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

CONTENTS

Annexes

SECTION A. General description of small-scale project activity

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

Yunnan Hongta Cement Waste Heat Recovery Power Generation Project

Version: 1.~~7~~8

Date: ~~23/09/2010~~10/10/2012

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

Yunnan Hongta Cement Waste Heat Recovery Power Generation Project (hereafter as 'the Project') is located in Shangdeng Industrial area, Dali Economic Development Zone, Dali Prefecture, Yunnan Province, P.R. China. The Project is conducted by Yunnan Hongta Dianxi Cement Co., Ltd. The Project will capture the remaining heat from 3,000 t/d cement production line – heat that currently is exhausted directly into the atmosphere without onsite use.

The total installed generating capacity of the Waste Heat Recovery (WHR) system will be 6 MW. The WHR system is expected to produce 42,380 MWh/y, after deducting a small part of electricity utilized by the WHR system, 39,200MWh/y will be used onsite for the cement production which will substitute those from the China Southern Power Grid (hereafter as "CSPG") in the absence of the Project. Therefore, the Project will save 39,200MWh/y of fossil-fuel-fired power generation with an annual amount of 34,151tCO_2e emission reduction.

The project Feasibility Study Report (FSR) and Environment Impact Analysis (EIA) were completed separately in February and March, 2008. Due to the financial analysis of the project activity in FSR, the project owner held a board meeting on 11/04/2008 and decided to adopt the suggestion in FSR to taking the proposed project as a CDM project to increase the project financial attraction. After getting the approval for FSR and EIA, the project owner started to contact with CDM consulting company and finally signed agreement with HCTEE[1]. On 22/08/2008 the project owner signed the construction contract which marks the propose project starting as a CDM project. Following this, the main equipments purchase agreements were signed in following three months. With the help of HCTEE, the project owner signed ERPA with the Buyer on 22/01/2009. And the record for China NDRC was got on 04/02/2009. In March, the project owner held stakeholders' meeting and distributed 50 questionnaires to survey the attitude of residents around to the proposed project. (Please refer details in Section B.5)

The real construction of the proposed project started on 08/09/2008 with the order to commence. One hand the construction was in process, on the other hand the main equipments were purchased. And at the beginning of 2009, all the equipments started to be installed which lasted six months. From June, 2009, the project enters a restructuring stage. And during July and August, 2009, the project involves into commissioning. Finally, the project will start operation in September, 2009.[2]

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[1] Hangzhou Carbon Trade Environment Engineering Co., Ltd

[2] The project construction and operation schedule.

The Project technology is a process of energy conversion. Through the AQC boiler and the SP boiler, the supplied water recovers low-temperature waste heat produced by cement clinker production line, then turns into steam, and through steam pipe into turbine, so that turbine rotates in a high speed, generators are driven, which translated into the final product – electricity. The main objective of the Project is utilizing waste heat from cement production line for power generation which will be used onsite. In the absence of the Project, the cement factory only obtains electricity from the CSPG. The Project will reduce electricity requirements from CSPG which is mainly formed by fossil fuel. This project decreases CO_2 emission by cutting down fossil fuel consumption.

The Project activity's contribution to China's sustainable development:

1) The project activity promotes pure low-temperature waste heat power generation technology to some extent in cement industry; speeds up the cement industry energy saving work in progress in the implementation of emission reduction.

2) The project activity will improve the diversity and structure of China Southern Power Grid; Mitigate conflict between supply and demand of electricity; Reduce the emission of CO_2.by utilizing the waste heat and reducing the power grid's reliance on fossil fuel based power sources.

3) The Project construction and operation of WHR system – provides a number of employment opportunities for local people. The Project activity creates full time employment for 18 employees (16 workers and 2 administrative personnel), and will be a certain role in promoting economic development.

In views mentioned above, the proposed project activity strongly contributes to the sustainable development.

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)
People's Republic of China (Host)	Yunnan Hongta Dianxi Cement Co., Ltd.	No
United Kingdom	British Gas Trading Limited	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.:

Yunnan Province

A.4.1.3. City/Town/Community etc:

Dali Prefecture

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

The geographical coordinates of the project site are shown in Table A4.1-1 and are graphically depicted in the maps in Figure A4.1-1.

Table A4.1-1

	Longitude	Latitude
Dianxi Cement Line	E100°20′32′′~E100°20′45′′	N25°40′55′′~N25°41′11′′

Figure 1. Location of Yunnan Province in China

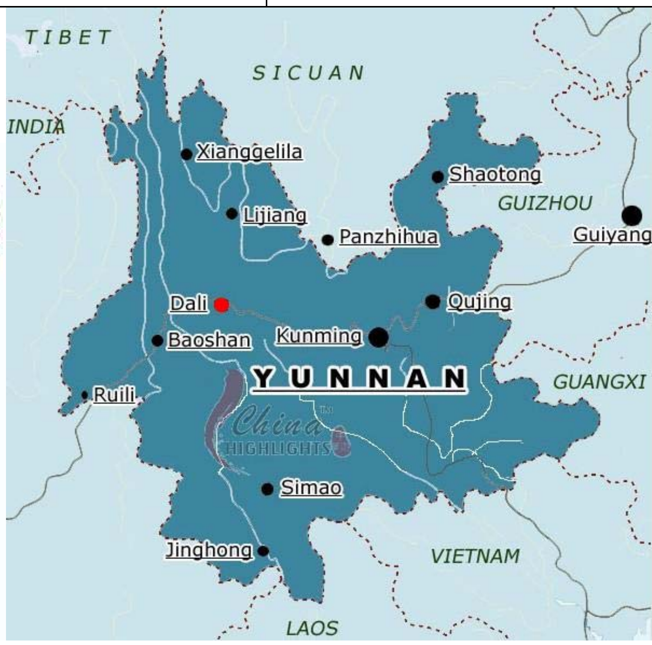

Figure 2. Location of Dali Prefecture in Yunnan

Figure 3. Location of the Project Site at Shangdeng, Dali Prefecture

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

Type and category

The proposed project activity will utilize waste heat at existing facilities as an energy source for generation of electricity. The recovery of waste heat is a new initiative in an existing practice, and it will result in emission reductions of less than 60,000 tCO_2 equivalent annually. Therefore, the project activity can be regarded as a small-scale project activity and fit the simplified modalities and procedures for small-scale CDM project activities. 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 Energy Recovery (gas/ heat/pressure) Projects (Version 02)

Technology used in Project

During clinker production, the cement factory burns coal to preheat (in the suspension preheater (SP)) raw material before it enters the kiln. The clinker that results from this process then proceeds through an Air Quenching Cooler (AQC) before grinding and storage. These high temperature processes produce

tremendous amounts of waste heat typically vented to the atmosphere. This Project activity captures heat from the SP and AQC phases of production to generate power.

The project adopts low-temperature waste heat recovery for power generation technology. The WHR system used in this Project activity consists of two heat recovery boilers (also called heat recovery steam generators, or HRSG) and a single power generator (also called a turbine). The WHR system re-routes the wasted heat to the two HRSGs: one on the suspension preheater and one on the air quencher cooler. Steam from the SP and AQC boilers is combined to power a turbine which produces electricity. All the equipments employed are domestically manufactured. So there is no technology transferred involved in the Project. The following Table A4.2-1 shows the technical parameters of the major equipment to be employed.

Table A4.2-1: General information about technical parameter

Device Name	Quantity	Technical Parameter
Steam Turbine	1	Model: BN6.0－2.29/0.20 Rated Power: 6MW Rated Rotation Speed: 3,000r/min Rated Inlet Steam Pressure: 2.29MPa Rated Inlet Steam Temperature: 370℃ Rated Second Inlet Steam Pressure: 0.20MPa Rated Second Inlet Steam Temperature: 150℃ Exhaust Pressure: 0.007Mpa Designed life time: > 30 years Manufacturer: Qingdao Jieneng Steam turbine Group Co., Ltd.
Generator	1	Model: QF_1－6－2 Rated Power: 6MW Rated rotation speed: 3,000r/m Designed life time: > 30 years Manufacturer: Sichuan Dongfeng Electric Factory Co., Ltd
AQC boiler	1	Model: QC148/380-15.5(2.5)-2.3(0.3)/(160) Inlet Gas Flow: 148,000m^3/h Inlet Gas Temperature: 380℃ Rated Steam Flow: 15.5/2.5t/h Rated Steam Pressure: 2.3/0.3MPa Feed Water Temperature: 100/30℃ Designed life time: >20 years Manufacturer: Sichuan Chuanrun Dynamical Equipment Co., Ltd
SP boiler	1	Model: QC241/365-22(5.4)-2.3(0.2)/235(160) Inlet Gas Flow: 241,000m^3/h Inlet Gas Temperature: 365℃ Rated Steam Flow: 22/5.4t/h Rated Steam Pressure: 2.3/0.2MPa Rated Steam Temperature: 235/160℃ Feed Water Temperature: 100/30℃ Designed life time: >20 years Manufacturer: Sichuan Chuanrun Dynamical Equipment Co., Ltd
ASH boiler	1	Model: QC50/526-38-2.3/380 Inlet Gas Flow: 50,000m^3/h Inlet Gas Temperature: 526℃ Rated Steam Flow: 38t/h Rated Stem Pressure: 2.3MPa

		Rated Steam Temperature: 380℃ Inlet Steam Temperature: 220℃ Designed life time: > 20 years Manufacturer: Sichuan Chuanrun Dynamical Equipment Co., Ltd

