

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

CONTENTS

- A. General description of the small scale project activity
- B. Application of a baseline and monitoring methodology.
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the proposed small scale project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring Information

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

>>

Liuzhou Yangguang Power Generation Co., Ltd cement WHR¹ for 6 MW power generation project

Version: 1.0

Date: 15/04/2008

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

>>

Liuzhou Yangguang Power Generation Co., Ltd cement WHR for 6 MW power generation project (hereafter referred to as the “Project”) is being developed by Liuzhou Yangguang Power Generation Co., Ltd. (hereafter referred to as the “Project Developer”). The project activity involves the capture and utilization of waste heat from two cement production lines. The waste heat is utilised for the purpose of power generation. The Project will be implemented at Guangxi Yufeng Cement Plant in the Guangxi Zhuang Autonomous Region, People’s Republic of China (hereafter referred to as the “Host Country”). The total installed capacity of the Project will be 6 MW, with a predicted electricity supply to the grid of 44,896MWh per annum.

The main objective of the Project is to utilize waste heat from 2 cement production lines for generating electricity which will be utilized by Guangxi Yufeng Cement Plant. Cement Production Line #1 has an original design capacity of 2000 tonnes of clinker per day using the damp-dry process technique for clinker production, and Cement Production Line #3 has an original design capacity of 2500 tonnes of clinker per day using the new dry process technique for clinker production. A third cement production line on the same site has an existing WHR system for electricity generation, although the installation of this WHR system was only possible due to funding from the Japanese government. The power produced by the Project will be exported to the cement plant’s onsite power grid which is connected to the China South Power Grid. The power produced by the project will therefore displace power which would otherwise have been supplied by the China South Power Grid (hereafter referred to as the “Grid”). The Project will contribute to the more efficient use of energy at the cement production facility and reduce reliance on fossil fuel based energy. The electricity currently generated by the Grid is relatively carbon intensive, with an operating margin emission factor of 1.0120tCO₂/MWh and a build margin emission factor of 0.6784tCO₂/MWh.

The project is contributing to sustainable development of the Host Country. Specifically, the project:

- Increases employment opportunities in the area where the project is located (Approximately 30 people will be permanently employed for the project operation and the construction of the project secures jobs in the construction sector) and thereby contributes to poverty alleviation
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from diesel and coal-supplied electricity generation

¹ Waste Heat Recovery.

CDM – Executive Board

- Promotes greater energy efficiency in the cement industry in Guangxi Zhuang Autonomous Region through demonstrating efficient technology

A.3. Project participants:

>>

Name of party involved (*) (host) indicates a host party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Host Country: People's Republic of China	Liuzhou Yangguang Power Generation Co., Ltd.	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group PLC.	No

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the small-scale project activity:**A.4.1. Location of the small-scale project activity:**

>>

A.4.1.1. Host Party(ies):

>>

People's Republic of China

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

>>

Guangxi Zhuang Autonomous Region

A.4.1.3. City/Town/Community etc:

>>

Liuzhou City

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

>>

The project activity is to be implemented in Guangxi Yufeng Cement Plant in a suburb of Liuzhou City. The geographical coordinates of the project site are East 109°4'48", and North 24°22'13".



Fig.A4.1.The Map of the Proposed Project

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

Type and category

The project falls under UNFCCC sectoral scope 4: Manufacturing Industries. According to Appendix B of the UNFCCC’s published simplified procedures for small scale activities, this project falls into the following type and category:

Type : III – Other Project Activities

Category : Q– Waste gas based Energy System (Version1)

The Project also refers to AMS I.C “Thermal energy for the user with or without electricity” version 13 and AMS I.D “Grid connected renewable electricity generation” version 13 for the calculation of the baseline emissions.

Technology used in project activity

The production of cement involves the following processes

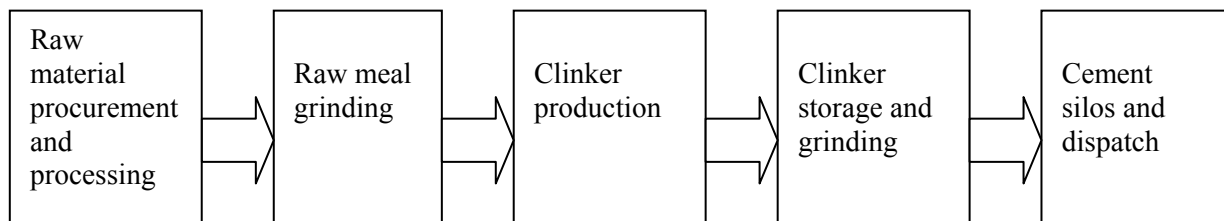


Fig. A 4.2 Cement production process

Clinker production involves passing raw meal through a pre-heater (PH) stack containing cyclone heaters to a long rotating kiln to create clinker, and then cooling this in the Air Quenching Cooler (AQC). A large amount of the total energy demand of the cement plant is used in this process. Waste heat is generated during clinker production and is currently vented to the atmosphere without utilization. If this thermal energy is captured and used for electricity generation, as proposed in this Project Activity, part of the electricity from the Grid (predominantly supplied by coal-fired power resources) will be substituted and significant GHG emissions reductions will occur.

The waste heat recovery (WHR) system (as shown in Figure B.3 in section B.3) will utilize the low temperature waste heat of the exit gases from the PH and the AQC in order to generate electricity. The proposed Project involves the installation of three WHR boilers: one will be installed at the PH stage of cement line #3 to capture heat from exhaust gasses, and the other two boilers will be separately installed at the AQC stages of cement lines #1 and #3 to capture heat contained in the clinker. The steam from the three boilers will be fed into a steam turbine generator to produce electricity. The WHR captive power plant consists of three WHR boilers, one steam turbine generator, a controlling system, a water-circulation system and dust-removal system, please refer to figure B.3 in section B.3.

The major facilities which will be employed in the project activity are shown in table A 4.2:

Table A 4.2 the characteristics of exit gases from the SP and AQC at the inlet and outlet of the boilers									
Production Lines		SP boiler			AQC boiler			Steam Turbine	
		Flux Nm ³ /h	Temperature/°C		Flux Nm ³ /h	Temperature/°C		Power MW	Pressure MPa
			Inlet	Outlet		Inlet	Outlet		
Guangxi Yufeng Cement Line	1# Kiln				75000	360	≤100	6	1.25
	3# Kiln	165000	355	210	102210	360	≤100		

The Project started construction on April 16, 2007², after CDM was taken into account on May 26, 2006. The project started operation on February 4, 2008.

Table A.4.3. Timeline for the development of the proposed Project

Stage	Date	Source
Consideration of CDM	26/5/2006	Date of signing ERPA ³ CDM consideration can also be found in the Project Application Report ⁴ , P.56

² See Yufeng Group News Paper, Issue 390.

CDM – Executive Board

Signing Equipment Purchase Agreement	From 8/2/2007 to 25/9/2005	Equipment Purchase Agreement
Construction Start	16/04/2007	Yufeng Group Newspaper, Issue 390.
Operation Start	04/02/2008	Yufeng Group Newspaper, Issue 390.

The Project will use state-of-the-art but recognised technology in electricity generation and transmission. All the equipments employed are domestically manufactured. The Project Developer is experienced in handling and operating this kind of equipment.

A.4.3 Estimated amount of emission reductions over the chosen <u>crediting period</u>:

>>

The estimation of the emission reductions during the crediting period is presented in table A4-3.

Table A4-3 The estimation of the emission reductions in the first crediting period

Year*	The estimation of annual emission reductions (tCO ₂ e)
2008	37,867
2009	37,867
2010	37,867
2011	37,867
2012	37,867
2013	37,867
2014	37,867
2015	37,867
2016	37,867
2017	37,867
The estimation of total emission reductions in the first crediting period	378,670
Total number of crediting years	10
The estimation of annual average emission reductions in the first crediting period	37,867

*for years from October to October

A.4.4. Public funding of the <u>small-scale project activity</u>:
--

>>

The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

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

³ See Emission Reductions Purchase Agreement

⁴ Project Application Report was completed in April 2007

CDM – Executive Board

Based on the information provided in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities⁵, the Project is not a part of any large scale project or program and is not a debundled component of a large project activity.

The project participants have not registered or are not applying to register any other small-scale CDM project activity

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the Project at the closest point.

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

>>

The category for the project activity according to Appendix B of the UNFCCC's published simplified modalities and procedures for small-scale activities is:

Type III: Other project activities

Category III.Q: "Waste gas based energy systems" Version 01 in effect as of EB 35

The methodology also refers to:

- AMS I.C (paragraphs 6 to 13) "Thermal energy for the user with or without electricity" Version 13, in effect as of EB38.
- AMS I.D "Grid connected renewable electricity generation" version 13(in effect as of EB36) for baseline emission calculations.
- The approved "Tool to calculate the emission factor for an electricity system" Version 01, in effect as of EB 35.

