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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Name of the Project: Nanhai MSW Incineration II Project
Version: 11
Date: 06/01/2012

A.2. Description of the project activity:

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Nanhai MSW Incineration II Project (hereafter referred to as the project or the proposed project) is located at Shougouling, Shishan Forestry Centre, Shishan Town, Nanhai District, Foshan City, Guangdong Province, P.R. China. The Project is invested, constructed and operated by Foshan Nanhai Green Renewable Energy Co., Ltd.. (hereafter referred to as the project owner).

Foshan Nanhai Green Renewable Energy Co., Ltd. was founded in April 2006， which is a joint venture of Nanhai Development Co., Ltd. and Foshan Nanhai Lianda Investment (Holdings) Company, Ltd.. The main purpose of the investment is to help the government solve the MSW issue as well as developing recycling economy by means of utilizing the waste heat from the combustion of MSW.

With three 500t/d MSW combustion production lines, the project will treat 1,500 tons of MSW per diem. The combustion system is composed of three 500t/d mechanical grate incinerators, matched with two sets of 15MW steam turbine and two sets of 20MW generators. The project will process 495,000 tons[1] of MSW every year, and consume 168 tons of 0# light diesel as auxiliary fuel. The MSW combustion line will work 8,000hours every year, generating 168,655 MWh electricity, of which 134,924 MWh will be exported to the South China Power Grid (SCPG) to which the project activity is connected. Since the incinerators will be started one by one and under test run during 2011, the project is expected to be running at 50% of its full capacity in the first year of operation.

By combusting MSW that would otherwise be disposed of at landfill, the proposed project activity avoids the emission of methane that would be generated under landfill condition. In the meanwhile, by utilizing the waste heat from the combustion of MSW, the boilers can produce steam to generate power to replace the electricity that would otherwise be generated by fossil-fuel fired power plants which are connected to SCPG. The baseline scenario of this project is the same as the scenario prior to the implementation of the project, namely the landfill gas is vented directly and the equivalent power is supplied by the SCPG. It is estimated that in the first crediting period of the project (from 1st April 2012 to 31st March 2019), the average annual GHG emission reduction will be 183,530tCO_2e.

Before the implementation of the project, the local MSW was usually disposed of at nearby landfill, where no landfill gas capturing system erected and the landfill gases are released to

[1] According to the BOT agreement between project owner and Nanhai Municipal Administration Bureau.

atmosphere directly. The equivalent power generated by the project was supplied by the SCPG. The baseline scenario identified in section B.4 is the same as the scenario existing prior to the start of implementation of the project activity. The implementation of the project will meet the requirement of local MSW harmless treatment, and significantly improve local environment. Also, the proposed project fits the priority development sector of integrated utilization of resource and energy saving of China, and helps reduce GHG emission that would occur in baseline scenarios such as power generating by fossil-fuel fired plants and MSW treatment at landfill. In the mean while, the implementation of the project will support local sustainable development in the following ways:

- Reduce GHG emission compared to common practice.
- Relieve the pressure of power demand, and improve the innovation in urban resource integrated utilization sector.
- Provide a solution to local MSW sanitary treatment.
- Reduce pollutant release in power sector, compared to common practice.
- Create job opportunities for local government during the construction and operation of the project.

A.3. Project participants:

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Project participants to the project activity are the following:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host)	Foshan Nanhai Green Renewable Energy Co., Ltd. (project owner)	No
U.K.	Climate Bridge Ltd. (CER buyer)	No
U.K.	Noble Carbon Credits Limited (CER buyer)	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.:

>>
Guangdong Province

A.4.1.3. City/Town/Community etc:

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Shougouling, Shishan Forestry Centre, Shishan Town, Nanhai District, Foshan City

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

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The project is located within Nanhai District, Foshan City, Guangdong Province. The geographical coordinates are east longitude 113.0328 ℃E and north latitude 23.1575 ℃N, Figure A-1 shows the geographic location of the project.

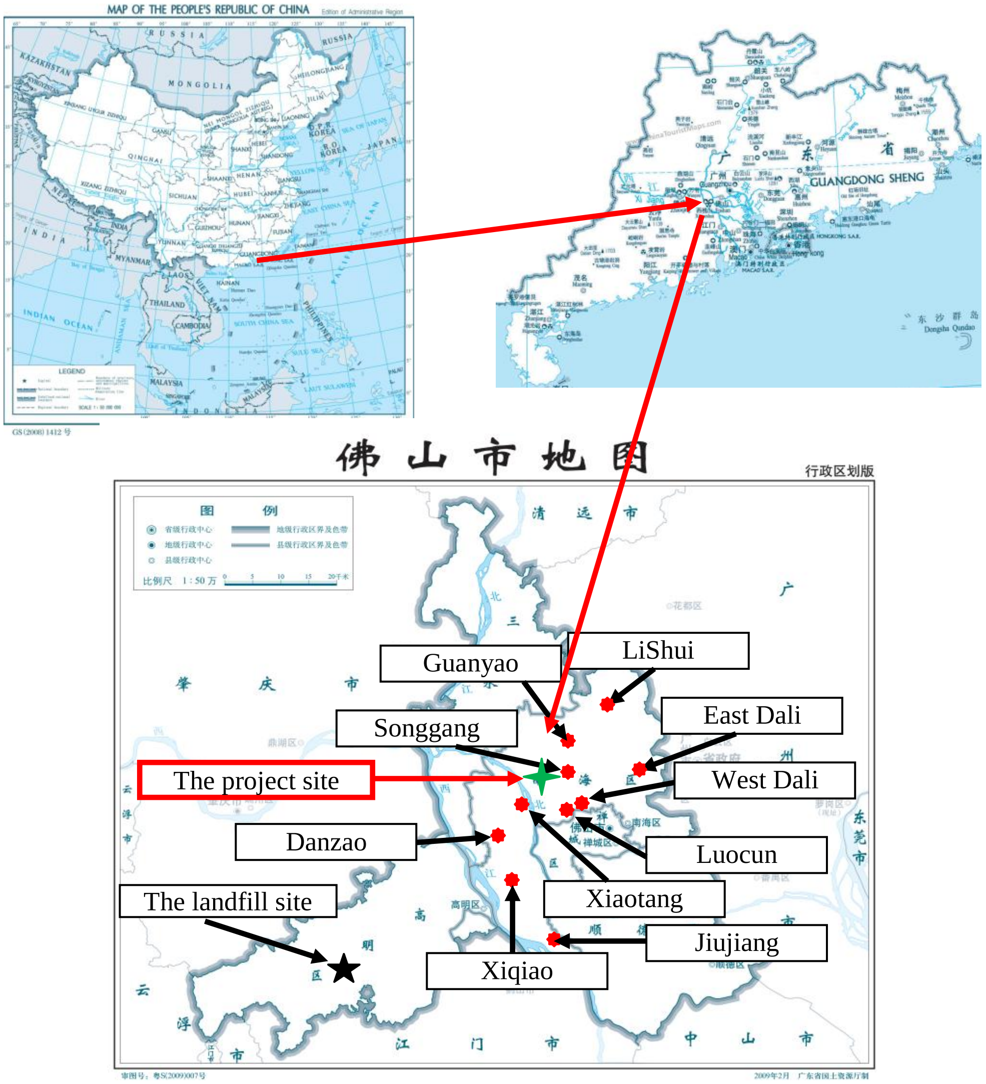

Figure A-1 The location of the project Site, landfill site and collection points

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

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The objective falls into sector scope 1: energy industries and sector scope 13: Waste handling and disposal.

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

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The MSW treatment capacity of the proposed Project is 1,500 t/d, 495,000 t/a. The incineration system is composed of three sets of mechanical grate incinerators with individual capacity of 500t/d. Two sets of 15MW turbine and two sets of 20MW generator are matched with the incineration system, generating power by utilizing the waste heat from MSW combustion. Imported incinerators will be employed in the key processes. When the project is operational, it will consume 168 tons of 0# light diesel as auxiliary fuel each year. The energy from the auxiliary fossil fuel is less than 50% of the energy from the incinerators. The project will generate 168,655MWh electricity each year, and export 134,924MWh to South China Power Grid, which includes Guangdong Power Grid, Yunnan Power Grid, Guangxi Power Grid, and Guizhou Power Grid.

The flow chart and monitoring locations of the project are shown in Figure A-2 and the key technical indicators of major equipments are shown in Table A-1.

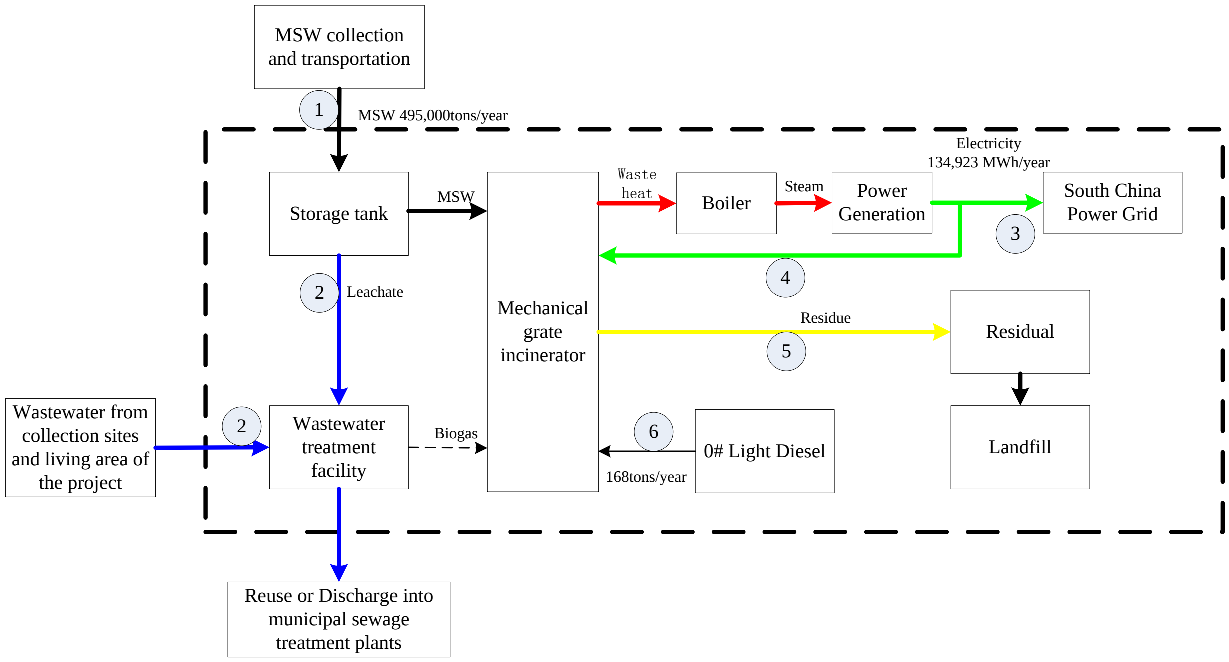

Figure A-2 The flow chart and monitoring locations of the project

①	The amount of MSW fed into the project
②	Amount of waste water treated anaerobically and COD of wastewater

③	The amount of electricity supplied to the SCPG
④	The amount of electricity consumed by the project
⑤	Amount of the residue waste and fraction of residual carbon
⑥	Amount of fossil fuel consumption on-site

Table A-1. Key technical indicators of major equipments

Items	Parameters	Unit
Incinerator		
Quantity	3	set
Type	Reciprocating mechanical grate incinerator	
Treatment capacity	500	ton
Residence time of flue gas in the furnace at the min. temperature ≥850℃	≥2	sec
Range for Low Heat Value of MSW	4,000~8,000	kJ/kg
Annual operation time	≥8,000	hour
Service life of the Grate	15	year
Boiler		
Quantity	3	set
Type	CG-500-50.5/4.0/400-LJ	
Annual operation time	≥8,000	hour
Pressure of the superheated steam	4	MPa
Temperature of the superheated steam	400	℃
Efficiency	≥80	%
Service life	31	year
Steam Turbine-Generator		
Steam turbine		
Quantity	2	set
Type	N15-3.8/395	
Rated power	15	MW
Pressure of the main steam	$3.8^{+0.2}_{-0.3}$	MPa
Temperature of the main steam	395^{+10}_{-15}	℃
Steam consumption rate	≦4.714	kg/kW.h
Service life	≥30	year
Generator		
Quantity	2	set
Type	QF_2W-20-2	
Rated power	20	MW
Rated Voltage	10.5	kV
Rotational speed	3,000	r/min

Power factor	0.8	
Efficiency	97.4	%
Service life	≥30	year

The incinerator is the core equipment in the MSW incineration treatment process, and significantly influences the entire process layout, combustion performance. The mechanical grate incinerators and its main control equipments used in the project are imported. The implementation of the project will contribute to the transferring of technology and knowledge updating in the industry.

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

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Renewable crediting period (7 years×3) is adopted by the project. It is expected that the project activity will reduce annual average GHG emissions of about 183,530tCO_2e during the first crediting period from 01/04/2012 to 31/03/2019.

Table A-2 Estimated emission reductions throughout the first crediting period

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
01/04/2012-31/12/2012	62,784
2013	129,444
2014	163,473
2015	189,468
2016	209,901
2017	226,439
2018	240,208
01/01/2019-31/03/2019	62,994
Total estimated reductions (tonnes of CO_2e)	1,284,711
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	183,530

A.4.5. Public funding of the project activity:

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There is no public funding from Annex I Parties for this 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:

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The proposed project is applicable to the approved baseline and monitoring methodology AM0025 "Avoided emissions from organic waste through alternative waste treatment processes"(Version 12).

The methodology also refers to the latest approved versions of the following tools:

- Tool for the demonstration and assessment of additionality (Version 05.2);
- Tool to calculate the emission factor for an electricity system (Version 2.1.0);
- Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (Version 05);
- Tool to determine project emissions from flaring gases containing methane (Version 01).

The above mentioned methodologies and tools are all available at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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The methodology AM0025 is employed to determine the baseline and the emission reductions of the project. The Project satisfies all applicable conditions of the methodology AM0025 as analysed in table B-1 below.

Table B-1 Applicable conditions of methodology AM0025 and the proposed Project activity

Applicable conditions of the methodology AM0025	The Project
The project activity involves one or a combination of the following waste treatment options for the fresh waste that in a given year would have otherwise been disposed of in a landfill. Option e) incineration of fresh waste for energy generation, electricity and/or heat. The thermal energy generated is either consumed on-site and/or exported to a nearby facility. Electricity generated is either consumed on-site, exported to the grid or exported to a nearby facility. The incinerator is rotating fluidized bed or circulating fluidized bed or hearth or grate type.	The proposed project activity which is located in Nanhai District, Foshan City, Guangzhou Province will incinerate MSW for energy generation. Electricity generated from the project will be exported to SCPG. The combustion heat will be recovered and utilized to generate power for on-site use, as well as for exporting to SCPG. The project employs the mechanical grate incineration system.

In case of anaerobic digestion, gasification or RDF processing of waste, the residual waste from these processes is aerobically composted and/or delivered to a landfill.	As the proposed project is of incineration of MSW, this is not applicable.
In case of composting, the produced compost is either used as soil conditioner or disposed of in landfills.	As the proposed project is of incineration of MSW, this is not applicable.
In case of RDF/stabilized biomass processing, the produced RDF/stabilized biomass should not be stored in a manner that may result in anaerobic conditions before its use.	As the proposed project is of incineration of MSW, this is not applicable.
If RDF/SB is disposed of in a landfill, project proponent shall provide degradability analysis on an annual basis to demonstrate that the methane generation, in the life-cycle of the SB is below 1 % of related emissions. It has to be demonstrated regularly that the characteristics of the produced RDF/SB should not allow for re-absorption of moisture of more than 3%. Otherwise, monitoring the fate of the produced RDF/SB is necessary to ensure that it is not subject to anaerobic conditions in its lifecycle.	As the proposed project is of incineration of MSW, this is not applicable.
In the case of incineration of the waste, the waste should not be stored longer than 10 days. The waste should not be stored in conditions that would lead to anaerobic decomposition and, hence, generation of CH_4.	The MSW will be stored in the storage tank for no longer than 6 days[2]. The waste will not be stored in conditions that would lead to anaerobic decomposition and CH_4 emission.
The proportions and characteristics of different types of organic waste processed in the project activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the project activity.	The composition of the MSW of Nanhai are analysed by the Energy Institute of Chinese Academy of Sciences. The result of the analysis can be used to estimate the landfill gas production with the multi-phase model stated in the latest version of *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (Version 5).*

[2] Calculated using the information provide from FSR(Second Version) P47

The project activity may include electricity generation and/or thermal energy generation from biogas, syngas captured, RDF/stabilized biomass produced, combustion heat generated in the incineration process, respectively, from the anaerobic digester, the gasifier, RDF/stabilized biomass combustor, and waste incinerator. The electricity can be exported to the grid and/or used internally at the project site. In the case of RDF produced, the emission reductions can be claimed only for the case where the RDF used electricity and/or thermal energy generation can be monitored.	The combustion heat from the incinerator will be recovered and used to generate power through steam turbine generators. The electricity is for on-site use as well as exporting to SCPG. No thermal generation is involved in the proposed project.
Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill despite environmental regulations mandates the treatment of the waste, if any, using any of the project activity treatment options mentioned above.	In China, there is no regulation requiring MSW to be treated by incineration[3]. At present, landfill is still the main method to treat MSW. In the absence of the proposed Project, the MSW of Nanhai will be treated in the landfill.
The compliance rate of the environmental regulations during (part of) the crediting period is below 50%; if monitored compliance with the MSW rules exceeds 50%, the project activity shall receive no further credit, since the assumption that the policy is not enforced is no longer tenable.	In China, landfill is the common method of treating MSW. There is no regulation requiring MSW be treated by incineration or other methods. The compliance rate of the environmental regulations during the crediting period will be monitored.
Local regulations do not constrain the establishment of RDF production plants/thermal treatment plants nor the use of RDF/stabilized biomass as fuel or raw material.	As the proposed project is of incineration of MSW, this is not applicable.
In case of RDF/stabilized biomass production, project proponent shall provide evidences that no GHG emissions occur, other than biogenic CO2, due to chemical reactions during the thermal treatment process (such as Chimney Gas Analysis report).	As the proposed project is of incineration of MSW, this is not applicable.
The project activity does not involve thermal treatment process of neither industrial nor hospital waste.	The project is only designed to incinerate fresh MSW. Neither industrial nor hospital waste will be treated by the proposed project.

