



**CLEAN DEVELOPMENT MECHANISM  
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)  
Version 03.1 - in effect as of: 28 July 2006**

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**SECTION A. General description of project activity****A.1. Title of the project activity:**

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Yulong Tongli WHR<sup>1</sup> Project

Version: 03

Date: 28/05/2008

**A.2. Description of the project activity:**

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Zhumadian Yulong Tongli Cement Co., Ltd (hereafter referred to the “project entity”) has one clinker production line with capacity of 5,000 t/d located in Zhumadian City, Henan Province. At present, the electricity consumed in cement production of project entity was imported from Central China Power Grid. The annual power demand of the project entity was 176,550MWh.

In cement plant, about 90% of total energy is used as heat energy in clinker production. Out of total heat consumed in the calcination process, about 35% of heat is often discharged as waste heat to the surroundings without utilization. Therefore, a great deal of energy has been wasted, and the heat pollution in the workplace is serious. To effectively utilize the low temperature waste heat of the exit gases from Suspension Preheater (SP) and Air Quenching Chamber (AQC), the project entity has made decision to build one waste heat recovery captive power station (hereafter referred to the “project activity”).

The project activity includes installation of 2 Waste Heat Recover boilers (one WHR boiler for SP exit gas and one WHR boiler for AQC exit gas), one steam turbine and one generator. The total power capacity of steam turbine generator is 9MW. After implement of the project activity, the annual expected substituted amount of electricity supplied from Central China Power Grid will be 55,940 MWh which will displace the equivalent amount of electricity supplied by Central China Power Grid, thereby reducing the emission of GHGs from burning of fossil fuels at thermal power plants which supply electricity to the grid. The annual expected emission reductions are 54,547 tCO<sub>2</sub>e of the project activity.

The project activity will produce many positive environmental and socio-economic benefits and contribute to the local sustainable development. Various benefits associated with the project activity are as following:

**Socio-economic benefits**

The project activity will provide some positions for the professionals, workers and residents in the region. The project activity also will bring in related economic benefits for the local community and will lead to sustainable economic and industrial growth in the region.

**Environmental benefits**

The project activity will utilize the waste heat for power generation, thereby reducing effects of thermal pollution which will benefit the staffs in the workplace. Furthermore, the electricity generated from the project activity will help to reduce the emissions of GHGs and mitigate other environmental pollution (SO<sub>2</sub> and NO<sub>x</sub>) at the thermal power plants supplying power to Central China Power Grid.

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<sup>1</sup> Waste Heat Recovery



The project activity started in December, 2006. The project entity was very knowledgeable about the possibilities offered by CDM. The key events are given in table A2.1.

Table A2.1 Overview of key events in the development of the project

01/2006	The project entity received information about Kyoto Protocol and CDM through the CCement.com <sup>2</sup> .
08/2006	The project entity discussed with the CDM developer.
09/2006	The project entity signed development contract with CDM developer.
10/2006	The feasible study report had been finished.
11/2006	The Report of Work Commencement of Yulong WHR project was issued
12/2006	Start civil construction
08/2007	Start commissioning

### **A.3. Project participants:**

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<b>Name of Party involved (*) ((host) indicates a host Party)</b>	<b>Private and/or public entity(ies) project participants (*) (as applicable)</b>	<b>Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)</b>
People's Republic of China (host Party)	Zhumadian Yulong Tongli Cement Co., Ltd.	No
Sweden	Carbon Asset Management Sweden AB	No

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For detailed information on participants in the project activities, please refer to Annex 1.

### **A.4. Technical description of the project activity:**

#### **A.4.1. Location of the project activity:**

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##### **A.4.1.1. Host Party(ies):**

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People's Republic of China

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

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Henan Province

##### **A.4.1.3. City/Town/Community etc:**

<sup>2</sup> <http://www.ccement.com/news/2006/1-19/C1763332534.htm>



&gt;&gt;

Zhumadian City, Queshan County

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

&gt;&gt;

The project activity is located in Zhumadian Yulong Tongli Cement Co., Ltd, which is situated in Queshan County, Zhumadian City, Henan province, China, at a distance of 0.5 km from Jingguang Railway, 1.0 km from 107 national highway (seen in Fig. A 4-1). Its geographical coordinates are north latitude 32°46' 58" and east longitude 114°02'24".



Fig. A 4-1 Site of the project activity

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

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As per the scope of the project activity defined in the 'list of sectoral scopes and approved baseline and monitoring methodologies', the project activity falls under Scope Number 1-Energy Industries (renewable/non-renewable sources).

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

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There are several processes involved in cement production, including raw material preparation, grinding, clinker production, clinker storage and grinding, clinker silos and dispatch, and so on. Large amount of energy consumption for the production of cement occurs in the clinker production. This involves passing raw materials through a preheater stack containing cyclone heaters to a long rotating kiln to create clinker and then cooling clinker in the clinker cooler.

In clinker production process, a great amount of waste heat is vented to the atmosphere without utilization. This course has wasted natural resources and caused serious heat pollution in the workplace. If the waste



heat captured and used for power generation, as proposed in the project activity, it can significantly improve energy efficiency and reduce the equivalent amount of power imported from Central China Power Grid.

The project entity will adopt WHR system to effectively utilize the waste heat of the exit gases from Suspension Preheater (SP) and Air Quenching Chamber (AQC). The WHR system in the project activity consists of one set of SP boiler, one set of AQC boiler, one steam turbine generator, DCS system, water-circulation system and dust-removal system etc. The waste heat from SP and AQC will be led to WHR boilers (SP boiler and AQC boiler) to generate steam for power generation. The steam from SP boiler and AQC boiler will be united and led to steam turbine generator for power generation. The major equipment will be employed in the project activity refers to table A 4-1.

Table A 4-1 The major equipment employed in the project activity

Name	Model number	Number	Manufacturer
AQC Boiler	QC240/360-20(5.9)-1.6(0.35)/345(190)	1	Hangzhou Boiler Group Co., Ltd.
SP boiler	QC340/315-18-1.6/320	1	Hangzhou Boiler Group Co., Ltd.
Steam-additional condensing turbine	BN9-1.6/0.35	1	CITIC Heavy Machinery Inc.
Generator	QF-K9-2	1	CITIC Heavy Machinery Inc.

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

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The total expected emission reductions of the project activity in the 10 years crediting period are 545,470tCO<sub>2</sub>e. And the expected emission reductions in the fixed crediting period are demonstrated in the table below.

<b>Years</b>	<b>Annual estimation of emission reductions in tonnes of CO<sub>2</sub>e</b>
01/05/2008~31/12/2008	36,365
2009	54,547
2010	54,547
2011	54,547
2012	54,547
2013	54,547
2014	54,547
2015	54,547
2016	54,547
2017	54,547
01/01/2018~30/04/2018	18,182
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	<b>545,470</b>
<b>Total number of crediting years</b>	<b>10</b>



<b>Annual average over the crediting period of estimated reductions (tonnes of CO<sub>2</sub>e)</b>	<b>54,547</b>
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**A.4.5. Public funding of the project activity:**

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No public funding from any Annex I parties are involved in the 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 project activity:**

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The Approved consolidated methodology version 02 of ACM0004 “Consolidated baseline methodology for waste gas and/or heat for power generation”.

The Approved consolidated monitoring methodology version 02 of ACM0004 “Consolidated monitoring methodology for waste gas and/or heat for power generation”

For more information regarding the proposals and their consideration by the Executive Board please refer to <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

This methodology also refers to Approved consolidated methodology version 06 of ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” and the latest version (version 03) of the “Tool for the demonstration and assessment of additionality”.

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

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The methodology	The Proposed Project Activity
The methodology applies to project activities that generate electricity from waste gas and/or heat and/or pressure in industrial facilities.	The project activity will generate power by utilizing low temperature waste heat of exit gases from SP and AQC in cement production.
The methodology applies to electricity generation project activities that displace electricity generation with fossil fuels in the electricity grid or displace captive generation.	The proposed project activity will generate electricity which will be connected to Central China Power Grid thereby displacing electricity generation with fossil fuels in the grid.
The methodology applies to electricity generation project activities where no fuel switch is done in the process where the waste heat or waste gas is produced after implementation of the project activity.	No fuel switch is being done in the process where the waste heat or waste gas is produced after implementation of the project activity.
The methodology covers both new and existing facility.	The project activity has implemented waste heat recovery project.



