397	325,815	0	319,418
2022	6,397	328,839	0	322,442
Total (tonnes of CO_2e)	**63,970**	**3,123,493**	**0**	**3,059,523**

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

B.7.1 Data and parameters monitored:

In accordance with ACM0001, AMS III.H, and AMS I.D, the following data and parameters will be monitored during the project crediting period.

Data / Parameter:	$S_{l,PJ,y}$, $S_{final,PJ,y}$
Data unit:	t/year
Description:	Amount of dry matter in the sludge
Source of data to be used:	Measured on-site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See annex 3 for detail.
Description of measurement methods and procedures to be applied:	Monitoring of 100% of the sludge amount through continuous or batch measurements and moisture content through representative sampling to ensure the 90/10 confidence/precision level. Based on data monitored, the total sludge amount on dry basis will be calculated.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$BG_{burnt,y}$
Data unit:	m^3
Description:	Biogas volume in year y
Source of data to be used:	On-site continuous flow meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Measured hourly. Biogas recovered, fuelled, flared or otherwise utilized is monitored using the continuous flow meters. The data will be recorded and archived electronically and kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The project owner will inspect the flow meters regularly to ensure that they function properly within the error limit.
Any comment:	-

Data / Parameter:	$W_{CH4,Y}$
Data unit:	%
Description:	Methane content in biogas in the year y
Source of data to be used:	Continued gas analyzer
Value of data applied for the purpose of calculating expected emission	Monitored ex-post

reductions in section B.5	
Description of measurement methods and procedures to be applied:	The fraction of methane in the biogas will be monitored with a continuous analyser with periodical measurements at a 90/10 confidence/precision level. The data will be recorded and archived on a regular basis and kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The project owner will inspect and calibrate the analyzer regularly to ensure that they function properly within the error limit.
Any comment:	-

Data / Parameter:	**T**
Data unit:	^oC
Description:	Temperature of the biogas
Source of data to be used:	Gas analyzer with temperature measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Temperature of the biogas is required to determine the density of methane combusted. The data will be recorded and archived on a regular basis and kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The project owner will inspect and calibrate the analyzer regularly to ensure that they function properly within the error limit.
Any comment:	-

Data / Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the biogas
Source of data to be used:	Gas analyzer with pressure measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Pressure of the biogas is required to determine the density of methane combusted. The data will be recorded and archived on a regular basis and kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The project owner will inspect and calibrate the analyzer regularly to ensure that they function properly within the error limit.
Any comment:	-

Data / Parameter:	$\mathbf{W_x}$
Data unit:	ton
Description:	Quantity of MSW dumped
Source of data to be used:	Records from landfill operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Reasonable estimation based on current status and implementation plan from landfill operator., see Annex 3.
Description of measurement	On site measurement continuously and aggregated at least annually.

methods and procedures to be applied:	
Any comment:	-

Data / Parameter:	**$LFG_{total,y}$**
Data unit:	m^3
Description:	Total amount of landfill gas captured at Normal Temperature and Pressure
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Measured continuously by a flow meter. Data to be aggregated monthly and yearly. (Average value in a time interval not greater than an hour shall be used in the calculations of emission reductions)
QA/QC procedures to be applied:	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	-

Data / Parameter:	**$LFG_{flare,y}$**
Data unit:	m^3
Description:	Amount of landfill gas flared at Normal Temperature and Pressure
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0(The flaring system is not installed).
Description of measurement methods and procedures to be applied:	Measured continuously by a flow meter. Data to be aggregated monthly and yearly (Average value in a time interval not greater than an hour shall be used in the calculations of emission reductions) .
QA/QC procedures to be applied:	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	-

Data / Parameter:	**$LFG_{electricity,y}$**
Data unit:	m^3
Description:	Amount of landfill gas combusted in power plant at Normal Temperature and Pressure.
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Measured continuously by a flow meter. Data to be aggregated monthly and yearly for each power plant (Average value in a time interval not greater than an hour shall be used in the calculations of

	emission reductions).
QA/QC procedures to be applied:	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	-

Data / Parameter:	**$PE_{flare,y}$**
Data unit:	tCO2e
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data to be used:	Calculated as per the "Tool to determine project emissions from flaring gases containing methane"
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0(The flaring system is not installed).
Description of measurement methods and procedures to be applied:	As per the "Tool to determine project emissions from flaring gases containing methane"
QA/QC procedures to be applied:	As per the "Tool to determine project emissions from flaring gases containing methane"
Any comment:	

Data / Parameter:	**W_{CH4}**
Data unit:	m³ CH4/m³ LFG
Description:	Methane fraction in the landfill gas
Source of data to be used:	To be measured continuously by project participants using certified equipment.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Shall be measured using equipment that can directly measure methane content in the landfill gas, estimation of methane content of landfill gas based on measurement of other constituents of the landfill gas such as CO2 is not permitted. Measured continuously by continuous gas quality analyser (average value in a time interval not greater than an hour shall be used in the calculations of emission reductions).
QA/QC procedures to be applied:	-The gas analyser should be subject to a regular maintenance and testing regime to ensure accuracy
Any comment:	-

Data / Parameter:	**T**
Data unit:	^{o}C
Description:	Temperature of the landfill gas
Source of data to be used:	Project participants
Value of data applied for the	Monitored ex-post

purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously to determine the density of methane D_{CH4}. No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters
QA/QC procedures to be applied:	-Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards.
Any comment:	-