[3] Construction Bureau, State Environmental Protection Administration and Ministry of Science & Technology.The Technology Policy on MSW Management and Pollution Prevention. No.2000 [120].

In case of waste incineration, if auxiliary fossil fuel is added into the incinerator, the fraction of energy generated by auxiliary fossil fuel is no more than 50% of the total energy generated in the incinerator.	The project will consume approximately 168 tons of 0# light diesel as auxiliary fuel, which can generate energy $7.4*10^3$ GJ. The annual electricity supplied to grid by this project is 134,924MWh, around $4.8*10^5$ GJ. So, the energy generated by auxiliary fossil fuel is no more than 50% of the total energy generated in the incinerator.
This methodology is not applicable to project activities that involve capture and flaring of methane from existing waste in the landfill.	The project is designed only to incinerate fresh MSW and does not involve the capturing and flaring of landfill gas.

The project activity corresponds to the criteria regarding the waste incineration described above and is therefore applicable to the AM0025 (version 12).

The "Tool to calculate the emission factor for an electricity system" can be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid. In the proposed Project, the power generated through MSW combustion will be exported to the SCPG to replace grid electricity, so the tool is applicable to the Project.

The "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" is used to calculate methane reduction. The tool is not applicable to stockpiles. The tool is applicable in cases where the solid waste disposal site where the waste would be dumped can be clearly identified. The tool is not applicable to hazardous wastes. Since the indentified landfill in the baseline scenario is permanent MSW disposal site and more than 5 meters in depth, clearly not stockpiles; and the proposed project will incinerate MSW which is not hazardous and can be clearly identified, the tool is applicable to the Project.

The "Tool to determine project emissions from flaring gases containing methane" is applicable under the following conditions:1) The residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen; 2) The residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others) or from gases vented in coal mines (coal mine methane and coal bed methane). The biogas generated from the waste water of the project will be destroyed by sending to the incinerator, which complies with the above conditions. The tool is applicable to calculate the project emission from flaring of the biogas.

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

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According to methodology AM0025 (Version 12), the project boundary is the site of the project activity where the waste is treated. This includes the facilities for processing the waste, on-site electricity generation and/or consumption, onsite fuel use, wastewater treatment plant and the landfill site. The project boundary does not include facilities for waste collection, sorting and transport to the project site. Since the proposed project provides electricity to a grid, the project boundary also includes those plants connected to SCPG, which is composed of Guangdong Power Grid, Yunnan Power Grid, Guangxi Power Grid, and Guizhou Power Grid. The project boundary is show in figure B-1.

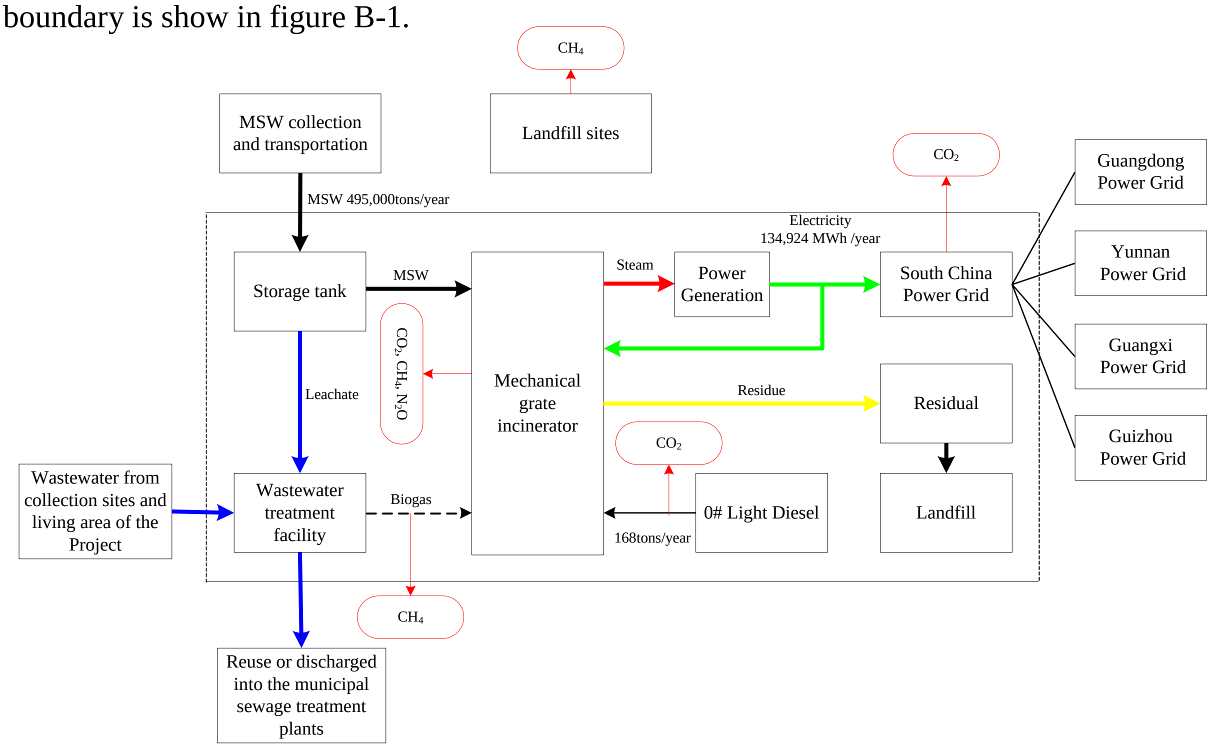

Figure B-1 Project boundary

Overview of the emission sources included in or excluded from the project boundary is provided in Table B-2.

Table B-2: Overview of the emission sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Emissions from decomposition of waste at the landfill sites	CH_4	Included	The major source of emissions in the baseline
		N_2O	Excluded	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of this gas is conservative.
		CO_2	Excluded	CO2 emissions from the decomposition of organic waste are not accounted.
	Emissions from electricity consumption	CO_2	Included	Electricity may be consumed from the grid or generated onsite/offsite in the baseline scenario.

		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Emissions from thermal energy generation	CO_2	Excluded	No thermal energy generation is included in the project activity.
		CH_4	Excluded	No thermal energy generation is included in the project activity.
		N_2O	Excluded	No thermal energy generation is included in the project activity.
Project activity	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	Included	May be an important emission source. It includes vehicles used on-site, heat generation, start up of the gasifier, auxiliary fossil fuels needed to be added into incinerator, etc.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Emissions from on-site electricity use	CO_2	Included	May be an important emission source. If electricity is generated from collected biogas/syngas, these emissions are not accounted for. CO_2 emissions from fossil based waste from RDF/stabilized biomass combustion to generate electricity to be used on-site are accounted for.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Direct emissions from the waste treatment processes	N_2O	Included	May be an important emission source for composting activities. N_2O can be emitted from incineration, syngas produced, anaerobic digestion

				of waste and RDF/stabilized biomass combustion.
		CO_2	Included	CO_2 emissions from incineration, gasification or combustion of fossil based waste shall be included. CO_2 emissions from the decomposition or combustion of organic waste are not accounted.
		CH_4	Included	The composting process may not be complete and result in anaerobic decay. CH_4 leakage from the anaerobic digester and incomplete combustion in the flaring process are potential sources of project emissions. CH_4 may be emitted from stacks from incineration, the gasification process and the RDF/stabilized biomass combustion.
	Emissions from waste water treatment	CO_2	Excluded	CO_2 emissions from the decomposition of organic waste in waste water are not accounted.
		CH_4	Included	The wastewater treatment should not result in CH_4 emissions, such as in anaerobic treatment; otherwise accounting for these emissions should be done.
		N_2O	Excluded	Excluded for simplification. The emission source is assumed to be very small.

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

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According to the approved methodology AM0025 (version 12) and the latest version of the "Tool for the demonstration and assessment of additionality" (Version 05.2) is applied to identify the alternative scenarios of the project.

step 1. Identification of alternative scenarios

Sub-Step 1a: Define alternative scenarios to the proposed CDM project activity

Alternatives for the disposal/treatment of the fresh waste in the absence of the project activity, i.e. the scenario relevant for estimating baseline methane emissions, to be analysed should include, inter alia:

M1. The project activity, incineration of waste, not implemented as a CDM project;
M2. Disposal of the waste at a landfill where landfill gas captured is flared;
M3. Disposal of the waste on a landfill without the capture of landfill gas.

The project activity also includes the production of electricity using combustion heat from the incinerators, and the export of the electricity to SCPG. 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 by-product of one of the options of waste treatment as listed in M1 above, not undertaken 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.

Since the proposed project only recovers combustion heat for electricity generation, without providing heat for on-site use or nearby facilities, alternative P2 and alternative P3 are all cogeneration plant, are not the baseline scenarios to the proposed project.

Alternatives P5 would not be feasible, as the area of the project site is lack of renewable resource such as wind power, hydro, solar, geothermal for power generation[4], except waste heat from MSW incineration. Therefore, P5 is not feasible.

Outcome of Sub-Step 1a:

M1, M2 and M3 for treatment of MSW, P1, P4 and P6 for power supply are applicable for further discussion. P2, P3 and P5 are not applicable for the proposed project.

[4] http://www.foshan.gov.cn/zwgk/fsgb/fsrmzfbgs/201009/t20100928_1871595.html

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

Technical Code for Municipal Solid Waste Sanitary Landfill (CJJ17-2004) enforced the landfill operator to recover and flare or utilize the LFG, however, according to the Report for Chinese MSW Treatment and Fees Charging Status, issued by National Development and Reform Commission[5], landfilling MSW without LFG recovery is the common practice all around China (more than 85% of treated MSW was landfilled, and less than 3% of the landfills recovered and utilized the LFG). Thus, the regulation is systematically not enforced and that non-compliance with these requirements is widespread in China.

According to the document provide by Nanhai District Municipal Administration, in absence of the proposed project, the MSW will be treated in Baishiao Landfill, which started operation since 2005, and the LFG from this landfill is still released into atmosphere without recovery and utilization.

Therefore, M2 and M3 are all considered as feasible and realistic alternative scenario to the project.

For the alternative P4, according to the regulations issued by the State Council, it is prohibited to construct thermal power plants of less than 135MW[6]. Therefore, the alternative of building a new coal-fired power plant with the same installed capacity the project is in direct conflict against current Chinese regulations. Therefore, the alternative P4 cannot be a realistic and credible baseline alternative for power generation.

Outcome of Sub-step 1b:

M1, M2 and M3 are applicable for further discussion.

P1 and P6 are applicable for further discussion; P2, P3, P4 and P5 are not applicable for the proposed project.

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

For each alternative reserved in Step 1, as per the methodology AM0025, the objective of this step is to demonstrate that the identified baseline fuel is available in abundance in the host country and there is no supply constraint. For each alternative reserved in Step 1 for further discussion:

For alternative **P1**, according to the document provided by Nanhai District Municipal

[5] http://www.ndrc.gov.cn/jggl/jgqk/t20070126_113814.htm

[6] The State Council Office PRC (2002), Notice on the Restriction of the Installation of Fossil-Fuel-Fired Power units with Capacity of and/or below135MW (Notice No. 2002-6). Source: http://www.gov.cn/gongbao/content/2002/content_61480.htm

Administration, Nanhai District will produce 2,800tMSW daily. The project only consumes 1500tMSW daily, therefore, there is no fuel supply constraint, P1 is a realistic and credible baseline alternative.

For the alternative **P6**, because most grid-connected power plants of China are fossil fuel fired and China has a great amount of coal resources, there is also no fuel constraint. Consequently, **P6** is a realistic and credible baseline alternative.

Based on the analysis of Step 2, the following alternatives are identified for further discussion:

M1, M2 and M3 are applicable for further discussion.

P1 and P6 are applicable for further discussion.

Step 3: Step 2 and/or Step 3 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 (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).

Alternative M2 is not feasible due to the following reasons: firstly, the baseline landfill does not recover and utilize the LFG; secondly, LFG recovery and flare generate no revenue but need investment and cost to install and operate relevant facilities; thirdly, there are no forced legal and regulatory requirements for the LFG recovery and utilization as mentioned above. So, without subsidiary, the landfill operator has no intention to recover and flare the LFG. Therefore, alternative M2 is not applicable.

The combination of alternative **M1** and **P1** (hereinafter referred to as the "**Combined scenario I**") is the project activities, not undertaken as a CDM project.

M1: The project activity, incineration of waste, not implemented as a CDM project.
P1: Power generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity.

In accordance with the additionality demonstration process of B.5, without CDM revenue taken into account, the IRR of total investment of the project, the combination of alternative M1 and alternative P1 is 6.47% which is below the benchmark IRR 8%, without any economical attraction. Consequently, the combined alternative of M1 and P1 cannot be a realistic and credible baseline alternative. The specific financial analysis is described in section B.5 below.

The combination of alternative **M3** and **P6** (hereinafter referred to as the "**Combined scenario II**") is disposal the MSW in landfill site without capturing of landfill gas, and the same amount of electricity generated as the proposed project is obtained from the grid.

M3: Disposal of the waste on a landfill without the capture of landfill gas.
P6: Existing and/or new grid-connected power plants.

It does not need any additional investment or activities and therefore is the only realistic and credible baseline scenario.

STEP 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or contractual requirements should be taken into consideration.

Only one credible and plausible alternative remains which is the combined scenario II.

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 additionality of the Project is demonstrated and assessed by using the "Tool for the demonstration and assessment of additionality" (Version 05.2) approved by EB.

The first version FSR of the proposed project was prepared in July 2006, however, as some investment input parameters were substantially changed according to the latest regulations and market situation, such as the income tax was reduce from 33% to 25% from 1 January 2008[7], the second version FSR was prepared in Mar 2008. Realizing that the CDM revenues can alleviate the investment barriers faced by the Project, the project owner made the investment decision based on the second version FSR on 12 May 2008. According to the new project approval process, the Project Application Report (PDR) was prepared in May 2008 based on technical design and financial analysis parameters of the second version FSR. And the PDR was approved by Guangdong DRC on 22 April 2009.

The project owner has started CDM consulting company selection since early 2008, and signed CDM consultancy agreement on 23 December 2008. The project was notified to National Development and Reform Commission on 25 December 2008 and signed ERPA with Climate Bridge Ltd. on 14 October 2009.

From the above mentioned milestones of the project, it is clearly that the project owner took CDM consideration seriously during the project implementation.

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

[7] http://www.gov.cn/flfg/2007-03/19/content_554243.htm

Table B-3 Project Timeline and CDM Timeline

Date	**Project timeline** Events
July 2006	FSR (first version).
16 July 2007	EIA completed
March 2008	FSR (second version)
May 2008	Project Application Report (PAR) based on the second version FSR
3 June 2008	Signing procurement contract for incinerators.
25 December 2008	Waste heat recovery boiler procurement contract signed
28 November 2008	EIA approval from national environment protection department
12 December 2008	Steam turbine and generator contract signed
9 February 2009	Supplement agreement of incinerator procurement contract signed
22 April 2009	FSR approval from Guangdong DRC
8 May 2009	Start of construction
28 January 2010	Equipment installation contract signed

Date	**CDM timeline** Events
12 May 2008	Board investment decision based on the second version FSR
Early 2008 -December 2008	CDM consulting company selection
23 December 2008	CDM consultancy agreement signed by project owner with consultant company.
25 December 2008	Notification to NDRC as a CDM project
4 March 2009	Stakeholders meeting
14 October 2009	ERPA signed with Climate Bridge Ltd.
21 May 2010	Global Stakeholder Process
11 June 2010	On-site validation by DOE

The additionality of the Project activity is assessed and demonstrated using “Tool for the demonstration and assessment of additionality” (version 05.2) as follows:

Step 1- Identification of alternatives to the project activity consistent with current laws and regulations
Step 2- Investment analysis
Step 4- Common practice analysis

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

As described in Section B.4, the following realistic and credible alternatives available to the project activity are identified for each component of the project activity.