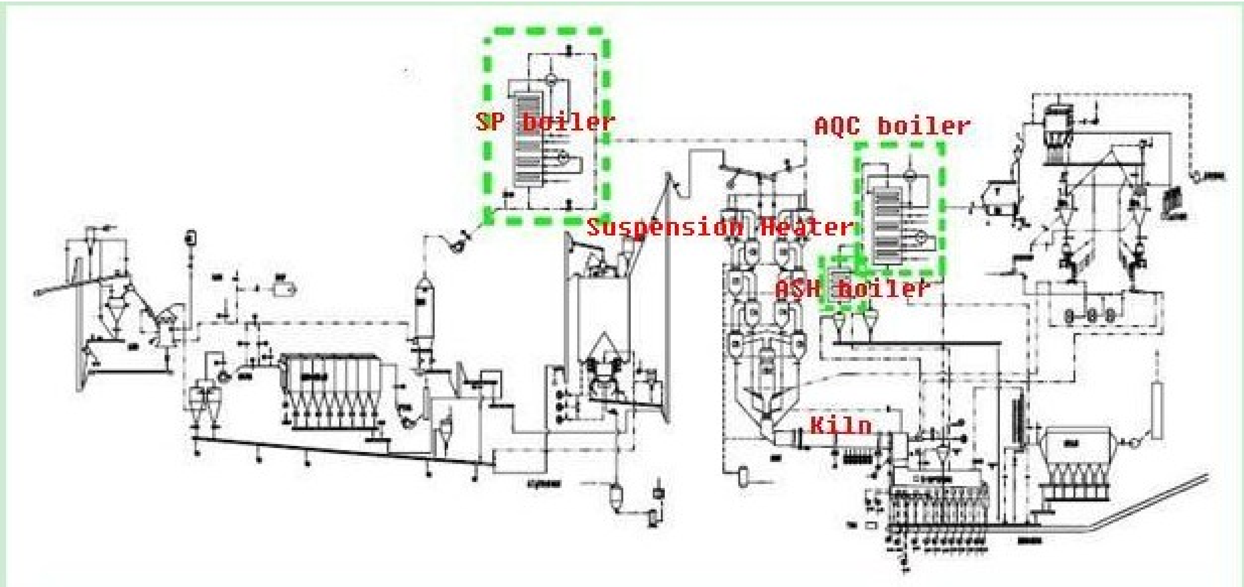

Figure 4. The general layout of 4# kilns

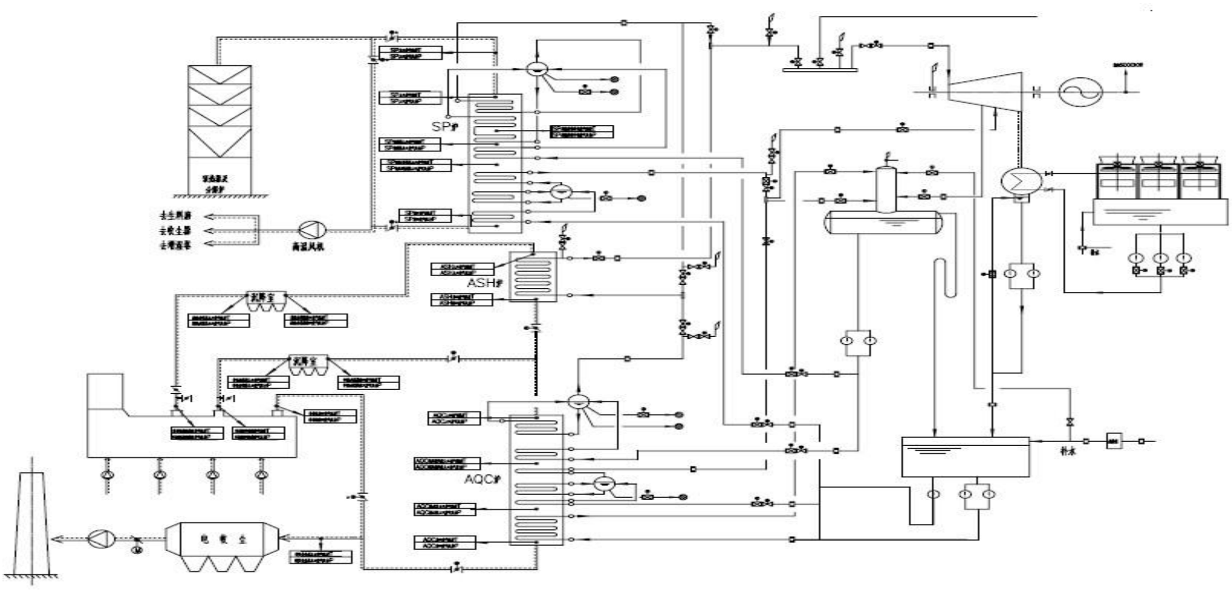

Figure 5. The 4# kiln

The baseline scenario is the same as the scenario existing prior to the start of the project.

Monitoring equipments and their location in the systems:

Electricity monitoring instruments installed by the project activity to measure Net power supply from the project activity to the cement production facility are located on the power lines connecting the CDM project activity to the internal electricity grid of the cement production facility. An electrical connection diagram indicating the exact position and type of monitoring instruments, and a more detailed description on amongst others measuring intervals and calibration, is presented in Section B.7.2.

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

The emission reductions due to the Project will have a 1×10 years crediting period, estimated to be started from date of 01/09/2010 after the Project successfully registered as the CDM project at the EB. The estimation of the emission reductions during the crediting period is presented in table A4-3.

Table A4.3-1 The estimation of emission reductions in the crediting period

Years	Estimation of annual emission reductions in tonnes of CO_2e
01/09/2010-31/12/2010	11,384
2011	34,151
2012	34,151
2013	34,151
2014	34,151
2015	34,151
2016	34,151
2017	34,151
2018	34,151
2019	34,151
01/01/2020-31/08/2020	22,767
Total estimated reductions (tonnes of CO_2e)	341,510
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	34,151

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

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

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

Based on the information provided in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[3], the Project is not a part of any large scale project or program and is not a debundled component of a large Project.

For a small scale project, the project participants have not registered or are not applying to register any

[3] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

other small-scale CDM project

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

For the Project, there is no any project meeting these conditions, so the Project is not a debundled component of a large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

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

AMS-III.Q (Version 02)- "Waste Energy Recovery (gas/ heat/pressure) Projects".

Methodology AMS-III.Q also refers to:

1. Appendix B of the UNFCCC's published simplified modalities and procedures for small-scale activities

2. The approved "Tool to calculate the emission factor for an electricity system" (Version 02).

More information about the methodology can be obtained at:

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

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

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

The project utilizes waste heat at existing facilities to produce electricity, which is compliance with the applicability criteria of the given methodology AMS III.Q. The annual emission reductions achieved by the proposed project are estimated to be 34,151 tCO2e, which is less than 60,000 tCO2 equivalent per year, the threshold value for type III small-scale CDM projects.
Therefore, the project activity qualifies as a small-scale project activity and it will remain under the limit of small-scale project activity type III during every year of the crediting period.

No.	Methodology applicability criteria	Project in accordance with the applicability criteria
1	The category is for project activities that utilize waste gas and/or waste heat at existing facilities as an energy source for:	The Project is the installation of a 6MW power plant using waste heat from a cement production plant to generate electricity. The

	(a) Cogeneration; or (b) Generation of electricity; or (c) Direct use as process heat; or (d) For generation heat in element process. (e.g. steam, hot water, hot oil, hot air) (e) For generation of mechanical energy	Project Activity therefore meets this applicability requirement.
2	The category is also applicable to project activities that use waste pressure to generate electricity at existing facilities.	The Project is not such case and use only waste heat which meets the item 1.
3	The recovery of waste gas/heat may be a new initiative or an incremental gain in an existing practice	The Project utilizes recovered waste heat which was discharged directly and generates electricity. So the Project is a new initiative project.
4	In case the project activity is an incremental gain, the difference between the technology used before project activity implementation and the project technology should be clearly shown. It should be demonstrated why there are barriers for the Project that did not prevent the implementation of the technology used before the Project implementation.	This applicability condition is not relevant, as the recovery of waste heat is a new initiative in an existing cement plant.
5	Measures are limited to those that result in emission reductions of less than or equal to 60kt CO_2 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 60kt CO_2 equivalent annually.	The emission reduction due to this Project is 34,151 tCO_2, which is less than 60kt CO_2 equivalents annually.
6	The category is applicable under the following conditions: (a) The energy produced with the recovered waste gas/heat or waste pressure should be measurable. (b) 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. (c) 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: (i) By **direct measurements** of energy content and amount of the waste gas/heat or waste pressure for at least three years prior to the start of the project activity. (ii) **Energy balance** of relevant sections of the	(a) The electricity produced by the Project is measured using electricity meters. (b) The electricity generated in the Project will be used within the cement facility where the waste heat is produced. The electricity displaces emission intensive electricity imported from CSPG. (c) Prior to the implementation of the Project the waste heat generated by cement production system was released into the atmosphere which can be demonstrated by option (ii) **Energy balance** and the drawing for the cement production plant before the Project implementation.

	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 shall 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. (iii) **Energy bills** (electricity, fossil fuel) to 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. (iv) 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.	
7	For the purpose of this category waste energy is defined as: a by-product gas/heat/pressure from machines and industrial processes having potential to provide usable energy, for which it can be demonstrated that it was wasted. For example gas flared or released into the atmosphere, the heat or pressure not recovered (therefore wasted). Gases that have intrinsic value in a spot market as energy carrier or chemical (e.g. natural gas, hydrogen, liquefied petroleum gas, or their substitutes) are not eligible under this category.	Waste heat utilized by the Project Activity is generated by the cement production line and is originally released into the atmosphere before the implementation of the Project Activity. The Project Activity therefore meets this applicability requirement.

The Project meets all the conditions as shown in the above table and then the approved Methodology AMS-III.Q (Version 02) is applicable to the proposed Project.

B.3. Description of the project boundary:

In accordance with methodology AMS-III Q, the project boundary comprises geographical site of the cement plant, steam turbine, generator, boiler, desalting waster station and hot water circulating pump etc. The spatial extent of the Project physical boundary that provides electricity to a cement plant which is connected with CSPG and includes all the power plants connected to CSPG. According to China NDRC

"2008 Baseline Emission Factors for Regional Power Grids in China"[4], the CSPG covers Guangdong Province, Guangxi Province, Guizhou Province and Yunnan Province. The process diagram of the Project is illustrated in the following.