Data / Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the landfill gas
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Monitored ex-post
Description of measurement methods and procedures to be applied:	Measured continuously to determine the density of methane D_{CH4}. No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters.
QA/QC procedures to be applied:	Measuring instruments should be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards.
Any comment:	-

Data / Parameter:	**EL_{LFG}**
Data unit:	MWh
Description:	Net quantity of electricity delivered to the grid which is produced by using LFG under the project activity.
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 3
Description of measurement methods and procedures to be applied:	Directly measured by electricity meter installed at the project site and the connected substation. The data will be measured and recorded hourly, and aggregated monthly. All data will be monitored and archived electronically. Double-check by electricity sale receipts.
QA/QC procedures to be applied:	-Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Any comment:	

Data / Parameter:	**Operating hours of the generators**
Data unit:	Hours
Description:	Operating hours of the generators
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7,200
Description of measurement methods and procedures to be applied:	On site measurement of the operating hours of the generators. All data are measured and archived electronically, and recorded annually.
QA/QC procedures to be applied:	The generators will be calibrated regularly according to manufacturer's specifications
Any comment:	-This is monitored to ensure methane destruction is claimed for methane used in generator when it is operational.

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	Onsite consumption of electricity provided by the ECPG and attributable to the project activity during the year y if any
Source of data to be used:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Continuously measured by electricity meters. Data aggregated at least annually.
QA/QC procedures to be applied:	Cross-check measurement results with invoices for purchase electricity if relevant.
Any comment:	

Data / Parameter:	$FC_{PJ,y}$
Data unit:	Volume or mass unit
Description:	Onsite consumption of fossil fuel due to the project activity during the year y if any
Source of data to be used:	Onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	On-site measurement.
QA/QC procedures to be applied:	Cross-check measurement results with invoices for purchase electricity if relevant.
Any comment:	

The project operator will archive all the monitoring records and data during the crediting period and two years after by means of electronic and paper backup.

B.7.2 Description of the monitoring plan:

1. Monitoring Management

Xiamen Perfect New Energy Co., Ltd., as the developer and SPC (Special Purpose Company) of the proposed project, will be responsible for the monitoring of the project in accordance with the CDM requirements. The monitoring organization is shown in Fig.B.7.2.-1 below.

- **CDM Manager**

One competent manager, to be designated by SPC, will be responsible for this monitoring plan and supervise the collected data. The technology department, financial department and management department will assist him/her. The CDM Manager will be the main contact person for the DOE, Chinese DNA, carbon buyers, consultants as well as related local authorities, during the crediting period.

- **CDM Project Team**

There are three members in the CDM project team, who are responsible for reading, recording and archiving the metering data, and inform the CDM manager about the implementation of the project and all the metering data.

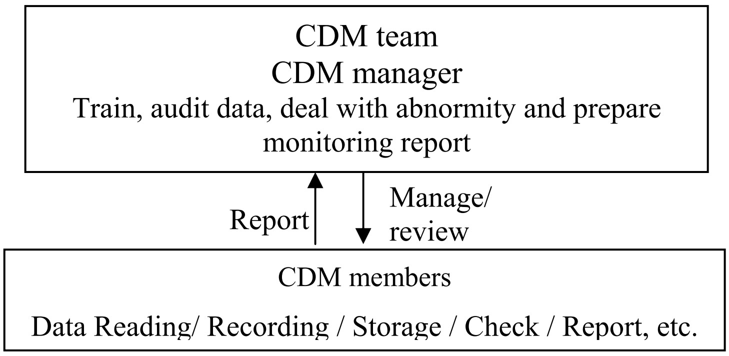

Fig. B.7.2.-1 Project Monitoring Organization

2. Data to be monitored

The project participants will monitor the emission reductions by methods, indicators, and frequency required by the Monitoring Methodology ACM0001, AMS.III.H and AMS.I.D to ensure project ERs are measurable and real. The monitoring methodology is based on direct measurement of the amount of dry matter in the sludge, landfill gas, biogas captured and destroyed in the flare and electricity generating units as well as the electricity delivered to and consumed by the project from the ECPG. Monitoring data at the locations where the monitoring instruments will be equipped will be collected and documented.

3. Quality control and quality assurance procedures

Flow meters, gas analyzers, other critical CDM project equipment and instruments will be subject to regular maintenance and testing according to technical specifications from the manufactures to ensure accuracy and good performance. Calibration of equipment will be conducted periodically according to their technical specifications.

Electricity meters, which will be selected and equipped by the grid company at a later date, will be subject to annual checkups and calibration for accuracy in accordance with the *Technical Administrative Code of Electric Energy Metering (DL/T448-2000).*

4. Documents storage

- List of monitoring equipment (flow meters, gas analyzers, electricity meters, etc.), including their numbers, names, manufacturers, specifications, use requirements, etc.
- Calibration lists and reports, including equipment or parts calibrated, date, method and procedures of calibration, their precision after these procedures, personnel, devices needed,etc.
- Maintenance lists and reports, including equipment or parts maintained, date, method and procedures of maintenance, their performance after these procedures, personnel, devices needed, etc.
- Operational manual of the proposed project
- Meeting minutes of CDM project team meeting
- Non-conformance reports
- Worksheets, monthly and yearly
- Training plan
- Internal audit/inspection reports, including personnel, time, findings, corrective actions, follow-up inspections
- Annual monitoring review

5. Emergency preparedness for unintended emissions
In case of equipment malfunction or breakdown, timely corrective actions will be carried out to minimize the unintended emissions. Working staff will be trained to appropriately cope with emergent situations. The plant operator must frequently inspect, at least once a week, all methane-containing parts of the plant (on the surface). All findings will be documented. In cases leakages are found, the leakages will be reduced and repaired according to the plant operation manual and manufacturer's recommendations.