The project activity satisfies the applicability conditions as specified in the methodology ACM0004 (version 02). Therefore the said methodology is applicable for the project activity.

### **B.3. Description of how the sources and gases included in the project boundary:**

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As per the methodology, the project boundary includes the sources related to project emission and baseline emission. Therefore the Project Boundary is defined as the rotating kiln generating the waste heat of the project activity, heat recovery boilers (SP boiler and AQC boiler), waste heat generator unit and its auxiliary facilities and all power plants which join up with the Central China Power Grid. Table B 3-1 illustrates which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

Table B 3-1: Overview on emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
<b>Baseline</b>	Central China Power Grid	CO <sub>2</sub>	Included	Main emission source
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative.
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative.
<b>Project Activity</b>	The project activity	CO <sub>2</sub>	Excluded	No auxiliary fuels are fired in the project activity, so the emissions resource will be excluded.
		CH <sub>4</sub>	Excluded	Excluded for simplification.
		N <sub>2</sub> O	Excluded	Excluded for simplification.

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

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Baseline methodology ACM0004 states that the alternatives to the baseline scenario should include all possible options that provide or produce electricity for in-house consumption and/or sale to grid or other consumptions. As per ACM0004, those baseline scenarios have been excluded that:

- Do not comply with legal and regulatory requirement; or
- Depend on key resources such as fuels, material or technology that are not available at the project site.

The possible alternative baseline scenarios are as follows:

**Baseline scenario 1:** The proposed project activity, not undertaken as a CDM project activity

The project entity may adopt waste heat recovery utilization systems for power generation to generate electricity. It is in compliance with all applicable legal and regulatory requirements. However, this alternative can not be considered as financially attractive to investors and faces series of barriers (as detailed in Section B.5.) making it predictably prohibitive. Hence this option should not be taken as a part of baseline scenario.

**Baseline scenario 2:** Continuation of equivalent import of electricity from Central China Power Grid

Currently, the project entity imports electricity from Central China Power Grid. In the absence of the project activity, the power station will annually provide 176,550 MWh to the cement plants. However, the project entity does have the option to continue to import electricity from Central China Power Grid. This alternative is in compliance with all applicable legal and regulatory requirements and economically attractive, therefore it can be taken as the baseline scenario.

**Baseline scenario 3:** New fossil fuel (coal/diesel/gas) based captive power plant

The project entity can generate equivalent amount of power using fossil fuel based captive power plant. However, as per Chinese power regulations, thermal power plants of less than 135MW<sup>3</sup> are prohibited.

<sup>3</sup>Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135MW or Below



As the installed capacity of the project activity is only 9MW which is less than 135MW, the construction and operation of fossil fuel based captive power plant does not comply with the current legal and regulatory requirements. Therefore this scenario can be excluded from the baseline scenario.

**Baseline scenario 4:** New hydro power station with installed capacity of 9MW

The project entity may adopt hydro power station with installed capacity of 9MW for power generation. It is in compliance with all applicable legal and regulatory requirements. However, there is no natural condition to build hydro power station on the site of the project activity. Therefore it can be excluded from the baseline scenario.

**Baseline scenario 5:** Other uses of waste heat

For the project activity, baseline scenario 5 is not a feasible alternative because the cement plant at which the project is located is far away from the city and there are no any other potential demands for heating. And the cement plant is located far from the other industry, so it is not technically and economically feasible to supply the waste heat for industry utilization. Then the waste heat can only be utilized for power generation. Therefore this scenario is not an acceptable baseline scenario alternative. As requested by the methodology, evidence and supporting documents to exclude the last three baseline options has been provided to the DOE and validated.

It can be concluded that Alternative 1 and 2 are the only two possible baseline scenarios that cannot be eliminated due to prohibitive barriers. Step 2 of the additionality tool will determine the most economically attractive alternative as the baseline scenario.

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

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As per ACM0004 (version 02), the project proponent determine the additionality based on ‘Tools for demonstration and assessment of additionality’ (version 03) to demonstrate its additionality.

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

***Sub-step 1a: Define alternatives to the project activity***

Alternative to the project activity have been defined as following:

**Alternative 1:** The proposed project activity not undertaken as a CDM project activity;

**Alternative 2:** Continuation of equivalent import of electricity from Central China Power Grid;

**Alternative 3:** New fossil fuel (coal/gas/ diesel) based captive power plant;

**Alternative 4:** New hydro/ wind power captive power plant;

**Alternative 5:** Other use of the waste heat.

Details of alternatives to the project activity refer to section B.4., and the preferable alternative is alternative 2: continuation of equivalent import of electricity from Central China Power Grid.

***Sub-step 1b: Enforcement of applicable laws and regulations***

Please refer to Section B.4 for the demonstration that except the **alternative 3** “Fossil fuel based captive power plant”, the remaining alternatives are all in conformity with applicable laws and regulations.

Alternative 1 and 2 are the only two possible baseline scenarios that cannot be eliminated due to prohibitive barriers. These two scenarios thus have to be compared with an economic comparison in order to determine the appropriate baseline scenario.



**Step 2: Investment analysis**

The purpose of this step is to determine whether the project activity is economically or financially attractive than other alternatives without additional revenue/funding, possibly from the sale of emission reductions (CERs). The investment analysis was conducted through the following steps:

***Sub-step 2a: Determine appropriate analysis method***

Tools for the demonstration and assessment of additionality suggest three analysis methods including simple cost analysis (option I), investment comparison analysis (option II) and benchmark analysis (option III). Because the project will earn the revenues not only the CDM but also electricity sales, the option I is not appropriate method. Thus, the investment comparison analysis method (Option II) is used.

***Sub-step 2b: Investment comparison analysis (Option II)***

A Net Present Value (NPV) analysis is an economic comparison tool widely used in the private sector for investment appraisal, comparing two possible scenarios with each other by taking into account relevant future cash flows. The NPV analysis's discount rate is chosen to be the equity Internal Rate of Return (IRR) in accordance with the "Tool for the demonstration and assessment of additionality /version 03".

With reference to Parameter Research on Economic Assessment of Projects, the financial benchmark rate of return (after tax) of Chinese Cement industry accounts for 12%<sup>4</sup> of the equity investment IRR.

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

Based on the feasibility study report of the project, basic parameters for calculation of financial indicators are shown in table B 5-1 (below):

Table B 5-1 Basic parameters from the feasibility study report

No.	Parameter	Value
1	Installed capacity	9MW
2	Estimated annual supplied to Grid	55,940MWh
3	Project lifetime	15 years
4	Total investment	RMB 59.86 million
5	The price of purchasing electricity from Central China Power Grid	0.326 CNY/KWh
6	Unit Cost of Power supply	0.265 CNY/KWh
7	Value added tax	17%
	Income tax	33%

- Crediting period: 10 years
- Expected CERs price: 7.0 \$/tCO<sub>2</sub>e

**(2) Comparison of NPV for the project and the financial benchmark**

In accordance with the investment comparison analysis (Option II), alternative 1 (the project activity) is considered financially less attractive than alternative 2 (Equivalent electricity import from the grid) if the NPV is negative. As can be seen from the submitted excel file, the NPV is minus 7.04 million Yuan. Thus, in line with the methodology, it can be concluded by this economic analysis that scenario 2 is the most plausible baseline scenario.

***Sub-step 2d: Sensitivity analysis***

<sup>4</sup> The third edition of Project Economic Evaluation Methods and Parameters, 2006, page 74



The objective of sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in support of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive.

For the project, the following financial parameters were taken as uncertain factors for sensitive analysis of financial attractiveness:

- (1) Total investment
- (2) Annual O&M cost
- (3) Electricity generated by the project activity

When the above three financial indicators fluctuate within the range of -10% to +10%, the NPV of total investment of the project varies to different extent. The impacts to NPV by above parameters fluctuation are (not considering CERs income) seen in table B 5-3.

Table B 5-3 the sensitivity analysis of the NPV of the project activity without CDM (unit: million)

Fluctuation range of parameters	-10%	-5%	0	5%	10%
Total investment	-1.92	-4.53	-7.04	-9.78	-12.43
Annual O&M cost	-3.59	-5.33	-7.04	-8.75	-10.39
Annual net electricity generated	-12.85	-9.95	-7.04	-4.03	-0.93

The table B 5-3 shows that the NPV will decrease with increase of total investment or annual O&M cost, and it will increase with decrease of total investment or annual O&M cost. When the total investment or annual O&M cost decreases 10%, the NPV is still negative.