More information about the methodology can be obtained at:

<http://cdm.unfccc.int/methodologies/index.html>

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

>>

AMS-III.Q (Version 01) is chosen and is applicable to the proposed project due to the following reasons:

Methodology applicability criteria	Project Activity in accordance with the applicability criteria
The category is for project activities that utilize waste gas and/or waste heat at existing facilities as an energy source for:	The project activity is the installation of a 6MW power plant using waste heat from a cement plant to generate electricity.

⁵ <http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf>

CDM – Executive Board

<p>Cogeneration; or Generation of electricity; or Direct use as process heat source; or For generation heat in element process. (e.g. steam, hot water, hot oil, hot air)</p>	
<p>Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO₂ equivalent annually. Wherever the measures lead to waste heat recovery which is incremental to an existing practice of waste heat recovery, only the incremental gains in GHG mitigation should be taken into account and such incremental gains shall result in emission reductions of less than or equal to 60 kt CO₂ equivalent annually.</p>	<p>The emission reduction due to this project activity is less than 60 kt CO₂ equivalent annually which is detailed in Part B.6.</p>
<p>The energy produced with the recovered waste gas/heat or waste pressure should be measurable.</p>	<p>The electricity produced by the project activity will be measured using an electricity meter.</p>
<ul style="list-style-type: none"> • Energy generated in the project activity shall be used within the facility where the waste gas/heat or waste pressure is produced. An exception is made for the electricity generated by the project activity which may be exported to the grid. 	<p>The electricity generated in the project activity is exported to the cement plant's onsite electricity grid which is connected to the China South Power Grid.</p>
<ul style="list-style-type: none"> • The waste gas/heat or waste pressure utilized in the project activity would have been flared or released into the atmosphere in the absence of the project activity. This shall be proven by one of the following options: <ul style="list-style-type: none"> o By direct measurements of energy content and amount of the waste gas/heat or waste pressure for at least <i>three years</i> prior to the start of the project activity. o Energy balance of relevant sections of the plant to prove that the waste gas/heat or waste pressure was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance must demonstrate that the waste gas/heat or waste pressure was not used and also provide conservative estimations of the energy content and amount of waste gas/heat or waste pressure released. o Energy bills (electricity, fossil fuel) to 	<p>Prior to the implementation of the project activity the waste heat generated by Cement Production Lines was released into the atmosphere. Pyrology Reports were commissioned for each of the two Cement Production lines. Energy balance was used in the Pyrology Reports to estimate the energy content of the waste heat released prior to the project activity.</p>

CDM – Executive Board

<p>demonstrate that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by waste gas/heat or waste pressure and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities.</p> <p>o Process plant manufacturer's original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas/heat produced for rated plant capacity per unit of product produced.</p>	
<p>For the purpose of this category waste gas/heat/pressure is defined as: by-product gas/heat or pressure of machines and technical processes for which no useful application is found in the absence of the project activity and for which it can be demonstrated that it has not been used prior to, and would not be used in absence of the CDM project activity (e.g. because of low pressure, heating value or quantity available). In the project scenario, this waste gas/heat/pressure is recovered and conditioned for use.</p>	<p>The waste heat is a by-product of the clinker production processes. The Pyrology Reports quantify the amount of energy contained in the waste heat that cannot be used by any processes on site. In addition, there are no other potential users of heat near to the cement production facility. Waste heat was therefore released directly into atmosphere before the project activity (as shown in the Pyrology Reports) and would have continued to have been released into the atmosphere in the absence of the project activity. The waste heat used in the project activity therefore fits the definition of 'waste heat' provided in the methodology.</p>

The applicability criteria stated in methodology AMS-IIIQ (Version 01) are met on the basis of the reasons above.

The project activity meets all the conditions above and is therefore applicable to the methodology.

B.3. Description of the project boundary:
--

>>

In accordance with methodology AMS-III Q, the project boundary for a small-scale WHR project that provides electricity to a cement plant which is connected with South China Power Grid encompasses the physical, geographical site of the cement plant, and includes the power plants connected to the South China Power Grid.

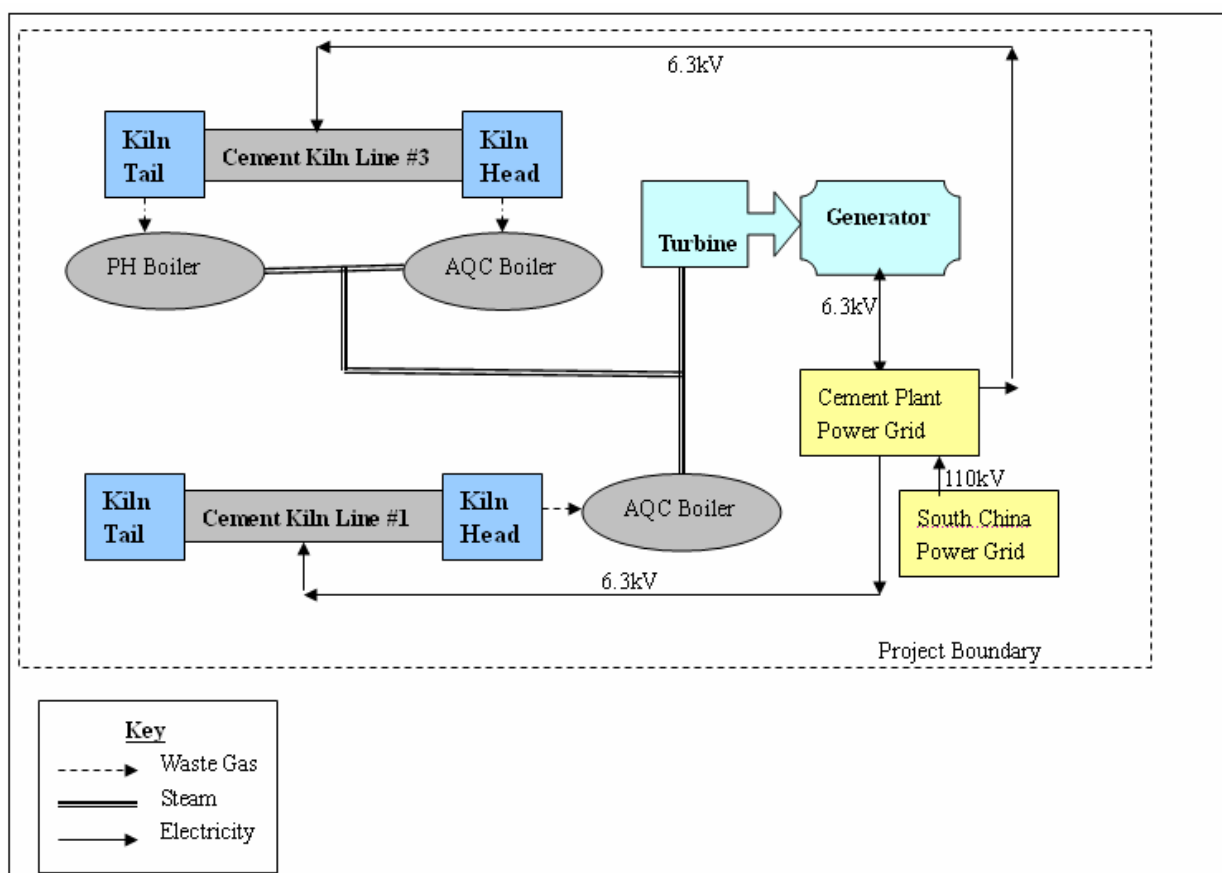


Figure B.3 Project Boundary⁶

Table B.4.1. Key Information and Data Used to Determine the Baseline Scenario

Variable	Value / Unit	Source
Operating Margin Emission Factor	1.0120 tCO ₂ /MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2002-2006
Build Margin Emission Factor	0.6748 tCO ₂ /MWh	Calculated from the China Energy Statistics Yearbook 2006 and the China Electric Power Yearbooks 2004-2006
Combined Margin Emission Factor	0.8434 tCO ₂ /MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the

⁶ Production line #1 is semi-dry process and production line #3 is new dry process.

CDM – Executive Board

		China Electric Power Yearbooks 2002-2006
Power supplied to cement plant by the project in year y	44,896MWh	Project Application Report P52

B.4. Description of baseline and its development:

>>

According to AMS III.Q, for computing the emissions in the baseline the procedure provided in paragraphs 6 to 13 of AMS I.C shall be used. The project activity is the situation described in paragraph 9 of AMS I.C. Therefore, the baseline scenario is the situation where, in the absence of the project activity, waste heat from cement production line is emitted to the atmosphere and the electricity used by the cement plant is imported from the South China Power Grid.