6. Verification
The verification is the key of the CDM project and all the documents have to be in place, archived and accumulated in a final Monitoring review, which will be submitted to the DOE, who verifies the CDM project during the crediting period. The CDM manager will work closely with the verifier and answer all questions raised by the DOE for emission reduction verification.

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

Completion date: 21/2/2011

Name of entity/person determining the baseline and monitoring plan:

Shanghai Weitai Environment Co., Ltd.

Address: Room 1102, 480 Wulumuqi Road (North), Shanghai, China
Zip Code: 200040
Tel: +86-21-32525665
Fax: +86-21-32525670

None of the person / entity mentioned above is the project participants.

Company name: EJ Business Partners Co., Ltd.
Address: 33-11 Honcho 5-Chome Nakano-Ku, Tokyo, Japan
Zip code: 164-0012

Tel: +81-3-6382-6222
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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/01/2013 or the registration date whichever comes later.

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

10 years.

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

C.2.1. Renewable crediting period

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

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2013 or the registration date whichever comes later.

C.2.2.2. Length:

10 years.

SECTION D. Environmental impacts

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

Construction Stage

Air emissions
Construction site activities such as digging, filling, and dirt and gravel hauling will mainly cause the disturbance and creation of dust and particles in the air. In order to prevent such dust pollution, watering and spraying at the construction site will be performed regularly. Water will be regularly sprayed onto onsite dirt piles when there is a delay in their clearing and removal. Also, water will be used when loading dirt into trucks, and covering materials will be used to prevent dirt from falling from them. In addition, vehicles carrying dirt and rubble will be fully closed to prevent its escape during the transportation period.

Wastewater
Wastewater generated during the construction will include wastewater containing sediment from the construction site and domestic wastewater from construction workers. Wastewater from cleaning materials, equipment and vehicles will be reused after sedimentation. Before entering into the existing treatment facilities at the landfill site, wastewater leaving the construction site will go through an oil separation and sedimentation process.

Noise
Noise will come mainly from the use of various types of construction machinery. Noise requirements will be followed in accordance with GB12523-90, *Noise Limits at Construction Site Boundary*, and construction hours will be appropriately scheduled. Construction machinery with a low-noise level will be used whenever possible, and equipment will be maintained and kept in good working condition, so as to reduce the noise level of the equipment.

Solid Waste
Debris from construction will include waste building materials, sand and gravel material, construction soil, broken bricks, concrete and discarded equipment parts, etc. There will be strict management of construction waste management and transportation. When necessary, waste will be piled in order to reduce waste from scattering. Regularly clearing and removal of waste as well as material recycling is essential. Domestic waste will be disposed of at the landfill with no impact on the surrounding environment.

Operation Stage

Air emissions
The main purpose of the project is to reduce the level of the greenhouse gas methane that is released from the landfill, as well as to reduce emissions of odorous pollutants such as H_2S and NH_3. The emission of flue gases such as SO_x and NO_x from gas generators and flaring will be controlled within the limits according to the *Emission Control Standard of Air Pollutants of Xiamen* (DB35/323-1999) and the *Integrated Emission Standard of Air Pollutants* (GB16297-1996).

Wastewater
Domestic wastewater will be treated in a wastewater treatment plant to meet national discharge standards. Water condensate from the gas collection system will be sent directly back to the existing landfill leachate treatment system, and will meet national standards for discharge, e.g. *Discharge Control Standard of Water Pollutants of Xiamen* (DB35/322-1999) and *Integrated Wastewater Discharge Standard* (GB8978-1996) before being discharged.

Noise
The operation of machinery will produce noise. Noise will mainly come from blower and transformer units. By barring the sound with walls and through distance, this noise will have a minimum impact on the environment. The noise limits will be controlled within 65 db during the day and 55 db at night, which complies with the *Standard of Noise at Boundary of Industrial Enterprises* (GB12348-90).

Solid Waste
During the site's operation, rubbish will be generated by facility workers and will be disposed of at the landfill.

During the construction and operation periods of the project, all requirements will be strictly carried out in accordance with the EIA, and effective measures will be taken to control and reduce environmental pollution.

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:

No negative environmental impacts are expected to result from the project activities. In fact, the implementation of the project will improve local waste management practices to a higher standard, and fulfil reductions of greenhouse gas emission, odour, and environmental pollutants.

SECTION E. Stakeholders' comments

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

The stakeholder meeting will be held after the establishment of the SPC for the project activity. Stakeholders will be included residents living near the landfill, landfill operation and management personnel and general workers, social institutions, as well as others who were interested in LFG technology and CDM, and government staff etc.

E.2. Summary of the comments received:

No negative comments are received from the following stakeholders;

General Water of Xiamen Sewage Co., Ltd. (Treatment of waste water and sludge)

- Currently, a part of sludge generated from waste water treatment facility is treated and/or considered as composting, incineration, and landfilling etc. However, the definite treatment method has not been fixed yet.

- The amount of the sludge will be increased in accordance with the growing of the population in Xiamen, we are looking forward to implementing the project because the power generation by using sludge and drying is designated as model project of Chinese government.

Xiamen Eastern Landfill site

- It is necessary to consider including power generation for the utilization of methane gas generated from landfill waste. We also hope to realize the sludge utilization.