The table B 5-3 also shows that the NPV will increase when the generated electricity quantity increases, and it will decrease with decrease of the generated electricity quantity. When the generated electricity quantity increases 10%, the NPV is still negative.

Based on the above analysis, without support from CERs income, the project is not economically attractive, therefore the project is additional.

### Step 3: Barrier analysis

Based on **Step 2**, the project is not economically attractive without support from CERs income and the project is additional. Therefore, the barrier analysis step is skipped.

### Step 4: Common practice analysis

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

Projects developed within the same province face a similar regulatory framework and investment climate that makes them comparable thus the common practice is conducted at Province level. By the end of May 2006, the number of cement plants reached 253<sup>5</sup> in Henan province. There is no one cement plant has installed waste heat utilization boilers for power generation among the 253 cement plants, except the four cement plants, Xinxiang Pingyuan Tongli Cement plant, Henan Yuhe Tongli Cement plant, and Huanghe Tongli Cement plant and this proposed project activity<sup>6</sup>, which are intend to install the WHR system and have started the CDM development process in attempt to gain incentives from CERs revenues.

It can be seen clearly that among the 253 cement plants in Henan province, the proposed project activity together with the above 3 projects are the first of this kind in this big province.

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

<sup>5</sup> <http://www.dcement.com/henan/Index.asp>

<sup>6</sup> The letter from the Henan Building Material Industry Association to project entity.



As faced the aforesaid barriers and lack of financing attraction, all of the above similar projects in Henan province have applied for the support of CDM and the three projects have obtained the approval of Chinese DNA<sup>7</sup>.

In conclusion, the proposed project activity passes all the necessary steps of additionality analysis, and is additional. In the absence of the proposed project activity, the project entity will continue importing electricity from the regional grid, and the power plants (coal-fired) that provide this electricity will keep on discharging carbon dioxides into the air.

## **B.6. Emission reductions:**

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### **B.6.1: Explanation of methodological choices:**

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Calculate the emissions reductions of the project activity according to the approved consolidated baseline methodology ACM0004 (version 02).

#### **Step 1 Determination of project emissions:**

Project emissions are applicable only if auxiliary fuels are fired for generation start-up, in emergencies, or to provide additional heat gain before entering the waste heat recovery boiler as per the methodology ACM0004 (version 02). As there are no CO<sub>2</sub> emissions from combustion from auxiliary fossil fuels, thus there will not be any emissions in the project activity.

#### **Step 2 Determination of baseline emissions:**

The baseline scenario applicable to the project activity is “import of electricity from the grid”. Therefore, the baseline emission factor for displaced electricity has been calculated in accordance with Version 06 of the methodology ACM0002.

According to the latest rules to project boundary of version 06 of ACM0002, the project entity can:

- 1) Use the delineation of grid boundaries as provided by the DNA of the host country if available; or
- 2) Use, where DNA guidance is not available, the following definition of boundary.

In large countries with layered dispatch system (e.g. state/provincial/regional/national), the regional grid definition should be used. Thus, Central China Power Grid has been selected as the project boundary.

The electricity baseline emission factor ( $EF_y$ ) is calculated as a combined margin ( $CM$ ) as the weighted average of the Operating Margin emission factor ( $EF_{OM,y}$ ) and the Build Margin emission factor

( $EF_{BM,y}$ ). Since the methodology stated that calculation of operating margin should use the most recent data applicable at the time of PDD submission, the calculations for this combined margin are based on data from *China Energy Statistical Yearbook* (the most recent data applicable are from 2004, 2005, 2006), *China Electric Power Yearbook* (the most recent data applicable are from 2002, 2003, 2004, 2005, 2006) and *2006 IPCC Guidelines*.

#### **STEP 2.1: Calculation of Operation Margin Emission Factor**

$EF_{OM,y}$  will be calculated based on one of the four following methods:

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

<sup>7</sup> <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1536.pdf>



Each method is described as below:

#### Method (a) Simple OM

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount grid generating output. Among the total electricity generations in 2001-2005 of Central China Power Grid where the project activity connected into, the low-cost/must run resources constitute less than 50% of total amount grid generating output. The detailed information can be seen in Table B 6-1. Table B 6-1 Annual electricity generation of Central China Power Grid of 2001-2005

No.	Year	Electricity generation/GWh			Percentage of hydropower/%
		Total Power	Thermal power	hydropower	
1	2001 <sup>8</sup>	281,711	178,156	103,554	36.76
2	2002 <sup>9</sup>	312,788	200,347	112,440	35.95
3	2003 <sup>10</sup>	367,289	240,839	126,448	34.43
4	2004 <sup>11</sup>	440,665	270,846	169,094	38.37
5	2005 <sup>12</sup>	496,430	304,825	191,548	38.56

#### Method (b) Simple adjusted OM

The simple adjusted OM needs the annual load duration curve of the grid. As the detailed data of dispatch of Central China Power Grid and power plants are often taken as confidential business information, those data are not publicly available. Therefore, it is difficult to adopt Method (b) for the calculation of the baseline emission factor of operating margin.

#### Method (c) Dispatch data analysis OM

Dispatch data analysis OM should be the first methodological choice if the dispatch data are available, because this method can truly reflect the substitutable relationship between the amounts of electricity output from power plants of the baseline grid and from the proposed project activity and the emission reductions generated. Method (c) cannot be adopted for the proposed project because of unavailability of the dispatch data of Central China Power Grid.

#### Method (d) Average OM

Method (d) can only be used when low-cost/must run resources constitute more than 50% of total amount of grid output. According to the calculation of Table B 6-1, the project doesn't apply to the method, so it is not suitable for the project.

Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin ( $EF_{OM,y}$ ) for the project activity.

In accordance with ACM0002, the Simple OM emission factor ( $EF_{OM,y}$ ) is calculated as the generation-weighted average emissions per electricity unit (tCO<sub>2</sub>e/MWh) of all generation sources serving the system, excluding those low-operating cost and must-running power plants. The formula of Simple OM factor is calculated as below:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_j GEN_{j,y}} \quad (B.6-1)$$

Where:

$COEF_{i,j}$  is the CO<sub>2</sub> emission coefficient of fuel  $i$  consumed (tCO<sub>2</sub>e/mass or volume unit of the fuel),

<sup>8</sup> China Electric Power Yearbook 2002 page. 625;

<sup>9</sup> China Electric Power Yearbook 2003 page. 593;

<sup>10</sup> China Electric Power Yearbook 2004 page. 709;

<sup>11</sup> China Electric Power Yearbook 2005 page. 485.

<sup>12</sup> China Electric Power Yearbook 2006 page. 572



$GEN_{j,y}$  is the electricity (MWh) delivered to the grid by source  $j$ ,

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

$j$  is the power sources delivering electricity to the grid, not including low-operating cost and must run power plants

The CO<sub>2</sub> emission coefficient  $COEF_{i,j}$  is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i \quad (B.6-2)$$

Where:

$NCV_i$  is the net calorific value (energy content) per mass or volume unit of a fuel  $i$ ,

$EF_{CO_2,i}$  is the CO<sub>2</sub> emission factor per unit of energy of the fuel  $i$ ,

$OXID_i$  is the oxidation factor of the fuel  $i$ .

According to the suggestions by EB<sup>13</sup>, if without plant data, the aggregated generation/power supply, coal consumption of generation/power supply and emission coefficient of fuel types of each plant could be weighted, and the average emission factor for the grid for each fuel type can be used to estimation of OM emission coefficient.

Therefore, in formula (B.6-1):

$COEF_{i,j}$  is the CO<sub>2</sub> emission coefficient of fuel  $i$  consumed (tCO<sub>2</sub>e/mass or volume unit of the fuel),

$GEN_{j,y}$  is the electricity (MWh) delivered to Central China Power Grid,

$F_{i,j,y}$  is the amount of fuel  $i$  (in a mass or volume unit) consumed by years  $y$  of Central China Power Grid,

$j$  refers to Central China Power Grid, not including low-operating cost and must-run power plants.