The electricity generated from the waste heat will be used by the cement plant to replace that supplied by the South China Power Grid. Accordingly, the grid emission coefficient determined in accordance with the provisions of AMS.I.D is considered for baseline emission calculations. Please see section B6 for details.

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

In accordance with Attachment A of Appendix B of the simplified modalities and procedures for small-scale CDM project activities, additionality is demonstrated by showing that the Project activity would not have occurred anyway due to the existence of an investment barrier, substantiated by a benchmark analysis.

Investment Analysis***Sub-step a: Determine appropriate analysis method***

Three options can be applied to conduct the investment analysis. These are the simple cost analysis (Option I), the investment comparison analysis (Option II) and the benchmark analysis (Option III).

Since this project will generate financial/economic benefits other than CDM-related income, through the sale of generated electricity, Option I (Simple Cost Analysis) is not applicable.

Given that the Project Developer does not have alternative and comparable investment choices, the benchmark analysis (Option III) is more appropriate than investment comparison analysis (Option II) for assessing the financial attractiveness of the project activity.

Sub-step b: Option III – Application of benchmark analysis

The financial attractiveness of this project will be determined by comparing the project IRR (without CDM income) with the benchmark rate applied in China's cement industry, which is published by the

CDM – Executive Board

Government of China⁷. The benchmark is accordingly set at 12%. If the project IRR (without CDM income) is less than 12%, the project is not considered to be financially attractive in the absence of CDM revenues, and is therefore considered to be additional.

Sub-step c: Calculation and comparison of financial indicators

The main financial parameters used in the financial analysis are as follows:

Table B.5-1: Main parameters used for financial calculations

Main parameters	Unit	Value	Source
Installed capacity	MW	6	Project Application Report P8
Operating hours per year	hours/year	8,000	Project Application Report P52
Annual net electricity supplied	MWh/yr	44,896	Project Application Report P52
Capital cost	RMB	42,845,900	Project Application Report P51
Operating cost	RMB/year	9,000,000	Project Application Report Table5
Electricity Tariff (include VAT)	RMB/MWh	400	Power Purchase Agreement
VAT	%	17	Project Application Report Annex 6
Urban + education tax	%	10	Project Application Report P52
Income tax	%	33	Project Application Report P52

The financial analysis results are shown in Table B.5-2. As shown in this table, without carbon credits the project's IRR is 8.26%, which is much lower than the benchmark rate of 12%. This therefore indicates that in comparison to other alternative investments, the project without carbon credits is not financially attractive to a rational investor.

Table B.5-2 Financial indicators of the project

	with CDM financing	without CDM financing
IRR	13.41%	7.80%

Summary of results of project analysis.

⁷ Methodology and Parameters applying in Construction Project Economic Analysis (2006), Page 202, China Planning Publishers, Beijing

Sub-step d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Electricity Tariff
- Investment Costs
- Operational Costs
- Operating Hours

The required alteration needed in each parameter in order to reach the benchmark was assessed. Table B.5.2 summarizes the results of the sensitivity analysis, in showing the variations needed to reach a positive IRR.

Table B.5.2. IRR results of sensitivity analysis

	Variation of the parameter needed to reach a positive IRR
Operating costs	- 22.81%
Investment costs	- 29.25%
Electricity tariff	+ 14.17%
Operating hours	+ 37.52%

Significant variations in the key parameters in favour of the project would be needed in order to generate a positive IRR. These variations do not reflect a realistic range of assumptions for the input parameters of the financial analysis.

- **Operating costs:** A 22.81% decrease in operation costs is very unlikely to happen. Because during the project construction, the cost of labour increased. This increase demonstrates that a decrease in operating cost is unrealistic and that consequently the IRR is not likely to reach 12%.
- **Investment costs:** A 29.25% decrease in investment costs is very unlikely to happen, as it is much more likely that power projects will experience cost *increases* rather than cost decreases during construction, because unexpected events will increase investment costs. These increases demonstrate that a decrease in investment costs is extremely unrealistic and that consequently the IRR is not likely to reach 12%.
- **Electricity tariff:** The Project developer has signed a power purchase agreement (PPA) with Guangxi Yufeng Cement Plant, which fixed the tariff as 0.40 RMB/kWh⁸. Furthermore, since 2002, P. R. China has been applying a new electricity tariff control policy, known as the “Price Competition for Power Supply to the Grid” policy⁹, in the power industry. Free competition between power plants is encouraged in order to lower cost of power production and thereby electricity tariffs. As a result, the electricity tariff of the proposed Project is unlikely to be increased by 14.17% and the benchmark is unlikely to be reached.

⁸ See the power purchase agreement with Guangxi Yufeng Cement Plant.

⁹ Notice of the State Council on Printing and Distributing the Plan Regarding the Restructuring of the Power Industry (No.5 [2002] of the State Council)

CDM – Executive Board

- **Operating hours:** The expected operating hours of the proposed Project indicated in the Project Application Report were calculated based on historical operation hours data of the cement plant production lines. The operating hours are likely to fluctuate only within a small range. A 37.5% increase would mean that the annual operating hours would be more than the number of hours in one year, which is clearly not possible. Therefore increasing the operating hours cannot cause the Project IRR to be greater than the benchmark IRR.

These results show that very favourable circumstances, which are not realistic, would be needed for the Project IRR to reach the benchmark IRR. We can conclude that the Project IRR is lower than the benchmark IRR for a realistic range of assumptions for the input parameters of the financial analysis, and therefore that the project is also not financially attractive. This demonstrates that the project activity would not be implemented without the CDM.

The proposed project activity passes all the necessary steps of additionality analysis and is additional. In the absence of the proposed project activity, the cement plant will continue importing electricity from China South Power Grid, which will continue discharging carbon dioxides into the air.

B.6 Emission reductions:

B.6.1. Explanation of methodological choices:
--

>>

Indicative Simplified Baseline and Monitoring Methodology AMS III.Q: “Waste gas based energy systems” (Version 01, EB35) is chosen for the proposed project activity.

As per methodology AMS III.Q, emission reductions of the project are equal to the baseline emissions minus project emissions. Leakage emissions need not be considered.

Baseline Emissions:

According to Baseline Methodology AMS III.Q, for computing the emission in the baseline the procedure provided in paragraphs 6 to 13 of AMS I.C shall be used.

The baseline emissions for the year y shall be determined as follows:

$$BE_y = EG_y \times EF_{elec,y}$$

Where:

BE_y are total baseline emissions during the year y in tons of CO₂

EG_y is the quantity of electricity supplied to cement plant

$EF_{elec,y}$ is the CO₂ emission factor for the electricity source displaced due to the project activity, during the year y in tons CO₂/MWh

According to AMS I.C the CO₂ emission factor of the electricity $EF_{elec,y}$ shall be calculated as per the procedures detailed in the latest version of AMS I. D “Grid connected renewable electricity generation”.

CDM – Executive Board

AMS I.D. (Version 13, EB 36) offers two choices for preparing the baseline calculation for this type of project activity. The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_{2e}/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system”.

OR

(b) The weighted average emissions (in kg CO_{2e}/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) above will be applied for this project, which uses a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system”.

This PDD uses the calculations published by the DNA of P. R. China¹⁰ to determine the Operating Margin (OM) emission factor¹¹ and the Build Margin (BM) emission factor¹² using the most recent data available.

The description below follows all steps of the “Tool to calculate the emission factor for an electricity system”, version 01, EB 35, to calculate the combined margin emission factor and focuses on the key process of the calculation of the emission factors. Please see Annex 3 for the baseline data underlying the calculations.

Step 1. Identify the relevant electric power system

P.R. China is divided into regional electricity systems which are defined by the DNA of P.R. China¹³.

The Project is located in Guangxi Zhuang Autonomous Region which belongs to the South China Power Grid (SCPG). Therefore, the relevant electric power system is identified as the SCPG.

Step 2. Select an operating margin (OM) method

The “Tool to calculate the emission factor for an electricity system” offers four methods to calculate the OM emission factor ($EF_{grid,OM,y}$):

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

Of these procedures, Option (a) (Simple OM) is applied. This is because low-cost / must run resources constitute less than 50% of total grid generation in average of the five most recent years. From 2001 to

¹⁰ National Coordination Committee on Climate Change – National Development and Reform Commission (NDRC)

¹¹ See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls> for the EF_{OM}

¹² See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf> for the EF_{BM}

¹³ See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf>

CDM – Executive Board

2005 respectively, 34%, 33%, 31%, 30% and 30% of the electricity generated in the SCPG came from low-cost / must run resources¹⁴.

Power plants registered as CDM project activities are included in the sample group that is used to calculate the OM as long as the criteria for including the power sources in the sample group apply.