Disposal/Treatment of the fresh waste

M1. The project activity (i.e. incineration of MSW) not implemented as a CDM project;
M2. Disposal of waste at a landfill where landfill gas captured is flared;
M3. Disposal of waste at a landfill without the capture of landfill gas.

Electricity generation

P1. Power generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity;
P6. Existing and/or new grid-connected power plants.

Step 2 Investment analysis

Determine whether the proposed project activity is financially attractive or economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).To conduct the investment analysis, use the following Sub-steps:

Sub-step 2a. Determine appropriate analysis method

"Tool for the demonstration and assessment of additionality" (version 05.2) suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the project will earn revenues not only from the CERs sales but also from electricity sales and MSW disposal fee, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The alternative of the project is existing landfill and South China Power Grid rather than new investment projects. Therefore Option II is not appropriate. The project will use benchmark analysis method (Option III) based on the consideration that benchmark IRR of the cement sector is available.

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

With reference to "Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects" which is issued by Operation Department of Power Generation and Transmission, State Power Corporation, the financial benchmark IRR of total investment applicable to the power industry in China is 8% (after tax). On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

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

According to the *Feasibility Study Report(second version)*, the basic data and assumptions for calculation of financial indicators of the project are summarized below. These parameters are consistent with the approved PAR.

Table B-4 Financial details of the Project

Item	Sources	Value
Total static investment	FSR(second version)	612,120,240 RMB
Initial current capital	FSR(second version)	5,815,606 RMB
O&M cost	IRR Spreadsheet	64,761,053 RMB[8]
Annual electricity generation	FSR(second version)	168654.7MWh
On-site electricity consumption rate	FSR(second version)	20%
Electricity tariff	BOT Agreement	0.55RMB/kWh(For whole lifetime of the project)
MSW disposal fee	FSR(second version)	95 RMB/t
VAT	FSR(second version)	17%
Urban construction tax	FSR(second version)	7%
Education surtax	FSR(second version)	3%
Income Tax	FSR(second version)	25%
Loan	FSR(second version)	445,000,000 RMB
Annual loan interest rate	FSR(second version)	6.12%
Project life	FSR(second version)	30 year
Project IRR (after-tax) (without CERs revenue)		**6.47%**
Project IRR (after-tax) (with CERs revenue)	Assumed CER price 8.5 Euro/CER, Euro to RMB exchange rate 1:10	**9.27%**

In accordance with the benchmark analysis (Option III), if the financial indicators (such as IRR) of a project are lower than the benchmark, the project is not considered as financially attractive. Based on the data above, without CERs sales revenues, the Project IRR is 6.55%, which is lower than the benchmark 8% (after-tax). The Project is not financially attractive.

Sub-step 2d. Sensitivity analysis

For the Project, the following financial indicators are taken as uncertain factors for sensitive analysis of financial attractiveness:

- Total static investment
- Annual O&M costs
- MSW disposal fee
- Electricity tariff
- Annual MSW disposal
- Annual power generation

[8]In FSR Annex Material Cost and Other Fee, the annual combustion fuel is estimated as 200tons, which is inconsistent with the data (200m^3) listed in FSR p110. PP confirms that the data in the Annex is wrong. Therefore, the O&M cost from IRR spreadsheet is used, which is more conservative.

The results of sensitive analysis of four indicators of the Project are shown in Table B-5 and Figure B-2.

Table B-5 The IRR sensitivity to different financial indicators of the Project (without CERs revenues)

Variation	-10.00%	-5.00%	0.00%	5.00%	10.00%
Total static investment	7.48%	6.96%	6.47%	6.03%	5.61%
Annual O&M costs	7.42%	6.95%	6.47%	5.99%	5.48%
MSW disposal fee	5.77%	6.13%	6.47%	6.82%	7.17%
Electricity tariff	5.35%	5.93%	6.47%	7.01%	7.52%
Annual MSW disposal	5.38%	5.96%	6.47%	6.97%	7.44%
Annual electricity generation	5.35%	5.93%	6.47%	7.01%	7.52%

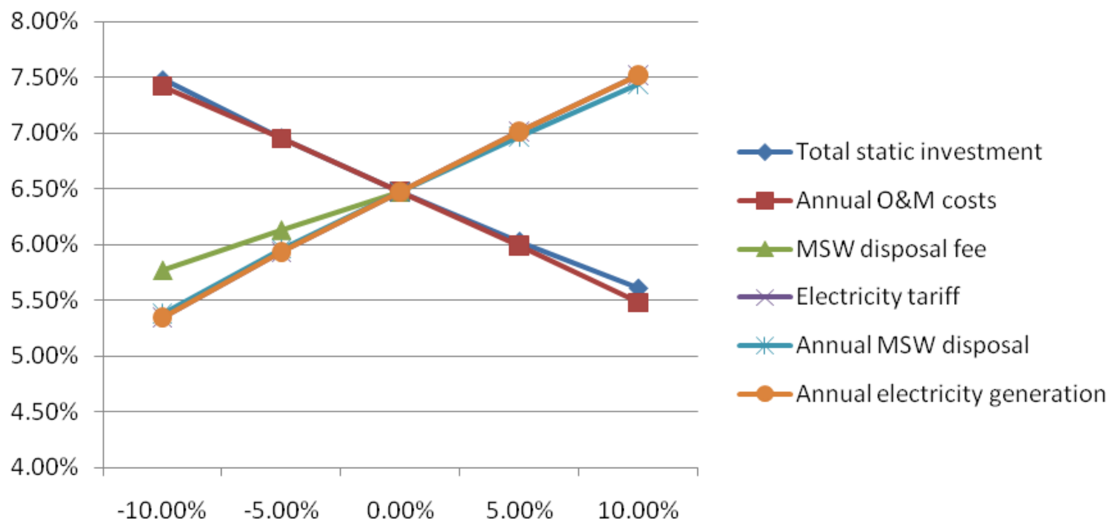

Figure B-2. The IRR sensitivity to different financial indicators of the Project (without CERs sales revenues)

Table B-6 Critical point analysis

Critical point	Total static investment	Electricity tariff	MSW disposal fee	O&M	Power generation	MSW disposal
IRR=8%	-15%	+15%	+24%	-18%	+15%	17%

- As shown in the sensitivity analysis, even the variation range of the uncertain factors reaches 10%, the IRR of total project investment of the Project could not reach the benchmark.

- With a decrease of the total static investment by 15%, the project IRR will reach the benchmark. However, it is impossible due to that the actual total static investment is much higher than the estimated investment in the FSR(second version).

- When electricity tariff increases by 15%, the project IRR will reach the benchmark. According to the latest regulation issued by Gongdong Price Bureau on 23 Aug 2010[9], the MSW incineration electricity tariff will be increased to 0.689RMB/kWh(0.439RMB/kWh since the 16th operation year). Even without the consideration of the MSW disposal fee decrease (according to clause 15.5.2.1 of the BOT agreement, when the electricity fee increase 0.01RMB/kWh, the MSW disposal fee will decrease 1.40 RMB/t, and vice versa), the project IRR (7.83%) is still lower than the benchmark with the new tariff. So, it is impossible for the project to cross the benchmark with the tariff increase.

- The MSW disposal fee has been contracted with the local relevant government, so it is impossible for the project owner to get an increase of this fee to cross the benchmark.

- The O&M cost of the project is impossible to decrease by 18%, when the Project IRR will cross the benchmark. According to the China Statistic Yearbook 2009[10], the Consumer Price Index from the year 2004 to 2008 was 103.9, 101.8, 101.5, 104.8 and 105.9, which indicated that the O&M cost is always increased.

- The treatment capacity of the incinerator lines can only increase 10% with no more than 4 hours in 24 hours in accordance with the technical parameter of the incinerator. Therefore, it is impossible for the project to increase the power generation by 15% and annual MSW disposal by 17% when the project IRR could cross the benchmark.

According to the sensitivity analysis and critical analysis, within reasonable range of each parameter, the project IRR is always lower than the benchmark.

However, if the project can be successfully registered as a CDM project, the CERs sales revenues will guarantee the loan payback, supplement the high project cost and significantly improve the financial indicators of the project. Considering the CERs sales revenues (calculated with EURO 8.5/tCO_2e, 21 years crediting period), the IRR of the project will be significantly improved to reach the benchmark, as shown in Table B-4.

Table B-7 IRR comparison

	The Project(after-tax)	**Benchmark(after-tax)**
Without CDM revenue (%)	6.47%	8%
With CDM revenue (%)	9.27%	8%

It is shown in Table B-7 that CERs sales revenues can alleviate the identified barriers, therefore the project is additional.

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[9] http://www.gdprice.org/2010/0914/5052.html

[10] http://www.stats.gov.cn/tjsj/ndsj/2009/indexeh.htm

Step 3. Barrier analysis

According to “Tool for the demonstration and assessment of additionality” (version 05.2), Step 3 is not used for the proposed Project activity.

Step 4 Common practice analysis

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

The proposed project is located in Guangdong Province. Referred to the published information[11,12], similar projects (Daily MSW disposal capacity is within ±50% of the project) operated and under construction from 2000 to 2005 in Guangdong Province are shown in Table B-6.

Table B-8 MSW incineration projects with similar technology to the Project

Name of Project	Installed Capacity(MW)/Treatment capacity (tonnes/d)	Incinerator	Project Operator
1. Guangzhou Likeng MSW Incineration Power Project	15/1000	Matin Grate Type	Guangdong Environment and Sanitation Administration.
2. Guangzhou Likeng MSW Incineration Power Project Phase II	40/2000	Mechanical Grate Type	Guangdong Environment and Sanitation Administration
3. Shenzhen Baoan Laohukeng MSW Incineration Power Project[13]	24/1200	Multi-level Grate Type	Shenzhen Energy & Environmental Protecting Co., Ltd
4. Shenzhen Baoan Baigehu MSW Incineration Power Project	9/1000	Multi-level Grate Type	Shanghai Environment investment Co., Ltd.
5. Shenzhen Longgang Dagongye District MSW Incineration Project	12/800	Multi-level Grate Type	Shenzhen Energy & Environmental Protecting Co., Ltd
6. Shenzhen Nanshan MSW Incineration Power Project	12/800	Multi-level Grate Type	Shenzhen Energy & Environmental

[11] http://forum.solidwaste.com.cn/onload/20083111048469288.doc

[12] http://www.chinacitywater.org/bbs/archiver/?tid-2935.html

[13] http://www.gd.xinhuanet.com/newscenter/ztbd/2007-10/18/content_11436396.htm

			Protecting Co., Ltd
7. MSW incineration power plant in Huizhou City	12/800	Thermal decomposing incinerator	Ruiwei renewable energy Co., Ltd. [14]
8. Hengli MSW incineration power plant in Dongguan City	30/1050	Circulating fluidized bed	Beijing Zhongke General Energy Environmental Protecting Co., Ltd.
9. Foshan Nanhai Environmental Protection Power Generation Project	12/1400	Impulse Cast Grate Type	Green Power International Holding(Group) Co., Ltd.

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

Existing MSW incineration for power generation projects in Guangdong province with similar scale to the Project are analyzed as follows:

According to the "Tool for the demonstration and assessment of additionality"(Version 05.2), only projects which are operational and similar to the proposed project activity need to be discussed. Therefore, No.2[15], No.4 and No.5[16] projects can be excluded due to no operational details could be obtained before the date when the PDD was completed.

No.1 project is an experimental project for MSW incineration for power generation and one of main objectives of this project is to gain experience for MSW incineration and power generation. Since this project is "first of its kind" in Guangdong Province, all investment comes from the local government of Guangdong Province[17] .

No.3 and No.6 projects are all located in Shenzhen City. Shenzhen City is one of Special Economic Zones in China. The investment condition in Shenzhen is significantly deferent with the city where the proposed project located. The MSW disposal fee is 198RMB/ton in Shenzhen City[18], which is much higher than that (95RMB/ton) of the project. Therefore, the investment environment is different.

No.7 project is invested by an international company,[19] and the technology of the incinerator is different.

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[14] http://www.richwaygroup.com/cn/rwjj.php

[15] http://www.cn-hw.net/html/china/200911/12127.html

[16] http://news.sznews.com/content/2011-05/20/content_5653532.htm

[17] http://info.ep.hc360.com/2005/10/19082133205.shtml

[18] http://www.ewise.com.cn/2005report/free/2005nengyuan0132.htm

[19] http://www.richwaygroup.com/cn/xmfw_content.php?id=75

No.8 the technology employed by this project is domestic and totally different with the proposed project.

No.9, the treatment capacity of this project is actually 400ton/day[20,21], which is incomparable with the proposed project, and the technology employed by this project is different.

So, the project is not a common practice in Guangdong Province.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The methodology AM0025 (version 12) is applied in the context of the project in the following steps:

1. Project emissions (PE_y)

$$PE_y = PE_{elec,y} + PE_{fuel,on\text{-}site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y} \quad \mathbf{(1)}$$

Where,

PE_y = the project emissions during the year y (tCO_2)

$PE_{elec,y}$ = the emissions from electricity consumption on-site due to the project activity in year y(tCO_2)

$PE_{fuel,on\text{-}site,y}$ = the emissions on-site due to fuel consumption in year y (tCO_2)

$PE_{c,y}$ = the emissions during the composting process in year y (tCO_2e)

$PE_{a,y}$ = the emissions from the anaerobic digestion process in year y (tCO_2e)

$PE_{g,y}$ = the emissions from the gasification process in year y (tCO_2e)

$PE_{r,y}$ = the emissions from the combustion of RDF/stabilized biomass in year y (tCO_2e)

$PE_{i,y}$ = the emissions from waste incineration in year y (tCO_2)

$PE_{w,y}$ = the emissions from waste water treatment in year y (tCO_2)

(1) Emissions from electricity use ($PE_{elec,y}$)

$$PE_{elec,y} = EG_{PJ,FF,y} * CEF_{elec} \quad \mathbf{(2)}$$

Where,

$EG_{PJ,FF,y}$ = the amount of electricity consumed from the grid as a result of the project activity, measured using an electricity meter (MWh)

CEF_{elec} = the carbon emissions factor for electricity generation in the project activity (tCO_2/MWh)

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[20] http://news.solidwaste.com.cn/view/id_24765

[21] According to the document provided by Nanhai District Municipal Administration, the treatment capacity of this project is actually 400 ton/d, and this project will be removed due to the new environmental regulation.

All electricity consumed by the project activity will be supplied by MSW combustion. Thus it is assumed that the amount of electricity consumed from the grid is zero.

(2) Emissions from fuel use on-site ($PE_{fuel,on\text{-}site,y}$)

The 0# light diesel oil will be added in incinerators as auxiliary fuel. The designed annual average consumption of light diesel oil is approximately168 tons/year. Emissions from consumption of the light diesel oil are calculated below.

$$PE_{fuel,on\text{-}site,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel} \qquad \textbf{(3)}$$

Where,
$F_{cons,y}$ = the fuel consumption on site in year y (kg).
NCV_{fuel} = the net caloric value of fuel (MJ/kg).
EF_{fuel} = the CO_2 emissions factor of the fuel (tCO_2/MJ).