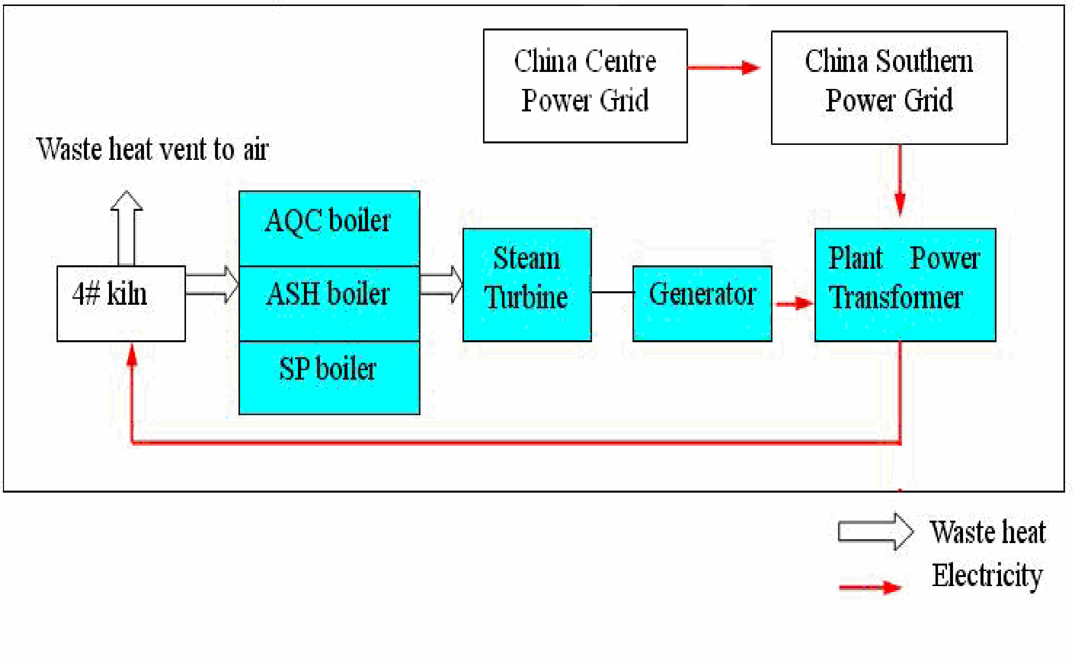

Figure 6. The diagram of the Project boundary

Table B.3-1. Key Information and Data Used to Determine the Baseline Scenario

Variable	**Value / Unit**	**Source**
Operating Margin Emission Factor	1.0608 tCO_2/MWh	2008 Baseline Emission Factors for Regional Power Grids in China
Build Margin Emission Factor	0.6816 tCO_2/MWh	2008 Baseline Emission Factors for Regional Power Grids in China
Combined Margin Emission Factor	0.8712 tCO_2/MWh	Calculated from the 2008 Baseline Emission Factors for Regional Power Grids in China as in B.6.1.

B.4. Description of baseline and its development:

According to AMS III.Q, the baseline scenario is the situation where, in the absence of the Project, waste heat from cement production system is emitted to the atmosphere and the electricity used by the cement plant is imported from CSPG.

The electricity generated from the waste heat will be used by the cement plant to replace that supplied by

[4] China NDRC (30/12/2008), 2008 Baseline Emission Factors for Regional Power Grids in China. Source: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf

CSPG. Accordingly, the grid emission factor is determined in accordance with the provisions of 'Tool to calculate the emission factor for an electricity system'. The baseline emission will be calculated in accordance with AMS-III.Q. Please see section B.6 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:

Below we provide a summarized implementation schedule of the project, illustrating the main events during the development of the project activity.

Table B.5 Implementation schedule of the project activity

Date	Stage
02/2008	Completion of FSR by Sinoma Energy Conservation Ltd.
23/03/2008	Completion of EIA by State Environmental Protection Administration
11/04/2008	The board of directors took meeting and made decision that the Project should be a CDM project[5]
28/04/2008	The approval of FSR[6]
07/05/2008	The approval of EIA[7]
06/06/2008	Signed consultancy agreement with Hangzhou Carbon Trade Environment Engineering Co., Ltd. (HCTEE)[8]
11/08/2008	The project owner required the general contractor DENED to support taking the proposed project as a CDM project.[9]
14/08/2008	DENED confirmed to do their effort to support it.[10]
22/08/2008	The project started (the project owner signed the construction contract with Dalian East New Energy Development Co., Ltd (DENED).)[11]
04/09/2008	The general contractor DENED signed the purchase agreement of turbine with Qingdao Jieneng Steam Turbine Group Co., Ltd [12]
06/09/2008	The general contractor DENED signed the purchase

[5] Board Resolution, 11/04/2008.

[6] Investment record (replace FSR approval) by Yunnan Province Economic Committee, 28/04/2008.

[7] The project EIA was approved by Yunnan Province Environment Protection Bureau, 07/05/2008.

[8] Consulting agreement, 06/06/2008.

[9] Letter from Yunnan Hongta Dianxi Cement Co., Ltd to Dalian East New Energy Development Co., Ltd, 11/08/2008

[10] Confirm letter from DENED to Yunnan Hongta Dianxi Cement Co., Ltd, 14/08/2008.

[11] Construction Contract, 22/08/2008.

[12] The Purchase agreement of the turbine, 04/09/2008.

	agreement of boiler with Sichuan Chuanrun Power Equipment Manufacturing Co., Ltd. [13]
08/09/2008	Order for commence[14]
04/11/2008	The general contractor DENED signed the purchase agreement of generator with Sichuan Dongfeng Electric Machinery Works Co., Ltd [15]
22/01/2009	Signed Emission Reduction Purchase Agreement with British Gas Trading Limited (BGTL)[16]
04/02/2009	Application for CDM to NDRC[17]
16/03/2009	Notice for the stakeholders' meeting[18]
21/03/2009	The project owner held stakeholders' meeting[19] and gathered the questionnaire
31/05/2009	Got the LOA of China[20]

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 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 owner 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.

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

[13] The Purchase agreement of the boiler, 06/09/2008.

[14] Order for commence, 08/09/2008.

[15] The Purchase agreement of the generator, 04/11/2008.

[16] ERPA between the project owner and the buyer, 22/01/2009.

[17] Record in NDRC.

[18] Notice for the stakeholders' meeting, 16/03/2009.

[19] Minutes of the stakeholders meeting, 21/03/2009.

[20] LOA of China.

Government of China. According to '*Construction project economic evaluation methods and parameters*' (third edition), the benchmark is accordingly set at 12%[21]. 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

According to the Feasibility Study Report, the basic data and assumptions for the calculation of the financial indicator of the Project are summarized in the following Table **B.5-1**.

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

Main parameters	**Unit**	**Value**	**Source**
Installed capacity	MW	6	Feasibility Study Report (FSR)[22]
Operating hours per year	hours/year	7400	FSR
Annual net electricity supply	MWh/y	39,200	FSR
Total investment	RMB	57,990,200	FSR
Electricity Tariff (excluding VAT)	RMB Yuan/KWh	0.41	FSR
VAT	%	17	FSR
City Maintenance & Construction tax	%	7	FSR
Educational surcharges	%	4	FSR
Income tax	%	25	FSR
Emission Reduction	tCO_2e	34,151	Calculated

Table B.5-2 Financial indicators of the Project

	with CDM financing	without CDM financing
IRR	12.30%	7.52%

The financial analysis results are shown in Table B.5-2. As shown in this table, without carbon credits the project's IRR is 7.52%, 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.

Sub-step d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

· Total Investment

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[21] China NDRC [2006]1325, '*Construction project economic evaluation methods and parameters*' (third edition) http://www.bjeca.org.cn/Article_Show2.asp?ArticleID=639

[22]Sinoma Energy Conservation Ltd, 02/ 2008. Feasibility Study Report of the Project.

· Operation and Maintenance Costs (O&M Costs)

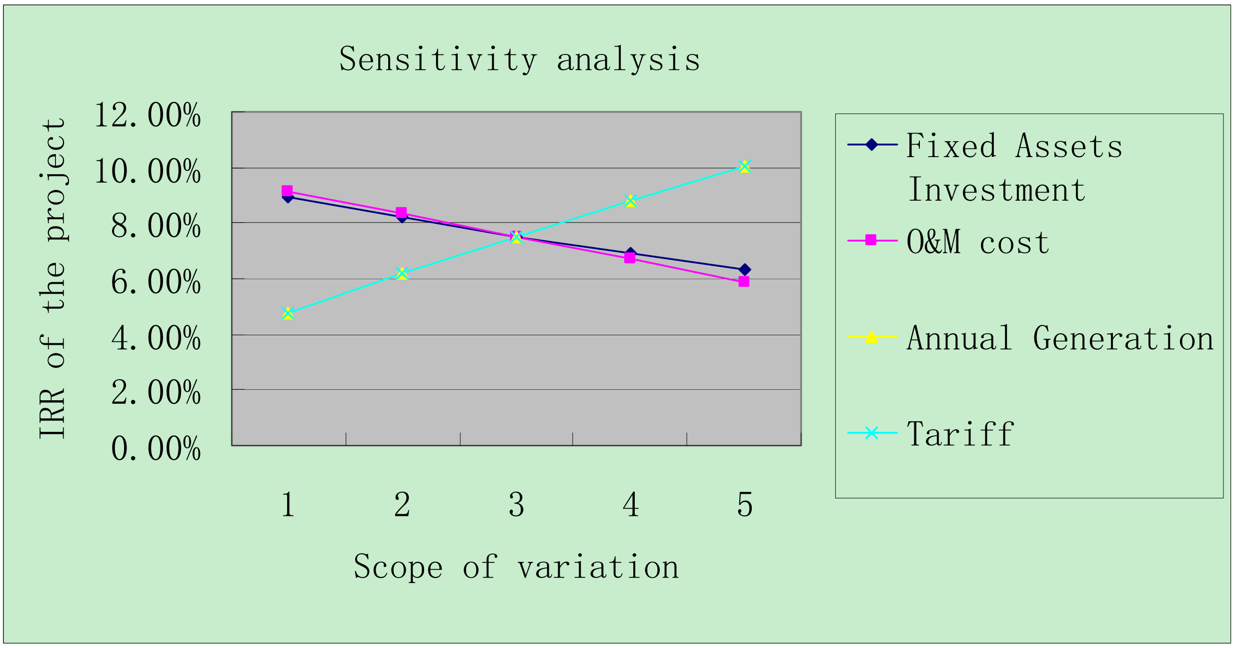
· Electricity generation

· Electricity Tariff

The required alteration needed in each parameter in order to reach the benchmark was assessed. Table B.5.3 summarize the results of the sensitivity analysis, in showing the variations in range of -10% to +10%.

Table B.5-3 Project IRR results of sensitivity analysis

Project IRR - without CERs	**-10%**	**-5%**	**0%**	**5%**	**10%**
Total Investment	8.91%	8.19%	7.52%	6.91%	6.33%
O&M cost	9.11%	8.33%	7.52%	6.70%	5.85%
Electricity generation	4.76%	6.18%	7.52%	8.81%	10.05%
Tariff	4.75%	6.18%	7.52%	8.81%	10.05%



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.

- **Total Investment:** A 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%.

- **Operation and Maintenance costs:** A decrease in operation costs is very unlikely to happen. Due to the cost of labour increased during the project construction. This increase demonstrates that a decrease in operating cost is unrealistic and that consequently the IRR is not likely to reach 12%.

- **Electricity Generation:** The expected operating hours of the Project indicated in the FSR 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 substantial 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 reach the benchmark.