The “Tool to calculate the emission factor for an electricity system” offers the choice between two data vintages calculate the Simple OM emission factor ($EF_{grid,OMsimple,y}$):

- *Ex-ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.
- *Ex-post* option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

$EF_{grid,OMsimple,y}$ is calculated *ex-ante* using the data from 2002 to 2005, available in the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2002-2006. This data vintage remains fixed during the crediting period.

Step 3. Calculate OM emission factor according to the selected method

The “Tool to calculate the emission factor for an electricity system” offers three options to calculate $EF_{grid,OMsimple,y}$:

- *Option A*: Based on data on fuel consumption and net electricity generation of each power plant / unit
- *Option B*: Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit
- *Option C*: Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Detailed data on the individual power plants connected to the SCPG necessary for applying option A and option B is not available; therefore, options A and B cannot be used. Since only nuclear and renewable power generation are considered as low-cost / must-run power sources and since the quantity of electricity supplied to the grid by these sources is known, option C is applicable and used to calculate the Simple OM emission factor.

$EF_{grid,OMsimple,y}$, using option C is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{y,grid}} \quad (1)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

¹⁴ China Electric Power Yearbooks 2002-2006; see Annex 3 for detailed calculation.

CDM – Executive Board

$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit) (country-specific values are used)
$EF_{CO_2,i,y}$	=	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)
$EG_{y,grid}$ ¹⁵	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

$$EF_{grid,OMsimple,y} = 1.0120 \text{ tCO}_2/\text{MWh}$$

For detailed information, please see Annex 3.

Step 4. Identify the cohort of power plants 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:

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

However, due to the fact that data on electricity generation of each power plant / unit in the grid is currently not available in P. R. China (see Step 3), EB guidance on the estimation of the build margin in P.R. China can be applied for the purpose of defining the sample group¹⁶. In accordance with the guidance, the build margin consists of the set of power capacity additions in the electricity system that comprises 20% of the system generation capacity (in MW) and that have been built most recently and is The set of power capacity additions included in the build margin is determined as follows:

$$\frac{\sum_j CAP_{j,y-n}}{\sum_j CAP_{j,y}} \geq 20\% \quad (2)$$

$\sum_j CAP_{j,y-n}$	=	The aggregate incrementally installed power capacity of all kinds of power generation sources j (MW) in year $y-n$
$\sum_j CAP_{j,y}$	=	The aggregate incrementally installed power capacity of all kinds of power generation sources j (MW) in year y
n	=	The number of years ($y-1, y-2, \dots, y-n$) which have to be considered to comprise 20% of the system generation capacity (in MW) and that have been built most recently

¹⁵ $EG_{y,grid} = \text{GEN} \times (1 - \text{rate of internal use by the power station})$. See Annex 3 and section B.6.2. for details.

¹⁶ See: EB guidance on estimating the build margin for AM0005, consolidated in ACM0002 which refers to the Tool to calculate the emission factor for an electricity system

<http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM> and http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

CDM – Executive Board

In the period from 2003 to 2005 (2005 being the most recent year for which data is available), the amount of power capacity additions made up over 20% of the total SCPG generation capacity in 2005. Therefore $n = 2$.

Since data on the electricity generation of each individual power plant / unit in the grid is not available in P. R. China, power plants registered as CDM project activities cannot be isolated and are taken into account in the build margin.

The “Tool to calculate the emission factor for an electricity system” offers the choice between two data vintages to calculate the BM:

- *Option 1.* For the first crediting period, the build margin emission factor is calculated *ex-ante* based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.
- *Option 2.* For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity

The BM emission factor ($EF_{grid,BM,y}$) is calculated *ex-ante* using the data from 2002 to 2005, available in the China Energy Statistics Yearbook 2006 and the China Electric Power Yearbooks 2004-2006. This data vintage remains fixed during the first crediting period and will be updated for the second crediting period.

Step 5. Calculate the build margin emission factor

According to the “Tool to calculate the emission factor for an electricity system”, $EF_{grid,BM,y}$ is the generation-weighted average emission factor of all power units m during the most recent year y for which power generation data is available. However, due to the fact that data on both electricity generation and emission factor of each power plant / unit in the grid is currently not available in P. R. China (see Step 3), EB guidance on the estimation of the build margin in P.R. China can also be applied for the purpose of estimating the BM emission factor¹⁷ and $EF_{grid,BM,y}$ is calculated as follows:

$$EF_{grid,BM,y} = \frac{CAP_{thermal,y-n,y}}{\sum_j CAP_{j,y-n,y}} \times EF_{thermal,adv} \quad (3)$$

- $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $CAP_{thermal,y-n,y}$ = The incrementally installed power capacity of thermal power generation sources (MW) in the SCPG in year y compared to that of year $y-n$
- $\sum_j CAP_{j,y-n,y}$ = the aggregate incrementally installed power capacity of all kinds of power generation sources j (MW) in the SCPG in year $y-n$ compared to that of year $y-n$
- $EF_{thermal,adv}$ = The emission factor of thermal power generation sources of the SCPG with the efficiency level of the best commercially available technology in P. R. China, for y the most recent historical year for which power

¹⁷ See: <http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM> and http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

CDM – Executive Board

generation data is available

$EF_{Thermal,Adv}$ is calculated as follows:

$$EF_{Thermal,Adv} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (4)$$

Where:

$EF_{i,Adv}$ = The CO₂ emission factor of fuel i (tCO₂/MWh) using the best commercially available technology in P. R. China and taking into account the carbon content and the oxidation factor of fuel i ¹⁸

$Coal$, Oil = Solid fuel, liquid fuel and gaseous fuel respectively
and Gas

λ_i = The weight of CO₂ emissions from fuel i fired power plants in the total CO₂ emissions from thermal power, using the most recent available data

And

$$\lambda_{Coal} = \frac{\sum_{i=Coal} FC_{i,y} \times EF_{CO2,i,y}}{\sum_i FC_{i,y} \times EF_{CO2,i,y}} \quad (5)$$

$$\lambda_{Oil} = \frac{\sum_{i=Oil} FC_{i,y} \times EF_{CO2,i,y}}{\sum_i FC_{i,y} \times EF_{CO2,i,y}} \quad (6)$$

$$\lambda_{Gas} = \frac{\sum_{i=Gas} FC_{i,y} \times EF_{CO2,i,y}}{\sum_i FC_{i,y} \times EF_{CO2,i,y}} \quad (7)$$

Where $FC_{i,y}$ and $EF_{CO2,i,y}$ are defined as in equation 1.

$EF_{grid,BM,y} = 0.6748 \text{ tCO}_2/\text{MWh}$
--

For detailed information, please see Annex 3.

Step 6. Calculate the combined margin emission factor

The combined margin (CM) emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (8)$$

Where:

¹⁸ See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>

CDM – Executive Board

- $EF_{grid,CM,y}$ = Combined margin CO₂ emissions factor in year y (tCO₂/MWh)
 $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)
 $EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)
 w_{OM}^y = Weighting of operating margin emissions factor, which is 0.5 by default
 w_{BM} = Weighting of build margin emissions factor, which is 0.5 by default

$EF_{grid,CM,y}=0.5*1.0120+0.5*0.6748=0.8434$	tCO ₂ /MWh
---	-----------------------

For detailed information, please see Annex 3.

Then baseline emissions (BE_y) are obtained as:

$$BE_y = EG_y \times EF_{grid,CM,y} \quad (9)$$

Where:

- BE_y = Baseline emissions in year y (tCO₂)
 EG_y = Electricity supplied by the project p to the grid in year y (MWh)
 $EF_{grid,CM,y}$ = Combined margin CO₂ emissions factor in year y (tCO₂/MWh)

Capping of baseline emissions

As an introduction of element of conservativeness, AMS III.Q requires that the baseline emissions should be capped irrespective of planned/unplanned or actual increases in output of the plant, changes in operational parameters and practices, changes in fuel types and quantity resulting in an increase in waste gas generation.

The capping baseline emissions is determined as below:

$$BE_{c,y} = BE_y \times f_{cap}$$

$BE_{c,y}$ are capped baseline emissions during the year y in tons of CO₂

BE_y are total baseline emissions during the year y in tons of CO₂

According to the methodology there are two possible methods for estimating f_{cap} . The required data for method 1 is not available therefore method 2 will be used to estimate f_{cap} .

According to method 2 the manufacturer's data for the industrial facility shall be used to estimate the amount of waste gas/heat/pressure the industrial facility generates per unit of product generated by the process that generates waste gas/heat/pressure. The waste heat is generated in the kilns of cement production lines #1 and #3, that produce clinker. Therefore the production of clinker in lines #1 and #2 is the process that most logically relates to waste heat generation and is the most justifiable and accurate product that relates to waste heat production.