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

At this moment, no negative comments were received. So, no further action has been taken.
It will be taken action if any comments received at the stakeholders meeting which will be held after the establishment of the SPC for project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Owner/Host

Organization:	Xiamen Perfect New Energy Co., Ltd.
Street/P.O.Box:	No. 28 North Hubin Road
Building:	9/F, Jian Ye Building
City:	Xiamen
State/Region:	Fujian Province
Postfix/ZIP:	361012
Country:	China
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Liu
Middle Name:	
First Name:	Jun Xiao
Department:	
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Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public fund from parties included in Annex I of the UNFCCC involved in this project activity.

Annex 3

BASELINE INFORMATION

A. Emission Factor of East China Power Grid[6,7,8,9]

I. Operating Margin

Fuel consumed by the ECPG in year 2006

Fuel type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Subtotal	Carbon Content	Oxidation	Emission factor	LHV	CO_2 emission (tCO_2e)
								(tc/TJ)	(%)	($kgCO_2/TJ$)	(MJ/t,km3)	K=F×I×J/100000 (mass)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J	K=F×I×J/10000 (volume)
Raw coal	10^4tn	2744.45	10945.42	6065	3455.2	2369.63	**25579.7**	25.8	100	87,300	20,908	466,898,181
Cleaned coal	10^4tn						**0**	25.8	100	87,300	26,344	0
Other clean coal	10^4tn		150.54		23.06		**173.6**	25.8	100	87,300	8,363	1,267,436
briquette	10^4tn						**0**	26.6	100	87,300	20,908	0
Coke	10^4tn			39.07			**39.07**	29.2	100	95,700	28,435	1,063,184
Coke oven gas	10^8m^3	1.71	3.13	0.23	0.71		**5.78**	12.1	100	37,300	16,726	360,603
Other gas	10^8m^3	84.64	106.54	3.28	25.12		**219.58**	12.1	100	37,300	5,227	4,281,088
Crude oil	10^4tn			20.3			**20.3**	20	100	71,100	41,816	603,543
Gasoline	10^4tn						**0**	18.9	100	67,500	43,070	0
Diesel oil	10^4tn	2.13	3.7	4.11	1.21	1.11	**12.26**	20.2	100	72,600	42,652	379,635
Fuel oil	10^4tn	44.51	3.77	71.98	0.02	4.5	**124.78**	21.1	100	75,500	41,816	3,939,439
LPG	10^4tn						**0**	17.2	100	61,600	50,179	0
Refinery	10^4tn	0.29	0.4		2.95		**3.64**	15.7	100	48,200	46,055	80,803
Natural gas	10^8m^3	3.2	13.5	9.18			**25.88**	15.3	100	54,300	38,931	5,470,911
Other petroleum	10^4tn	18.82	3.57				**22.39**	20	100	72,200	41,816	675,980
Other coking products	10^4tn						**0**	25.8	100	95,700	28,435	0
Other energy	10^4tne	6.66	2.8	27.45	3.21		**40.12**	0	0	0	0	0
											Total	485,020,803

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6 China Energy Statistical Yearbook 2007~2009

7 China Electric Power Yearbook 2007~2009

8 2006 IPCC Guidelines for National Greenhouse Gas Inventories

9 http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

Electricity generation and supply by the ECPG in year 2006

Province	Generation	Generation	On-site use	Supply
	(10^8kWh)	(MWh)	(%)	(MWh)
Shanghai	720.33	72,033,000	5.06	68,388,130
Jiangsu	2512.58	251,258,000	5.69	236,961,420
Zhejiang	1403.49	140,349,000	5.62	132,461,386
Anhui	718.67	71,867,000	6.05	67,519,047
Fujian	555.8	55,580,000	4.51	53,073,342
Total				558,403,325

Fuel consumed by the ECPG in year 2007

Fuel type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Subtotal	Carbon Content	Oxidation	Emission factor	LHV	CO_2 emission (tCO_2e)
								(tc/TJ)	(%)	($kgCO_2/TJ$)	(MJ/t,km3)	K=F×I×J/100000 (mass)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J	K=F×I×J/10000 (volume)
Raw coal	10^4tn	2754.04	11060.78	7350	3929.9	3097.87	**28192.59**	25.8	100	87,300	20,908	514,590,436
Cleaned coal	10^4tn						**0**	25.8	100	87,300	26,344	0
Other clean coal	10^4tn		459.17		29.32		**488.49**	25.8	100	87,300	8,363	3,566,416
briquette	10^4tn						**0**	26.6	100	87,300	20,908	0
Coke	10^4tn			35.06			**35.06**	29.2	100	95,700	28,435	954,063
Coke oven gas	10^8m^3	0.89	9.73	0.22	1.56	0.75	**13.15**	12.1	100	37,300	16,726	820,402
Other gas	10^8m^3	98.92	70.45	3.41	36.3	1.71	**210.79**	12.1	100	37,300	5,227	4,109,712
Crude oil	10^4tn			15.15			**15.15**	20	100	71,100	41,816	450,427
Gasoline	10^4tn						**0**	18.9	100	67,500	43,070	0
Diesel oil	10^4tn	1.23	5.37	2.76		1.01	**10.37**	20.2	100	72,600	42,652	321,111
Fuel oil	10^4tn	40.76	1.55	29.52		2.04	**73.87**	21.1	100	75,500	41,816	2,332,156
LPG	10^4tn						**0**	17.2	100	61,600	50,179	0
Refinery	10^4tn	0.2	0.63		2.55		**3.38**	15.7	100	48,200	46,055	75,031
Natural gas	10^8m^3	4.61	19.17	11.01			**34.79**	15.3	100	54,300	38,931	7,354,444
Other petroleum	10^4tn	20.39	2.78				**23.17**	20	100	72,200	41,816	699,529
Other coking products	10^4tn						**0**	25.8	100	95,700	28,435	0
Other energy	10^4tne	6.89	28.88	44.93	7.52	9.43	**97.65**	0	0	0	0	0
											Total	535,273,726