- **Electricity Tariff:** the electricity tariff used in the analysis is the only data that the project owner can obtain at the time of investment decision. Furthermore the electricity tariff is strictly regulated by China government and it is hard to forecast the future electricity tariff by the project owner. As the electricity tariff is related tightly to the national economy and livelihood of people, the government of China has to make the electricity tariff steady. As a result, the electricity tariff of the proposed Project is unlikely to be increased and the benchmark is unlikely to be reached.

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 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 the CSPG, which will continue discharging carbon dioxides into the air.

Therefore, the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the adopted Methodology for the Project AMS III.Q: “Waste Energy Recovery (gas/ heat/pressure) Projects” (Version 02), “Tool to calculate the emission factor for an electricity system” (Version 02) is chosen for the calculation of the baseline emission factor.

As per the methodology, emission reductions of the project are equal to the baseline emissions minus project emissions and the leakage emissions.

Baseline Emissions

According to Baseline Methodology AMS III.Q, The baseline emissions for the year y shall be determined as follows:

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$$

Where,

$BE_{Elec,y}$ = Baseline emissions from electricity during the year y in tons of CO_2

$BE_{Ther, y}$ = Baseline emissions from thermal energy (due to heat generation by element process) during the year y in tons of CO_2.

Due to the Project is not considering the heat generation, the baseline emission is equal to the baseline emission from the electricity generation by the waste heat. Therefore,

$$BE_{En,y} = BE_{Elec,y}$$

Baseline emissions from electricity ($BE_{elec, y}$) generated by waste heat can be calculated as follows:

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_{j}\sum_{i}(EG_{i,j,y} * EF_{Elec,i,j,y})$$

Where,

$BE_{elec, y}$ = Baseline emissions due to displacement of electricity during the year y in tons of CO_2.

$EG_{i, j, y}$ = The quantity of electricity supplied to the recipient j by generator, that in the absence of the project activity would have been sourced from i source (i can be either grid or identified source) during the year y in MWh; and

$EF_{elec, i, j, y}$ = The CO_2 emission factor for the electricity source i (i=gr (grid) or i=is (identifiedsource), displaced due to the project activity, during the year y in tons CO_2/MWh;

f_{wcm} = Fraction of total electricity generated by the project activity using waste energy This fraction is 1 if the electricity generation is purely from use of waste energy.
NOTE: For project activity using waste pressure to generate electricity, electricity generated from waste pressure use should be measurable and this fraction is 1;

f_{cap} = Capping factor to exclude increased waste energy utilization in the project year y due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in project year y is same or less than that generated in base years.

Calculate f_{wcm}:

According to the methodology AMS-III.Q, if the electricity generation is purely from use of waste energy, this fraction is 1. Due to feasibility study report the electricity generation in the Project activity is all from utilization of waste heat of cement production, so:

f_{wcm}: = 1

Calculate f_{cap}:

According to the methodology ACM0012, there are three methods for estimating f_{cap}. There is no historic data, and the waste gas can not be direct measurement, Method 1 and Method 2 are invalid for calculation. Therefore, Method 3 is adopted to estimate f_{cap}:

Case-1: The energy is recovered from WECM and converted into final output energy (i.e. electricity in the proposed project) through waste heat recovery equipment. For such cases f_{cap} should be the ratio of actual energy recovered under the project activity (direct measurement) divided by the maximum theoretical energy recoverable using the project manufacturer's specifications can be used. Alternatively, technical assessment can be conducted by independent qualified/certified external process experts such as chartered engineers.

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

Where:

$Q_{OE,BL}$, is the output/intermediate energy that can be theoretically produced (in appropriate unit), to be determined on the basis of maximum recoverable energy from the WECM, which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of CDM project activity;

$Q_{OE,y}$, is the quantity of actual output/intermediary energy during the year y (in appropriate unit).

The value of f_{cap} is assumed to be 1 for ex-ante calculation in the PDD, and which will be determined by actual measurement for the crediting year, f_{cap} is set to 1 in case the calculated value of f_{cap} is higher than 1, while f_{cap} will be less than 1 if the actual measured electricity output ($Q_{OE,y}$)is greater than the value $Q_{OE,BL}$ (i.e. 42,380MWh) in baseline.

Step 1: Identify the relevant electricityr system

P.R. China is divided into regional electricity systems which are defined by the DNA of P.R. China. The Project is located in Dali Prefecture, Yunnan Province which belongs to CSPG. Therefore, the relevant electric power system is identified as the CSPG.

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

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

As for project, Option I is chosen in emission factor calculation.

Step 3: Select a method to determine the operating margin (OM)

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.

For accurate data on grid system dispatch order for each power plant in the system and the amount of power dispatched from all plants in the system during each hour is not available in China, while historical data available for the last five years (2002-2006) for CSPG show that the ratio of electricity generated by low operating cost and must run sources, which are less than 20%, it was decided to apply the Simple OM method as suggested in “Tool to calculate the emission factor for an electricity system”.

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; or

- *Ex-post* option: Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used.

Simple OM is calculated *ex-ante* using the data from 2004 to 2006, available in the China Energy Statistics Yearbooks 2005-2007 and the China Electric Power Yearbooks 2005-2007. These data vintage remains fixed during the crediting period.

Step 4: Calculate the operating margin emission factor according to the selected method

The “Tool to calculate the emission factor for an electricity system” offers two options to calculate Simple OM emission factor:

• Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or
• Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:
(a) The necessary data for Option A is not available; and

(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and

(c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

Detailed data on the individual power plants connected to the CSPG necessary for applying option A is not available; therefore, options A 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 B is applicable and used to calculate the Simple OM emission factor.

$EF_{grid,OMsimple,y}$, using option B 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:

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

Where:

$EF_{grid,\ OMsimple,\ y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,\ y}$ = 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)
$EF_{CO2,\ i,\ y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year y
y = The relevant year as per the data vintage chosen in Step 3

$EF_{grid,\ OMsimple,\ y}$ = 1.0608 tCO_2/MWh

The project adopts the data from the latest published by Chinese DNA on 30/12/2008[23]. For detailed information, please see Annex 3.

Step 5. Identify the group 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.

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 group. 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.

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 (version 02)" 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.

The BM emission factor ($EF_{grid,\ BM,\ y}$) is calculated *ex-ante* using the data from 2004 to 2006, available in the China Energy Statistics Yearbook 2005-2007 and the China Electric Power Yearbooks 2005-2007.

[23] See footnote 3. China NDRC (30/12/2008), 2008 Baseline Emission Factors for Regional Power Grids in China. Source: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf

These data vintage remains fixed during the first crediting period and will be updated for the second crediting period.

Step 6. 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 factor and $EF_{grid, BM,y}$ is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{BL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid, BM, y}$ = Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh);
$EG_{m, y}$ = Net electricity generated and delivered to the grid by m in year *y*;
$EF_{BL, m, y}$ = Emission factor in year *y* (tCO_2/MWh);
m = Power units included in the build margin;
y = Most recent historical year for which power generation data is available.

Because capacities of technologies using coal, oil and gas cannot be separated from the total thermal power generation from publicly available statistics, the following method is used for the calculation: first, use the energy balance data of the most recent year available and calculate the percentages of CO_2 emissions of power generation using solid, liquid and gas fuel in the total CO_2 emission. Second, calculate grid thermal power emission factors, using the percentages (as weights) and emission factors of technologies corresponding to best available efficiencies. Lastly, the thermal power emission factor is multiplied by the percentage of thermal power in the newest 20% capacity in the grid, and the result is the Build Margin emission factor of the grid.

Note that the data used can not distinguish the capacity installed in coal, fossil fuel, and gas from total fire power generation. Therefore, the calculation used as following:

Step a, percentage of CO_2 emitted, λ, for each solid, liquid and gas power generation:

$$\lambda_{Coal,y} = \frac{\sum_{i=Coal,j} F_{i,j,y} * NCV_{i,y} * EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} * NCV_{i,y} * EF_{CO2,i,j,y}}$$

$$\lambda_{Oil,y} = \frac{\sum_{i=Oil,j} F_{i,j,y} * NCV_{i,y} * EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} * NCV_{i,y} * EF_{CO2,i,j,y}}$$

$$\lambda_{Gas,y} = \frac{\sum_{i=Gas,j} F_{i,j,y} * NCV_{i,y} * EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} * NCV_{i,y} * EF_{CO2,i,j,y}}$$

Where:

$F_{i,j,y}$ = The fuel *i* (tce), consumption of province *j* in year *y*;
$NCV_{i,y}$ = Net calorific value of the biomass residue type *i* (GJ/ton of dry matter or GJ/liter);
$EF_{CO2,i,j,y}$ = Emission factor of type *i*, *j* in year *y* (tCO_2/MWh);
Coal, Oil and Gas = Solid fuel, liquid fuel and gaseous fuel respectively.

Step b: calculating $EF_{Thermal,y}$

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

Where:

$EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$ and $EF_{Gas,Adv,y}$ are emission factors of the most advanced commercial coal, oil and gas power generation technologies.

Step c: calculating $EF_{BM,y}$:

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y}$$

Where,

$CAP_{Total,y}$ = Total newly capacity installed;
$CAP_{Thermal,y}$ = Capacity of thermal generation installed.

$EF_{grid,BM,y}$ = **0.6816 tCO2/MWh**

The project adopts the data from the latest published by Chinese DNA on 30/12/2008[24]. For detailed information, please see Annex 3.

Step 7. Calculate the combined margin emission factor

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

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

Where:

$EF_{grid,CM,y}$ = Combined margin CO_2 emissions factor in year *y* (tCO_2/MWh);
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh);
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh);

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[24] See footnote2.China NDRC (30/12/2008), 2008 Baseline Emission Factors for Regional Power Grids in China. Source: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf

w_{OM} = 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.

$$\boldsymbol{EF_{grid, CM, y} = 0.5*1.0608 + 0.5*0.6816 = 0.8712\ tCO_2/MWh}$$

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.