The data quoted had in Annex 3. The result is:

$$EF_{OM,y} = 1.2909 \text{ tCO}_2/\text{MWh}$$

### STEP 2.2: Calculation of Build Margin Emission Factor

It is calculated as the generation-weighted average emission factor (tCO<sub>2</sub>e/MWh) of a sample of power plants of grid, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_m GEN_{m,y}} \quad (B.6-3)$$

Where:

$F_{i,m,y}$  is the amount of fuel  $i$  (in a mass or volume unit) consumed by plant  $m$  in years  $y$ ;

$COEF_{i,m,y}$  is the CO<sub>2</sub> emission coefficient (tCO<sub>2</sub>e/mass or volume unit of the fuel) of fuel  $i$ , taking into account the carbon content of the fuels used by plant  $m$  and the percent oxidation of the fuel in year  $y$ ;

$GEN_{m,y}$  is the electricity (MWh) delivered to the grid by plant  $m$ .

Calculations for the Build Margin emission factor ( $EF_{BM,y}$ ) has been done as ex-ante based on the most recent information available on plants already built for sample Group  $m$  of Central China Power Grid at the time of PDD submission. The sample Group  $m$  consists of either:

a) The five power plants that have been built most recently, or

<sup>13</sup> [http://cdm.unfccc.int/UserManagement/FileStorage/AM\\_CLAR\\_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ](http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ)



b) The power plants capacity additions in the electricity system generation (in MWh) and that have been built most recently.

As per the clarifications are given by EB<sup>14</sup>, the project activity can:

- 1) Use of capacity additions during last 1-3 years for estimating the build margin emission factor for grid electricity.
- 2) Use of weights estimated using installed capacity in place of annual electricity generation to calculate BM emission coefficient.
- 3) Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption.

As the limit of data obtained for calculation the proportion of Coal-fired, Gas-fired and oil-fired power capacity to the total power capacity in Central China Power Grid, this PDD will adopt the following method to calculate BM emission factor:

① Use the data of fuel consumption in the latest year to calculate the proportion of the GHGs emissions of Coal-fired, Oil-fired and Gas-fired resources to the total GHGs emissions, the proportion is given by:

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (B.6-4)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (B.6-5)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (B.6-6)$$

Where:

$F_{i,j,y}$  is the amount of fuel  $i$  (in tce) consumed in province  $j$  in year(s)  $y$ ,

$COEF_{i,j,y}$  is the CO<sub>2</sub> emission coefficient of fuel  $i$  (tCO<sub>2</sub> / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources  $j$  and the percent oxidation of the fuel in year(s)  $y$ ,

② Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption, and the above data to calculate the emission factor of thermal power.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal, Adv} + \lambda_{Oil} \times EF_{Oil, Adv} + \lambda_{Gas} \times EF_{Gas, Adv} \quad (B.6-7)$$

where  $EF_{Coal, Adv}$ ,  $EF_{Oil, Adv}$  and  $EF_{Gas, Adv}$  the emission factor of efficiency level of Coal-fired, Oil-fired and Gas-fired respectively of the best technology commercially available.

③ Use the data obtained in ② and the increased percentages of thermal power to calculate Build Margin emission factor of Central China Power Grid.

<sup>14</sup> [http://cdm.unfccc.int/UserManagement/FileStorage/AM\\_CLAR\\_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ](http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ)



$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (B.6-8)$$

Where,

$CAP_{Total}$  is the total newly added capacity of power capacity,

$CAP_{Thermal}$  is the newly added capacity of thermal power.

The fraction of new increased thermal power plants of Central China Power Grid could be seen in table B 6-3.

Table B 6-3 Installed capacity of Central China Power Grid of 2002, 2003 and 2005

	2002 <sup>15</sup>	2003 <sup>16</sup>	2005 <sup>17</sup>
Hydro Plants (MW)	31034.7	36557	38405.2
Thermal Plants (MW)	43303.2	46893.5	60167.2
Total of installed capacity (MW)	74337.9	83450.5	99695.5
Percentage of installed capacity (%)	24.60	19.62	100
Fraction of newly increased thermal Plants (%)	69.52		

Table B 6-3 shows the installed power capacity in Central China Power Grid in year 2002, 2003 and 2005. It shows that the capacity additions is only 19.62% during 2003~2005, but 24.60% during 2002~2005 of installed capacity in 2004. Thus data in years 2002 and 2005 are used to calculate the BM emission coefficient of Central China Power Grid. Thermal power plants accounted for 69.52% of the total capacity additions in Central China Power Grid during 2002-2005.

The data quoted had in Annex 3. The result is:

$$EF_{BM,y} = 0.6593 \text{ tCO}_2/\text{MWh}$$

### STEP2.3: Calculation of Baseline Emission Factor

It is calculated as the weighted average of the Operating Margin emission factor ( $EF_{OM,simple,y}$ ) and the Build Margin emission factor ( $EF_{BM,y}$ ):

$$EF_y = \omega_{OM} \times EF_{OM,simple,y} + \omega_{BM} \times EF_{BM,y} \quad (B.6-9)$$

Where the weighted  $\omega_{OM}$  and  $\omega_{BM}$ , by default, are 50% (i.e.,  $\omega_{OM} = \omega_{BM} = 0.5$ ),  $EF_{OM,simple,y}$  and  $EF_{BM,y}$  are calculated as described in Steps 1 and 2 above and are expressed in tCO<sub>2</sub>e/MWh.

The Building Margin Emission Factor ( $EF_y$ ) was calculated according to the above data:

Table B 6-4 Calculation of CM emission factor

OM (tCO <sub>2</sub> e/MWh)	BM (tCO <sub>2</sub> e/MWh)	CM (tCO <sub>2</sub> e/MWh)
A	B	C=A×0.5+B×0.5
1.2909	0.6593	0.9751

### STEP2.4 Calculation of Baseline Emissions

$$BE_y = EF_y \times EG_y \quad (B.6-10)$$

<sup>15</sup> China Electric Power Yearbook 2003 page. 593

<sup>16</sup> China Electric Power Yearbook 2004 page. 709

<sup>17</sup> China Electric Power Yearbook 2006 page. 571



Where

$BE_y$  is the baseline emission due to displacement of electricity during the year  $y$  in tons of CO<sub>2</sub>e,

$EG_y$  is the net quantity of electricity generated by the project activity during the year  $y$  in MWh,

$EF_y$  is the CO<sub>2</sub> baseline emission factor for the electricity displaced due to the project activity in during the year  $y$  in tCO<sub>2</sub>e/MWh.

### Step 3 Estimation of emission reductions:

As per the methodology (ACM0004) the emission reductions by the project activity ( $ER_y$ ) are calculated as the difference between baseline emissions ( $BE_y$ ) and project emissions ( $PE_y$ ). As there are no project emissions in the project activity, the emission reductions are equivalent to the baseline emissions.

#### B.6.2. Data and parameters those are available at validation:

>>

<b>Data / Parameter:</b>	$EF_y$
Data unit:	tCO <sub>2</sub> /MWh
Description:	Calculated ex ante as a weighted sum of emission factors of Operating Margin and Build Margin. The emission factor is fixed throughout the crediting period.
Source of data used:	China Electric Power Yearbook (2002- 2006)
Value applied:	0.9751
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission factor calculated according to the methodology presented in ACM0002: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006).
Any comment:	

<b>Data / Parameter:</b>	Operating Margin Emission Factor ( $EF_{OM}$ )
Data unit:	tCO <sub>2</sub> /MWh
Description:	Calculated ex ante as the average emission factor of the grid excluding must run, low cost sources.
Source of data used:	China Electric Power Yearbook (2002- 2006)
Value applied:	1.2909
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission factor calculated according to the methodology presented in ACM0002: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006).
Any comment:	

<b>Data / Parameter:</b>	Build Margin Emission Factor ( $EF_{BM}$ )
Data unit:	tCO <sub>2</sub> /MWh
Description:	Calculated ex ante as weighted average emission factor of the 20% most





	recent power plants built
Source of data used:	China Electric Power Yearbook (2002- 2006)
Value applied:	0.6593
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission factor calculated according to the methodology presented in ACM0002: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006).
Any comment:	

<b>Data / Parameter:</b>	Installed capacity of Central China Power Grid
Data unit:	MW
Description:	Installed capacity of Central China Power Grid in 2001-2005
Source of data used:	China Electric Power Yearbook (2002- 2006)
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deriving from official statistical data
Any comment:	To calculate the Build Margin emission factor

<b>Data / Parameter:</b>	Power generation of Central China Power Grid
Data unit:	GWh
Description:	Power generation from Central China Power Grid in 2001-2005
Source of data used:	China Electric Power Yearbook (2002-2006)
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deriving from official statistical data
Any comment:	To calculate percent of low-cost/must run resources to total amount of grid power generation and Operation Margin emission factor