(3) Emissions during the composting process ($PE_{c,y}$)

The proposed project utilizes the waste incineration technology, so $PE_{c,y}$ =0 **(4)**

(4) Emissions from the anaerobic digestion process ($PE_{a,y}$)

The proposed project utilizes the waste incineration technology, so $PE_{a,y}$ =0 **(5)**

(5) Emissions from the gasification process ($PE_{g,y}$)

The proposed project utilizes the waste incineration technology, so $PE_{g,y}$ =0 **(6)**

(6) Emissions from the combustion of RDF/stabilized biomass ($PE_{r,y}$)

The proposed project utilizes the waste incineration technology, so $PE_{r,y}$ =0 **(7)**

(7) Emissions from waste incineration ($PE_{i,y}$)

$$PE_{i,y} = PE_{i,f,y} + PE_{i,s,y} \qquad \textbf{(8)}$$

Where,
$PE_{i,f,y}$ = the fossil-based waste CO_2 emissions from waste incineration in year y (tCO_2e)
$PE_{i,s,y}$ = the N_2O and CH_4 emissions from the final stacks from waste incineration in year y (tCO_2e)

- Emissions from fossil-based waste ($PE_{i,f,y}$)

$$PE_{g/r/i,f,y} = \sum_i A_i \times CCW_i \times FCF_i \times EF_i \times \frac{44}{12} \qquad \textbf{(9)}$$

Where,
$A_{i,y}$ = the amount of MSW fed into the waste incineration plant (t/yr)
FCF_i = the fraction of fossil carbon in MSW (fraction)
EF_i = the combustion efficiency for waste (fraction)
CCW_i =the fraction of carbon content in waste type i(fraction)
12/44 = the conversion factor (tCO_2/tC)

$$A_i = A_{MSW,y} \frac{\sum_{n=1}^{z} p_{n,i,y}}{z} \qquad (10)$$

Where,
Ai = Is the amount of waste type *i* fed into the gasifier or RDF/stabilized biomass combustor or into the waste incineration plant (t/yr)
$A_{MSW,y}$ = Is the amount of MSW fed into the gasifier or RDF/stabilized biomass combustor or into the waste incineration plant (t/yr)
$p_{n,j,y}$ = Is the weight fraction of the waste type *i* in the sample n collected during the year *y*
Z = Number of samples collected during the year *y*

- Emissions from waste incineration ($PE_{i,s,y}$)

$$PE_{i,s,y} = Q_{biomass,y} * (EF_{N2O} * GWP_{N2O} + EF_{CH4} * GWP_{CH4}) * 10^{-3} * CF \qquad \textbf{(11)}$$

Where,
$Q_{biomassy}$ = the amount of waste incinerated in year *y* (tons/d).
EF_{N2O} = the aggregate N_2O emission factor for waste combustion (kgN_2O/tonne of waste).
GWP_{N2O} = the Global Warming Potential of nitrous oxide (tCO_2/tN_2O)
EF_{CH4} = the aggregate CH_4 emission factor for waste combustion ($kgCH_4$/tonne of waste).
GWP_{CH4} = the Global Warming Potential of methane (tCO_2/tCH_4)
CF = the conservativeness factor.

(8) Emissions from wastewater treatment ($PE_{w,y}$)

The project activity will treat the wastewater with aerobic and anaerobic treatment process for leachate.

$$PE_{CH4,w,y} = Q_{COD,y} * P_{COD,y} * B_o * MCF_P \qquad \textbf{(12)}$$

Where,
$PE_{CH4,w,y}$ =Methane emissions from the waste water treatment in year *y* (tCH_4/y)
$Q_{COD,y}$ =Amount of wastewater treated anaerobically or released untreated from the project activity in year *y* (m^3/yr), which shall be measured monthly and aggregately annually

$P_{COD,y}$ =Chemical Oxygen Demand (COD) of wastewater ($tCOD/m^3$),which will be measured monthly and averaged annually
B_o =Maximum methane producing capacity ($tCH_4/tCOD$)
MCF_P =Methane conversion factor (fraction), preferably local specific value should be sued. In absence of local value, MCF_P default values can be obtained from table 6.3, chapter 6, volume 5 from IPCC 2006 guidelines.

The methane generated from the anaerobic system will be transferred to the MSW tank and finally fed back to the enclosed incinerators, thus the waste methane is combusted. According to the manufacture's specifications of the incinerator, during the operation of the incinerator, the exhaust gas from the incinerator will be no less than 850^o C and the residence time will be no less than 2 seconds (as per Table A-1). Auxiliary fuel will be used to keep the temperature at this level when the Lower Heat Value of the MSW is too low to ensure this temperature. This will ensure that the methane destruction efficiency is higher than the default value of an enclosed flare when the flare temperature is above 500^o C and the flare operates complying with the manufacturer's specifications [22]. However, for conservativeness, the methane combustion efficiency of the incinerator is taken as the default value of the enclosed flare, i.e. the default methane combustion efficiency of the incinerator is 90%. According to the AM0025, if flaring occurs, the "Tool to determine project emissions from flaring gases containing methane" should be used to estimate methane emissions.

$$PE_{w,y}= PE_{CH4,w,y}*(1-\eta_{flare,h})* GWP_{CH4} \quad \textbf{(13)}$$

Where,
$\eta_{flare,h}$ = Flare efficiency in hour h

2. Baseline emissions (*BEy*)

$$BE_y = (MB_y - MD_{reg,y}) + BE_{EN,y} \quad \textbf{(14)}$$

Where,
BE_y = the baseline emissions in year y (tCO_2)
MB_y = the methane produced in the landfill in the absence of the project activity in year y (tCO_2e)
$MD_{reg,y}$ = methane that would be destroyed in the absence of the project activity in year y (tCO_2e)
$BE_{EN,y}$ = Baseline emissions from generation of energy displaced by the project activity in year y (tCO_2)

(1) Methane that would be destroyed in the absence of the project activity in year *y* ($MD_{reg,y}$)

$$MD_{reg,y}= MB_y* AF \quad \textbf{(15)}$$

[22] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories gives a standard value for the fraction of carbon oxidised for gas combustion of 99.5% (Reference Manual, Table 1.6, page 1.29)

Where,
AF = Adjustment Factor for MB_y (%)

The parameter *AF* shall be estimated as follows:

- In cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements, the ratio between the destruction efficiency of that system and the destruction efficiency of the system used in the project activity shall be used;
- In cases where a specific percentage of the "generated" amount of methane is to be collected and destroyed has been is specified in the contract or mandated by the regulation, this percentage divided by an assumed efficiency for the collection and destruction system used in the project activity shall be used.

Due to the reasons mentioned in B.4., the regulations are rarely enforced and most of Chinese landfill site are not provisioned with landfill gas collection and treatment facilities. Therefore, AF=0.00.

(2) Methane generation from the landfill in the absence of the project activity (MB_y)

The amount of methane that is generated each year (MB_y) is calculated as per the latest version of the approved *Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*, considering the following additional equation:

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

Where,

$BE_{CH4,\,SWDS,\,y}$	= the methane generation from the landfill in the absence of the project activity in year *y* (tCO_2e)
φ	= model correction factor to account for model uncertainties (0.9)
f	= fraction of methane captured at the landfill and flared, combusted or used in another manner
GWP_{CH4}	= Global Warming Potential (GWP) of methane (tCO_2/tCH_4), valid for the relevant commitment period
OX	= 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	= fraction of methane in the landfill gas (volume fraction) (0.5)
DOC_f	= fraction degradable organic carbon (DOC) that can decompose.
MCF	= methane correction factor.
$W_{j,x}$	= amount of organic waste type *j* prevented from disposal in the landfill in the year *x* (tones)
DOC_j	= fraction of degradable organic carbon (by weight) in the waste type *j*.
k_j	= decay rate for the waste type *j*.
j	=is waste type category (index)

x = year during the crediting period: x runs from the first year of the first crediting period ($x=1$) to the year y for which avoided emissions are calculated ($x=y$)

y = year for which methane emissions are calculated

(3) Baseline emissions from generation of energy displace by the project activity

$$BE_{EN,y} = BE_{elec,y} + BE_{thermal,y} \tag{17}$$

Where,

$BE_{elec,y}$ = the baseline emissions from electricity generated utilizing the combustion heat from incineration in the project activity and exported to the grid plant (tCO_2)

$BE_{thermal,y}$ = the baseline emissions from thermal energy produced utilizing the biogas /syngas collected/RDF/stabilized biomass/combustion heat from incineration in the project activity displacing thermal energy from onsite/offsite fossil fuel fueled boiler. In the case of the Project activity, since thermal generation is not involved, $BE_{thermal,y}$ is 0.

$$BE_{elec,y} = EG_{d,y} * CEF_d \tag{18}$$

Where,

$EG_{d,y}$ = 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 = the carbon emissions factor for the displaced electricity source in the project scenario (tCO_2/MWh)

$$CEF_d = EF_{y\ CM\ grid} \tag{19}$$

In case the generated electricity from the combustion heat from incineration displaces electricity that would have been generated by other power plants in the grid in the baseline, CEF_d should be calculated according to the *"Tool to calculate the emission factor for an electricity system" (version 02.1.0).*

The methodological tool *"Tool to calculate the emission factor for an electricity system" (version 02.1.0)* determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity.

The methodological tool *"Tool to calculate the emission factor for an electricity system" (version 02.1.0)* provides procedures to determine the following parameters:

Parameter	Unit	Description
$EF_{grid, CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year *y*
$EF_{grid, BM,y}$	tCO_2/MWh	Building margin CO_2 emission factor for grid connected power generation in year *y*
$EF_{grid, OM,y}$	tCO_2/MWh	Operation margin CO_2 emission factor for grid connected power generation in year *y*

The following six steps are applied to calculate the emission factor for an electricity system:

STEP 1: Identify the relevant electric power system.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3: Select an operating margin (OM) method.
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Identify the cohort of power units to be included in the build margin (BM).
STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electric power system

In accordance with the *Tool to Calculate the Emission Factor for an Electricity System*, the project electricity system of the Project is identified according to the delineation of the project electricity system and connected electricity systems published by China's DNA.

Electricity generated by the Project will displace the electricity purchased from South China Power Grid. According to the *2009 Baseline Emission Factors for Regional Power Grids in China* issued by Chinese DNA which provides the delineation of relevant electric power systems, SCPG is the relevant electric power system of the Project. SCPG is composed of Guangdong Power Grid, Yunnan Power Grid, Guangxi Power Grid, and Guizhou Power Grid.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

In the calculation of this Project, option I is adopted, namely only grid power plants are included in the calculation.

Step 3. Select an operating margin (OM) method

Four methods are provided in the *Tool to calculate the emission factor for an electricity system* (version 02.1.0) for the calculation of Operating Margin Emission Factor(s) ($EF_{grid,OM,y}$), they are:

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

According to *"China Power Statistics Yearbook"* 2004-2008, in recent five years from 2003 to 2007, the low cost/must run power generation plants constituted 31.06%, 29.95%, 30.42%, 29.79% and 29.28% of the total grid generation.

As a result of above data, the low-cost/must run resources constitute less than 50% of total SCPG grid generation, so method a) Simple OM is used to calculate the operational margin emission factor of the SCPG.

The emission factors were determined ex ante (A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation) and will not be updated during the first crediting period.

Step 4. Calculate the operating margin emission factor ($EF_{grid,OM,y}$ ***) according to the selected method***

According to "*Tool to calculate the emission factor for an electricity system"*, the simple OM is calculated with the average emission factor of the grid that the Project is connected to, exclusive of the low-cost/must run units. In this PDD, the simple OM is calculated with option B based on the following reasons:

a) The data necessary for option A is not attainable;
b) The only low-cost/must run units are nuclear and renewable energy, while the amount of power exported to the grid by these units are accessible;
c) Off-grid power plants are not included in the calculation.

In this PDD, the OM data is sourced from the China DNA's publish. As Option B, the simple OM shall be calculated in the following steps: namely calculated with the total net on-grid power generation, fuel type and total fuel consumption. The detail calculation formula is:

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

Where:

$EF_{grid,OMsimple,y}$ is the simple operating margin CO_2 emission factor in year y in tCO_2/MWh;
$FC_{i,y}$ is the amount of fossil fuel type i consumed in the project electricity system in year y in mass or volume unit;
$NCV_{i,y}$ is the net calorific value (energy content) of fossil fuel type i in year y in GJ/mass or volume unit;
$EF_{CO2,i,y}$ is the CO_2 emission factor of fossil fuel type i in year y in tCO_2/GJ;
EG_y is the 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 in MWh;
i are all fossil fuel types combusted in power sources in the project electricity system in year y;
y is the three most recent years for which data are available at the time of submission of the CDM-PDD to the DOE for validation.

With reference to the *2009 Baseline Emission Factors for Regional Power Grids in China* (renewed on July 6th, 2009), the simple OM emission factor ($EF_{grid,OM,y}$) of South China Power Grid is 0.9987 tCO_2e/MWh (see Annex 3 for details).

Step 5. Identify the cohort of power units to be included in the build margin

According to the *Tool to calculate the emission factor for an electricity system*, the sample group of power units m used to calculate the build margin consists of either:

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

It is suggested that project participants should use the set of power units that comprises the larger annual generation.

Considering data availability, CDM EB accepts the following deviation in application of methodology[23]:

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

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.
Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power

23 Http://cdm.unfccc.int/Projects/Deviations.

generation technology. And finally calculate the emission factor using the efficiency level of the best technology commercially available in China.

According to the *Tool to calculate the emission factor for an electricity system*, project participants shall choose between one of the following two options to calculate the Build Margin Emission Factor ($EF_{grid,BM,y}$).

Option 1. Calculate the Build Margin emission factor ($EF_{grid,BM,y}$) ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission.
Option 2. For the first crediting period, the Build Margin emission factor ($EF_{grid,BM,y}$) must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur.

For subsequent crediting periods, the Build Margin emission factor ($EF_{grid,BM,y}$) should be calculated ex-ante, as described in option 1 above.

Option 1, calculate the Build Margin emission factor ($EF_{grid,BM,y}$) ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission is employed by the Project.

Step 6. Calculate the build margin emission factor

To calculate the Build Margin Emission Factor ($EF_{grid,BM,y}$) according to the *Tool to calculate the emission factor for an electricity system* using equation (5):

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

where:

$EF_{grid,BM,y}$ is the build margin CO_2 emission factor in year y in tCO_2/MWh;
$EG_{m,y}$ is the net quantity of electricity generated and delivered to the grid by power unit m in year y in MWh;
$EF_{EL,m,y}$ is the CO_2 emission factor of power unit m in year y in tCO_2/MWh;
m is the power units included in the build margin;
y is the most recent historical year for which power generation data are available.
Since the data of installed capacities cannot be separated to coal fired, oil fired and gas fired currently, BM is calculated with the following steps and formula:
Step a. Calculate the power generation emissions for solid fuel, liquid fuel and gas fuel and each share in the total emissions based on the *Energy Balance Table* of the most recent year.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (22)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (23)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (24)$$

where:

$F_{i,j,y}$ is the amount of fuel i consumed by power plant /unit j in year(s) y in mass or volume unit ,
$NCV_{i,y}$ is the net calorific value (energy content) of fossil fuel type i in year y in GJ/mass or volume unit;
$EF_{CO2,i,j,y}$ is the CO_2 emission factor of fossil fuel type i in year y in tCO_2/GJ.
COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

Step b. Calculate the emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (25)$$

Where $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are emission factor proxies of efficiency level of the best coal fired, oil fired and gas fired power generation technology commercially available in China. (See Annex 3 for detail.)

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

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

Where $CAP_{Total,y}$ is total capacity additions while $CAP_{Thermal,y}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2006 to 2008. The emission factors and oxidation factors of the fuels adopted are obtained from Table 1.3 and Table 1.4 on page 1.21-1.24 of volume 2 of 2006 *IPCC Guidelines for National Greenhouse Gas Inventories*. With reference to the *2009 Baseline Emission Factors for Regional Power Grids in China* (renewed on July 6th, 2009), the weighted average fuel consumption for power generation of 30 sets of 600 MW coal fired power generation units with the lowest coal consumption set up in 2006 (329.94 gCe/kWh) and the 200 MW oil/gas fired combined cycle power generation units with the best performance (252 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

With reference to the *2009 Baseline Emission Factors for Regional Power Grids in China* (renewed on July 6th, 2009), the Build Margin emission factor ($EF_{grid,BM,y}$) of South China Power Grid is 0.5772 tCO_2e/MWh.

Step 7. Calculate the combined margin emissions factor

Based on the *Tool to calculate the emission factor for an electricity system*, the emission factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$), as

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM} \quad \textbf{(27)}$$

According to the *Tool to calculate the emission factor for an electricity system*, the default value of weight w_{OM} is 0.50 and the default value of weight w_{BM} is 0.50. Therefore

$EF_{elec,i,j,y} = EF_{grid,CM,y}$ = 0.9987×0.5 +0.5772×0.5 =0.7880 (tCO_2e/MWh).

3. Calculate the project leakage GHG emissions

The sources of leakage considered in the methodology are CO_2 emissions from off-site transportation of waste materials in addition to CH_4 and N_2O emissions from the residual waste from the anaerobic digestion, gasification processes and processing/combustion of RDF. In case of waste incineration, leakage emissions from residual waste of MSW incinerator should be accounted for. Positive leakage that may occur through the replacement of fossil-fuel based fertilizers with organic composts are not accounted for.