Therefore:

$$PE_y = 0$$

Leakage emission

According to AMS-III.Q, no leakage is considered.

$$L_y = 0$$

Emission reduction

The emission reductions ER_y by the proposed Project during a given year y calculation is as follows:

$$ER_y = BE_y - PE_y - L_y$$

$$= BE_y$$

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

Data / Parameter:	$EG_{i,j,y}$
Data unit:	MWh
Description:	The quantity of electricity supplied to the recipient *j* by generator, which in the absence of the project activity would have been sourced from *i* source during the year *y*
Source of data used:	China Electric Power Yearbook
Value applied:	Refer to B.6 and Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology AMS-III.Q
Any comment:	

Data / Parameter:	$EF_{Elec,i,j,y}$
Data unit:	tons CO_2/MWh
Description:	The CO_2 emission factor for the electricity source *i* (i=gr (grid) or i=is (identified source)), displaced due to the project activity, during the year *y*
Source of data used:	China Electric Power Yearbook (2003-2007)

Value applied:	Refer to B.6 and Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The detailed plant-level data are considered confidential information and are not available; the provincial data from China Electric Power Yearbook are used.
Any comment:	

Data / Parameter:	f_{wcm}
Data unit:	
Description:	Fraction of total electricity generated by the project activity using waste energy
Source of data used:	1
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the methodology AMS-III.Q, if the electricity generation is purely from use of waste energy, this fraction is 1. Due to FSR the electricity generation in the Project activity is all from utilization of waste heat of cement production. So $f_{wcm:}$ = 1.
Any comment:	

Data / Parameter:	f_{cap}
Data unit:	
Description:	Energy that would have been produced in project year y using waste energy generated in base year expressed as a fraction of total energy produced using waste energy in year *y*.
Source of data used:	1
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the methodology AMS-III.Q, the ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base year. Due to the Project situation, the waste energy generated in year *y* is same as that generated in base year. Therefore, f_{cap} = 1.
Any comment:	

Data / Parameter:	$FC_{i,y}$
Data unit:	t/m^3
Description:	Amount of fuel *i* consumed by relevant power sources *j* delivering electricity to the CSPG in years y.
Source of data used:	China Energy Statistics Yearbook (2005-2007)
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods	Detailed fuel consumption data by power plants are not publicly available, the aggregated data by fuel types are used instead.

and procedures actually applied :	
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$NCV_{i,y}$
Data unit:	TJ/ton or TJ/m^3
Description:	Net calorific value (energy content) per mass or volume unit of a fuel *i*.
Source of data used:	"Chinese Energy Statistical Yearbook" 2005-2007
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance for the purpose of calculating fuel emission factors
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$EF_{CO2,i,}$
Data unit:	tCO_2e/MWh
Description:	CO_2 emission factor per unit of energy of the fuel *i*.
Source of data used:	Revised 2007 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values are used because country specific values of oxidation factors in China are not available.
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$EF_{Coal, Adv,y}$ $EF_{Oil, Adv,y}$ *and* $EF_{Gas, Adv,y}$
Data unit:	tCO_2/MWh
Description:	Emission Factor of the best available commercial power plants for coal, oil and gas power plants.
Source of data used:	"2007 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology AMS-III.Q for the purpose of BM calculation. Data is from an official national source.
Any comment:	See Annex 3 for details. Low degree of data uncertainty.

Data / Parameter:	λ_{Coal}, λ_{Oil}, λ_{Gas}

Data unit:	%
Description:	The percentage of CO_2 emitted for each source, coal, oil and gas, in the total emission at year 2006.
Source of data used:	"Chinese Energy Statistical Yearbook" 2007 edition,
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology AMS-I.D. Data is from an official national source. See section B.6.1. Step 2 for details.
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$CAP_{i,j,y}$
Data unit:	MW
Description:	Installed generation capacity, i, per year, y, and provincial grid, j
Source of data used:	"Chinese Electricity Yearbook" 2005-2007 editions,
Value applied:	Varies with province and year
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology AMS-I.D for the purpose of calculating BM. Data is from an official national source.
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2e/MWh
Description:	Operating Margin Emission Factor of CSPG
Source of data used:	2008 Baseline Emission Factors of Power Grids in China published by NDRC.
Value applied:	1.0608
Justification of the choice of data or description of measurement methods and procedures actually applied :	Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 30/12/2008 (http://cdm.ccchina.gov.cn)
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build Margin Emission Factor of CSPG
Source of data used:	2008 Baseline Emission Factors of Power Grids in China published by NDRC.
Value applied:	0.6816
Justification of the	Notification on Determining Baseline Emission Factor of China's Grid

choice of data or description of measurement methods and procedures actually applied :	published on the official web site of the Chinese DNA on 30/12/2008 (http://cdm.ccchina.gov.cn)
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	EF_y
Data unit:	tCO_2e/MWh
Description:	CM Emission factor of CSPG
Source of data used:	2008 Baseline Emission Factors of Power Grids in China published by NDRC.
Value applied:	0.8712
Justification of the choice of data or description of measurement methods and procedures actually applied :	Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 30/12/2008 (http://cdm.ccchina.gov.cn)
Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	$Q_{OE,BL}$
Data unit:	MWh
Description:	Output energy (electricity) that can be theoretically produced (in MWh), to be determined on the basis of maximum recoverable energy from the WECM, which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of CDM project activity.
Source of data used:	For estimating the theoretical recoverable energy, manufacturer┌ s specifications or FSR can be used.
Value applied:	42,380
Justification of the choice of data or description of measurement methods and procedures actually applied :	Alternatively, technical assessment can be conducted by independent qualified/certified external process experts such as chartered engineers.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The Project supplies 39,200MWh net electricity to the facility per year.

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

$$ER_y = BE_y - PE_y - L_y$$

ER_y = Emission reductions in year *y* (tCO_2)

BE_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)

$$BE_y = BE_{En,y} + BE_{flst,y}$$

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

$$BE_{flst,y} = 0$$

So,

$$BE_y = BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$$

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

$$BE_{Ther,y} = 0$$

So,

$$BE_y = BE_{En,y} = BE_{Elec,y} = f_{cap} \times f_{wcm} \times \sum_j \sum_i (EG_{i,j,y} \times EF_{Elec,i,j,y})$$

$$= 1 \times 1 \times \sum_j \sum_i (39200 \times 0.8712)$$

And 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:

$$ER_y = BE_y = EF_{CM} \times EG_y$$

$$= EF_{CM} \times (EG_{pj\ to\ grid,y} - EG_{grid\ to\ pj,y})$$

$$= 0.8712\ tCO_2/MWh \times 39{,}200 MWh/y = 34{,}151\ tCO_2e/y$$

To sum up, the Project will be able to supply electricity 39,200MWh/y to the CSPG. Therefore, annual emission reduction of the Project is estimated at 34,151tCO_2e.

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

Table B.6.4 Estimate of Emission Reductions in the crediting period

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
01/09/2010-31/12/2010	0	11,384	0	11,384
2011	0	34,151	0	34,151
2012	0	34,151	0	34,151
2013	0	34,151	0	34,151
2014	0	34,151	0	34,151
2015	0	34,151	0	34,151
2016	0	34,151	0	34,151
2017	0	34,151	0	34,151
2018	0	34,151	0	34,151
2019	0	34,151	0	34,151
01/01/2020-31/08/2020	0	22,767	0	22,767
Total (tonnes of CO_2e)	0	341,510	0	341,510

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

B.7.1 Data and parameters monitored:

Parameter:	$EG_{total,y}$
Unit:	MWh
Description:	Total ~~E~~electricity quantity generated by the project in year y
Source of data:	~~Meter monitored~~Electricity meter
Value of data:	42,380
Brief description of measurement methods and procedures to be applied:	The total electricity quantity generated by the Project will be continuously measured. Recording of data will be taken from energy meters located at the Project site.
QA/QC procedures to be applied(if any):	Measured continuously by meter M1 ~~with electronic meters~~ (0.5S) and recorded monthly. ~~The meter reading records would be used to verify the energy exported to the grid. This data will be cross checked on a regular basis between the metering devices at the Project stations to assure consistency, accuracy and transparency.~~
Any comment:	Process and method above are suitable for all plants

Parameter:	$EG_{pj\ to\ grid,y}$
Unit:	MWh
Description:	~~Net electricity quantity generated by the project.~~ Net electricity supplied to the cement production line connected to the grid
Source of data:	~~Meter monitored~~Electricity meter
Value of data:	39,200
Brief description of	The net electricity supplied to the cement production line connected to the grid

measurement methods and procedures to be applied:	~~electricity generated by the project to the grid~~ will be continuously measured. ~~Recording of data will be taken from energy meters located at the Project site.~~
QA/QC procedures to be applied(if any):	Measured continuously by bidirectional meter M4~~with electronic meters~~ (0.5S) and recorded monthly. The parameter will be crosschecked by the readings of meter M3.~~Payment invoices made to the grid operator and payment receipts together with the meter reading recordwould be used to verify the energy exported to the grid. This data will be cross checked on a regular basis between the metering devices at the Project stations to assure consistency, accuracy and transparency.~~
Any comment:	Process and method above are suitable for all plants

Parameter:	$EG_{grid\ to\ pj,\ y}$
Unit:	MWh
Description:	Electricity quantity supplied to the project from the grid
Source of data:	~~Plant records~~ Electricity meter
Value of data:	0
Brief description of measurement methods and procedures to be applied:	The electricity supplied to the project from the grid will be continuously measured~~with electronic meters (0.5S) and recorded monthly~~. ~~Recording of data will be taken from energy meters located at the Project site.~~
QA/QC procedures to be applied(if any):	Measured continuously by bidirectional meter M4 (0.5S) and recorded monthly. The parameter will be crosschecked by the readings of meter M3.
Any comment:	Process and method above are suitable for all plants

Parameter:	$Q_{OE,y}$
Unit:	MWh
Description:	Annual electricity generation by the Project Activity in year y
Source of data:	~~Meter monitored~~ Electricity meter
Value of data:	42,380
Brief description of measurement methods and procedures to be applied:	Onsite online measurement by electric meter M1 (0.5S) ~~MWHR~~, Continuously and aggregated monthly
QA/QC procedures to be applied(if any):	The CDM engineer In-charge would be responsible for regular calibration and management of the meters according to the National standards and regulations as described in section B.7.2.
Any comment:	Process and method above are suitable for all plants

B.7.2 Description of the monitoring plan:

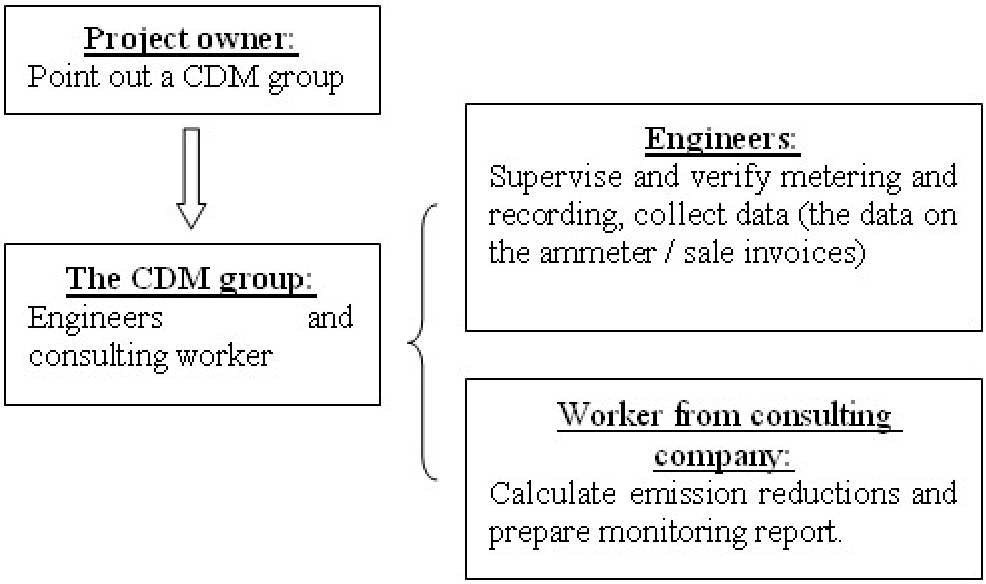
This section details the steps taken to monitor the GHG emissions reductions on a regular basis from the proposed project in the People's Republic of China. The Monitoring set up for this project has been developed to ensure that the project is well organized in terms of the collection and archiving of complete and reliable data.