CDM – Executive Board

f_{cap} will be calculated as follows:

$$f_{cap} = \frac{Q_{WG,BL}}{Q_{WG,y}}$$

$$Q_{WG,BL} = Q_{BL,product} \times q_{wg,product}$$

Where:

- $Q_{WG,y}$ Quantity of energy contained in the recovered waste heat used for energy generation during year y (kJ)
- $Q_{WG,BL}$ Quantity of energy contained in the recovered waste heat generated prior to the start of the project activity (kJ)
- $Q_{BL,product}$ Production by process that most logically relates to waste heat generation in baseline. This is estimated based on 3 years average prior to start of project activity.
- $q_{wg,product}$ Amount of waste gas/heat/pressure the industrial facility generates per unit of product generated by the process that generates waste gas/heat/pressure.

The manufacturer's data for the facility that is required to calculate the amount of waste heat generated is not available. Therefore, in accordance with the methodology, an assessment was carried out by independent process experts to estimate a conservative quantity of waste heat generated by the plant per unit of clinker produced. The results of this are shown in Table B 6.1

Table B 6.1 Amount of waste heat generated by the cement production lines per unit of clinker

Waste Heat Source	Parameter	Units	Value
Cement Production Line #1 ACQ	$q_{WG,BL,AQC\#1}$	kJ/tonne of clinker	291.20
Cement Production Line #3 ACQ	$q_{WG,BL,AQC\#3}$	kJ/tonne of clinker	347.64
Cement Production Line #3 PH	$q_{WG,BL,PH\#3}$	kJ/tonne of clinker	356.52

The historic annual production of clinker for the two cement plants was used to calculate the quantity of energy contained in the recovered waste heat generated prior to the project activity, $Q_{WG,BL}$, as shown in Table B 6.2 and Table B 6.3 below.

CDM – Executive Board

Table B 6.2 Historic Annual Production of Clinker

Cement Production Line	Annual Production of Clinker			Average Annual Production of Clinker
	2005	2006	2007	
	<i>(tonnes/year)</i>	<i>(tonnes/year)</i>	<i>(tonnes/year)</i>	<i>(tonnes/year)</i>
Cement Production Line #1 ACQ	798937	769963	749053	772651
Cement Production Line #3 ACQ	-	712231 ¹⁹	876538	712231 ²⁰
Cement Production Line #3 PH	-	712231 ²¹	876538	712231 ²²

Table B 6.3 Annual waste heat generation

Cement Production Line	Waste heat generated per unit of clinker	Average annual production of clinker	Annual waste heat generation in the baseline
	<i>kJ/kg</i>	<i>(tonnes/year)</i>	<i>kJ/year</i>
Cement Production Line #1 ACQ	291.20	772651	225,050,317,866
Cement Production Line #3 ACQ	347.64	712231 ²³	247,605,517,732
Cement Production Line #3 PH	356.52	712231 ²⁴	253,928,823,112
Total ($Q_{WG,BL}$)			726,584,658,710

The methodology requires that the quantity of energy contained in the recovered waste heat, $Q_{WG,y}$, is monitored in order to calculate the parameter f_{cap} . The waste heat is recovered from the gases leaving the cement production lines. There are two possible methods of obtaining the energy contained in the recovered gases:

Method 1

Measure the flow rate of the gases and the temperature and pressure of the gases before and after each of the boilers and use these parameters to calculate the energy lost by the gases in each boiler, this will be the energy recovered.

¹⁹ Cement Production Line #3 started operation on 28/02/2006. Between 28/02/2006 and 31/12/2006 Cement Production Line #3 produced 597104 tonnes of clinker. This has been extrapolated based on a 365 day year, to give an equivalent annual production of 712231 tonnes per year.

²⁰ As less than two years of historic production data is available at the time of validation, and for the purpose of conservativeness, the lower of the two values for annual production is used.

²¹ See above

²² See above

²³ As less than two years of historic production data is available at the time of validation, and for the purpose of conservativeness, the lower of the two values for annual production is used.

²⁴ See above

CDM – Executive Board
Method 2

Measure flow rate of the steam/water and the temperature and pressure of the steam/water before and after each of the boilers and use these parameters to calculate the energy gained by the steam/water in each boiler. The energy gained by the steam will be divided by the energy transfer efficiency of the boilers to obtain the energy recovered from the gases in each boiler.

Accurately and reliably measuring the flow of the waste gases directly would be very difficult to achieve due to the high levels of dust particles in the gases and the large diameter of the pipework. Therefore Method 1 cannot be applied. Method 2 will be used.

Therefore, $Q_{WG,y}$ will be calculated as follows:

$$Q_{WG,y} = \sum_i \frac{Q_{Steam,i,y}}{\eta_i}$$

Where:

$Q_{Steam,y,i}$ the energy gained by the steam/water in boiler i

$\eta_{boiler,i}$ the efficiency of boiler i

For the purposes of the PDD estimates it is assumed that the waste gas generated by the project in year y will be the same or less than that generated in the baseline year, therefore it is assumed that:

$$f_{cap} = 1$$

Project Emissions:

The main emission for the Project is supplemental electricity use. There will be no combustion of auxiliary fuels. Net electricity delivered to the cement plant is used to calculate the baseline emissions, and therefore, supplemental electricity is taken into consideration in the Baseline Emission calculation. Therefore:

$$PE_y = 0$$

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

Data / Parameter:	$Q_{WG,BL}$
Data unit:	kJ/year
Description:	Quantity of waste energy generated per year prior to the start of the Project Activity
Source of data used:	Calculated from the Project Application Report, Pyrology Reports and data from the Project Developer
Value applied:	726,584,658,710
Justification of the choice of data or	Data obtained from Project Application Report and Pyrology Reports.

CDM – Executive Board

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

Data / Parameter:	<i>Installed Capacity of the project activity</i>
Data unit:	MW
Description:	The installed capacity of the project activity
Source of data used:	Project Application Report P8
Value applied:	6
Justification of the choice of data or description of measurement methods and procedures actually applied :	Date obtained from Project Application Report
Any comment:	

Data / Parameter:	$FC_{i,y}$
Data unit:	t, m³
Description:	Amount of fossil fuel type <i>i</i> consumed in the project electricity system in year <i>y</i> (mass or volume unit)
Source of data used:	China Energy Statistics Yearbooks (2004-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	MJ/t, kJ/m³
Description:	Net calorific value (energy content) of fossil fuel type <i>i</i> in year <i>y</i>
Source of data used:	China Energy Statistics Yearbook 2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$EF_{CO_2,i,y}$
--------------------------	-----------------------------------

CDM – Executive Board

Data unit:	tCO₂/TJ
Description:	CO ₂ emission factor of fossil fuel type <i>i</i> in year <i>y</i>
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	

Data / Parameter:	<i>EG_y</i>
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the grid, not including low-cost / must-run power plants / units, in year <i>y</i> (MWh)
Source of data used:	China Electric Power Yearbooks (2002-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	<i>Internal use rate of power station</i>
Data unit:	%
Description:	The internal use rate of power source <i>j</i> in each province connected to the grid
Source of data used:	China Electric Power Yearbooks (2004-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	<i>OXID_i</i>
Data unit:	%
Description:	The oxidation factor of the fuel <i>i</i>

CDM – Executive Board

Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	The aggregate incrementally installed power capacity of all kinds of power generation sources j (MW) in the grid in year y
Source of data used:	China Electric Power Yearbooks (2003-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$CAP_{thermal,y-n,y}$
Data unit:	MW
Description:	The aggregate incrementally installed power capacity of thermal power generation sources (MW) in the grid in year y compared to that of year $y-n$
Source of data used:	China Electric Power Yearbooks (2003-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	λ_i
Data unit:	%
Description:	The weight of CO ₂ emissions from fuel i fired power plants in the total CO ₂ emissions from thermal power, using the most recent available data
Source of data used:	China Energy Statistics Yearbook 2006
Value applied:	See Annex 3

CDM – Executive Board

Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	EF_{CM}
Data unit:	tCO ₂ /MWh
Description:	The combined margin emission factor of SCPG
Source of data used:	China Energy Statistics Yearbooks (2004-2006), China Electric Power Yearbooks (2002-2006) Official website of the DNA of P. R. China: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	Boiler efficiency, η_i
Data unit:	%
Description:	Efficiency of boiler i
Source of data used:	Manufacturers documentation
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is obtained from the manufacturer of the boiler.
Any comment:	

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

>>

The *ex-ante* emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_{c,y} - PE_y - L_y$$

Where:

CDM – Executive Board

ER_y	=	Emission reductions in year y (tCO ₂)
$BE_{c,y}$	=	Baseline emissions in year y (tCO ₂)
PE_y	=	Project Emissions in year y (tCO ₂)
L_y	=	Leakage emissions in year y (tCO ₂)

As shown in section B.6.1 project emissions are zero. Hence:

$$PE_y = 0.$$

As shown in section B.6.1, leakage need not be considered. Hence:

$$L_y = 0.$$

Therefore: $ER_y = BE_{c,y}$

Refer to Section B.6.1. for equations used to estimate the baseline emissions.