Electricity generation and supply by the ECPG in year 2007

Province	Generation	Generation	On-site use	Supply
	(10^8kWh)	(MWh)	(%)	(MWh)
Shanghai	726	72,600,000	4.72	69,173,280
Jiangsu	2709	270,900,000	5.55	255,865,050
Zhejiang	1723	172,300,000	5.83	162,254,910
Anhui	848	84,800,000	5.92	79,779,840
Fujian	723	72,300,000	5.59	68,258,430
Total				635,331,510

Fuel consumed by the ECPG in year 2008

Fuel type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Subtotal	Carbon Content	Oxidation	Emission factor	LHV	CO_2 emission (tCO_2e)
								(tc/TJ)	(%)	($kgCO_2/TJ$)	(MJ/t,km3)	K=F×I×J/100000 (mass)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J	K=F×I×J/10000 (volume)
Raw coal	10^4tn	2964.04	10890.2	7316.17	4887.18	3264.88	**29322.47**	25.8	100	87,300	20,908	535,213,779
Cleaned coal	10^4tn						**0**	25.8	100	87,300	26,344	0
Other clean coal	10^4tn		513.34		33.49		**546.83**	25.8	100	87,300	8,363	3,992,351
briquette	10^4tn						**0**	26.6	100	87,300	20,908	0
Coke	10^4tn			31.12			**31.12**	29.2	100	95,700	28,435	846,847
Coke oven gas	10^8m^3	0.5	11.65	0.13	5.62	0.31	**18.21**	12.1	100	37,300	16,726	1,136,085
Other gas	10^8m^3	98.42	77.84	3.57		6.36	**186.19**	12.1	100	37,300	5,227	3,630,092
Crude oil	10^4tn			8.31			**8.31**	20	100	71,100	41,816	247,066
Gasoline	10^4tn						**0**	18.9	100	67,500	43,070	0
Diesel oil	10^4tn	5.85	4.04	2.05		1.04	**12.98**	20.2	100	72,600	42,652	401,930
Fuel oil	10^4tn	24.43	0.39	13.48		1.81	**40.11**	21.1	100	75,500	41,816	1,266,316
LPG	10^4tn						**0**	17.2	100	61,600	50,179	0
Refinery	10^4tn	0.05	0.28		1.5	0.57	**2.4**	15.7	100	48,200	46,055	53,276
Natural gas	10^8m^3	3.65	25.14	8.99		0.19	**37.97**	15.3	100	54,300	38,931	8,026,681
Other petroleum	10^4tn	21.33	3.09				**24.42**	20	100	72,200	41,816	737,268
Other coking products	10^4tn						**0**	25.8	100	95,700	28,435	0
Other energy	10^4tne	15.88	62.57	34.54		8.99	**121.98**	0	0	0	0	0
											Total	555,551,691

Electricity generation and supply by the ECPG in year 2008

Province	Generation (10^8kWh)	Generation (MWh)	On-site use (%)	Supply (MWh)
Shanghai	794	79,400,000	4.88	75,525,280
Jiangsu	2735	273,500,000	5.51	258,430,150
Zhejiang	1748	174,800,000	5.77	164,714,040
Anhui	1074	107,400,000	5.72	101,256,720
Fujian	748	74,800,000	5.61	70,603,720
Total				670,529,910

In addition, during 2006～2008 the ECPG imported electricity from Central China Power Grid(“GGPG”) and Shanxi Yangcheng Power Grid (“SYPG”). The imported electricity amount and emissions are shown below.

		2006	2007	2008
1.1	Imported generation from SYPG(MWh)	11,150,820	12,773,620	16,903,640
1.2	Emission factor of SYPG (tCO_2e/MWh)	0.99702	0.97254	1.00495
1.3	Imported emission from SYPG(MWh)	11,117,582	12,422,864	16,987,234
2.1	Imported generation from CCPG(MWh)	24,029,150	31,823,310	35,684,610
2.2	Emission factor of CCPG (tCO_2e/MWh)	1.12157	1.10197	1.04205
2.3	Imported emission from CCPG (tCO_2e)	26,950,312	35,068,445	37,185,083
3.1	Imported generation from ECPG (MWh)	558,403,325	635,331,510	670,529,910
3.2	Imported emission from ECPG (MWh)(tCO_2e)	485,020,803	535,273,726	555,551,691
1.1+2.1+3.1	Total generation (MWh), Σ GEN	593,583,295	679,928,440	723,118,160
1.3+2.3+3.3	Total emission (tCO_2e), $\Sigma F_{i,m,y} \times COEF$	523,088,697	582,765,035	609,724,008

Therefore, OM emission factor of the ECPG is the average value of 2006~2008.

$$EF_{grid,OMsimple,y} = \frac{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

= (523,088,697+582,765,035+609,724,008) / (593,583,295 + 679,928,440+723,118,160)
= 0.8592 tCO2e/MWh

II. Build Margin

According to the recent research[10] undertaken by the National Development and Reform Commission ("NDRC", Chinese DNA), the subcritical generating system with a capacity above 600MW represents the most advanced technology commercially used in domestic coal-fired plants. The weighted value based on the coal consumption by 68 sets of 600MW subcritical generating units installed in 2008 is calculated as 314.35 gce/kWh, which also means the power supply efficiency of these plants is weighted as 39.08%.
The combine cycle technology with a capacity of 200MW stands for the most advanced technology used in thermal plants fired by gas or oil in China. Based on the statistics in 2008, the thermal plant with the maximum power supply efficiency 51.46% consumed the equivalent fuel of 238.74 gce/kWh.