1. Introduction

The project owner adopts the approved baseline methodology AMS-III.Q "Waste Energy Recovery Projects" to determine the baseline and calculate the emission reductions from the total electricity generation from the recovery of waste heat. The approved monitoring methodology AMS-III.Q is therefore used for developing the monitoring plan. Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

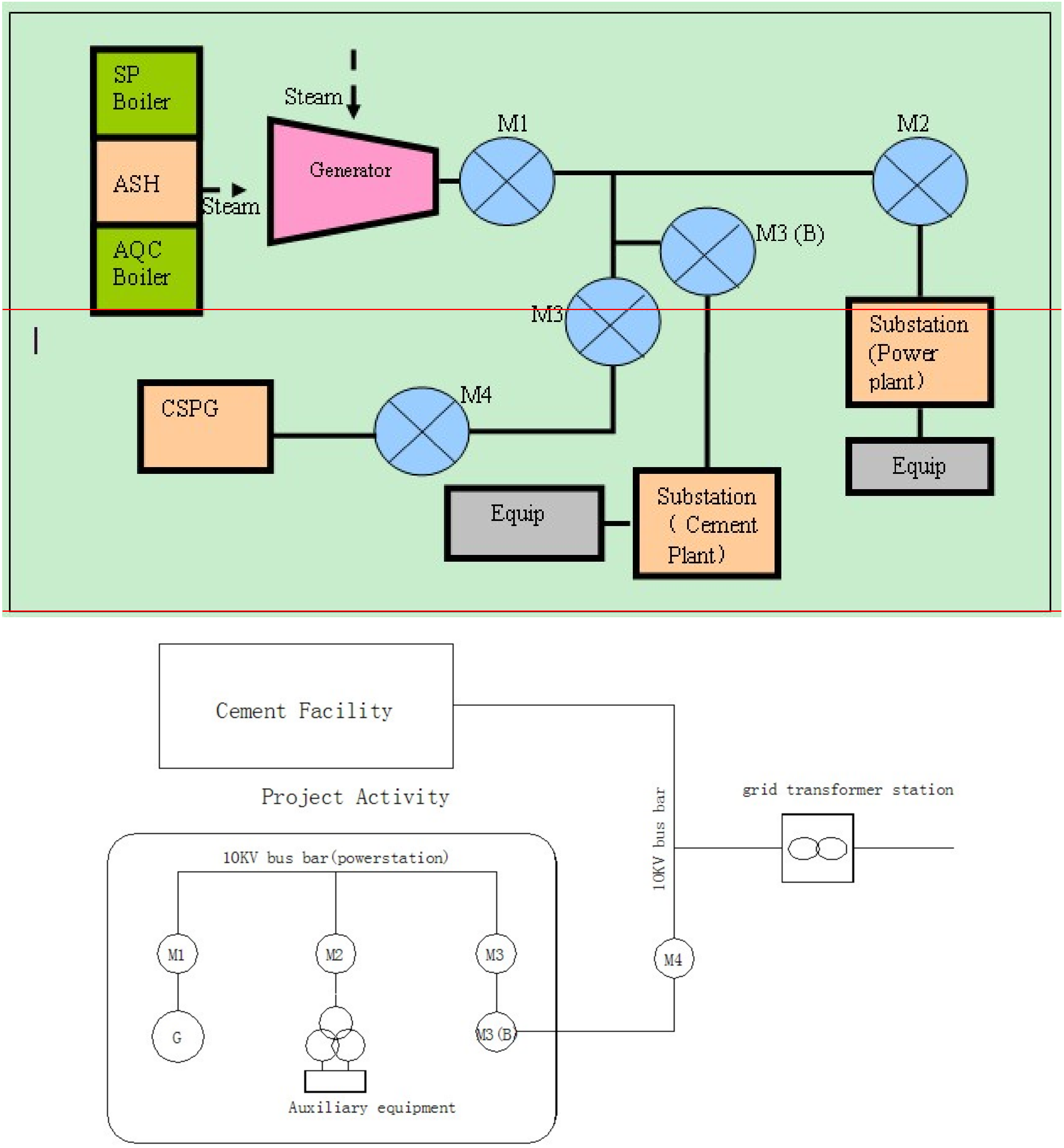
2. Monitoring Organization

Overall responsibility for monitoring and carrying out the monitoring following this monitoring plan lies with the project owner. The project owner will point out a CDM group which consists of engineers and worker from CDM consulting company. The engineers of the CDM group will supervise and verify metering and recording, collect data (the data on the ammeter / sale invoices) under the help of CDM consulting worker, who will calculate emission reductions and prepare monitoring report.



3. Monitoring equipment and Installation

The monitoring equipment-Meters should be configured and installed according to the electric power installation regulation and technical administrative code of electric energy metering device (DL/T488-2000). The metering equipment will be certified by the energy measurement and technology institutions of local power company. The electrical connection diagram of the Project is in the following.



B7. Simplified diagram of ammeter installation

There are ~~four~~ five meters installed at the project site, the detailed information of these meters are list as below: ~~(M1, M2, M3, M3 (B): DSSD331 100V 1.5(6)A) with the accuracy of 0.5s, M1, M2 and M3 are the main meters, and M3 (B) is the backup meter:~~

a) M1, measuring the total electricity quantity generation generated by the Project ($EG_{total,pj,y}$/$Q_{OE,BL}$), will be installed on site. As all waste heat recovered by the Project is for generating electricity, meter M1 -also measures the actual annual electricity generation by the Project activity ($Q_{OE,y}$).

b) M2, measuring the electricity self consumed by the power plant, will be installed on site.

c) M3, is a bidirectional electricity meter that measuring both the net electricity supplied to the cement production line connected to the grid ($EG_{pj\ to\ grid,y}$) and the electricity supplied to the Project from the grid ($EG_{grid\ to\ pj,y}$)measure the net electricity supplied to the Grid (EG_y/$Q_{OE,y}$), will be installed on site. The readings of meter M3 will be used for crosscheck of the readings of meter M4.

d) M3 (B), is the backup meter of meter M3measure the electricity supplied to the cement production plant (EG_y/$Q_{OE,y}$), will be installed on site.

e) M4 is the ammeter installed at the Grid and a bidirectional electricity meter managed by the Electric Power bureau[25]. that -measuring both the net electricity supplied to the cement production line connected to the grid ($EG_{pj\ to\ grid,y}$) and the electricity supplied to the Project from the grid ($EG_{grid\ to\ pj,y}$). The readings of meter M4 is used for emission reduction calculation of the Project.

In sum, the meter M4 is the main meter for emission reduction calculation of the Project and will be crosschecked by the recordings of meter M3. The meter M3 (B) is the backup meter of M3 will be used only if the meter M3 is in fault/emergency. In case of meter M3, M3 (B) and meter M4 are in fault, the difference of meter M1 and M2 will be used.

4. Calibration

A power interchange agreement between project owner and Grid Company defines the metering arrangements and the required quality control procedures to ensure accuracy. The metering equipment are calibrated and checked annually for accuracy so that the metering equipment shall have sufficient accuracy. The net energy output registered by the meters alone will suffice for the purpose of billing and emission reduction verification as long as the error in the meters is within the agreed limits.

Calibration is carried out by Grid Company with the records being supplied to the proposed Project. Both meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

All the meters installed shall be tested by aptitude testing agency entrusted by the project owners and grid company within 10 days after: (a) The detection of a difference larger than the allowable error in the readings of both meters; (b) the repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications;

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

[25] According to the Approval of Grid Connection of the Project (Yundianji [2009] 217), the net electricity generated by the Project can be only supplied to the Yunnan Hongta Dianxi Cement plant. The project activity is only approved to be connected to the Yunnan Grid. However, it is forbidden to sale electricity to the grid. Meanwhile, it is also not allowed to supply electricity to any third part or any electrical contract generated.

5. Date collection

The steps required to monitor the emissions reductions are:

a Grid Company reads ~~main~~ meter M4 and records the result monthly.

b Grid Company supplies readings ~~and invoice~~ to the project owner.

c The project owner records meter M1, M2, M3 and M3 (B)~~the net electricity to the grid~~.

~~d The project owner records the electricity from the grid if it occurs.~~

d The project owner provides reports annually the readings and calculations to the DOE for verification.

6. 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.

7. Monitoring report

Monitoring reports will be prepared by the CDM director annually, and then submitted to the general manager for final review. The monitoring report will be submitted to the DOE and other relevant agencies.

8. Data management system

Physical document such as paper-based maps, diagrams and environmental assessments will be collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the proposed project, the project material and monitoring results will be indexed. And all data including calibration records is kept until 2 years after the end of the total credit time of the CDM project.

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

The study of the baseline and monitoring methodology was concluded on 27/05/2009.

Name of person/entity determining the baseline:

Hangzhou Carbon Trade Environment Engineering Co., Ltd

Room 1122 of Buynow Keji Mansion, No.23 Jiaogong Rd, West Lake District, Hangzhou City, Zhejiang Province, China.

Contact person：Tina Wang

Tel: +86 0571 5683 4629

Fax: +86 0571 5683 4630

Email: wmn1432000@yahoo.com.cn

The entity is not one of the Project Participants listed in Annex 1 of the 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:

22/08/2008 (The project owner signed the construction contract)

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

21 years (including 1 year construction period)

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 01/09/2010, or on the date of registration of the CDM Project, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The Project 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, which was developed by State Environmental Protection Administration on 23/03/2008, has been approved by Yunnan Provincial Environmental Protection Bureau on 07/05/2008 with No. [2008] 126[26].