Table B.6.1 Key Information and Data used to calculate the Baseline Emissions

	Per year (average)	10 years
Operating Margin Emissions Factor (EF_{OM_y} in tCO ₂ /MWh)	1.0120	1.0120
Build Margin Emissions Factor (EF_{BM_y} in tCO ₂ /MWh)	0.6748	0.6748
Baseline Emissions Factor (EF_y in tCO ₂ /MWh)	0.8434	0.8434
Electricity supplied to the grid by Project (EG MWh)	44,896	448,960
Baseline Emissions (BE tCO ₂)	37,867	378,670
Emission Reduction (tCO ₂)	37,867	378,670

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

Year*	Estimation of Project activity Emission (tonnes of CO ₂ e)	Estimation of baseline emission (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of Emission reductions (tonnes of CO ₂ e)
2008	0	37,867	0	37,867
2009	0	37,867	0	37,867

CDM – Executive Board

2010	0	37,867	0	37,867
2011	0	37,867	0	37,867
2012	0	37,867	0	37,867
2013	0	37,867	0	37,867
2014	0	37,867	0	37,867
2015	0	37,867	0	37,867
2016	0	37,867	0	37,867
2017	0	37,867	0	37,867
Total	0	378,670	0	378,670

*full year from October to October

B.7 Application of a monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

Data / Parameter:	EG _y
Data unit:	MWh
Description:	The net electricity generation from the project activity per annum.
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	44,896
Description of measurement methods and procedures to be applied:	The data is monitored continuously, and the quantity of electricity will be recorded every month, and archived for at least two years after the crediting period has ended, or the last issuance of CERs, whichever occurs later.
QA/QC procedures to be applied:	The energy meters will undergo maintenance / calibration to the industry standards
Any comment:	

Data / Parameter:	$Q_{Steam,y,i}$
Data unit:	kJ
Description:	Energy gained by the steam/water in boiler <i>i</i> in year <i>y</i>
Source of data to be used:	Measured/calculated
Value of data applied for the purpose of calculating expected	See Annex 3

CDM – Executive Board

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Flow rate of the steam/water and the temperature and pressure of the steam/water before and after each of the boilers will be measured. These will be used to calculate the energy gained by the steam/water in each boiler.
QA/QC procedures to be applied:	The measuring equipment will undergo maintenance / calibration to the industry standards
Any comment:	

Data / Parameter:	$Q_{WG,y}$
Data unit:	kJ
Description:	Energy contained in recovered waste gas in year y
Source of data to be used:	Measured/calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	726,584,658,710
Description of measurement methods and procedures to be applied:	Calculated from the monitored parameter $Q_{Steam,y,i}$ and the efficiency of each boiler, η_i . See section B.6.1 for more details.
QA/QC procedures to be applied:	The measuring equipment will undergo maintenance / calibration to the industry standards
Any comment:	

B.7.2 Description of the monitoring plan:
--

>

This section details the steps taken to monitor the GHG emissions reductions on a regular basis from the Liuzhou Yangguang Power Generation Co., Ltd cement WHR for 6 MW power generation project in the People's Republic of China.

The Monitoring set up for this project has been developed to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data.

1. Monitoring organisation

Roles and responsibilities will be defined for the relevant staff involved in CDM monitoring, and the prospect of nominating a CDM Manager will be considered. If appointed, the CDM Manager will have the overall responsibility for the monitoring system on this project.

CDM – Executive Board

A CDM Manager, or an appropriate senior manager, will manage the process of training new staff, ensuring trained staff perform the monitoring duties and that where trained monitoring staff are absent, the integrity of the monitoring system is maintained by other trained staff.

Staff involved in the CDM project will receive relevant training from either EcoSecurities, a contracted consultant, or the relevant Chinese authority. Records of trained CDM staff will be retained by the Project Developer.

A formal set of monitoring procedures will be identified prior to the start of the crediting period. They will include issues such as training, data quality assurance and control, and relevant back-up procedures. It is worth noting that in most cases, those procedures identified will be based on existing on-site practises.

Liuzhou Yanguang Power Generation Co., Ltd and EcoSecurities will work together in drafting any new procedures. Any changes to procedures will need to be agreed to by both parties. The CDM Manager, or appropriate senior manager, will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established.

2. Monitoring equipment and installation

Given that the emission factor is calculated *ex-ante*, and referring to the Monitoring Methodology AMS III.Q, the parameters to be monitored are electricity supplied to the grid by the project and the quantity of waste heat used for electricity generation (detailed in B.7.1). Appropriate metering equipment will be installed prior to the start of the project crediting period to measure these parameters, specifically: Through calibration regimes as advised by the manufacturer or industrial standard, the accuracy of meters installed will be ensured to comply with the acceptable range as outlined in the relevant national standard.

Records of the meters (type, make, model and calibration documentation) will be retained as part of the quality control system.

3. Data recording procedure, management and archiving

Data recorded from the meters onsite will be checked by a different person than the one who conducted the initial recording. The CDM manager, or appropriate senior manager will compile the data every month.

All written documentation such as maps, drawings, the Environmental Impact Assessment (EIA) and the Preliminary Design Report, should be stored and should be available to the verifier so that the reliability of the information may be checked.

4. Quality Assurance and Quality Control

The quality of data generated by this project will be maintained through the development of an overarching monitoring system. This system include procedures used to double check data, for staff training, meter calibration and the adherence to the relevant standards.

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

CDM – Executive Board

>>

The baseline study and the monitoring methodology was concluded on 28/03/2008. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group Plc, Contact:

Jiangguang.Li@ecosecurities.com

Full contact details are provided in Annex – I of this document

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:

>>

08/02/2007 (Date that the Equipment Purchase Agreement was signed)²⁵

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

>>

20 years

C.2 Choice of the crediting period and related information:
C.2.1. Renewable crediting period
C.2.1.1. Starting date of the first crediting period:

>>

Not applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:
C.2.2.1. Starting date:

>>

The crediting period will start on 01/10/2008, or on the date of registration of the CDM project activity, whichever is later.

C.2.2.2. Length:

²⁵ starting date of this project is the earlier date of the start of construction (16/04/2007) and signing of the equipment purchase agreement (08/02/2007)

CDM – Executive Board

>>

10 years

SECTION D. Environmental impacts

>>

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

>>

The project activity has developed and passed a full Environmental Impact Assessment (EIA) in line with the requirements of the Chinese Government. The EIA of the whole project has been approved by Guangxi Zhuang Autonomous Region Environmental Protection Bureau in December, 2007.

The EIA considered the project activity's impact on the air environment, water environment, acoustical environment and ecological environment as discussed below:

Air environment

The project activity will have a positive impact on the local air quality. Electrostatic precipitators collect the dust from the SP and AQC exit gas in the absence of the project activity. Once the project activity is implemented, it is expected to lead to a reduction in air particulates in the flue gas as additional dust removal equipment will be installed to remove dust from the exit gases before they enter the AQC boiler. Also, some of the dust will be settled in the SP boiler and the AQC boilers before the gas passes into the electrostatic precipitator for further settlement.

Thermal Pollution

Thermal pollution is serious in cement works as a great amount of heat has been vented to the atmosphere without utilization. In cement plant, more than 35% of the heat used in clinker burning process is discharged as waste heat to the surroundings without utilization. In the absence of the project activity there would have been considerable amount of thermal pollution in the surroundings. The project activity will utilize the waste heat for power generation and thereby reduce the effects of thermal pollution which will benefit the staff in the workplace.

Acoustical Environment Impact

Noise sources include construction noise and noise from the equipment installed during the construction phase. Noise from turbine, Generator, fans, centrifugal pumps etc is the major noise sources after the implement of the project activity. The proper measures will be adopted to mitigate the influence of noise as follows:

- Noise from the blast blowers, the induce draft fans are reduced by providing silencers in the duct. Power generation equipments will be placed in a noise-containing room so as to limit noise pollution to the vicinity.
- The central control room, which has a high concentration of management and operation personnel, will adopt noise-proof designs. The working area will be sealed away from the power generation equipment to reduce noise pollution, while tree planting will be done to provide a natural noise silencer for the power station.

Impact on Water Environment

CDM – Executive Board

There will be no poisonous or harmful substance in the water generated by the project activity. The wastewater will be discharged to the drainage system after it has been carefully treated. So, the project activity will have little impact on the water environment.

Ecology

There are no endangered species located in and around the plant area and the project activity will not occupy any land not already within the boundary of the cement plant.