Leakage emissions should be estimated from the following equation:

$$L_y=L_{t,y} + L_{r,y} + L_{i,y} + L_{s,y} \quad \textbf{(28)}$$

Where,

$L_{t,y}$ = the leakage emissions from increased transport in year y (tCO_2);

$L_{r,y}$ = the leakage emissions from the residual waste from the anaerobic digester, the gasifier, the processing/combustion of RDF/stabilized biomass, or compost in case it is disposed of in landfills in year y (tCO_2);

$L_{i,y}$ =the leakage emission from the residual waste from MSW incinerator in year y (tCO_2e);

$L_{s,y}$ = the leakage emissions from end use of stabilized biomass.
The proposed project utilizes the waste incineration technology, then $L_{r,y}$=0, $L_{s,y}$=0. From Figure1, it is obliviously that the distance between the location of the Project site and collection points, is smaller than the distance between collection points and the landfill site. Therefore, the leakage emission caused by increasing transportation is 0, $L_{t,y}$=0.

Leakage Emissions from the residual waste from MSW incineration ($L_{i,y}$)

In case of waste incineration, leakage emissions from the residual waste of MSW incinerator should be accounted for using the following equations:

For the Proposed Project, the residual waste from the incinerator contains up to 5% residual carbon then:

$$L_{i,y} = A_{residual,y} * F_{Cresidual} * 44/12 \qquad \textbf{(29)}$$

Where,
$A_{residual,y}$=the amount of the residual waste from the incinerator(t/y)
$F_{Cresidual}$=the fraction of residual carbon contained in the residual waste (%).

4. Calculate the emission reductions

According to the above analysis the emission reduction of the project activity is calculated as follows:

$$ER_y = BE_y - PE_y - L_y \qquad \textbf{(30)}$$

Where,
ER_y = the emission reductions in year y (tCO_2)
BE_y = the emissions in the baseline scenario in year y (tCO_2)
PE_y= the emissions in the project scenario in year y (tCO_2)
L_y = the leakage in year y (tCO_2)

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

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Data / Parameter:	***GWP_{CH4}***
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	IPCC 2006 guideline.
Value applied:	21
Justification of the choice of data or description of measurement methods and	-

procedures actually applied :	
Any comment:	-

Data / Parameter:	***GWP_{N2O}***
Data unit:	tCO_2e/tN_2O
Description:	Global warming potential of N_2O
Source of data used:	IPCC 2006 guideline.
Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***EF_{N2O}***
Data unit:	$gN_2O/tMSW$
Description:	Aggregated N_2O emission factor
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Waste, Chapter 5 Incineration and Open Burning of Waste, Table 5.4 N_2O Emission Factors for Incineration of MSW. Type of Incineration/Technology: Continuous incineration, Stoker.
Value applied:	47
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value is used since specific country/project value is not available
Any comment:	-

Data / Parameter:	***EF_{CH4}***
Data unit:	$gCH_4/tMSW$
Description:	Aggregated CH_4 emission factor
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Waste, Chapter 5 Incineration and Open Burning of Waste, Table 5.3, CH_4 Emission Factors for Incineration of MSW. Type of Incineration/Technology: Continuous Incineration, Stoker.
Value applied:	0.2
Justification of the choice of data or	IPCC default value is used since specific country/project value is not available.

description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	***NCV_{fuel}***
Data unit:	MJ/kg
Description:	Net caloric value of the fuel used in the project
Source of data used:	Device Technical Agreement of Incinerators
Value applied:	44.27
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***EF_{fuel}***
Data unit:	tCO_2/MJ
Description:	CO_2 emission factor of the fuel used
Source of data used:	IPCC 2006 guideline.
Value applied:	Diesel: $74.8* 10^{-6}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	-

Data / Parameter:	***Bo***
Data unit:	$tCH_4/tCOD$
Description:	Maximum methane producing capacity
Source of data used:	IPCC 2006 guideline.
Value applied:	0.265
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 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 :	Default value suggested in the tool.
Any comment:	-

Data / Parameter:	***OX***
Data unit:	-
Description:	Oxidation factor
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 :	The landfill is covered with plastic film or soil, for conservative 0.1 was chosen.
Any comment:	-

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 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 (DOC)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 :	Using 2006 IPCC Guidelines 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:	***MCF***
Data unit:	-
Description:	Methane conversion 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 :	The alternative 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 *"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site."*
Any comment:	-

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

Waste classification	***DOCj（% wet waste）***
A. Wood and wood product	43
B. Pulp, paper and cardboard	40
C. Food, food waste, beverage and tobacco	15

	D. Textiles	24
	E. Gardens, yard and park waste	20
	F. Plastic	0
	G. Glass, metal and other inert waste	0
	H. Rubber a d Leather	0
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:	k_j	
Data unit:	-	
Description:	Decay rate for waste type *j*	
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 5,Table 3.3	
Value applied:	**Waste Type *j***	***Kj***
	Wood and wood product	0.035
	Pulp, paper and cardboard	0.07
	Food, food waste, beverage and tobacco	0.4
	Textiles	0.07
	Gardens, yard and park waste	0.17
	Glass, plastic, metal, other inert waste	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average temperature of Nanhai District is 21.8℃. The annual mean precipitation is 1,638mm[24]. Based on this data, the climate is classed as: Tropical (MAT>20℃), Wet (MAP>1000mm).	
Any comment:	-	

Data / Parameter:	***CF***
Data unit:	-
Description:	Conservativeness factor
Source of data used:	Approved methodology AM0025 table 3

[24] FSR/PDR P26

Value applied:	1.37
Justification of the choice of data or description of measurement methods and procedures actually applied :	To be conservative, according to AM0025, the estimated uncertainty range selected as greater than 100%, and the assigned uncertainty band as 150%.
Any comment:	-

Data / Parameter:	***MCF_p***
Data unit:	-
Description:	Methane conversion factor for waste water treatment
Source of data used:	Table 6.3, chapter 6, volume 5 from IPCC 2006 guidelines
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	The wastewater was treated by UASB (Up-flow Anaerobic Sludge Bed) which is anaerobic reactors, so 0.8 was selected from table 6.3, chapter 6, volume 5 from IPCC 2006 guidelines.
Any comment:	-

Data / Parameter:	***$EF_{grid,OM,y}$***
Data unit:	tCO_2/MWh
Description:	Operation Margin Emission Factor of Central China Power Grid
Source of data used:	Report on 2009 Baseline Emission Factors for Regional Power Grids by China DNA released on 2nd July,2009 http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2333.pdf
Value applied:	0.9987
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***$EF_{grid,BM,y}$***
Data unit:	tCO_2/MWh
Description:	Built Margin Emission Factor of Central China Power Grid
Source of data used:	Report on 2009 Baseline Emission Factors for Regional Power Grids by China DNA at released on 2nd July,2009

	http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2333.pdf
Value applied:	0.5772
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***$FC_{i,y}$, $F_{i,j,y}$***
Data unit:	10^4t or 10^8m^3
Description:	The amount of fuel *i* consumed in the project electricity system in province *j* in year *y*
Source of data used:	*China Energy Statistical Yearbook 2006-2008*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics data
Any comment:	Used for the calculation of $EF_{OM,y}$ and $EF_{BM,y}$.

Data / Parameter:	***$NCV_{i,y}$***
Data unit:	TJ/t , or TJ/km^3
Description:	The net calorific value (energy content) per mass or volume unit of a fuel *i* in year y
Source of data used:	*China Energy Statistical Yearbook 2008*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the latest version of '*Tool to calculate the emission factor for an electricity system*(version 02)', the proposed project uses the national values.
Any comment:	Used for the calculation of $EF_{OM,y}$ and $EF_{BM,y}$

Data / Parameter:	***$EF_{CO2,i,y}$***
Data unit:	tC/TJ (which can be converted to tCO_2e/TJ)
Description:	The CO_2 emission factor per unit of the fuel *i* in year y
Source of data used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or	According to the latest version of '*Tool to calculate the emission factor for an electricity system*' (version 02), the proposed project uses the IPCC default

description of measurement methods and procedures actually applied :	values.
Any comment:	Used for the calculation of $EF_{OM,y}$ and $EF_{BM,y}$

Data / Parameter:	***EG_y***
Data unit:	MWh
Description:	Net electricity generated and delivered to the SCPG by power plant/unit j in year y, except for the low-cost/must-run power plant
Source of data used:	*China Electric Power Yearbook 2006-2008*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics data in accordance with the latest version of '*Tool to calculate the emission factor for an electricity system*' (version 02)'.
Any comment:	-

Data / Parameter:	***$EF_{Coal,Adv,y}$***
Data unit:	tCO_2/MWh
Description:	Emission factors reflecting the efficiency level of the best coal-fired power generation technology commercially available in China.
Source of data used:	Notification of 2009 Baseline Emission Factors for Regional Power Grids in China published by Chinese DNA.
Value applied:	0.9135
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released official data
Any comment:	Used for the calculation of $EF_{BM,y}$

Data / Parameter:	***$EF_{Oil,Adv,y}$***
Data unit:	tCO_2/MWh
Description:	Emission factors reflecting the efficiency level of the best oil-fired power generation technology commercially available in China.
Source of data used:	Notification of 2009 Baseline Emission Factors for Regional Power Grids in China published by Chinese DNA.
Value applied:	0.4138
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released official data

Any comment:	Used for the calculation of $EF_{BM,y}$

Data / Parameter:	$\boldsymbol{EF_{Gas, Adv, y}}$
Data unit:	tCO_2/MWh
Description:	Emission factors reflecting the efficiency level of the best gas-fired power generation technology commercially available in China.
Source of data used:	Notification of 2009 Baseline Emission Factors for Regional Power Grids in China published by Chinese DNA.
Value applied:	0.5706
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released official data
Any comment:	Used for the calculation of $EF_{BM,y}$

Data / Parameter:	$\boldsymbol{CAP_{i,j,y}}$
Data unit:	MW
Description:	The installed capacity of power source *i* of province *j* of SCPG in year *y*
Source of data used:	*China Electric Power Yearbook 2006-2008*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released official data
Any comment:	Used for the calculation of $EF_{BM,y}$

Data / Parameter:	***Electricity Import***
Data unit:	MWh
Description:	Net electricity import from Central China Power Grid (CCPG) to SCPG
Source of data used:	*China Electric Power Yearbook 2006-2008*
Value applied:	Please refer to Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Released official data
Any comment:	Used for the calculation of $EF_{OM,y}$

B.6.3 Ex-ante calculation of emission reductions:

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1. The baseline emissions BE_y are calculated as follows:

As described in B.4, the baseline emission BE_y is composed of $BE_{CH4,SWDS,Y}$ and $BE_{EN,Y}$.

$BE_y = BE_{CH4,SWDS,Y} + BE_{EN,y}$

Breakdown calculations:

1.1 The Baseline Emissions from electricity generation displaced by the project activity ($BE_{EN,y}$):

Table B-9 calculation of $BE_{EN,y}$

Parameter	Description	Value	Source
$EG_{d,y}$	Power exported to grid(Mwh)	134,924	FSR(second version)
CEF_d	Carbon emission factor of displaced power	0.78795	China DNA (the NDRC)

$BE_{EN,y}$ is calculated as per the following formula:

$BE_{EN,y} = BE_{elec,y} = EG_{d,y} * CEF_d$ = 134,923.8*0.78795 = 106,313 tCO_2e

According to the FSR(second version), the three incinerators of the projects will be put into use one by one in the first year of operation, therefore the power to be generated in the first year is anticipated to be 50% of full capacity.

$BE_{EN,2011}$ = 106,313*50% = 53,157 tCO_2e

1.2 CH_4 that will be produced in the landfill in the absence of the Project activity ($BE_{CH4,SWDS,y}$):

Table B-10 Necessary values to calculate $BE_{CH4,SWDS,y}$

Parameter	Description	Value	Source
φ	Correction factor for model uncertainty	0.9	AM0025
f	CH_4 fraction flared, combusted or used by any other means in the landfill	0	AM0025
GWP_{CH4}	Global warming potential of CH_4	21	IPCC
OX	Oxidation factor	0.1	IPCC 2006
F	CH_4 fraction in landfill gas	0.5	AM0025

<table>
<tr><td>DOC_f</td><td>Degradable organic carbon</td><td>0.5</td><td>IPCC 2006</td></tr>
<tr><td>MCF</td><td>Methane correction factor</td><td>1.0</td><td>IPCC 2006</td></tr>
<tr><td>$W_{j,x}$</td><td>The amount of waste type j that is avoided from being treated in landfills in year x</td><td><table>
<tr><td>Waste type j</td><td>$W_{j,x}$(tons)</td></tr>
<tr><td>Kitchen</td><td>212,553.00</td></tr>
<tr><td>Paper</td><td>36,531.00</td></tr>
<tr><td>Wood</td><td>50,242.50</td></tr>
<tr><td>Plastics</td><td>27,918.00</td></tr>
<tr><td>Textiles</td><td>40,095.00</td></tr>
<tr><td>Glass and metal</td><td>36,234.00</td></tr>
<tr><td>Rubber and leather</td><td>0</td></tr>
<tr><td>Others</td><td>91,426.50</td></tr>
<tr><td></td><td></td></tr>
</table></td><td>Calculated based on the “Waste Composition Report of MSW in Nanhai District”, issued by Chinese Academy of Science Guangzhou Energy Research Institute.</td></tr>
<tr><td>DOC_j</td><td>Fraction of degradable organic carbon in waste type j</td><td><table>
<tr><td>Waste type j</td><td>DOC_j</td></tr>
<tr><td>Kitchen</td><td>15%</td></tr>
<tr><td>Paper</td><td>40%</td></tr>
<tr><td>Wood</td><td>43%</td></tr>
<tr><td>Plastics</td><td>0</td></tr>
<tr><td>Textiles</td><td>24%</td></tr>
<tr><td>Glass and metal</td><td>0</td></tr>
<tr><td>Rubber and leather</td><td>0</td></tr>
<tr><td>Others</td><td>0</td></tr>
</table></td><td>IPCC 2006</td></tr>
<tr><td>K_j</td><td>Decay rate of waste type j</td><td><table>
<tr><td>Waste type j</td><td>DOC_j</td></tr>
<tr><td>Kitchen</td><td>40%</td></tr>
<tr><td>Paper</td><td>7%</td></tr>
<tr><td>Wood</td><td>3.5%</td></tr>
<tr><td>Plastics</td><td>0</td></tr>
<tr><td>Textiles</td><td>7%</td></tr>
<tr><td>Glass and metal</td><td>0</td></tr>
<tr><td>Rubber and leather</td><td>0</td></tr>
<tr><td>Others</td><td>0</td></tr>
</table></td><td>IPCC 2006</td></tr>
<tr><td>Y</td><td>Crediting period</td><td>7</td><td></td></tr>
</table>

According to formular:

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

The calculation result of $BE_{CH4,SWDS,y}$ is:

Table B-11 calculation result of $BE_{CH4,SWDS,y}$

Year	$BE_{CH4,SWDS,y}$ (tCO_2e/year)
01/04/2012-31/12/2012	74,581
2013	145,174
2014	179,203
2015	205,198
2016	225,631
2017	242,169
2018	255,938
01/01/2019-31/03/2019	66,926

In summary, the calculation result of BE_y is:

Table B-12 calculation result of BE_y

Year	$BE_{CH4,SWDS,y}$(tCO_2e/year)	$BE_{EN,y}$(tCO_2e/year)	BE_y(tCO_2e/year)
01/04/2012-31/12/2012	74,581	79,735	154,316
2013	145,174	106,313	251,487
2014	179,203	106,313	285,516
2015	205,198	106,313	311,512
2016	225,631	106,313	331,944
2017	242,169	106,313	348,482
2018	255,938	106,313	362,251
01/01/2019-31/03/2019	66,926	26,578	93,505

2. Calculation of Project Emission PE_y

According to section B.4, $PE_y = PE_{fuel,on\text{-}site,y} + PE_{i,f,y} + PE_{i,s,y} + PE_{w,y}$

Specific calculations are:

2.1 Emission from on-site fuel use ($PE_{fuel,on\text{-}site,y}$)

Table B-13 values used to calculate $PE_{fuel,on\text{-}site,y}$

$PE_{fuel,on\text{-}site,y}$	Parameter	Description	Unit	Value	Source
	$F_{cons,y}$	On-site fuel consumption in year y	m^3	200	FSR(second version)
		Density of 0# diesel	t/m^3	0.84	http://ks.cn.yahoo.com/question/1307041004819.html
	NCV_{fuel}	Net caloric Value of the fuel used	MJ/kg	44.27	Incinerator Technical Agreement
	EF_{fuel}	CO_2 emission factor of the fuel used	Ton/MJ	$74.8*10^{-6}$	IPCC 2006 default value

The calculation result of $PE_{fuel,on\text{-}site,y}$ is:

$PE_{fuel,on\text{-}site,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel}$ = 556.31 tCO_2e/year