The Project EIA considered the impact on the air environment, water environment, acoustical environment and ecological environment as discussed below:

Air environment

In the construction period, construction materials transport, stacking and concrete mixing on site will generate dust and certain mechanical operations will produce a small amount of dust. In order to reduce dust generation, the project owner will rationally arrange construction time, optimize the construction program, sprinkler during the dry season when the construction work carried out and minimize production of dust by setting up straw mats and safety protective net, So that to mitigate the environmental impact of the region.

Water Environment

During the construction process, the waste water from industry and living life will be produced by the project activity. The quantity of industrial waste water discharged is 458.20 m^3/d, of which 288 m^3/d comes from the waste water(cleaning water) generated in the water circulation system, 120 m^3/d cleaning water comes from filter, 19.0 m^3/d waste water generated in chemical-processing, 24 m^3/d cooling water (cleaning water) and 7.2 m^3/d auxiliary production water. The quantity of the residential water is 1.73 m^3/d. All of the waste water is no poisonous or harmful produced by the Project. The cleaning water will be recycled directly, and the auxiliary production water will be treated according to GB/T18920-2002 before watering the construction site in the sunny days and storage in rainy. There is not outward discharge, therefore, the Project will have no impact on the water environment.

Solid Waste Environment

The Project solid wastes include construction garbage and living garbage. The quantity of the construction garbage is 15t/h, of which 13t/h comes from SP boiler and 2t/h comes from AQC boiler and separator. The quantity of the living garbage is 18Kg/d. Among them, the construction garbage from the project will be stored in a unified area and it will be removed to the site which designed by the sanitation department and timely treatment when the construction completed.

A small amount of living garbage will be gathered in the Plant, unity removed and then treated by sanitation department.
Thus the impact of the project activity on local environment will not be significant.

Acoustical Environment

During the construction period, due to the use of electric saws, electric drills, cranes and other construction machinery and construction material transport vehicles will have a certain amount of noise pollution. The proper measures will be adopted by the project owner to mitigate the influence of noise.

[26] Yunnan Environmental Protection Bureau (07/05/2008), No [2008] 126. The EIA Approval of the Project.

-The use of low-noise equipment;

-Reasonable arrangements for construction time, especially not construction at night;

-To optimize the construction program;

-To choose the optimal approach roads for construction vehicles, as far as possible from the source strength and route of transmission to reduce construction noise output.

-The central control room, which has a high concentration of management and operation personnel, will adopt noise-proof designs. Meanwhile, tree planting will be done to provide a natural noise silencer for the power station.

As a result, it is estimated that the noise levels at the plant boundaries in all directions will comply with tier III standard, as per *Standard of Noise at Boundary of Industrial Enterprises (GB 12348-90).Standard of Noise at Boundary of Industrial Enterprises (GB 12348-90)*.

Conclusion

As a whole, there will be a number of beneficial impacts to environment as a result of the Project 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:

According to the results of EIA and the reply from the Environmental Protection Bureau, the impact on the environment is not significant.

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 stakeholders' meeting was held on 21/03/2009[27]. Before that, the project owner had published a notice on 16/03/2009 to inform the residents around the meeting. The project owner, the consulting company and the relevant stakeholders attended the meeting. On the meeting the project owner gave a brief introduction of the proposed project. And then HCTEE introduced the project as a CDM project. Having heard above, the relevant stakeholders including the residents around and the local government expressed their opinions about the project. At last, a survey on 50 stakeholders were conducted and collected at that time. The local government and stakeholders were invited to submit comments on the Project.

[27] See footnote 18.

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

- Do you satisfy with the environment of Yunnan Hongta Cement Waste Heat Recovery Power Generation Project?
- What is the main environmental problem?
- What do you think is the key pollutant of the proposed project?
- Do you think the proposed project has impact on local environment?
- What is the key environmental problem after the implement of the proposed project in your opinion?
- Do you think the Project would be benefit for local development?
- Do you support the construction of the Project?

E.2. Summary of the comments received:

To investigate the impacts on local socio-economic and environmental aspects, the project owner had a public conference in project site to better understand stakeholders' comments. A survey was made among the potential stakeholders through questionnaires, mostly including local residents influenced by the Project and related institutions. 50 questionnaires were distributed and the main investigated issues as follows:

	Question	Opinion	Amount of questionnaire	Percent
1	Do you satisfy with the environment of Yunnan Hongta Cement Waste Heat Recovery Power Generation Project?	Great Satisfy	19	38
		Satisfy	31	62
		Dissatisfy	0	0
2	What is the main environmental problem?	Air	2	4
		Water	5	10
		Acoustic	40	80
		Solid waste	3	6
		Other	0	0
3	What do you think is the key pollutant of the proposed project?	Dust	2	4
		Waste water	5	10
		Acoustic	38	76

		Fluoride	**5**	**10**
		Other	**0**	**0**
4	**Do you think the proposed project has impact on local environment?**	**Serious pollution**	**0**	**0**
		Medium level pollution	**7**	**14**
		No pollution	**43**	**86**
5	**What is the key environmental problem after the implement of the proposed project in your opinion?**	**Surface water**	**36**	**72**
		Air	**3**	**6**
		Acoustic	**2**	**4**
		Ecology	**9**	**18**
		Other	**0**	**0**
6	**Do you think the Project would be benefit for local development?**	**Active**	**47**	**94**
		Passive	**0**	**0**
		No idea	**3**	**6**
7	**Do you support the construction of the Project?**	**Yes**	**45**	**90**
		No	**0**	**0**
		Indifferent	**5**	**10**

It could be found in 50 returns that most respondents hold a positive attitude toward the proposed project and support it.

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

Although no negative comments have been received on the project, the project owner will pay much attention to the concerns of stakeholders. In view of the environmental problems, the project entity will put all of the measures listed in the EIA into effect during the constructing and operating stage. Moreover, the local community possesses strong positive comments on the effects that the proposed project will make on the local economy and infrastructure. There has therefore been no need to modify the project due to comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Yunnan Hongta Dianxi Cement Co., Ltd.
Street/P.O.Box:	Shangdeng Industrial Area, Economic Development Zone,
Building:	/
City:	Dali Prefecture
State/Region:	Yunnan Province
Postfix/ZIP:	671000
Country:	P.R. China
Telephone:	+86 (0)872 2481334
FAX:	+86 (0)872 2481334
E-Mail:	hongchenhua@163.com
URL:	/
Represented by:	Xu Dunshan
Title:	General Manager
Salutation:	Mr.
Last Name:	Xu
Middle Name:	/
First Name:	Dunshan
Department:	/
Mobile:	/
Direct FAX:	+86 (0)872 2481334
Direct tel:	+86 (0)872 2481334
Personal E-Mail:	hongchenhua@163.com

Organization:	British Gas Trading Limited
Street/P.O.Box:	Millstream East, Maidenhead Road, Windsor SL45GD
Building:	/
City:	Windsor
State/Region:	/
Postfix/ZIP:	SL45GD
Country:	United Kingdom
Telephone:	+44 (0) 1753431040
FAX:	+44 (0) 1753431041
E-Mail:	/
URL:	/
Represented by:	Andy Kelly
Title:	Business Development Manager
Salutation:	Ms.
Last Name:	Kelly
Middle Name:	/
First Name:	Andy
Department:	/
Mobile:	/
Direct FAX:	+44 (0) 1753431040
Direct tel:	+44 (0) 1753431041
Personal E-Mail:	andy.kelly@centrica.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project will not receive any public funding from Annex 1 parties.

Annex 3

BASELINE INFORMATION

For the calculation of OM and BM, open data is also published by China's DNA-National Development and Reform Commission (NDRC) of China (DNA of China) on 30/12/2008. Details can be found in the following web link.

http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf
http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1888.pdf
http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081231101111351.pdf

The data among 2004-2006 used in OM calculation of the China Southern Power Grid are listed in table A3-1 to table A3-7.

Tables A3-1 Fossil Fuel-fired Power Generation of CSPG in 2004

Province	**Electricity Generation (10^8KWh)**	**Rate of Electricity (%)**	**Electricity Supply (MWh)**
Guangdong	1,693.89	5.42	160,208,116
Guangxi	201.43	8.33	18,465,088
Guizhou	497.2	7.06	46,209,768
Yunnan	243.22	7.56	22,483,257
Total			247,366,229

Power transmitted from CCPG to CSPG (MWh)	10,951,240
The average emission factor of CCPG (tCO_2/MWh)	0.82732
Total emission (tCO_2)	274,223,576
Total Electricity Supply(MWh)	258,317,469
EF in 2004(tCO_2/MWh)	1.06158

Data source: China Energy Statistical Yearbook 2005

Tables A3-2 Calculate the Operating Margin Emission Factor of CSPG in 2004

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	$EFCO_{2,i}$	$OXID_i$	NCV_i	Emission of CO_2(tCO_2e)
							(tc/TJ)	(%)	(MJ/t,m^3)	I=G*H*F*E*44/12/10000 （quantity）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10000 （volume）
Raw coal	10^4t	6,017.7	1,305	2,643.9	1,751.28	11,717.88	25.8	100	20,908	231,767,574
Cleaned coal	10^4t	0.21				0.21	25.8	100	26,344	5,233
Other washed coal	10^4t					0	25.8	100	8,363	0
Coke	10^4t					0	29.2	100	28,435	0
Coke oven gas	10^8m^3					0	12.1	100	16,726	0
Other gas	10^8m^3	2.58				2.58	12.1	100	5,227	59,831
Crude oil	10^4t	16.89				16.89	20	100	41,816	517,933
Petrol	10^4t					0	18.9	100	43,070	0
Diesel oil	10^4t	48.88			1.83	50.71	20.2	100	42,652	1,601,975
Fuel oil	10^4t	957.71				957.71	21.1	100	41,816	30,983,494
LPG	10^4t					0	17.2	100	50,179	0
Refinery gas	10^4t	2.86				2.86	15.7	100	46,055	75,825
Nature gas	10^8m^3	0.48				0.48	15.3	100	38,931	104,833
Other petroleum products	10^4t	1.66				1.66	20	100	38,369	46,708
Other coking products	10^4t					0	25.8	100	28,435	0
Other energy	10^4tce	79.42				79.42	0	100	0	0
									Total	265,163,407