Conclusion

As a whole, there will be a number of beneficial impacts to environment as a result of the project activity and the net impact under environmental pollution category will be positive as all necessary abatement measures would be adopted, and there will be no transboundary impacts.

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:

>>

Not applicable, since the construction and operation of the proposed project have no significant environmental impacts.

CDM – Executive Board

SECTION E. Stakeholders' comments

>>

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

>>

According to the Measures for Operation and Management of Clean Development Mechanism Projects in China, a survey on 54 residents has been conducted. The local government and stakeholders were invited to submit comments on the project activity.

A one page questionnaire, designed to be easily filled in by stakeholders, was sent out. A list of the questions included appears below:

- What impacts do you think the project activity will have on the local environment?
- What impacts do you think the project activity will have on employment in the local area?
- What impacts do you think the CDM project activity will have on the local economy?
- What impacts do you think the project activity will have on local society life?
- What impacts do you think the CDM project activity will have on your livelihood during the construction of the project?
- What would be the overall effects of the construction and operation of the CDM Project?
- Do you support the construction of the Project?

E.2. Summary of the comments received:

>>

Totally 50 questionnaires were collected, of which the major conclusions are summarized as follows:

	Positive/Yes	no impact/Indifferent	Negative/No
What impacts do you think the CDM project activity will have on the local environment?	90%	10%	0%
What impacts do you think the CDM project activity will have on the local employment?	82%	18%	0%
What impacts do you think the CDM project activity will have on the local economy?	78%	22%	0%
What impacts do you think the CDM project activity will have on the local	66%	34%	0%

CDM – Executive Board

society life?			
What impacts do you think the CDM project activity will have on your livelihood during the construction of the project?	44%	56%	0%
What would be the overall effects of the construction and operation of the CDM Project?	80%	20%	0%
Do you support the construction of the CDM Project?	100%	0%	0%

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

>>

No negative comments have been received on the project.

Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Liuzhou Yanguang Power Generation Co. Ltd.,
Street/P.O.Box:	Taiyang Village ,Liuzhou City, Guangxi
Building:	
City:	LiuZhou
State/Region:	Guangxi
Postfix/ZIP:	542610
Country:	China
Telephone:	0772-3885522
FAX:	0772-3885579
E-Mail:	yangzhuqiu@126.com
URL:	
Represented by:	Director
Title:	Vice Cheif Engineer
Salutation:	Sir.
Last Name:	Yang
Middle Name:	
First Name:	Zhuqiu
Department:	
Mobile:	+86 0 13601057668
Direct FAX:	0772-3885522
Direct tel:	0772-3885579
Personal E-Mail:	yangzhuqiu@126.com

Project Annex 1 participant:

Organization:	EcoSecurities Group Plc.
Street/P.O.Box:	40 Dawson Street
Building:	
City:	Dublin
State/Region:	
Postfix/ZIP:	02
Country:	Ireland
Telephone:	+353 1613 9814
FAX:	+353 1672 4716
E-Mail:	cdm@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	
Title:	President
Salutation:	Dr.
Last Name:	Moura Costa
Middle Name:	
First Name:	Pedro
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	cdm@ecosecurities.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding from Annex 1 parties.

Annex 3

BASELINE INFORMATION

Calculation of the Operating Margin Emission Factor of the South China Power Grid

Table A1 CO₂ emissions from thermal power plants of the South China Power Grid (2003)

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF (tC/TJ)	Oxidation factor (%)	NCV (MJ/t, kJ/m ³)	CO ₂ emissions (tCO ₂ e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=C*H*F*E*44/(12*100) (mass unit) I=C*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	4491.79	831.84	2169.11	1405.27	8898.01	25.80	100	20908	175993455.05
Clean Coal	10000t	0.05				0.05	25.80	100	26344	1246.07
Other washed coal	10000t			36.38	20.37	56.75	25.80	100	8363	448971.84
Coke	10000t				0.5	0.5	29.20	100	28435	15222.20
Coke Oven Gas	10 ⁸ m ³				0.04	0.04	12.10	100	16726	2968.31
Other Coal Gas	10 ⁸ m ³	3.21			11.27	14.48	12.10	100	5227	335797.81
Crude oil	10000t	6.85				6.85	20.00	100	41816	210055.71
Gasoline	10000t	0.02				0.02	18.90	100	43070	596.95
Diesel	10000t	31.9			0.76	32.66	20.20	100	42652	1031759.27
Fuel Oil	10000t	627.22	0.3			627.52	21.10	100	41816	20301304.48
LPG	10000t					0	17.20	100	50179	0.00
Refinery Gas	10000t	2.85				2.85	15.70	100	46055	75560.14
Natural Gas	10 ⁸ m ³					0	15.30	100	38931	0.00
Other petroleum products	10000t	11.35				11.35	20.00	100	38369	319357.98
other coking products	10000t					0	25.80	100	28435	0.00
Other energy	10000tce	93.21			22.35	115.56	0.00	0	0	0.00
									total	198736295.81

Data source: China Energy Statistics Yearbook 2004

Table A2 Electricity Generation of South China Power Grid (2003)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Guangdong	143351000	5.50	135466695
Guangxi	17079000	8.43	15639240
Guizhou	43295000	7.40	40091170
Yunnan	19055000	8.01	17528695
total			208725800

Data source: China Electric Power Yearbook 2004

Table A3 CO₂ emissions from thermal power plants of the South China Power Grid (2004)

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF (tC/TJ)	Oxidation factor	NCV	CO ₂ emissions (tCO ₂ e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/(12*100) (mass unit)
								(%)	(MJ/t, kJ/m ³)	I=G*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	6017.7	1305	2643.9	1751.28	11717.88	25.80	100	20908	231767573.55
Clean Coal	10000t	0.21				0.21	25.80	100	26344	5233.50
Other washed coal	10000t					0	25.80	100	8363	0.00
Coke	10000t					0	29.20	100	28435	0.00
Coke Oven Gas	10 ⁸ m ³					0	12.10	100	16726	0.00
Other Coal Gas	10 ⁸ m ³	2.58				2.58	12.10	100	5227	59831.38
Crude oil	10000t	16.89				16.89	20.00	100	41816	517932.98
Gasoline	10000t					0	18.90	100	43070	0.00
Diesel	10000t	48.88			1.83	50.71	20.20	100	42652	1601975.28
Fuel Oil	10000t	957.71				957.71	21.10	100	41816	30983494.25
LPG	10000t					0	17.20	100	50179	0.00
Refinery Gas	10000t	2.86				2.86	15.7	100	46055	75825.26
Natural Gas	10 ⁸ m ³	0.48				0.48	15.30	100	38931	104833.40
Other petroleum products	10000t	1.66				1.66	20.00	100	38369	46707.86
other coking products	10000t					0	25.80	100	28435	0.00
Other energy	10000tce	79.42				79.42	0.00	0	0	0.00
									total	265163407.45

Data source: China Energy Statistics Yearbook 2005

Table A4 Electricity Generation of South China Power Grid (2004)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Guangdong	169389000	5.42	160208116
Guangxi	20143000	8.33	18465088
Guizhou	49720000	7.06	46209768
Yunnan	24322000	7.56	22483257
total			247366229

Data source: China Electric Power Yearbook 2005

Table A5 CO₂ emissions from thermal power plants of the South China Power Grid (2005)

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF (tC/TJ)	Oxidation factor (%)	NCV (MJ/t, kJ/m ³)	CO ₂ emissions (tCO ₂ e) I=G*H*F*E*44/(12*100) (mass unit)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	6696.47	1435	3212.31	1975.55	13319.33	25.80	100	20908	263442601.85
Clean Coal	10000t				0.15	0.15	25.80	100	26344	3738.21
Other washed coal	10000t			10.39	33.88	44.27	25.80	100	8363	350237.59
Coke	10000t	4.79			8.05	12.84	29.20	100	28435	390906.18
Coke Oven Gas	10 ⁸ m ³				0.79	0.79	12.10	100	16726	58624.07
Other Coal Gas	10 ⁸ m ³	1.87			15.96	17.83	12.10	100	5227	413485.84
Crude oil	10000t	10.91				10.91	20.00	100	41816	334555.88
Gasoline	10000t	0.68				0.68	18.90	100	43070	20296.31
Diesel	10000t	31.96	2.02		1.81	35.79	20.20	100	42652	1130638.84
Fuel Oil	10000t	887.21				887.21	21.10	100	41816	28702703.26
LPG	10000t					0	17.20	100	50179	0.00
Refinery Gas	10000t	4.92				4.92	15.7	100	46055	130440.66
Natural Gas	10 ⁸ m ³	0.93				0.93	15.30	100	38931	203114.71
Other petroleum products	10000t	1.7				1.7	20.00	100	38369	47833.35
other coking products	10000t					0	25.80	100	28435	0.00
Other energy	10000tce	104.66	133.15		59.72	297.53	0.00	0	0	0.00
									total	295229176.74