2.2 Emission from the combustion of waste that contains fossil carbon ($PE_{i,f,y}$)

Table B-14 necessary values to calculate $PE_{i,f,y}$

$PE_{i,f,y}$	**Type**	**Fraction $P_{n,j,y}$**	**Dry material**	**Dry weight**	**CCW_i**	**FCF_i**	**EF_i**	**Emission(tCO_2e/year)**
	i	A	B	C=495,000*A*B	D	E	F	G=C*D*E*F*44/12
	Kitchen	42.94%	0.40	85,021.20	0.38	0.00	1	0
	Paper	7.38%	0.90	36,531.00	0.46	0.01	1	554.54
	Wood	10.15%	0.40	50,242.50	0.50	0.00	1	0
	Plastics	5.64%	1.00	27,918.00	0.75	1.00	1	76,774.50
	Textiles	8.10%	0.80	40,095.00	0.50	0.20	1	11,761.20
	Glass/metal	7.32%	1.00	36,234.00	0.00	0.00	1	0
	Rubber	0.00%	0.84	0.00	0.67	0.10	1	0
	Others	18.47%	0.90	91,426.50	0.03	1.00	1	9,051.22
	Total	100%						98,141.46

According to formula

$$PE_{g/r/i,f,y} = \sum_i A_i \times CCW_i \times FCF_i \times EF_i \times \frac{44}{12}$$

The calculation result of $PE_{i,f,y}$ is 98,141.46 tCO_2e/year

2.3 N_2O and CH_4 emission from the combustion of waste ($PE_{i,s,y}$)

Table B-15 necessary values to calculate $PE_{i,s,y}$

$PE_{i,s,y}$	**Parameter**	**Description**	**Unit**	**Value**	**Source**
	$Q_{biomass,y}$	Combusted waste in year y	ton	495,000	FSR(Second Version)
	EF_{N2O}	Aggregated N_2O emission factor	gN_2O/t	47	IPCC 2006 default value
	GWP_{N2O}	Global warming potential of N_2O	-	310	IPCC
	EF_{CH4}	Aggregated CH_4 emission factor	gCH_4/t	0.2	IPCC 2006 default value
	GWP_{CH4}	Global warming potential of CH_4	-	21	IPCC
	CF	Conservativeness factor		1.37	IPCC

The calculation result of $PE_{i,s,y}$ is :

$PE_{i,s,y}$=$Q_{biomass,y}$ * (EF_{CH4} * GWP_{CH4} + EF_{N2O} * GWP_{N2O}) * 10^{-3} * CF = 9,883.49 tCO_2e/year

2.4 Emission from wastewater treatment ($PE_{w,y}$)

Table B-16 Conditions of wastewater

Type of wastewater	Volume(m^3/d)	COD_{cr} (mg/L)
Leachate from the waste tank	225	30,000～60,000
Lab waste water	33	100
Wash water from waste unloading hall	6	500～1,000
Wash water from other workshops	8	～100
Living water	20	150～300
Water from boilers (cooled)	70	-
Wastewater from Nanhai I	133	20,000～30,000
Total volume (m^3/year)	163,350	
Average[25] COD_{cr} （mg/L）	35,366	

Table B-17 necessary values to calculate $PE_{w,y}$

$PE_{w,y}$	Parameter	Description	Unit	Value	Source
	$Q_{COD,y}$	Wastewater volume in year y	t/year	163,350	FSR(second version)
	$P_{COD,y}$	Average COD in year y	mg/L	35,366	ER sheet
	B_0	Maximum methane production capacity	tCH_4/tCOD	0.265	IPCC
	MCF_p	Methane conversion factor	-	0.8	IPCC 2006 default value
	GWP_{CH4}	Global warming potential of CH_4	-	21	IPCC
	$\eta_{flare,h}$	Combustion efficiency		90%	IPCC

Since the methane produced during the wastewater treatment process will be transported back into the waste storage tank, and eventually led into the incinerators for combustion, the emission calculation is:

$PE_{w,y}$= $Q_{COD,y}$ * $P_{COD,y}$ * B_0 * MCF_p * GWP_{CH4} * (1-$\eta_{flare,h}$) * 10^{-6} = 2,571.93 tCO_2e

[25] For conservative, the maximum COD_{cr} value of each type of wastewater is used.

In summary, the calculation result of PE_y is:

Table B-18 calculation result of PE_y

Year	PE_y (tCO_2e/year)
01/04/2012-31/12/2012	83,365
2013	111,153
2014	111,153
2015	111,153
2016	111,153
2017	111,153
2018	111,153
01/01/2019-31/03/2019	27,788

3. Calculation of leakage emission ($L_{i,y}$)

Table B-19 necessary values to calculate $L_{i,y}$

Parameter	Description	Value	Source
$A_{residual}$	Residual waste in incinerators	99,000	FSR(second version) (residual waste is 20% of total waste combusted)
$FC_{residual}$	Carbon fraction in residual waste	3%	FSR(second version)

The calculation of $L_{i,y}$ is:

$L_{i,y}= A_{residual,y} *F_{Cresidual}*44/12=$10,890 tCO_2e

Table B-20 calculation result of $L_{i,y}$

Year	$L_{i,y}$ (tCO_2e/year)
01/04/2012-31/12/2012	8,168
2013	10,890
2014	10,890
2015	10,890
2016	10,890
2017	10,890
2018	10,890
01/01/2019-31/03/2019	2,723

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

Emission reduction in the first crediting period is as follows:

Year	Estimation of project emission (tCO_2e)	Estimation of baseline emission(tCO_2e)	Estimation of leakage emission(tCO_2e)	Estimation of total reduced emission(tCO_2e)
01/04/2012-31/12/2012	83,365	154,316	8,168	62,784
2013	111,153	251,487	10,890	129,444
2014	111,153	285,516	10,890	163,473
2015	111,153	311,512	10,890	189,468
2016	111,153	331,944	10,890	209,901
2017	111,153	348,482	10,890	226,439
2018	111,153	362,251	10,890	240,208
01/01/2019-31/03/2019	27,788	93,505	2,723	62,994
Total	778,072	2,110,969	76,230	1,284,711
Average	111,153	305,573	10,890	183,530

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

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	$F_{cons,y}$
Data unit:	The mass or volume of the fuel consumed
Description:	Amount of fuel consumed on-site during year y within the crediting period
Source of data to be used:	Purchase invoice and/or metering
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The on-site fuel consumption is anticipated to be $200m^3$/year. The density of the 0# diesel is 0.84kg/L[26] , the weight of the consumption 0# diesel is 168tons.
Description of measurement methods and procedures to be applied:	The data can be acquired from the operation log of the project, and can be double checked according to the procurement invoice. The fossil fuel consumption on-site will be measured annually.
Monitoring	Annually

[26] http://ks.cn.yahoo.com/question/1307041004819.html

frequency	
QA/QC procedures to be applied:	Consumed fuel can be confirmed by checking the fuel procurement invoice.
Any comment:	-

Data / Parameter:	-
Data unit:	MJ
Description:	Energy generated by auxiliary fossil fuel added in the incinerator
Source of data to be used:	Purchase invoice
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Calculated based on $F_{cons,y}$ and NCV_{fuel} 168,000kg*44.27MJ/kg=7,437,360MJ
Description of measurement methods and procedures to be applied:	This parameter will be estimated multiplying the amount of auxiliary fossil fuel added in the incinerator to the net calorific value of this auxiliary fossil fuel.
Monitoring frequency	Annually
QA/QC procedures to be applied:	-
Any comment:	This parameter will be used to assess that the fraction of energy generated by fossil fuel is no more than 50% of the total energy generated in the incinerator. Energy generated by fossil fuel < 0.50 x (Qy + EGd,y)

Data / Parameter:	***EF***
Data unit:	Fraction
Description:	Combustion efficiency for waste
Source of data to be used:	The source of data should be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
Description of measurement methods and	100% No country or project specific data are available. Therefore, using 2006 IPCC Guidelines for default value.

procedures to be applied:	
Monitoring frequency	-
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	***NCV_{fuel}***
Data unit:	MJ/kg
Description:	Net calorific value of fuel
Source of data to be used:	Device Technical Agreement of Incinerators
Value of data applied for the purpose of calculating expected emission reductions in section B.5	44.27
Description of measurement methods and procedures to be applied:	Value sourced from the technical contract of the incinerator
Monitoring frequency	-
QA/QC procedures to be applied:	This value will be compared with the latest value published by IPCC, the conservative value will be used.
Any comment:	-

Data / Parameter:	***EF_{fuel}***
Data unit:	tCO_2/MJ
Description:	Emission factor of the fuel
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74.8×10^{-6}
Description of measurement methods and procedures to be applied:	This value will be updated as per published IPCC report
Monitoring	-

frequency	
QA/QC procedures to be applied:	IPCC 2006 default value
Any comment:	-

Data / Parameter:	***FCFi***
Data unit:	Fraction
Description:	Fraction of fossil carbon in total carbon of waste type i
Source of data to be used:	IPCC 2006 guideline default values
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Paper/cardboard: 1% Textiles: 20% Food waste: 0 Wood: 0 Garden and park waste: 0 Nappies: 10% Rubber and leather: 20% Plastics: 100% Metal: NA Glass: NA Other, inert waste: 100%
Description of measurement methods and procedures to be applied:	The following standards should be used to estimate fossil carbon fraction of waste type i: ● ASTM D6866-08: "Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis"; ● ASTM D7459-08: "Standard Practice for Collection of Integrated Samples for the Speciation of Biomass (Biogenic) and Fossil-Derived Carbon Dioxide Emitted from Stationary Emissions Sources".
Monitoring frequency:	The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year.
QA/QC procedures to be applied:	The sample test will be undertaken by certified institutes
Any comment:	-

Data / Parameter:	$\boldsymbol{A_{msw,y}}$
Data unit:	tons/yr
Description:	Amount of MSW combusted in the incinerators each year
Source of data to be used:	Project participant, measured by weighing machine
Value of data applied for the purpose of calculating expected	The amount of annual combusted MSW is anticipated to be 495,000 tons/yr.

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This parameter is calculated by weighing each truck's load before entry into the plant. The data will be aggregated monthly and annually. The weighing machine shall be calibrated regularly according to the plan made by the project proponent. The receipt for the revenue gained by MSW treatment can be a proof for double check.
Monitoring frequency:	Continuously
QA/QC procedures to be applied:	The project proponent will test the component and weight of the MSW regularly. The weigh will be calibrated every 3 months.
Any comment:	-

Data / Parameter:	***CCW_i***
Data unit:	%
Description:	Total carbon fraction in waste type i
Source of data used:	IPCC 2006 guideline.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Waste type: CCW_i Kitchen: 38 Paper: 46 Wood: 40 Plastics: 75 Fiber: 50 Glass and metal: 0 Rubber and leather: 67 Others: 3
Description of measurement methods and procedures to be applied:	IPCC default values
Monitoring frequency:	-
QA/QC procedures to be applied	-
Any comment:	-

Data / Parameter:	***$EG_{PJ,FF,y}$***
Data unit:	MWh
Description:	Amount of electricity consumed from the grid as a result of the project activity during the year y
Source of data to be used:	Electricity meter
Value of data applied	The electricity consumption on-site is generated from incineration, the

for the purpose of calculating expected emission reductions in section B.5	project emissions are calculated in the emissions from waste incineration (*PEi,y*), therefore, the $EG_{PJ,FF,y}$ here is zero.
Description of measurement methods and procedures to be applied:	The grid electricity consumed by the project will be monitored using the electricity meter installed at the substation. Copies of purchase invoices will be provided to the DOE by the project participant for cross reference. The readings of electricity meter will be aggregated monthly and annually, and archived during the crediting period and two years after.
Monitoring frequency	Continuous
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$A_{residual}$
Data unit:	tons/yr
Description:	The amount of the residual waste from the incinerator
Source of data to be used:	Project participant, measured by weighing machine
Value of data applied for the purpose of calculating expected emission reductions in section B.5	99,000 Calculated as 20% of the total amount of MSW fed into the incinerators.
Description of measurement methods and procedures to be applied:	Measured with weighing machine, The data will be aggregated monthly and annually and archived during the crediting period and two years after.
Monitoring frequency:	Aggregated at least annually
QA/QC procedures to be applied:	-
Any comment:	Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)

Data / Parameter:	$FC_{residual}$
Data unit:	%
Description:	Fraction of residual carbon in the residual waste of MSW incinerator
Source of data used:	Sample measurements by certified institute
Value of data applied for the purpose of calculating expected emission reductions	3%

in section B.5	
Description of measurement methods and procedures to be applied:	Sample test by a certified institute.
Monitoring frequency:	The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	***MB_y***
Data unit:	tCH_4
Description:	Amount of methane produced in the landfill in the absence of the project activity in year *y*
Source of data used:	Calculated as per the *"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Calculated as per the *"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"*
Description of measurement methods and procedures to be applied:	As per the *"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"*
Monitoring frequency:	As per the *"Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"*
QA/QC procedures to be applied:	As per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*"

Data / Parameter:	***AF***
Data unit:	Fraction
Description:	Methane destroyed due to regulatory or other requirements.
Source of data used:	Local and/or national authorities.
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:	Derived from or based upon local or national guidelines. This parameter will be renewed at the renewal of crediting period.
Monitoring frequency:	At renewal of crediting period
QA/QC procedures to be applied:	Data are derived from or based upon local or national guidelines, so QA/QC procedures for these data are not applicable.
Any comment:	Changes in regulatory requirements, relating to the baseline landfill(s) need to be monitored in order to update the adjustment factor (*AF*), or directly MD_{reg}. This is done at the beginning of each crediting period.

Data / Parameter:	$EG_{d,y}$
Data unit:	MWh
Description:	Amount of electricity generated utilizing the combustion heat from incineration in the project activity displacing electricity in the baseline during the year '*y*'.
Source of data to be used:	Electricity meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	134,924
Description of measurement methods and procedures to be applied:	The readings of electricity meter will be aggregated monthly and annually, and archived during the crediting period and two years after.
Monitoring frequency:	The data is to be continuously monitored.
QA/QC procedures to be applied:	Cross check with the electricity invoice or electricity transaction note
Any comment:	

Data / Parameter:	***f***
Data unit:	Fraction
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data to be used:	Written information from the operator of the solid waste disposal site and/or site visits at the solid waste disposal site
Value of data applied for the purpose of calculating expected	0

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	-
Monitoring frequency:	The data is to be annually monitored and the data will be archived electronically and kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	-
Any comment:	A value of 0 will be applied since it is already reflected in the emission reduction calculation equation in AM0025.

Data / Parameter:	W_x
Data unit:	tons
Description:	Total amount of organic waste prevented from disposal in year x (tons)
Source of data to be used:	Project participant, measured by weighing machine
Value of data applied for the purpose of calculating expected emission reductions in section B.5	495,000
Description of measurement methods and procedures to be applied:	This parameter is the same as A_i.
Monitoring frequency:	This parameter will be monitored continuously, aggregated at least annually.
QA/QC procedures to be applied:	Regularly testing and analysis by the project proponent will be carried out.
Any comment:	-

Data / Parameter:	$P_{n,j,y}$
Data unit:	Fraction
Description:	Weight fraction of the waste type j in the sample n collected during the year y
Source of data to be used:	Sample measurements by project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Food, food waste, beverage and tobacco: 42.94% Wood and wood products: 10.15% Pulp, paper and cardboard: 7.38% Textiles: 8.10% Garden and park waste: 0 Nappies: 0

	Glass and metal: 7.32% Plastic: 5.64% Rubber and leather: 0 Others, inert waste: 18.47%
Description of measurement methods and procedures to be applied:	Sample the waste prevented from disposal, using the waste categories j, as provided in the table for DOC_j and k_j, and weigh each waste fraction.
Monitoring frequency:	The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sample should be undertaken four times per year.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**z**
Data unit:	-
Description:	Number of samples collected during the year x
Source of data to be used:	Project participant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	
Monitoring frequency:	sample test, aggregated annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$Q_{COD,y}$
Data unit:	m^3/yr
Description:	Amount of wastewaster treated anaerobically or released untreated from the project activity in year *y*
Source of data to be used:	FSR(Second Version)
Value of data applied for the purpose of calculating expected emission reductions in	163,350

section B.5	
Description of measurement methods and procedures to be applied:	Measured value by flow meter.
Monitoring frequency:	Monitored continuously and aggregated monthly and annually.
QA/QC procedures to be applied:	The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy.
Any comment:	

Data / Parameter:	$P_{COD,y}$
Data unit:	$tCOD/m^3$
Description:	Chemical Oxygen Demand (COD) of wastewater
Source of data to be used:	measured by project participant or COD test instrument
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$35{,}366 \times 10^{-6}$
Description of measurement methods and procedures to be applied:	Measured value by COD testing instrument.
Monitoring frequency:	Monitored monthly and aggregated annually.
QA/QC procedures to be applied:	The monitoring instruments will be subject to regular maintenance and testing to ensure accuracy.
Any comment:	

Data / Parameter:	T_{flare}
Data unit:	℃
Description:	Temperature of the exhaust gas of the incinerators
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be	Measure the temperature of the exhaust gas stream in the incinerator by thermocouples. A temperature above 500 ^{o} C indicates that the incinerator is operating.

applied:	The data will be recorded every minute and aggregated monthly and yearly
Monitoring frequency:	Continuous
QA/QC procedures to be applied:	Thermocouples should be replaced or calibrated every year.
Any comment:	The methane generated from the anaerobic waste water treatment system will be combusted by the enclosed incinerators. According to the manufacturer's specifications of the incinerator, during the operation of the incinerators, the exhaust gas from the incinerators will be no less than 850° C and the residence time will be no less than 2 seconds (as per Table A-1), auxiliary fuel will be used to keep the temperature at this level when the Lower Heat Value of MSW is too low to ensure this temperature, which will ensure that the methane destruction efficiency is higher than the default value of the enclosed flare when the flare temperature is above 500℃ and the flare operates complying with the manufacturer's specifications[27].