<b>Data / Parameter:</b>	Thermal power plant self-use rate
Data unit:	%
Description:	Thermal power plant self-use rate of Central China Power Grid in (2001-2005)
Source of data used:	China Electric Power Yearbook (2002-2006)
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deriving from official statistical data
Any comment:	To calculate Operation Margin emission factor



<b>Data / Parameter:</b>	$F_{i,j}$
Data unit:	$10^4\text{t}$ or $10^8\text{m}^3$
Description:	Amount of fuels consumed by the power sources delivering electricity to Central China Power Grid
Source of data used:	China Energy Statistical Yearbook (2004-2006)
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deriving from official statistical data
Any comment:	To calculate the Operation Margin emission factor

<b>Data / Parameter:</b>	$NCV_i$
Data unit:	TJ/ $10^4\text{t}$ , $10^8\text{m}^3$ , $10^4\text{tce}$
Description:	It is the net calorific value (energy content) per mass or volume unit of the fuel consumed by the power sources delivering electricity to Central China Power Grid.
Source of data used:	China Energy Statistical Yearbook 2006
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deriving from official statistical data
Any comment:	To calculate the Operation Margin emission factor

<b>Data / Parameter:</b>	$OXID_i$
Data unit:	%
Description:	The oxidation rate of the fuel consumed by the power sources delivering electricity to Central China Power Grid.
Source of data used:	2006 IPCC Guidelines: page 1.23
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Deriving from official statistical data
Any comment:	To calculate the Operation Margin emission factor

<b>Data / Parameter:</b>	$EF_{C,i}$
Data unit:	%
Description:	Carbon emission factor of the fuel consumed by the power sources delivering electricity to Central China Power Grid.
Source of data used:	2006 IPCC Guidelines: page 1.23
Value applied:	Refer to Annex 3



Justification of the choice of data or description of measurement methods and procedures actually applied :	Default values
Any comment:	To calculate the Operation Margin emission factor

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

&gt;&gt;

#### Step 6.3-1 Estimate of GHG emissions by sources:

As discussed in B6.1, the project emissions are zero, that is:  $PE_y = 0$ .

#### Step 6.3-2 Estimated leakage:

As per ACM0004 (version 02), the leakage is not considered as the project activity has selected baseline methodology ACM0004 as its baseline methodology.

#### Step 6.3-3 Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

As the baseline emission factor ( $EF_y$ ) is 0.9751 tCO<sub>2</sub>e/MWh, the annual electricity displaced by the project activity ( $EG_y$ ) is 55,940MWh, then the annual baseline emissions of the project activity ( $BE_y$ ) are 54,547tCO<sub>2</sub>e.

Table B 6-5 Calculation of annual baseline emissions of the project activity

$EG_{GEN}$ (MWh)	$EG_{AUX}$ (MWh)	$EG_y = (EG_{GEN} - EG_{AUX})$ (MWh)	$EF_y$ (tCO <sub>2</sub> e/MWh)	$BE_y = EG_y * EF_y$ (tCO <sub>2</sub> e)
60,800	4,860	55,940	0.9751	54,547

#### Step 6.3-4 Estimate of emission reductions:

Since the project emissions are zero in the project activity, the emission reductions of the project activity ( $ER_y$ ) are equal to baseline emissions ( $BE_y$ ). The emission reductions of the project activity are 54,547tCO<sub>2</sub>e.

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

&gt;&gt;

The total expected emission reductions of the project activity in the 10 years crediting period are 545,470tCO<sub>2</sub>e. And the expected emission reductions in the fixed crediting period are demonstrated in the table below.

Year	Estimation of project activity emissions (tonnes of CO <sub>2</sub> e)	Estimation of baseline emissions (tonnes of CO <sub>2</sub> e)	Estimation of leakage (tonnes of CO <sub>2</sub> e)	Estimation of overall emission reductions (tonnes of CO <sub>2</sub> e)
01/05/2008~31/12/2008	0	36,365	0	36,365
2009	0	54,547	0	54,547
2010	0	54,547	0	54,547
2011	0	54,547	0	54,547



2012	0	54,547	0	54,547
2013	0	54,547	0	54,547
2014	0	54,547	0	54,547
2015	0	54,547	0	54,547
2016	0	54,547	0	54,547
2017	0	54,547	0	54,547
01/01/2018~30/04/2018	0	18,182	0	18,182
Total (tonnes of CO <sub>2</sub> e)	0	545,470	0	545,470

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

&gt;&gt;

**B.7.1. Data and parameters monitored:**

&gt;&gt;

Data / Parameter:	<b>Q<sub>i</sub></b>
Data unit:	Tonnes or m <sup>3</sup>
Description:	Volume of the auxiliary fuel used by the project activity
Source of data to be used:	The project design does not include the firing of auxiliary fuels. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	<b>EF<sub>i</sub></b>
Data unit:	tC/TJ
Description:	Carbon emissions factor of fuel
Source of data to be used:	The project design does not include the firing of auxiliary fuels. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.



Any comment:	
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Data / Parameter:	$NCV_f$
Data unit:	TJ per or $m^3$
Description:	Net Calorific Value of Fuel
Source of data to be used:	The project design does not include the firing of auxiliary fuels. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	$EG_{GEN}$
Data unit:	MWh
Description:	Power Generated by the project activity
Source of data to be used:	On-site instrumentation
Value of data applied for the purpose of calculating expected emission reductions in section B.5	60,800MWh
Description of measurement methods and procedures to be applied:	The procedure of measuring refers to B.7.2.
QA/QC procedures to be applied:	Refers to B.7.2.
Any comment:	

Data / Parameter:	$EG_{AUX}$
Data unit:	MWh
Description:	Power consumed by the project activity
Source of data to be used:	On-site instrumentation
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4,860MWh
Description of measurement methods and procedures to be applied:	The procedure of measuring refers to B.7.2.
QA/QC procedures to be applied:	Refers to B.7.2.
Any comment:	



Data / Parameter:	$EG_y$
Data unit:	$Nm^3$
Description:	Net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh
Source of data to be used:	Calculated.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	55,940
Description of measurement methods and procedures to be applied:	Calculated from measured parameters as $EG_y = EG_{GEN} - EG_{AUX}$ For details see section B7.2. Frequency: Calculated monthly in the basis of hourly data( $EG_{GEN}$ and $EG_{AUX}$ ) Data record: Electronic with paper back-up.
QA/QC procedures to be applied:	The procedure of measuring refers to B.7.2.
Any comment:	

Data / Parameter:	$Q_{WG}$
Data unit:	$Nm^3$
Description:	Flow rate of waste gas
Source of data to be used:	The project design does not include the firing of waste gas. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	$NCV_{WG}$
Data unit:	$TJ/Nm^3$
Description:	Net calorific value of the waste gas
Source of data to be used:	The project design does not include the firing of waste gas. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement	N.A.



methods and procedures to be applied:	
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	<b>H<sub>r</sub></b>
Data unit:	TJ/NWh
Description:	Average plant efficiency
Source of data to be used:	The project design does not include the firing of waste gas. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.
Any comment:	

Data / Parameter:	<b>Q<sub>i</sub></b>
Data unit:	Nm <sup>3</sup> /h
Description:	Flow rate of fuel i
Source of data to be used:	The project design does not include the firing of waste gas. Therefore no data source is used in the calculation of emission reduction due to the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	N.A.
QA/QC procedures to be applied:	N.A.
Any comment:	

#### **B.7.2. Description of the monitoring plan:**

>>

The baseline scenario of the project activity has been identified in accordance with ACM0004 as to continue import the equivalent amount of electricity from Central China Power Grid. Therefore, the monitoring plan was designed as required by ACM0004.