Data source: China Energy Statistics Yearbook 2006

Table A6 Electricity Generation of South China Power Grid (2005)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Guangdong	176080000	5.58	166606923
Guangxi	24800000	7.95	23033672
Guizhou	58076000	7.34	54141238
Yunnan	27933000	6.94	25387699
total			269169531

Data source: China Electric Power Yearbook 2006

Table A7 Power transferred from the Central Power Grid to the South China Power Grid

		2003	2004	2005
Power transferred	MWh	11100	10951240	96363000
Emission factor	tCO ₂ /MWh	0.7973	0.8273	0.7722

Table A8 Operating Margin Emission Factor of the South China Power Grid

		2003	2004	2005	Average EF_{OM} tCO ₂ /MWh
Total CO ₂ emissions	tCO ₂	198745146.3	274223576.0	369636773.2	1.0120
Electricity generation	MWh	208736899.8	258317469.1	365532530.7	

Calculation of the Build Margin Emission Factor of the South China Power Grid

Table A9 Calculation of the relevant emission factor of coal based power station

	Efficiency A	Carbon content (tC/TJ) B	Oxidation factor C	Emission factor (tCO ₂ /MWh) D=3.6/A/1000*B*C*44/12
EF coal,Adv	35.82%	25.8	100%	0.9508
EF gas,Adv	47.67%	15.3	100%	0.4237
EF oil,Adv	47.67%	21.1	100%	0.5843
Source	Statistics by the State Electricity Regulatory Commission (SERC) on newly built thermal plants in the 10th "Five-Year Plan" period 2000-2005, and Data from the NDRC (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf)	2006 IPCC Guidelines for National Greenhouse Gas Inventories	2006 IPCC Guidelines for National Greenhouse Gas Inventories	

Table A.10 Share of different fossil fuels in the total CO₂ emissions from thermal power plants of the South China Power Grid

Item	Value
λ _{coal}	89.49%
λ _{oil}	10.24%
λ _{gas}	0.27%

Therefore $EF_{thermal} = 89.49\% * 0.9508 + 10.24\% * 0.4237 + 0.27\% * 0.5843 = 0.9118 \text{ tCO}_2\text{e/MWh}$

Table A11 Installed capacity in the South China Power Grid in 2005

Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Tianshenqiao	Total
thermal power	MW	35182.6	4931.2	9634.8	4758.4	0.0	54507.0
hydro power	MW	9035.7	6085.3	4713.0	7993.1	2520.0	30347.1
nuclear power	MW	3780.0	0.0	0.0	0.0	0.0	3780.0
wind farm and others	MW	83.4	0.0	0.0	0.0	0.0	83.4
total	MW	48081.7	11016.5	14347.8	12751.5	2520.0	88717.5

Data source: China Electric Power Yearbook 2006

Table A12 Installed capacity in the South China Power Grid in 2004

Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total
thermal power	MW	30172.9	4378.1	7801.8	4306.9	46659.7
hydro power	MW	8584.6	5040.4	6896.5	7058.6	27580.1
nuclear power	MW	3780.0	0.0	0.0	0.0	3780.0
wind farm and others	MW	83.4	0.0	0.0	0.0	83.4
total	MW	42620.9	9418.5	14698.3	11365.5	78103.2

Data source: China Electric Power Yearbook 2005

Table A13 Installed capacity in the South China Power Grid in 2003

Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Tianshenqiao	Total
thermal power	MW	27231.4	3190.1	6465.8	3556.8		40444.1
hydro power	MW	8107.2	4525.2	3713.7	6543.2	2520.0	25409.3
nuclear power	MW	3780.0	0.0	0.0	0.0		3780.0
wind farm and others	MW	83.4	0.0	0.0	0.0		83.4
total	MW	39202.0	7715.3	10179.5	10100.0	2520.0	69716.8

Data source: China Electric Power Yearbook 2005

Table A14 Determination of the Build Margin Emission of the South China Power Grid

Type	installed capacity in 2003 A	installed capacity in 2004 B	installed capacity in 2005 C	new added installed capacity from 2003 to 2005 D=C-A	Split of new capacity
thermal power	40444.1	46659.7	54507.0	14062.9	74.01%
hydro power	25409.3	27580.1	30347.1	4937.8	25.99%
nuclear power	3780.0	3780.0	3780.0	0.0	0.00%
wind farm and others	83.4	83.4	83.4	0.0	0.00%
total	69716.8	78103.2	88717.5	19000.7	100.00%
compared to the capacity in 2005	78.58%	88.04%	100.00%		

Therefore, $EF_{BM} = 0.9118 * 74.01\% = 0.6748 \text{ tCO}_2/\text{MWh}$

Table A15 Baseline Emission Factor of the South China Power Grid (tCO_2/MWh)

A	Operating Margin Emission Factor	1.0120
B	Build Margin Emission Factor	0.6748
C	Combined Emission Factor ($C=0.5*A+0.5*B$)	0.8434

Baseline Calculation

Table A16 Generation of the South China Power Grid in 2001

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	109119	12110	27376	14305	162910
Hydro generation(GWh)	19073	17609	9565	21648	67895
Generation from other sources(GWh)	15000				15000
Total generation in province(GWh)	143192	29719	36941	35953	245805

CDM – Executive Board

Page 49

Percentage of thermal generation in 2001	66%
Percentage of all other resources in 2001	34%

Data source: China Electric Power Yearbook 2002

Table A17 Generation of the South China Power Grid in 2002

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	123081	13069	33231	15787	185168
Hydro generation(GWh)	16913	18634	9512	25062	70121
Nuclear generation(GWh)	20811	0	0	0	20811
Generation from other sources(GWh)	135	0	0	0	135
Total generation in province(GWh)	160940	31703	42743	40849	276235

Percentage of thermal generation in 2002	67%
Percentage of all other resources in 2002	33%

Data source: China Electric Power Yearbook 2003

Table A18 Generation of the South China Power Grid in 2003

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	143351	17079	43295	19055	222780
Hydro generation(GWh)	17136	19288	8019	26837	71280
Nuclear generation(GWh)	28930		0	0	28930
Generation from other sources(GWh)	159	0	0	0	159
Total generation in province(GWh)	189576	36367	51314	45892	323149

Percentage of thermal generation in 2003	69%
Percentage of all other resources in 2003	31%

Data source: China Electric Power Yearbook 2004

Table A19 Generation of the South China Power Grid in 2004

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
--	-----------	---------	---------	--------	---------------------------

	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	169389	20143	49720	24322	263574
Hydro generation(GWh)	14114	17229	23379	29350	84072
Nuclear generation(GWh)	28481	0	0	0	28481
Generation from other sources(GWh)	149	0	0	0	149
Total generation in province(GWh)	212133	37372	73099	53672	376276

Percentage of thermal generation in 2004	70%
Percentage of all other resources in 2004	30%

Data source: China Electric Power Yearbook 2005

Table A20 Generation of the South China Power Grid in 2005

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	176453	25023	58430	27281	287187
Hydro generation(GWh)	20774	19582	21335	33228	94919
Nuclear generation(GWh)	30476	0	0	0	30476
Generation from other sources(GWh)	156	0	0	0	156
Total generation in province(GWh)	227859	44605	79765	60509	412738

Percentage of thermal generation in 2005	70%
Percentage of all other resources in 2005	30%

Data source: China Electric Power Yearbook 2006

Table A21 Efficiency of Boilers and estimate of $Q_{Steam,y,i}$

Boiler	Annual waste heat generation in the baseline in boiler i in year y	Efficiency of boiler ²⁶	Energy gained by steam/ water in boiler i in year y ²⁷	Energy contained in recovered waste gas in boiler i in year y
	$Q_{WG,BL}$, (kJ/year)	η_i (%)	$Q_{Steam,y,i}$, (kJ/year)	$Q_{WG,y}$, (kJ/year)
	Calculated ex-ante (see B.6.1)	Ex-ante	To be monitored	Calculated ex post from $Q_{WG,BL}$ and η_i
Cement Production Line #1 AQC	225,050,317,866	76	171,038,241,578	225,050,317,866
Cement Production Line #3 AQC	247,605,517,732	76	188,180,193,476	247,605,517,732
Cement Production Line #3 PH	253,928,823,112	76	192,985,905,565	253,928,823,112
Total	726,584,658,710			726,584,658,710

²⁶ Source: Documents supplied by boiler supplier

²⁷ Estimated assuming waste heat generation in the project year will be the same as in the baseline year

Annex 4

MONITORING INFORMATION

No further information to be provided here.