Emission factor of most advanced technology commercially used in China's domestic thermal power plants

	Parameters	Power supply efficiency (%)	EF of fuel ($kgCO_2$/TJ)	Oxidation	Emission factor (tCO_2/MWh)
		A	B	C	D=3.6/A/10,000×B×C
Coal fire plant	$EF_{Coal,Adv,y}$	39.08	87,300	1	0.8042
Oil fire plant	$EF_{Oil,Adv,y}$	51.46	75,500	1	0.5282
Gas fire plant	$EF_{Gas,Adv,y}$	51.46	54,300	1	0.3799

[10] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

Fuel consumption and emission on the ECPG in 2008

		Shanghai	Jiangsu	Zhejiang	Anhui	Fwujian	Total	Caloric value	Emission factor	Oxidation	Emission（tCO_2e）
Fuel type	Unit	A	B	C	D	E	G=A+…+F	H	I	J	K=G×H×I×J/100,000
Raw coal	10^4ton	2,964.04	10,890.20	7316.17	4,887.18	3,264.88	29,322.47	20,908	87,300	1	535,213,779
Cleaned coal	10^4ton	0	0	0	0	0	0	26,344	87,300	1	0
Other washed coal	10^4ton	0	513.34	0	33.49	0	546.83	8,363	87,300	1	3,992,351
briquettes	10^4ton	0	0	0	0	0	0	20,908	87,300	1	0
Coke	10^4ton	0	0	31.12	0	0	31.12	28,435	95,700	1	846,847
Other coking product	10^4ton	0	0	0	0	0	0	28,435	95,700	1	0
Sub-total											**540,052,976**
Crude oil	10^4ton	0	0	8.31	0	0	8.31	41,816	71,100	1	247,066
Gasoline	10^4ton	0	0	0	0	0	0	43,070	67,500	1	0
Diesel oil	10^4ton	5.85	4.04	2.05	0	1.04	12.98	42,652	72,600	1	401,930
Fuel oil	10^4ton	24.43	0.39	13.48	0	1.81	40.11	41,816	75,500	1	1,266,316
Other petroleum product	10^4ton	21.33	3.09	0	0	0	24.42	41,816	72,200	1	737,268
Sub-total											**2,652,580**
Natural gas	10^7m^3	36.5	251.4	89.9	0	1.9	379.7	38,931	54,300	1	8,026,681
Coke oven gas	10^7m^3	5	116.5	1.3	56.2	3.1	182.1	16,726	37,300	1	1,136,085
Other gas	10^7m^3	984.2	778.4	35.7	0	63.6	1861.9	5,227	37,300	1	3,630,092
LPG	10^4ton	0	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10^4ton	0.05	0.28	0	1.5	0.57	2.4	46,055	48,200	1	53,276
Sub-total											**12,846,135**
Total											**555,551,691**

$$\lambda_{coal} = \frac{\sum_{i \in COAL, j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \qquad \lambda_{oil} = \frac{\sum_{i \in OIL, j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \qquad \lambda_{gas} = \frac{\sum_{i \in GAS, j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}}$$

λ_{coal} = 540,052,976 / 555,551,691 = 97.21%

λ_{oil} = 2,652,580/555,551,691= 0.48%

λ_{gas} = 12,846,135/555,551,691 = 2.31%

$EF_{thermal} = \lambda_{coal} * EF_{coal,Adv} + \lambda_{oil} * EF_{oil,Adv} + \lambda_{gas} * EF_{gas,Adv}$ = 0.7931 (tCO_2e/MWh)

Capacity addition during the 2006~ 2008 on the ECPG

Generation capacity of the ECPG installed in year 2008

Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal	MW	16,780	50,680	40,990	24,820	15,430	148,700
Hydro	MW	0	1,140	8,960	1,560	10,580	22,240
Nuclear	MW	0	2,000	3,070	0	0	5,070
Wind and other	MW	40	610	150	0	260	1,060
Total	MW	16,820	54,420	53,170	26,380	26,270	177,070

Generation capacity of the ECPG installed in year 2007

Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal	MW	14,150	53,340	39,490	17,760	13,910	138,650
Hydro	MW	0	140	8,520	1,510	9,800	19,970
Nuclear	MW	0	2,000	3,070	0	0	5,070
Wind and other	MW	268.8	517.8	40	0	269	1,095.6
Total	MW	14,418.8	55,997.8	51,120	19,270	23,979	164,785.6

Generation capacity of the ECPG installed in year 2008

Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal	MW	14,526	51,776	35,391	14,134	13,001	128,828
Hydro	MW	0	136	8,369	1,001	8,957	18,463
Nuclear	MW	0	0	3,066	0	0	3,066
Wind and other	MW	253	162	43	0	89	547
Total	MW	14,779	52,074	46,869	15,135	22,047	150,904

Therefore, the Build Margin of the ECPG is calculated as the table below:

Capacity addition of the ECPG during 2006~2008

Capacity	Capacity installed in 2006	Capacity installed in 2007	Capacity installed in 2008	Capacity addition 2006-2008	Capacity addition 2007-2008	Share in the capacity
	A	B	C	D	E	F
Thermal	128,828	138,650	148,700	32,640	18,116	85.60%
Hydro	18,463	19,970	22,240	2,972	1,336	7.80%
Nuclear	3,066	5,070	5,070	2,004	0	5.26%
Wind and other	547	1,096	1,060	513	-36	1.35%
Total	150,904	164,786	177,070	**38,129**	**19,416**	100.00%
Share in the capacity of 2008				21.53%	10.97%	

EF_{BM} =0.7931×85.6%= 0.6789tCO_2e/MWh

Taking the default value of weights w_{OM} and w_{BM}, 50% respectively, the emission factor of the ECPG is calculated as follows.