#### **(1) Guideline**



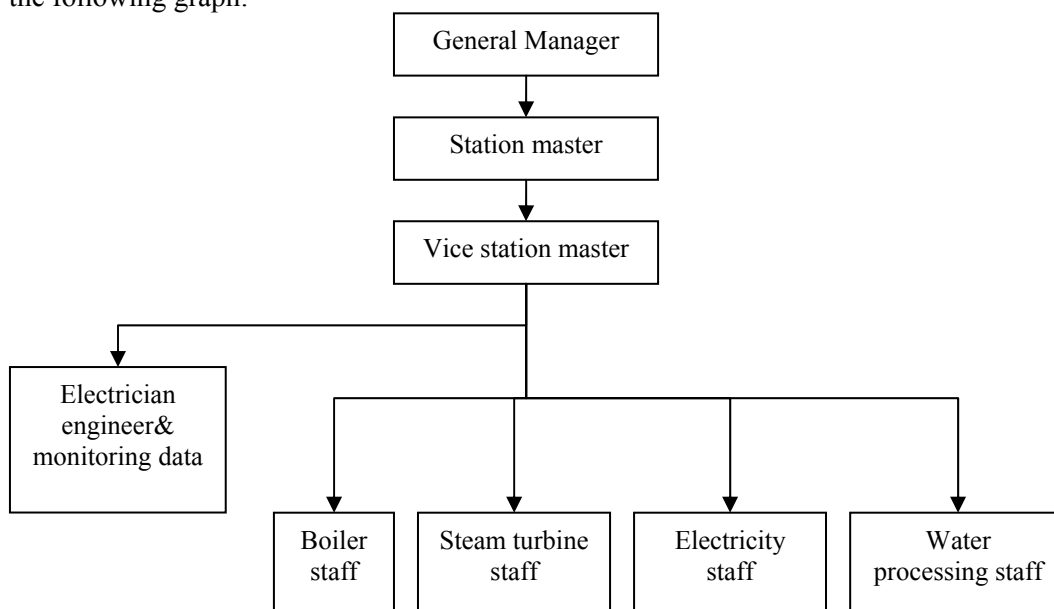
Monitoring plan is a guide on the arrangement of monitoring tasks and schedules. Monitoring personnel should carry out monitoring activities in accordance with the monitoring plan and ensure effective monitoring. The monitoring plan should ensure that monitoring information is real and measurable so as to provide DOE with real, reliable and transparent emission reduction calculation data. The monitoring planning should also ensure that the emission reductions are real and solid to CERs buyers.

The project activity will replace part of the power supplies from power sources burning fossil fuels, thereby leading to significant reduction of GHGs emissions. Baseline emission factor of Central China Power Grid was calculated ex-ante and needn't to be updated ex-post. Therefore, the net power supply from the project activity is the key parameter in monitoring.

Zhumadian Yulong Tongli Cement Co., Ltd. is the owner of the project activity and is also responsible for the implementation of the project activity. The present monitoring plan is to be followed throughout the monitoring process, and should be modified according to practical situation and the requirement from DOE in order to ensure that the monitoring of GHGs emission reduction is reliable, transparent, and conservative.

## (2) Management structure

The power station will set up a complete data management system, and the structure is demonstrated in the following graph:



## (3) Monitoring

The project entity and CDM developer should jointly implement monitoring plan to ensure the measuring accuracy of the electricity generated by the project activity. The electricity generated by the project activity can be monitored either by the kilowatt meters installed in the transformer station, which is connected to the grid, or by the DCS system in the power captive station. The monitoring data statistician will daily record the electricity generated and electricity consumed by the power station itself according to the monitoring plan. These data will be checked weekly by the vice power station master. The monitoring report will be submitted to the power station master monthly, and it will be verified and kept by the power station master.

On the basis of the required parameters to be monitored as described in the ACM0004 methodology are determined as follows:

$EG_{GEN}$  : Total electricity generated by the project activity.



Meter M4 records total electricity generation on a continuous basis.

$$EG_{GEN} = M3$$

$EG_{AUX}$  : Auxiliary electricity consumed by the project activity

Meter M2x records auxiliary electricity on a continuous basis.

$$EG_{AUX} = \sum_x M2x$$

$EG_y$  : Net quantity of electricity supplied to the cement work by the project.

Net supply of electricity is calculated as:

$$EG_y = EG_{GEN} - EG_{AUX}$$

The project entity meters the power generated, auxiliary consumption of equipment, net power supply to the internal grid by the project activity and auxiliary power consumption of a start-up device, as indicated in Figure 7.2.1. The details of each meter, i.e. recording frequency, calibration, data reporting and accuracy are provided in table 7.2.1.

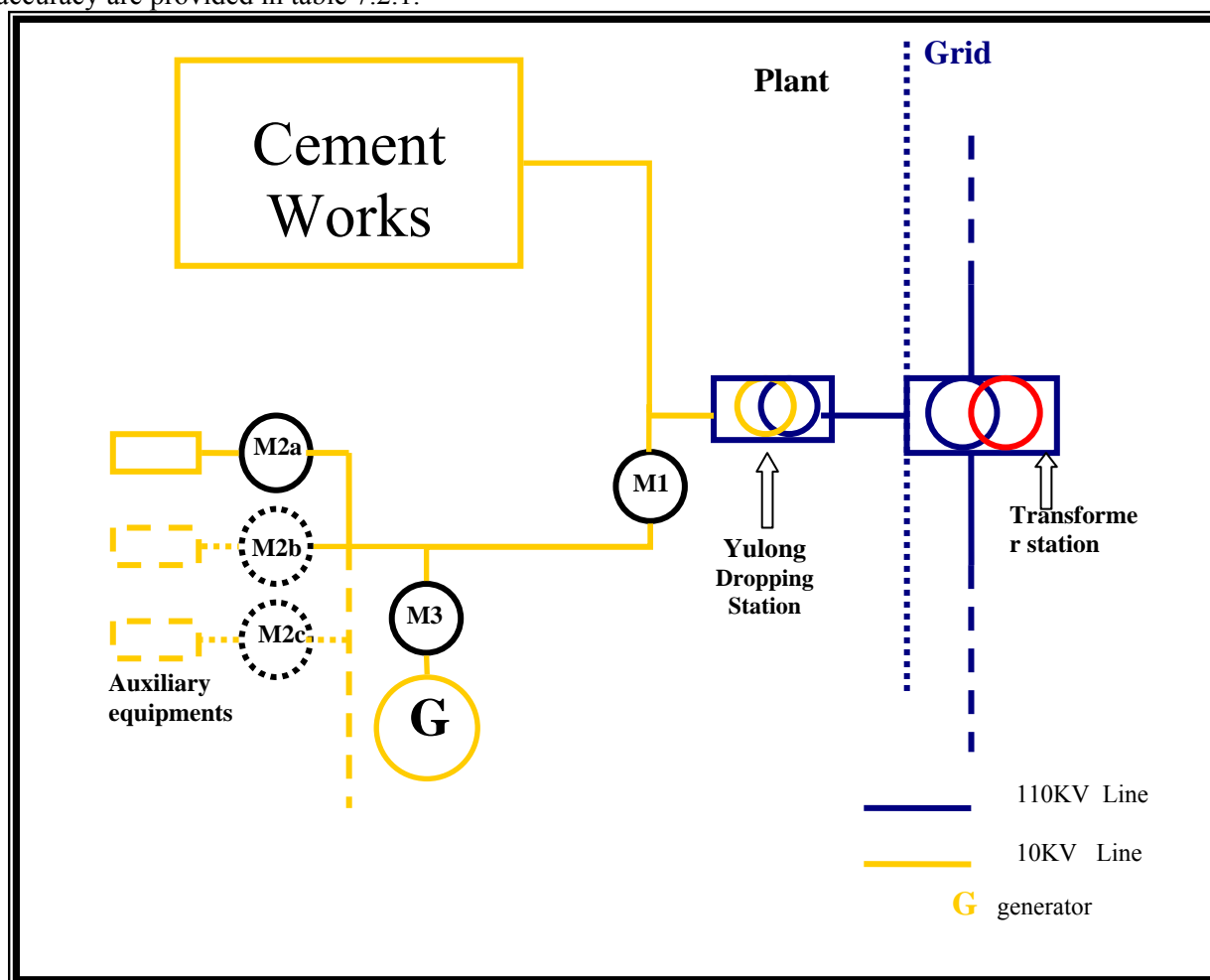


Figure 7.2.1. Simplified electrical diagram

#### (4) Calibration

Calibration will be carried out according the National standard (JJG596-1999) by an independent and authoritative organization, Zhumadian Power Supply Bureau after which the meters are sealed. The frequency of the calibration will be once a year at least, and the accuracy will be 0.5.



The meters are maintained by the project entity according to the national standard (DL/T447-2000 version). The relevant instruments should be calibrated, repaired and replaced if the reading error of instruments exceeds the permitted error range. And meter inspections are carried out with all parties to the meter reading being present to witness the reading,

**(5) Recording and preservation of relevant data**

The monitoring data will be daily recorded, and then saved in the video disc. The writing of monitoring data must be standard and can not be optionally altered. If the monitoring data assuredly need be corrected, it will be modified after being approved by the vice power station master. The person who modified the monitoring data must make a signature in the place where monitoring data will be modified. In reference column, the reason why the monitoring data are modified and modifying data will be written, and the signature also will be made.