Data / Parameter:	**$RATE^{Compliance}_{y}$**
Data unit:	Number
Description:	Rate of compliance
Source of data to be used:	Municipal bodies
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:	The compliance rate is based on the annual reporting of the municipal bodies issuing these reports. The state-level aggregation involves all landfill sites in the country. If the rate exceeds 50%, no CERs will be claimed. This parameter will be monitored annually
Monitoring frequency:	Annual
QA/QC procedures to be applied:	-
Any comment:	-

[27] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories gives a standard value for the fraction of carbon oxidised for gas combustion of 99.5% (Reference Manual, Table 1.6, page 1.29)

B.7.2 Description of the monitoring plan:

>>
This Monitoring Plan will set out a number of monitoring tasks in order to ensure that all aspects of projected greenhouse gas (GHG) emission reductions for the proposed project are controlled and reported. This requires an on-going monitoring of the project to ensure performance according to its design and that claimed Certified Emission Reductions (CERs) are actually achieved.

1. Monitoring Structure

The monitoring structure is shown by Figure 6 and implemented by the project owner.

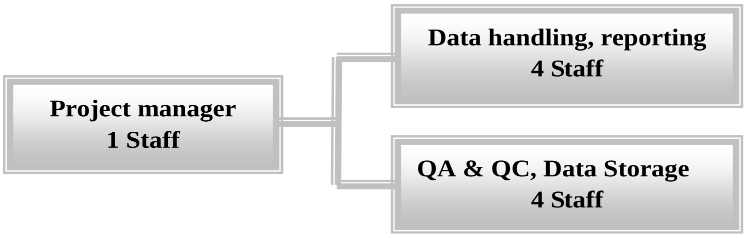

Figure 6. Monitoring structure of the Project

The project manager is responsible for 1) implementation and supervision of the monitoring activity 2) periodical training on the staff of the whole monitoring system 3) liaison of this CDM project.

The data handling and reporting staffs are responsible for managing, processing and submitting data.

The QA & QC and Data Storage staffs are responsible for calibration of meters and supervision of the whole process quality, and storage of the data.

2. Data to be monitored

The data to be monitored include MSW composition and quantity, electricity exported to SCPG, auxiliary fuel, and etc. In addition, monitoring of laws and regulations are also included.

- MSW composition and fraction of fossil carbon will be analyzed in accordance with the national or industry standards. These data will be analyzed at least quarterly by certified institute, and the average value of four quarters will be recognized to be the annual average value.
- The amount of waste to be incinerated will be measured and recorded automatically when each waste truck enters the incineration plant through the truck weighing machine installed at the gate. The data will be aggregated monthly and annually. The MSW treatment income receipt will be provided for cross check.
- Electricity delivered to SCPG by the project will be recorded by the electricity meter. Copies of receipts or invoices will be provided to the DOE for cross check.

- The grid electricity consumed by the project will be monitored using the electricity meter. Copies of purchase invoices will be provided to the DOE by the project participant for cross reference.
- The type and quantity of auxiliary fuel consumption will be monitored through the fuel purchase invoices.
- Laws and regulations regarding MSW treatment in China, and reports published by authorities (such as statistical yearbook, IPCC Guidelines and so on) will be monitored. If necessary, the default value used by the proposed project will be updated.
- Amount of slag will be monitored by weighing machine and the data will be aggregated at least annually. The fraction of residual carbon in the residual waste of MSW incinerator will be sample test by certified institute.
- The quantity of wastewater treated will be monitored by flow meter, COD of the waste water will be monitored by COD testing instrument or lab sampling test. The methane generated from waste water treatment system will be sent to incinerator for combustion. The temperature of the exhaust gas of the incinerators will be monitored by thermocouples, and the data of the temperature will be recorded every minute and will be aggregated monthly and yearly.

3. Installation and calibration of the monitoring equipment

The main monitoring equipment includes weighing machine, flow meters, COD testing instruments and electricity meters.

The weighing machine will be installed at the entrance of the plant. The accuracy, installation and calibration of the weighing machine should be consistent with national or industry regulations and standards. The weighing machine will record the weight of each waste truck going in and out of the plant. The difference between the two data provides the amount of the waste to be incinerated. The project owner will be responsible for the operation and maintenance of the weighing machine in accordance with manufacturer’s technical specifications and requirements.

The volume of leachate will be monitored by flow meters installed at the entrance of the wastewater treatment station. The COD of the wastewater will be monitored by COD analysis instrument continuously or by sample test in the lab according to the relevant standard method. The equipments will be subject to periodic calibration in accordance with the manufacturer’s technical specifications and requirements.

The net electricity delivered to and imported from the power grid shall be metered through the electricity meters. The installation of the electricity meter should under the control of the grid company. The metering equipment will be properly installed and calibrated according to *Technical administrative code of electric energy metering (DL/T448-2000)*. The grid company will be responsible for the operation and maintenance of the metering device.

The thermocouples should be replaced or calibrated every year in order to ensure its acutance.

4. Method of dealing with abnormity or errors

If the truck scale and electricity metering system are inaccurate by more than the allowable error, or have otherwise functioned improperly, the monitoring process should be:

• Carried out according to the relevant terms in the MSW treatment contract and electricity sales and purchase contract.

• The conservative data will be used to calculate the emission reductions achieved by the project during this period.

If the error data could not be calibrated and validated, the emission reductions achieved from these error data should not be claimed.

5. Data Management System

- Specific staff will be appointed by the project owner to take the overall responsibility for monitoring greenhouse gas emission reductions and keeping all the data collected as part of monitoring archived electronically and kept at least for two years after the end of the last crediting period.
- Electronic data and documents, including readings from ammeters connected into the computer central control system, will be regularly copied and archived via optical discs and storage tapes, and kept at least for two years after the end of the last crediting period.
- Written data and documents, including receipts for cross-checking of data, will be copied and archived with an explanation of the department or company where the original copy is kept, and kept for at least two years after the end of the last crediting period.
- Data recording, maintaining and archiving will be implemented in line with the *Quality Management System Standards* (GB/T-1 19001).

6. Monitoring Report

The Monitoring Report is for the purpose of describing the implementation of the Monitoring Plan, presenting the monitoring results and data, calculating the actual emission reductions and summarizing the Monitoring Plan during the past year. The annual monitoring report will be submitted by the CDM manager, and the contents will include, but are not limited to, the following:

- Calibration report of the monitoring equipment (including relevant laws and regulations).
- Maintenance and overhaul report of the monitoring equipment.
- Summary report of the testing methods of monitoring data and the monitoring results.
- Process and results of the emission reduction calculation.
- Summary report of the annual implementation of monitoring plan.
- Other information related to the monitoring plan.

The DOE will annually verify the emission reductions of the project. The project participants will offer all the information as required for verification, including monitoring data, monitoring report and other information.

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)

>>

The application of the baseline study and monitoring methodology of the Project was completed on 06/01/2012 by:

Name/Origination	**Project participate Yes/No**
China Construction Design International Address: Yihe Building, No.12 Dongtucheng Road, Chaoyang District, Beijing China Tel: 00-86-10-8426-5555 Fax: 00-86-10-8426-5500	No

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:

>>
03/06/2008[28].

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

>>
30 years 0 month

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

C.2.1. Renewable crediting period

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

>>
01/04/2012 or the registration date of the project activity, whichever is later.

C.2.1.2. Length of the first crediting period:

>>
7 years 0 month

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

[28] Signing procurement contract for incinerators.

SECTION D. Environmental impacts

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

>>

The Environment Impact Assessment (EIA) was completed by the South China Environmental Science Research Institute of Ministry of Environmental Protection of the People's Republic of China. On 28 November 2008, the Ministry of Environmental Protection of China approved the EIA of the Project ([2008]471). According to the EIA, the project may have the following potential influence on local environment, and the Project owner have prepared corresponding plans to control these risks:

By applying advanced imported mechanical grate incinerators and corresponding smoke and wastewater treatment measures, the pollutant emission can satisfy the requirement of the "MSW Incineration Pollution Control Standards" (GB18485-2001) and the requirement of Japan National Standards. Zero wastewater emission will be achieved by the project activity. During the operation of the project, environmental risk can be controlled as long as reasonable and effective measures are taken to manage and monitor pollutant emissions such as smoke, wastewater, noise and solid waste.

Waste gas control:

The major air pollutants that the project emits are acid gas (NO_x, SO_2, HCL, CO…etc), particles, heavy metals and their compounds, as well as organic pollutants (dioxin and furan). The design and operation management of a high effective and efficient waste gas filtration system is the key to anti-pollution for MSW incineration projects. The project employs widely-used semi-dry process that takes advantage of high efficiency and no need to treat the reaction products. After the waste gas goes through the reactor, chemical spray system and the bag de-dust system, the pollutant in the waste gas is controlled to satisfy corresponding standards and regulations. The gas will eventually be vented to the air through a chimney of 120m high. Monitoring devices are installed in the chimney to monitor the concentration of NO_2, SO_2, HCL, dust and dioxin.

The MSW storage tank of the project is air tight with blower installed to keep a negative air pressure in the storage tank, hence prevent the emission of stench gas. In the meanwhile, the tank gas is led into the incinerator during MSW combustion, thus the stench gas is flared. Medicine spray system is also designed to control the growth of microbes. The stench concentration within the site boundary is controlled and satisfies level II standard of the "Stench emission standard" (GB14554-93).

Solid waste control:

The main solid waste that the project generates includes combustion residuals, ashes and the dusts captured in the waste gas filtration system. The dusts collected by the waste gas filtration system will be stored in the dust warehouse and disposed of by qualified firms. The combustion residual will be treated by a qualified company appointed by Nanhai Municipal Administration Bureau.

Wastewater treatment:

After treated, the wastewater generated by the project will meet the requirement of "Water pollutant emission limit" issued by Guangdong Province, and will be re-used for cooling and greening use. Specific anti-leakage measures are taken in the MSW storage tank and the leachete tank to prevent potential pollutions to the ground water.

Noise control:

The major noise sources of the project are the turbine generators, boilers, cooling tower, and pumps. The project employs advanced mechanical equipments with minor noise. In the meanwhile, the plant and workshops are allocated reasonably so that the noise sources are physically concentrated. Noise-proof construction structure is applied in the control room and operation room. Greening is widely spread within the plant area to alleviate noise.

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

>>
The project employs clean integrated resource utilization technology to generate electricity whose environmental impacts comply with relevant laws and regulations of the host country. Environmental impacts are considered not significant.

SECTION E. Stakeholders' comments

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

>>
The Project is located near Guangzhou College Town, where local residents are sensitive to environmental conditions. The main stakeholders of the project are local residents and employees that include company staff, teachers, and workers. In order to investigate the potential impact that the project may have on local ecosystem and environment as well as understanding local government and stakeholders' comment for the construction of the project, Foshan Nanhai Green Renewable Energy Co., Ltd. carried out a questionnaire survey during 25th February to 27th February 2009 and hosted a stakeholder meeting on 4 March 2009 to understand the attitude and requirment of the public. The number of samples was 40, questionnaire response rate was 100%. The details of the samples are as follows:

Table 6. Sample component

Structure of gender		
Gender	**No.**	**Percentage (%)**
Male	21	52.5
Female	19	47.5

Structure of educational level		
Educational level	**No.**	**Percentage (%)**
Graduate	1	2.5
Undergraduate	19	47.5
College	7	17.5
Senior middle school	6	15
Junior middle school	5	12.5
Primary school	2	5

Structure of age		
Age	**No.**	**Percentage (%)**
Below 20	0	0
20-45	35	87.5
45-60	5	12.5

The questionnaires mainly focus on the following issues:

Your opinion on local environmental status.
What's your main economic source?
What do you think is the main problem with local environmental condition?
How is local power supply?
What do you think is the main barrier for local economic development?
Is the construction of the project beneficiary for local development?
Do you think the construction of the project will bring positive influence on you? Please elaborate.
Your biggest environmental concern with the construction of the Project.
Your any other comment or advice for the Project.

On 4th March 2009, the Project developer hosted a consultancy stakeholder meeting in Nanhai to have a discussion with the stakeholders about the construction of the Project and application of CDM. The main topics were as follows:

1. Introduction of meeting participants
2. Introduction of CDM background information and the application status of the Project
3. Introduction of the Project
4. Q&A
5. Meeting summary

In the meeting, the representative of local government as well as 14 individuals had a clear understanding of CDM. They were all supportive to the Project's application for CDM, and considered the application of CDM would result in a better environment for local residents to live in.

The meeting notification was published on Nanhai Daily and the website of Nanhai Development Co., Ltd, which is the parent company of Nanhai Green Renewable Energy Co., Ltd.

E.2. Summary of the comments received:

>>
According to the 40 questionnaires received:

All survey participants were supportive to the construction of the project. They all considered the construction of the project would benefit local economic development, alleviate local power shortage situation, create employment and remediate local environment.

All participants considered MSW incineration to generate power was the best practice to treat MSW.

All participants showed concerns about the waste water, waste gas, noise and solid waste generated during the construction and operation of the Project.

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

>>
According to the result of the survey, local stakeholders have sufficient knowledge of the project and are supportive to the construction of the project. Based on the comments and advice received from the stakeholders, it is not necessary to adjust the design, construction and operation of the project so far.

As for the problems related to waste water, waste gas, noise and solid waste generated during the construction and operation of the project that the stakeholders are concerned with, the project developer will implement all feasible methods to make sure the construction and operation of the project satisfy all mandatory environmental standards and regulations.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Foshan Nanhai Green Renewable Energy Co., Ltd.
Street/P.O.Box:	Dalan Branch, Shishan Forest Farm, Nanhai District, Foshan, Guangdong
Building:	
City:	Foshan
State/Region:	Guangdong
Postfix/ZIP:	528225
Country:	The People's Republic of China
Telephone:	86-757-81205522
FAX:	86-757-81208944
E-Mail:	Wangkai612@126.com
URL:	
Represented by:	Wang Kai
Title:	Manager
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	Business Department
Mobile:	
Direct FAX:	86-757-81205522
Direct tel:	86-757-81208944
Personal E-Mail:	

Organization:	Climate Bridge Ltd.
Street/P.O.Box:	Buckingham Palace Road
Building:	Level 2, 91-93 Buckingham Palace Road
City:	London
State/Region:	London
Postfix/ZIP:	SW1W 0RP
Country:	UNITED KINGDOM
Telephone:	+44 207 821 1603
FAX:	+44 207 100 9963
E-Mail:	aw@climatebridge.com
URL:	www.climatebridge.com
Represented by:	Alex Wyatt
Title:	CEO
Salutation:	Mr.
Last Name:	Wyatt
Middle Name:	
First Name:	Alex
Department:	
Mobile:	
Direct FAX:	+44 207 100 9963
Direct tel:	+44 207 821 1603
Personal E-Mail:	aw@climatebridge.com

Organization:	Noble Carbon Credits Limited
Street/P.O.Box:	13 Gilford Road
Building:	1st Floor, Gilford Hall
City:	Dublin
State/Region:	Sandymount
Postfix/ZIP:	4
Country:	Ireland
Telephone:	+ 353 1 260 7660
FAX:	+ 353 1 260 7661
E-Mail:	thorstenansorg@noblecarbon.com
URL:	www.thisisnoble.com
Represented by:	Mr. Thorsten Ansorg
Title:	Managing Director
Salutation:	Mr.
Last Name:	Ansorg
Middle Name:	Andreas
First Name:	Thorsten
Department:	
Mobile:	
Direct FAX:	+ 353 1 260 7660
Direct tel:	+ 353 1 260 7661
Personal E-Mail:	thorstenansorg@noblecarbon.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

Annex 3

BASELINE INFORMATION

The baseline information for calculation of OM, BM and CM emission factors of South China Power Grid (SCPG) is shown in the Report on 2009 Baseline Emission Factors for Regional Power Grids in China by Chinese DNA at http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm on 18th July 2009. The concrete processes are shown below:

Calculation of the Operating Margin emission factor ($EF_{OM,y}$)

The low calorific value, CO_2 emission factor and oxidation factor of fuels are listed in Table 1 below.