	OM (tCO_2e/MWh)	BM (tCO_2e/MWh)	EF (tCO_2e/MWh)
East China Power Grid	**0.8592**	**0.6789**	**0.76905**

B. Emission Reductions Calculation

Please refer to Section B.6.1 for the meanings of the parameters.

1. Project emissions PE_y

(1) $\mathbf{PE_{MSW,y} = PE_{EC,y} = EC_{PJ,y} * CEF_{elec,BL,y} * (1+TD_{L,y})}$
In the project design stage, $EC_{PJ,y} = 0$ and will be monitored during the crediting period.

(2) $\mathbf{PE_{biogas,y} = PE_{power,y} + PE_{s,treatment,y} + PE_{s,final,y} + PE_{fugitive,y}}$

In the project design stage, approx. 100kW will be used as the electricity consumption amount for sludge digester.
Thus, $\mathbf{PE_{power,y}}$ = EGp,y * EFco2 = 0.1*8760*0.76905 = 674
There is no sludge treatment system affected by the project, and not equipped with biogas recovery. Thus, $\mathbf{PE_{s,treatment,y}} = 0$.
According to the methodology AMS III.H, if the sludge is disposed in a landfill with biogas recovery, this term $\mathbf{PE_{s,final,y}}$ shall be neglected.
In this proposed project, the final sludge is designed to be dumped in Xiamen Eastern landfill with biogas recovery, so $\mathbf{PE_{s,final,y}} = 0$.

As for $\mathbf{PE_{fugitive,y}}$, the equation is shown below.

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

$$PE_{fugitive,s,y} = (1 - CEF_s) * MEP_{s,treatment,y} * GWP_{CH4}$$

$$MEP_{s,treatment,y} = \sum_{l} (S_{l,PJ,y} * MCF_{s,treatment,PJ,l}) * DOC_s * UF_{PJ} * DOC_F * F * \frac{16}{12}$$

Parameter	Value	Unit	Source of data
$S_{l,PJ,y}$	The estimated amount of sludge treated will be 250t/d on wet basis (w80%), so the amount of dry matter in sludge is 250×20%=50 t/d	-	The operation record by wastewater treatment plants.
CEF_s	0.9		The methodology AMS.III.H
DOC_s	0.5	%	The methodology AMS.III.H
UF_{PJ}	1.12	-	The methodology AMS.III.H

$MCF_{y,treatment,PJ,l}$	0.8	%	The methodology AMS.III.H
DOC_F	0.5	-	The methodology AMS.III.H
F	0.5	-	The methodology AMS.III.H
GWP_{CH4}	21	-	UNFCCC and Kyoto Protocol

According to the equation and data in the above table, $PE_{biogas,y}$ =6,397 tCO_2e/yr.

2. Baseline emissions BE_y

(1) **Baseline emissions from LFG treatment**

$$MB_{CH4,y} = \varphi \cdot (1-f) \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j (y-x)} \cdot (1-e^{-k_j})$$

Parameter	Value	Unit	Source of data
φ	0.9	-	Default value from *Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*
f	0	%	Landfill operation records
OX	0.1	-	2006 IPCC Guidelines, Vol.5, p.3.15
F	50	%	2006 IPCC Guidelines, Vol.5, p.3.15
DOC_f	0.5	-	2006 IPCC Guidelines, Vol.5, p.3.13
MCF	1.0	-	2006 IPCC Guidelines, Vol.5, p.3.14
DOC_j	(see table below)	-	2006 IPCC Guidelines, Vol.5, p.2.14

Waste type j	**DOC_j (%)**
Paper	40
Textile	24
Food waste	15
Wood	43
Garden and park waste	20
Plastic, glass, metals and other inert waste	0

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>k_j</td><td>
<table>
<tr><td colspan="2" rowspan="2">Waste type j</td><td>Boreal and Temperature (MAT >20℃)</td></tr>
<tr><td>Wet (MAP >1000mm)</td></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textile</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible, garden and park waste</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>food waste,</td><td>0.4</td></tr>
</table>
</td><td>-</td><td>2006 IPCC Guidelines, Vol.5, p.3.17</td></tr>
</table>

W_x: MSW landfilling quantity

Year	Quantity（ton）
2009	833,000
2010	925,700
2011	740,500
2012	555,300
2013	570,100
2014	584,900
2015	599,700
2016	603,900
2017	608,100
2018	612,300
2019	616,500
2020	620,700
2021	624,900
2022	629,100
Total	**9,124,700**

Source: Reasonable estimation based on current status and implementation plan from landfill operator.
Notes: Xiamen Eastern landfill started operation in Dec.2008 and the residual MSW, which will be obtained by deducting the amount of MSW treated with other methods from total generation amount, will be dumped at the disposal site.

Waste composition

MSW composition j	Percentage (%)
Food Waste	62.11
Garden and Yard Waste	0
Paper and Cardboard	4.56
Plastics	9.28
Textiles, Leather and Rubber	3.84
Metals	0.49
Glass	3.45
Wood	0.96
Diappers	0
Other Organics	2.54
Inorganics	12.77

Based on the above parameters and equation, methane generation at Xiamen Eastern landfill during the crediting period is shown in the table below.