The authenticity, veracity, timeliness and standardization of the monitoring data should be checked by the vice power station master. If something wrong is found, it will be corrected immediately. Based on daily monitoring report, the menstrual monitoring report will be formed. And it will be submitted to the power station master, who will verify this menstrual monitoring report.

All monitoring data will be preserved throughout the whole 10 years crediting period and the following two years. Necessary back-up of monitoring data will be done at regular intervals.

**(6) Quality control system for monitoring data**

Once the reading error of instruments exceeds the permitted error range or the instrument is found to be malfunctioning, the project entity should inform the local Power Supply Bureau, and the following action should be taken under the local Power Supply Bureau: (1) the measurement data of the meter that need be repaired, calibrated or replaced should be copied; (2) the project entity was responsible for examining for the meters, and the local bureau of quality and technical supervision was responsible for detection, calibration and lead sealing of the meters.

Under normal condition, the project entity was responsible for operation and maintenance of the meters in the WHR captive power stations.



Table 7.2.1 Details of the electricity monitoring instruments

<b>Meter</b>	<b>Electronic recording</b>	<b>Manual recording</b>	<b>Reporting</b>	<b>Calibration</b>	<b>Accuracy</b>	<b>Documentation</b>
M1	Hourly	daily	Monthly	Power Supply Bureau	Accuracy Class 0.5	Print out of electronic record, paper log
M2x	Hourly	daily	Monthly	Power Supply Bureau	Accuracy Class 0.5	Print out of electronic record, paper log
M3	Hourly	daily	Monthly	Power Supply Bureau	Accuracy Class 0.5	Print out of electronic record, paper log

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

&gt;&gt;

Date of completing the final draft of this baseline section:

11/05/2007

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

CHEN Ximing

Tel:

+86-21-64394196

Fax:

+86-21-64394170

E-mail:

cdm009@163.com

Organization: Shanghai Chuanji Investment Management Co., Ltd.

Shanghai Chuanji Investment Management Co., Ltd. is not the project participant.

**SECTION C: Duration of the project activity / Crediting period****C.1. Duration of the project activity:****C.1.1. Starting date of the project activity:**

&gt;&gt;

20/11/2006

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

&gt;&gt;

The expected operational life of the project activity is to exceed 15 years.

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

&gt;&gt;

The project uses fixed crediting period.

**C.2.1. Renewable crediting period**

&gt;&gt;

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

&gt;&gt;

**C.2.1.2. Length of the first crediting period:**

&gt;&gt;

**C.2.2. Fixed crediting period:**

&gt;&gt;

**C.2.2.1. Starting date:**

&gt;&gt;

01/05/2008 or the date after registration

**C.2.2.2. Length:**

&gt;&gt;

10 years.

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

&gt;&gt;

The project activity has undergone and passed full Environmental Impact Assessments (EIA) in line with all the requirements of the Chinese Government in May, 2006 by Zhumadian Environmental Protection Bureau.

By displacing electricity from Central China Power Grid, the project activity will reduce GHGs emissions related to firing of fossil fuels in the power plants supplying to the grid, which include carbon dioxide, sulphur oxides, nitrogen oxides etc. It will also help conserve the natural resource-coal/natural gas etc. These will greatly contribute to the regional and global benefits.

Considering the environmental impacts associated with such a project activity, the project entity had considered the following environmental impacts, and proper measures have been adopted to mitigate those impacts.

**1) Impact on Air Environment**

The project activity will have no negative impact except positive impact on the ambient air quality of the project activity. The WHR boilers will catch a large portion of the fine dust particles originally directly discharged into the air by the cement production line. This will undoubtedly contribute to the well-being of ambient air quality.

The project entity imports electricity from CCPG in the absence of the project activity. After the implementation of the project activity, part of the power demands from the project entity will be met by the WHR power station which burns no fossil fuels and generate no GHGs emissions, thereby reducing GHGs emissions of CCPG. And it is also expected to reduce the SO<sub>2</sub> and NO<sub>x</sub> emissions in CCPG after implementation of the project activity.

**2) Thermal Pollution**

Thermal pollution is serious in cement plant because a great amount of heat will be vented to the atmosphere without utilization. In cement plant, more than 35% of the heat used in clinker calcination process is discharged as waste heat to the surroundings without utilization. The project activity will utilize the waste heat for power generation, thereby reducing effects of thermal pollution which will benefit the staffs in the workplace.

**3) Impact on Acoustical Environment**

The noise will be produced from steam turbine generator and WHR boilers. The noise will be kept below the permissible level by taking proper measures. Noise from the WHR boilers will be reduced by equipping silencers. The steam turbine generator will be installed in the closed room with sound insulation. The trees will be planted near the workshop for the sake of noise abatement. Damping measures will be adopted to protect workers who are in charge of operation and management, and noise absorbing facilities to minimize noise pollutions will be furnished.

**4) Impact on Water Environment**

There is no poisonous and harmful substance in wastewater generated from the project activity. The wastewater will be discharged to the drainage system after treated up to the effluent standard. Thus, the project activity has no obvious impact on the water environment.

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

&gt;&gt;

As discussed above, the environmental impacts of the project activity are considered to be positive.

**SECTION E. Stakeholders' comments**

&gt;&gt;

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

&gt;&gt;

Since May, 2006, the project entity solicited the opinions of the major shareholders and presented the plan and later on the feasibility study of the project activity to relevant authorities, research institutes and governing bodies. As a result, two open conferences were held in June 2006 and March 2007 respectively.

- An open conference held near the project to which about 20 local residents, representatives from the company attended. The results of this conference was posted in announcement board, and provided an opportunity to post comments by e-mail or by telephone.
- Discussions with the representatives and experts from local authorities.
- A survey was carried out through distributing and collecting responses to a questionnaire in the workers and the local residents (113 questionnaires returned out of 120). — see Exhibit2.

The questionnaire includes the following questions:

1. What is your opinion of the project activity's impact on local economy?
2. What is your opinion about the impact to the environment?
3. What is your advice on construction of project activity and environmental protection?
4. What is your attitude about construction of this project activity?
5. What is the effect of CDM on construction of the project activity?

**E.2. Summary of the comments received:**

&gt;&gt;

**Comments received at experts' consultation conference:**

- All the representatives and experts were supportive to the project.
- All entities involved are convinced that the project activity is eco-friendly and will undoubtedly improve the energy efficiency of the cement plants.
- The investment in the project activity far exceeds the construction a coal-based captive power plant. The project entity should take effectively measures to lower down the investment risks.
- The project activity is not a common practice in Henan Province, and is extremely different from what the project entity's major business scope - cement production. The unfamiliar technology may bring some unexpected risks.

**Comments received at the meeting of local residents and representatives from the company**

- The environmental impacts of the project, such as air, acoustical and water environment.

**Comments received from the survey**

- All of the surveyed people were supportive to the project activity, and what they mainly concerned were the impacts on water resource and local environment.

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

&gt;&gt;

The project entity has carried out relevant measures to solve the concerns of the stakeholders whom were interviewed during the investigation for the project activity as following:

1. If the project activity implements as a CDM project activity, the project entity will get carbon credits from the transaction in international market. The revenues from the carbon credits will offset the high



primary investment and mitigate the high investment risk.

2. The project entity has planned to invite some senior engineers to manage the power station and provide necessary trainings to the workers in the WHR captive power plant. In this way, the risks associated with the unfamiliar technology in the project activity will be mitigated.

3. The project activity will have no negative impact except positive impact on the ambient air quality of the project activity. The noise will be kept below the permissible level by building a sound insulation wall. The wastewater will be discharged to the drainage system after treated up to the effluent standard.

**Exhibit: Photos of the survey**



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

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Represented by:	Zhu Baiming
Title:	Accountant
Salutation:	Mr.
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Represented by:	Niels von Zweigbergk
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Salutation:	
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**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

No public funding from any Annex I parties are involved in the project activity.