Table 1 Low calorific values, CO_2 emission factor and oxidation factor of fuels

Fuel type	Default Carbon Content	OXID	IPCC CO2 Emission Factor (the Lower Limits of the 95% Confidence Intervals)	Low Calorific Value
	（tc/TJ）	（%）		（MJ/t,km3）
	H	I	($kgCO_2$/TJ)	
Raw Coal	25.8	100	87,300	20908
Cleaned Coal	25.8	100	87,300	26344
Other Washed Coal	25.8	100	87,300	8363
Briquette	26.6	100	87,300	20908
Coke	29.2	100	95,700	28435
Coke Oven Gas	12.1	100	37,300	16726
Other Gas	12.1	100	37,300	5227
Crude Oil	20	100	71,100	41816
Gasoline	18.9	100	67,500	43070
Diesel Oil	20.2	100	72,600	42652
Fuel Oil	21.1	100	75,500	41816
LPG	17.2	100	61,600	50179
Refinery Gas	15.7	100	48,200	46055
Natural Gas	15.3	100	54,300	38931
Other Petroleum Products	20	100	75,500	41816
Other Coke Oven Products	25.8	100	95,700	28435
Other Energies	0	0	0	0

Source：The emission factors and oxidation factors are form *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 1.3,1.4, page 1.21-1.24, chapter 1Volume 2 Energy*. The net calorific values are quoted from *China Energy Statistical Yearbook 2008*

1. Calculation of Simple *OM* Emission Factor of SCPG for Year 2005

Table 2 CO_2 Emission Data of SCPG in Year 2005

Fuel type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Sub-total	Effective CO_2 EF	OXID	CO_2 emission factor of fossil fuel	Average Low Calorific Value	CO2 emission (tCO2e)
							（tc/TJ）	（%）	($kgCO_2$/TJ)	（MJ/t,km3）	J=E*H*I/100000 (for mass unit)
		A	B	C	D	E=A+B+C+D	F	G	H	I	J=E*H*I/10000 (for volume unit)
Raw coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	87,300	20,908	243,113,522
Cleaned coal	10^4t				0.15	**0.15**	25.8	100	87,300	26,344	3,450
Other washed coal	10^4t			10.39	33.88	**44.27**	25.8	100	87,300	8,363	323,211
Coke	10^4t	4.79			8.05	**12.84**	29.2	100	95,700	28,435	349,406
Coke oven gas	10^8m3				0.79	**0.79**	12.1	100	37,300	16,726	49,287
Other coal gas	10^8m3	1.87			15.96	**17.83**	12.1	100	37,300	5,227	347,626
Crude oil	10^4t	10.91				**10.91**	20	100	71,100	41,816	324,367
Gasoline	10^4t	0.68				**0.68**	18.9	100	67,500	43,070	19,769
Diesel oil	10^4t	31.96	2.02		1.81	**35.79**	20.2	100	72,600	42,652	1,108,250
Fuel oil	10^4t	887.21				**887.21**	21.1	100	75,500	41,816	28,010,178
LPG	10^4t					**0**	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	4.92				**4.92**	15.7	100	48,200	46,055	109,217
Natural Gas	10^8m^3	0.93				**0.93**	15.3	100	54,300	38,931	196,598
Other Petroleum Products	10^4t	1.7				**1.7**	20	100	75,500	41,816	53,671
Other Coke Oven Products	10^4t					**0**	25.8	100	95,700	28,435	0
Other Energies	10^4tCe	104.66	133.15		59.72	**297.53**	0	0	0	0	0
										Subtotal	274,008,550
China Energy Statistical Yearbook 2008											

Table 3 SCPG Fuel-fired Electricity Generation and *OM* EF in Year 2005

Province	Total generation (10^8 kWh)	Total generation (MWh)	Self-consumption electricity (%)	Total supply (MWh)			
Guangdong	1764.53	176,453,000	5.58	166,606,923	Electricity SCPG imported from CCPG MWh		20,264,000
Guangxi	250.23	25,023,000	7.95	23,033,672	Simple OM in CCPG in 2005		1.16148
Guizhou	584.3	58,430,000	6.94	54,141,238		Total Emissions tCO2	**297,544,857**
Yunnan	272.81	27,281,000	7.34	25,387,699		Total Power Supply MWh	**289,433,531**
Total				269,169,531	**Year 05**	EF	**1.02802**
Data source: China Electric Power Yearbook 2006							

2. Calculation of Simple OM Emission Factor of the SCPG for Year 2006

Table 4 CO_2 Emission Data of SCPG in Year 2006

Fuel type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Sub-total	Effective CO_2 EF	OXID	CO_2 emission factor of fossil fuel	Average Low Calorific Value	CO2 emission (tCO2e)
							（tc/TJ）	（%）	($kgCO_2/TJ$)	(MJ/t,km3)	J=E*H*I/100000 (for mass unit)
		A	B	C	D	E=A+B+C+D	F	G	H	I	J=E*H*I/10000 (for volume unit)
Raw coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	87,300	20,908	243,113,522
Cleaned coal	10^4t				0.15	**0.15**	25.8	100	87,300	26,344	3,450
Other washed coal	10^4t			10.39	33.88	**44.27**	25.8	100	87,300	8,363	323,211

Coke	10^4t	4.79			8.05	**12.84**	29.2	100	95,700	28,435	349,406
Coke oven gas	10^8m3				0.79	**0.79**	12.1	100	37,300	16,726	49,287
Other coal gas	10^8m3	1.87			15.96	**17.83**	12.1	100	37,300	5,227	347,626
Crude oil	10^4t	10.91				**10.91**	20	100	71,100	41,816	324,367
Gasoline	10^4t	0.68				**0.68**	18.9	100	67,500	43,070	19,769
Diesel oil	10^4t	31.96	2.02		1.81	**35.79**	20.2	100	72,600	42,652	1,108,250
Fuel oil	10^4t	887.21				**887.21**	21.1	100	75,500	41,816	28,010,178
LPG	10^4t					**0**	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	4.92				**4.92**	15.7	100	48,200	46,055	109,217
Natural Gas	10^8m^3	0.93				**0.93**	15.3	100	54,300	38,931	196,598
Other Petroleum Products	10^4t	1.7				**1.7**	20	100	75,500	41,816	53,671
Other Coke Oven Products	10^4t					**0**	25.8	100	95,700	28,435	0
Other Energies	10^4tCe	104.66	133.15		59.72	**297.53**	0	0	0	0	0
										Subtotal	274,008,550
Data source: China Energy Statistical Yearbook 2006											

Table 5 SCPG Fuel-fired Electricity Generation and *OM* EF in Year 2006

Province	**Total generation**	**Total generation**	**Self-consumption electricity (%)**	**Total supply**		
	(10^8 kWh)	**(MWh)**		**(MWh)**		
Guangdong	1884.29	188,429,000	5.27	178,498,792	Electricity SCPG imported from CCPG MWh	21,730,840
Guangxi	279.67	27,967,000	4.45	26,722,469	Simple OM in CCPG in 2006	1.12157

Guizhou	760.39	76,039,000	6.06	71,431,037		Total Emissions tCO2	**335,809,186**
Yunnan	397.91	39,791,000	4.12	38,151,611		Total Power Supply MWh	**336,534,748**
Total				314,803,908	**Year 06**	EF	**0.99784**
China Energy Statistical Yearbook 2007							
China Electric Power Yearbook 2007							

3. Calculation of Simple OM Emission Factor of the SCPG for Year 2007

Table 6 CO_2 Emission Data of SCPG in Year 2007

Fuel type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Sub-total	Effective CO_2 EF	OXID	CO_2 emission factor of fossil fuel	Average Low Calorific Value	CO2 emission (tCO2e)
							(tc/TJ)	（%）	($kgCO_2/TJ$)	(MJ/t,km3)	J=E*H*I/100000 (for mass unit)
		A	B	C	D	E=A+B+C+D	F	G	H	I	J=E*H*I/10000 (for volume unit)
Raw Coal	10^4t	7303.19	1490.01	4001.54	2735.88	**15530.62**	25.8	100	87,300	20,908	283,475,499
Cleaned Coal	10^4t					**0**	25.8	100	87,300	26,344	0
Other Washed Coal	10^4t			19.53	45.8	**65.33**	25.8	100	87,300	8,363	476,968
Briquette	10^4t	133.75				**133.75**	26.6	100	87,300	20,908	2,441,296
Coke	10^4t				1.31	**1.31**	29.2	100	95,700	28,435	35,648
Coke Oven Gas	10^8m3		0.84		2.06	**2.9**	12.1	100	37,300	16,726	180,925
Other Gas	10^8m3	0.89			19.15	**20.04**	12.1	100	37,300	5,227	390,714
Crude Oil	10^4t	0.87				**0.87**	20	100	71,100	41,816	25,866
Gasoline	10^4t					**0**	18.9	100	67,500	43,070	0
Diesel Oil	10^4t	29.92	1.26		3	**34.18**	20.2	100	72,600	42,652	1,058,396
Fuel Oil	10^4t	685.85	0.09			**685.94**	21.1	100	75,500	41,816	21,655,867

LPG	10^4t					**0**	17.2	100	61,600	50,179	0
Refinery Gas	10^4t					**0**	15.7	100	48,200	46,055	0
Natural Gas	10^8m^3	7.92				**7.92**	15.3	100	54,300	38,931	1,674,251
Other Petroleum Products	10^4t	0.67				**0.67**	20	100	75,500	41,816	21,153
Other Coke Oven Products	10^4t					**0**	25.8	100	95,700	28,435	0
Other Energies	10^4tCe	93.54	189.68		20.29	**303.51**	0	0	0	0	0
										Subtotal	311,436,583
Data source: China Energy Statistical Yearbook 2007											

Table 7 SCPG Fuel-fired Electricity Generation and *OM* EF in Year 2007

Province	**Total generation** (10^8 **kWh)**	**Total generation (MWh)**	**Self-consumption electricity (%)**	**Total supply (MWh)**			
Guangdong	2157	215,700,000	6.01	202,736,430	Electricity SCPG imported from CCPG MWh		24,237,240
Guangxi	361	36,100,000	7.42	33,421,380	Simple OM in CCPG in 2006		1.10197
Guizhou	843	84,300,000	6.62	78,719,340		Total Emissions tCO2	**374,404,628**
Yunnan	474	47,400,000	7.23	43,972,980		Total Power Supply MWh	**383,087,370**
Total				358,850,130	**Year 06**	EF	**0.97733**
Data source: China Electric Power Yearbook 2008							

4. Calculation of Simple OM Emission Factor of the SCPG

Table 8 Calculation of Simple *OM* Emission Factor of SCPG

	Total Power Supply (MWh)	CO2 emission (tCO_2)	*OM* Emission Factor (tCO_2/MWh)
2005	289,433,531	297,544,857	1.02802
2006	336,534,748	335,809,186	0.99784
2007	383,087,370	374,404,628	0.97733
The weighted average *OM* Emission Factor (tCO_2/MWh)			0.99871

The Operating Margin (*OM*) emission factor is the weighted average emission factors of year 2005-2007, as follows: $\boldsymbol{EF_{OM}}$ **= 0.99871** tCO_2/MWh.

Calculation of the Build Margin emission factor ($EF_{BM,y}$)

1. Calculation of percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

Table 9 Percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

Energy	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total E=A+B+C+D	NCV (MJ/t or 1000m^3) F	Emission factor (tC/TJ) G	Oxidation rate (%) H	Emission (tCO2e) I=E*F*G*H/100000
Raw Coal	10^4t	8214.78	1750.63	4298.8	3170.79	17435	20908	87300	1	318,235,546
Cleaned coal	10^4t	3.46	0	0	0	3.46	26344	87300	1	79,574
Other washed coal	10^4t	0	0.65	21.58	14.64	36.87	8363	87300	1	269,184
Briquette	10^4t	271.25	0	0	0	271.25	20908	87300	1	4,951,041
Coke	10^4t	0.04	1.69	0	2.15	3.88	28435	95700	1	105,584
Other Coke Oven Products	10^4t	0	0	0	0	0	28435	95700	1	0
Sub-Total										**323,640,928**

Crude oil	10^4t	0	0	0	0	0	41816	71100	1	0
Gasoline	10^4t	0	0	0	0	0	43070	67500	1	0
Diesel	10^4t	21.37	2.13	0	2.29	25.79	42652	72600	1	798596
Fuel oil	10^4t	467.97	0.41	0	0	468.38	41816	75500	1	14787262
Other petroleum products	10^4t	8.47	0	0	0	8.47	41816	75500	1	267407
Sub-Total										**15,853,266**
Nature gas	10^7m^3	321.7	0	0	0	321.7	38,931	54,300	1	6800588
Coke oven gas	10^7m^3	0	10	31.9	18	59.5	16,726	37,300	1	371208
Other coal gas	10^7m^3	0	308	0	216	524	5,227	37,300	1	1021628
LPG	10^4t	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10^4t	0.37	0	0	0	0.37	46,055	48,200	1	8213
Sub-Total										**8,201,637**
Total										**347,695,831**

China Energy Statistical Yearbook 2008

According to Table 9 and formula (3), (4), (5) in section B.6.1, the percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions are calculated as:

$$\lambda_{Coal,y} = 93.08\%,\ \lambda_{Oil,y} = 4.56\%,\ \lambda_{Gas,y} = 2.36\%$$

2. Calculating the fuel-fired emission factor ($EF_{Thermal}$)

Table 10 Parameters used for calculating fuel-fired emission factor

	Parameter	Efficiency of Power Supply (%)	Emission Factor of Fuel ($kgCO_2/TJ$)	Oxidation Factor	Emission Factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1,000,000*B*C
Coal-fired Power Plant	$EF_{Coal,Adv,y}$	38.10	87,300	1	0.8249
Gas-fired Power Plant	$EF_{Oil,Adv,y}$				

Oil-fired Power Plant	$EF_{Gas,Adv,y}$ $\overline{49.99}$ 49.99

$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$ = 0.8018 tCO_2e/MWh

3: Calculating the Build Margin (*BM*) emission factor ($EF_{BM,y}$)

Table 11 Installed Capacity data of SCPG in Year 2007

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	44,710	9,310	10,630	15,960	80610
Hydro power	MW	10110	10440	11580	8210	40340
Nuclear power	MW	3,780	0	0	0	3780
Wind power and other	MW	250	0	0	0	250
Total	MW	58,850.0	19,750.0	22,210.0	24,170.0	124980

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Table 12 Installed Capacity data of SCPG in Year 2006

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	40615	5434	8564	14350	68963
Hydro power	MW	9,320	7,624	9,698	7,534	34176
Nuclear power	MW	3780	0	0	0	3780
Wind power and other	MW	183	0	0	0	183
Total	MW	53,898.0	13,058.0	18,262.0	21,884.0	107102

China Electric Power Yearbook 2007

Table 13 Installed Capacity data of SCPG in Year 2005

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	35,183	4,931	4,758	9,635	54507
Hydro power	MW	9035.7	6085.3	7993.1	7233	30347.1
Nuclear power	MW	3,780	0	0	0	3780
Wind power and other	MW	83.4	0	0	0	83.4
Total	MW	48,081.7	11,016.5	12,751.5	16,867.8	88717.5

China Electric Power Yearbook 2006

Table 14 Calculation of *BM* Emission Factor of SCPG

	Installed capacity in 2005	Installed capacity in 2006	Installed capacity in 2007	Newly added capacity from 2005 to 2007	Share in total capacity additions
	(MW)	(MW)	(MW)	(MW)	
	A	B	C	D=C-A	
Thermal power	54,507.0	68,963	80,610	26,103.00	71.98%
Hydro power	30,347.1	34176	40340	9,992.90	27.56%
Nuclear power	3,780.0	3,780	3,780	0.00	0.00%
Wind power and Other	83.4	183	250	166.60	0.46%
Total	**88717.5**	**107102**	**124980**	**36262.5**	**100.00%**
Share in total installed capacity of 2007	70.99%	85.70%	100%		

$$\boldsymbol{EF_{BM,y}} = 0.8018 \times 71.98\% = 0.5772 \ tCO_2/MWh$$

<u>Calculating the baseline emission factor (*EF*$_y$)</u>

According to formula (8) in section B.6.1, the baseline emission factor of the SCPG is calculated as:

$$\boldsymbol{EF_y} = 0.9987 \times 0.5 + 0.5772 \times 0.5 = \mathbf{0.78795} \ tCO_2/MWh$$

The $\boldsymbol{EF_y}$ applied in this report is fixed for the first crediting period and may be revised at the renewal of the crediting period.

Annex 4

MONITORING INFORMATION

Please refer to the Monitoring Plan in Section B.7.