Year	Quantity（ton）
2013	16,514
2014	16,903
2015	17,358
2016	17,761
2017	18,125
2018	18,460
2019	18,771
2020	19,065
2021	19,344
2022	19,610
Total	**181,912**

LFG flaring and electricity generation

Year	Methane combustion by elec. generators (ton CH_4)	Methane combustion by flare (ton CH_4)	Methane destroyed (ton CH_4)	Direct emission by methane combustion (tCO_2e)
2013	8,136	1,595	9,731	204,358
2014	8,327	1,633	9,960	209,163
2015	8,552	1,677	10,229	214,801
2016	8,593	1,857	10,450	219,457
2017	8,593	2,054	10,647	223,585
2018	8,593	2,235	10,828	227,378
2019	8,593	2,403	10,996	230,912
2020	8,593	2,561	11,154	234,242
2021	8,593	2,712	11,305	237,404
2022	8,593	2,856	11,449	240,428
Total	**85,166**	**21,583**	**106,749**	**2,241,728**

$$BE_{EN,y} = EG_{d,y} * CEF_d$$

Parameter	Value	Unit	Source of data

<table>
<tr><td>$EG_{d,y}$</td><td>
<table>
<tr><td>Operation period</td><td>Electricity exported to ECPG</td></tr>
<tr><td>2013</td><td>32,381</td></tr>
<tr><td>2014</td><td>33,142</td></tr>
<tr><td>2015</td><td>34,035</td></tr>
<tr><td>2016</td><td>34,200</td></tr>
<tr><td>2017</td><td>34,200</td></tr>
<tr><td>2018</td><td>34,200</td></tr>
<tr><td>2019</td><td>34,200</td></tr>
<tr><td>2020</td><td>34,200</td></tr>
<tr><td>2021</td><td>34,200</td></tr>
<tr><td>2022</td><td>34,200</td></tr>
</table>
</td><td>MWh/yr</td><td>Estimated value based on installed capacity and electricity generation amount.</td></tr>
<tr><td>CEF_d</td><td>0.76905</td><td>tCO_2e/MWh</td><td>See Annex 3, part A. calculation of emission factor of ECPG</td></tr>
</table>

According to the equation and data in the above table, the results are as follows:

Year	$BE_{EN,y}$ (tCO_2e/yr)
2013	24,902
2014	25,488
2015	26,175
2016	26,302
2017	26,302
2018	26,302
2019	26,302
2020	26,302
2021	26,302
2022	26,302
Total	**260,676**

(2) Baseline emissions from the sludge digester

$$BE_{biogas,y} = BE_{power,y} + BE_{s,treatment,y} + BE_{s,final,y}$$

$$BE_{power,y} = EGP_{J,y} * CEF_{y,grid}$$

Parameter	Value	Unit	Source of data
$EGP_{J,y}$	Operation period / Electricity exported to ECPG: 2013: 6,840 2014: 6,840 2015: 6,840 2016: 6,840 2017: 6,840 2018: 6,840 2019: 6,840 2020: 6,840 2021: 6,840 2022: 6,840	MWh/yr	Estimated value based on installed capacity and electricity generation.
$CEF_{y,grid}$	0.76905	tCO_2e/MWh	See Annex 3, part A. calculation of emission factor of ECPG

$BE_{s,treatment,y}=0$

$$BE_{s,final,y} = S_{final,BL,y} * DOC_s * UF_{BL} * MCF_{s,BL,final} * DOC_F * F * \frac{16}{12} * GWP_{CH4}$$

Parameter	Value	Unit	Source of data

$S_{final,BL,y}$	The estimated amount of sludge treated will be 250t/d on wet basis (w80%), so the amount of dry matter in sludge is 250×20%=50 t/d	-	The operation record by wastewater treatment plants. The project plan
DOC_s	0.5	%	The methodology AMS.III.H
UF_{BL}	0.89	-	The methodology AMS.III.H
$MCF_{s,BL,final}$	1	%	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site.
DOC_F	0.5	-	The methodology AMS.III.H
F	0.5	-	The methodology AMS.III.H
GWP_{CH4}	21	-	UNFCCC and Kyoto Protocol

Based on the above parameters and equation, baseline emission from sludge digester during the crediting period is shown in the table below.

Year	BE_y（tCO_2e）
2013	55,712
2014	55,712
2015	55,712
2016	55,712
2017	55,712
2018	55,712
2019	55,712
2020	55,712
2021	55,712
2022	55,712
Total	**557,120**

3. Leakage emissions L_y

According to ACM0001, AMS III.H, no leakage effects need to be accounted, so $L_y = 0$

4. Emission Reductions ER_y

In sum, the baseline emission is shown below.

Year	Estimation of emission reductions from sludge treatment (tCO_2e)	Estimation of emission reductions from LFG treatment (tCO_2e)	Estimation of emission reductions (tCO_2e)
	N=C-D	O=(K+M)*(1-AF)	Q=N+O
2013	55,712	229,260	284,972
2014	55,712	234,650	290,362
2015	55,712	240,976	296,688
2016	55,712	245,759	301,471
2017	55,712	249,886	305,598
2018	55,712	253,679	309,391
2019	55,712	257,214	312,926
2020	55,712	260,543	316,255
2021	55,712	263,706	319,418
2022	55,712	266,730	322,442
Total	**557,120**	**2,502,403**	**3,059,523**

Annex 4

MONITORING INFORMATION

Please refer to B.7 for the monitoring information of the project.

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