Data Source: China Energy statistical Yearbook 2005

Tables A3-3 Fossil Fuel-fired Power Generation of CSPG in 2005

Province	Electricity Generation (10^8KWh)	Rate of Electricity (%)	Electricity Supply (MWh)
Guangdong	1,764.53	5.58	166,606,923
Guangxi	250.23	7.95	23,033,672
Guizhou	584.3	6.94	54,141,238
Yunnan	272.81	7.34	25,387,699
Total			269,169,531

Power transmitted from CCPG to CSPG (MWh)	20,264,000
The average emission factor of CCPG (tCO_2/MWh)	0.77216
Total emission (tCO_2)	310,876,215
Total Electricity Supply (MWh)	289,433,531
EF in 2005(tCO_2/MWh)	1.07409

Data source： China Energy Statistical Yearbook 2006

Tables A3-4 Calculate the Operating Margin Emission Factor of CSPG in 2005

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	$EFCO_{2,i}$	$OXID_i$	NCV_i	Emission of CO_2(tCO_2e)
							(tc/TJ)	(%)	($MJ/t,m^3$)	I=G*H*F*E*44/12/10000（quantity）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10000（volume）
Raw coal	10^4t	6,696.47	1,435	3,212.31	1,975.55	13,319.33	25.8	100	20,908	263,442,602
Cleaned coal	10^4t				0.15	0.15	25.8	100	26,344	3,738
Other washed coal	10^4t			10.39	33.88	44.27	25.8	100	8,363	350,238
Coke	10^4t	4.79			8.05	12.84	29.2	100	28,435	390,906
Coke oven gas	10^8m^3				0.79	0.79	12.1	100	16,726	58,624
Other gas	10^8m^3	1.87			15.96	17.83	12.1	100	5,227	413,486
Crude oil	10^4t	10.91				10.91	20	100	41,816	334,556
Petrol	10^4t	0.68				0.68	18.9	100	43,070	20,296
Diesel oil	10^4t	31.96	2.02		1.81	35.79	20.2	100	42,652	1,130,639
Fuel oil	10^4t	887.21				887.21	21.1	100	41,816	28,702,703
LPG	10^4t					0	17.2	100	50,179	0
Refinery gas	10^4t	4.92				4.92	15.7	100	46,055	130,441
Nature gas	10^8m^3	0.93				0.93	15.3	100	38,931	203,115
Other petroleum products	10^4t	1.7				1.7	20	100	38,369	47,833
Other coking products	10^4t					0	25.8	100	28,435	0
Other energy	10^4tce	104.66	133.15		59.72	297.53	0	100	0	0
									Total	295,229,177

Data Source: China Energy statistical Yearbook 2006

Tables A3-5 Fossil Fuel-fired Power Generation of CSPG in 2006

Province	Electricity Generation (10^8KWh)	Rate of Electricity (%)	Electricity Supply (MWh)
Guangdong	1,884.29	5.27	178,498,792
Guangxi	279.67	4.45	26,722,469
Guizhou	760.39	6.06	71,431,037
Yunnan	397.91	4.12	38,151,611
Total			314,803,908

Power transmitted from CCPG to CSPG (MWh)	21,730,840
The average emission factor of CCPG(tCO_2/MWh)	0.77134
Total emission (tCO_2)	352,951,910
Total Electricity Supply(MWh)	336,534,748
EF in 2006 (tCO_2/MWh)	1.04878

Data source： China Energy Statistical Yearbook 2007

Tables A3-6 Calculate the Operating Margin Emission Factor of CSPG in 2006

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	$EFCO_{2,i}$	$OXID_i$	NCV_i	Emission of CO_2(tCO_2e)
							(tc/TJ)	(%)	($MJ/t,m^3$)	I=G*H*F*E*44/12/10000 （quantity）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10000 （volume）
Raw coal	10^4t	7,303.19	1,490.01	4,001.54	2,735.88	15,530.62	25.8	100	20,908	307,179,636
Cleaned coal	10^4t					0	25.8	100	26,344	0
Other washed coal	10^4t			19.53	45.8	65.33	25.8	100	8,363	516,852
Briquette	10^4t	133.75				133.75	26.6	100	20,908	2,727,466
Coke	10^4t				1.31	1.31	29.2	100	28,435	39,882
Coke oven gas	10^8m^3		0.84		2.06	2.9	12.1	100	16,726	215,202
Other gas	10^8m^3	0.89			19.15	20.04	12.1	100	5,227	464,737
Crude oil	10^4t	0.87				0.87	20	100	41,816	26,679
Petrol	10^4t					0	18.9	100	43,070	0
Diesel oil	10^4t	29.92	1.26		3	34.18	20.2	100	42,652	1,079,777
Fuel oil	10^4t	685.85	0.09			685.94	21.1	100	41,816	22,191,288
LPG	10^4t					0	17.2	100	50,179	0
Refinery gas	10^4t					0	15.7	100	46,055	0
Nature gas	10^8m^3	7.92				7.92	15.3	100	38,931	1,729,751
Other petroleum products	10^4t	0.67				0.67	20	100	38,369	18,852
Other coking products	10^4t					0	25.8	100	28,435	0
Other energy	10^4tce	93.54	189.68		20.29	303.51	0	100	0	0
									Total	336,190,122

Data Source: China Energy statistical Yearbook 2007

Tables A3-7 The OM EF of CSPG

Year	2004	2005	2006
Emission factor (tCO_2/MWh)	1.06158	1.07409	1.04878
The average emission factor (tCO_2/MWh)	1.0608		

Table A3-8 Breakdown per fuel of annual emissions

		Guangdong	**Guangxi**	**Guizhou**	**Yunnan**	**Total**	**$EFCO_{2,i}$**	**NCV_i**	**$OXID_i$**	**Emission of CO_2(tCO_2e)**
							(tc/TJ)	**(MJ/t,m^3)**	**(%)**	I=G*H*I*F*44/12/10000 （quantity）
Fuels	Unit	A	B	C	D	E=A+…+ D	F	G	H	I=E*F*G*H*44/12/1000 （volume）
Raw coal	10^4t	7,303.19	1,490.01	4,001.54	2,735.88	15,530.62	20,908	25.8	1	307,179,636
Cleaned coal	10^4t	0	0	0	0	0	26,344	25.8	1	0
Other washed coal	10^4t	0	0	19.53	45.8	65.33	8,363	25.8	1	516,852
Briquette	10^4t	133.75	0	0	0	133.75	20,908	26.6	1	2,727,466
Coke	10^4t	0	0	0	1.31	1.31	28,435	29.2	1	39,882
Total										**310,463,836**
Crude oil	10^4t	0.87	0	0	0	0.87	41,816	20	1	26,679
Gasoline	10^4t	0	0	0	0	0	43,070	18.9	1	0
Coal oil	10^4t	0	0	0	0	0	43,070	19.6	1	0
Diesel oil	10^4t	29.92	1.26	0	3	34.18	42,652	20.2	1	1,079,777
Fuel oil	10^4t	685.85	0.09	0	0	685.94	41,816	21	1	22,191,288
Other petroleum products	10^4t	0.67	0	0	0	0.67	38,369	20	1	18,852
Other coking products	10^4t	0	0	0	0	0	28,435	25.8	1	0
Total										**23,316,596**
Nature gas	10^8m^3	79.2	0	0	0	79.2	38,931	15.3	1	1,729,751
Coke oven gas	10^8m^3	0	8.4	0	20.6	29	16,726	12.1	1	215,202
Other gas	10^8m^3	8.9	0	0	191.5	200.4	5,227	12.1	1	464,737
LPG	10^4t	0	0	0	0	0	50,179	17.2	1	0
Refinery gas	10^4t	0	0	0	0	0	46,055	15.7	1	0
Total										**2,409,690**
Total CO_2 emission										**336,190,122**

Data Source: China Energy statistical Yearbook 2007

From above tale, the following can be calculated：

$\lambda_{Coal, y} = 92.35\%$，$\lambda_{Oil, y} = 6.94\%$，$\lambda_{Gas, y} = 0.72\%$。

Emission factor of thermal power is calculated as follow:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.8862 \text{ tCO}_2\text{/MWh}$$

Table A3-9 Installed Capacity of CSPG in 2006

Installed Capacity	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal	MW	40,615	5,434	8,564	14,350	68,963
Hydro	MW	9,320	7,624	9,698	7,534	34,176
Nuclear	MW	3,780	0	0	0	3,780
Wind	MW	183	0	0	11	183
Total	MW	53,898	13,058	18,262	21,884	107,102

Data source：China Energy Statistical Yearbook 2007

Table A3-10 Installed Capacity of CSPG in 2005

Installed Capacity	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal	MW	35,182.6	4,931.2	4,758.4	9,634.8	54,507
Hydro	MW	9,035.7	6,085.3	7,993.1	7,233	30,347.1
Nuclear	MW	3,780	0	0	0	3,780
Wind	MW	83.4	0	0	112.2	83.4
Total	MW	48,081.7	11,016.5	12,751.5	16,867.8	88,717.5

Data source：China Energy Statistical Yearbook 2006

Table A3-11 Installed Capacity of CSPG in 2004

Installed Capacity	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal	MW	30,172.9	4,378.1	4,306.9	7,801.8	46,659.7
Hydro	MW	8,584.6	5,040.4	7,058.6	6,896.5	27,580.1
Nuclear	MW	3,780	0	0	0	3,780
Wind	MW	83.4	0	0	0	83.4
Total	MW	42,621	9,418.5	11,365.5	14,698.3	78,103.3

Data source： China Energy Statistical Yearbook 2005

Table A3-12 BM EF of CSPG

	Installed Capacity of 2004	Installed Capacity of 2005	Installed Capacity of 2006	Increase over previous year (MW)	Cumulative increase (%)
	A	B	C	D=C-A	
Thermal(MW)	46,659.7	54,507	68,963	22,303.3	76.91%
Hydro(MW)	27,580.1	30,347.1	34,176	6,595.9	22.75%
Nuclear(MW)	3,780	3,780	3,780	0	0
Wind(MW)	83.4	83.4	183	99.6	0.34%
Total	78,103.3	88,717.5	107,102	28,998.7	100%
% versus 2006	72.92%	82.84%	100%		

$EF_{grid,\ BM,\ y}$ = 0.8862×76.91% = 0.6816 tCO_2/MWh

Table A3-13 CM EF of CSPG

OM (tCO_2e/MWh)	BM (tCO_2e/MWh)	CM=(OM+BM)/2 (tCO_2e/MWh)
1.0608	0.6816	0.8712

Annex 4

MONITORING INFORMATION

No further information.

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