**Annex 3****BASELINE INFORMATION**1. Calculation of *OM* emission factor

Table 3-1 Annual electricity generation of Central China Power Grid of 2001-2004

No.	Year	Electricity generation/GWh			Percentage of hydropower /%
		Total Power	Thermal power	Hydropower	
1	2001	281,711	178,156	103,554	36.76
2	2002	312,788	200,347	112,440	35.95
3	2003	367,289	240,839	126,448	34.43
4	2004	440,665	270,846	169,094	38.37
5	2005	496,430	304,825	191,548	38.56
China Electric Power Yearbook 2002 page. 625 China Electric Power Yearbook 2003 page. 593 China Electric Power Yearbook 2004 page. 709 China Electric Power Yearbook 2005 page. 485 China Electric Power Yearbook 2006 page. 572					



Table 3-2 Operation Margin of Central China Power Grid in 2003

Fuel type	unit	Provinces and city cover by Central China Power Grid							Carbon Emission Factor (tc/TJ)	Fraction of carbon Oxidized (%)	Average Low Calorific Value (MJ/t,km <sup>3</sup> )	CO <sub>2</sub> Emissions tCO <sub>2</sub> e
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total				
		A	B	C	D	E	F	G=A+B+C+D+E+ F	H	I	J	K=G×H×I×J×44/ 2
Raw Coal	10 <sup>4</sup> t	1427.4	5504.9	2072.44	1646.47	769.47	2430.93	<b>13851.66</b>	25.8	100	20908	273971539.89
Cleaned Coal	10 <sup>4</sup> t							<b>0</b>	25.8	100	26344	0.00
Other ished coal	10 <sup>4</sup> t	2.03	39.63			106.12		<b>147.78</b>	25.8	100	8363	1169146.40
Coke	10 <sup>4</sup> t				1.22			<b>1.22</b>	29.2	100	28435	37142.18
Coke Oven Gas	10 <sup>8</sup> m <sup>3</sup>			0.93				<b>0.93</b>	12.1	100	16726	69013.15
Other Coal Gas	10 <sup>8</sup> m <sup>3</sup>							<b>0</b>	12.1	100	5227	0.00
Crude Oil	10 <sup>4</sup> t		0.5	0.24			1.2	<b>1.94</b>	20	100	41816	59490.23
Gasoline	10 <sup>4</sup> t							<b>0</b>	18.9	100	43070	0.00
Diesel	10 <sup>4</sup> t	0.52	2.54	0.69	1.21	0.77		<b>5.73</b>	20.2	100	42652	181015.94
Fuel Oil	10 <sup>4</sup> t	0.42	0.25	2.17	0.54	0.28	1.2	<b>4.86</b>	21.1	100	41816	157229.00
PLG	10 <sup>4</sup> t							<b>0</b>	17.2	100	50179	0.00
Refinery Gas	10 <sup>4</sup> t	1.76	6.53		0.66			<b>8.95</b>	15.7	100	46055	237285.34
Natural Gas	10 <sup>8</sup> m <sup>3</sup>					0.04	2.2	<b>2.24</b>	15.3	100	38931	489222.52
Other Petroleum products	10 <sup>4</sup> t							<b>0</b>	20	100	38369	0.00
Other Coking Products	10 <sup>4</sup> t							<b>0</b>	25.8	100	28435	0.00
Other Energy	10 <sup>4</sup> t		11.04			16.2		<b>27.24</b>	0	100	0	0.00
<b>Total</b>												<b>276,371,084.63</b>
Thermal power enerated	10 <sup>9</sup> KWh	271.65	955.18	395.32	295.01	163.41	327.82					
Station service power consumption rate	%	6.43	7.68	3.81	4.58	8.97	4.41					
Thermal power supply	10 <sup>9</sup> KW h	254.18	881.8 2	380.25	281.49	148.75	313.36	2259.88				

OM of Central China Power Grid in 2003(tCO<sub>2</sub>e/MWh)= 1.222947

Table 3-3 Operation Margin of Central China Power Grid in 2004

Fuel type	unit	Provinces and city cover by Central China Power Grid							Carbon Emission Factor (tc/TJ)	Fraction of carbon Oxidized (%)	Average Low Calorific Value (MJ/t,km <sup>3</sup> )	CO <sub>2</sub> Emissions tCO <sub>2</sub> e
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total				
		A	B	C	D	E	F	G=A+B+C+D+E+ F				
Raw Coal	10 <sup>4</sup> t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	<b>17144.1</b>	25.8	100	20908	339092605.29
Cleaned Coal	10 <sup>4</sup> t		2.34					<b>2.34</b>	25.8	100	26344	58316.13
Other ished coal	10 <sup>4</sup> t	48.93	104.22			89.72		<b>242.87</b>	25.8	100	8363	1921441.23
Coke	10 <sup>4</sup> t		109.61					<b>109.61</b>	29.2	100	28435	3337011.41
Coke Oven Gas	10 <sup>8</sup> m <sup>3</sup>			1.68		0.34		<b>2.02</b>	12.1	100	16726	149899.53
Other Coal Gas	10 <sup>8</sup> m <sup>3</sup>					2.61		<b>2.61</b>	12.1	100	5227	60527.09
Crude Oil	10 <sup>4</sup> t		0.86	0.22				<b>1.08</b>	20	100	41816	33118.27
Gasoline	10 <sup>4</sup> t		0.06			0.01		<b>0.07</b>	18.9	100	43070	2089.33
Diesel	10 <sup>4</sup> t	0.02	3.86	1.7	1.72	1.14		<b>8.44</b>	20.2	100	42652	266627.32
Fuel Oil	10 <sup>4</sup> t	1.09	0.19	9.55	1.38	0.48	1.68	<b>14.37</b>	21.1	100	41816	464893.14
PLG	10 <sup>4</sup> t							<b>0</b>	17.2	100	50179	0.00
Refinery Gas	10 <sup>4</sup> t	3.52	2.27					<b>5.79</b>	15.7	100	46055	153506.38
Natural Gas	10 <sup>8</sup> m <sup>3</sup>						2.27	<b>2.27</b>	15.3	100	38931	495774.61
Other Petroleum products	10 <sup>4</sup> t							<b>0</b>	20	100	38369	0.00
Other Coking Products	10 <sup>4</sup> t							<b>0</b>	25.8	100	28435	0.00
Other Energy	10 <sup>4</sup> t		16.92		15.2	20.95		<b>53.07</b>	0	100	0	0.00
Total												<b>346,035,809.73</b>
Thermal power enerated	10 <sup>9</sup> KW <sub>h</sub>	301.27	1093.5 <sub>2</sub>	430.34	371.86	165.2	346.27					
Station service power consumption rate	%	7.04	8.19	6.58	7.47	11.06	9.41					
Thermal power supply	10 <sup>9</sup> KW <sub>h</sub>	280.06	1003.9 <sub>6</sub>	402.02	344.08	146.93	313.69	2490.74				

OM of Central China Power Grid in 2003(tCO<sub>2</sub>e/MWh)= 1.389288



Table 3-4 Operation Margin of Central China Power Grid in 2005

Fuel type	unit	Provinces and city cover by Central China Power Grid							Carbon Emission Factor (tc/TJ)	Fraction of carbon Oxidized (%)	Average Low Calorific Value (MJ/t,km³)	CO₂ Emissions tCO₂e
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total				
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G×H×I×J×44/12
Raw Coal	10⁴t	1869.29	7638.9	2732.15	1712.27	875.4	2999.77	<b>17827.75</b>	25.8	100	20908	352614496.76
Cleaned Coal	10⁴t	0.02						<b>0.02</b>	25.8	100	26344	498.43
Other ished coal	10⁴t		138.12			89.99		<b>228.11</b>	25.8	100	8363	1804669.00
Coke	10⁴t		25.95		105			<b>130.95</b>	29.2	100	28435	3986695.05
Coke Oven Gas	10⁸m³			1.15		0.36		<b>1.51</b>	12.1	100	16726	112053.61
Other Coal Gas	10⁸m³		10.2			3.12		<b>13.32</b>	12.1	100	5227	308896.88
Crude Oil	10⁴t		0.82	0.36				<b>1.18</b>	20	100	41816	36184.78
Gasoline	10⁴t		0.02			0.02		<b>0.04</b>	18.9	100	43070	1193.90
Diesel	10⁴t	1.3	3.03	2.39	1.39	1.38		<b>9.49</b>	20.2	100	42652	299797.78
Fuel Oil	10⁴t	0.64	0.29	3.15	1.68	0.89	2.22	<b>8.87</b>	21.1	100	41816	286959.09
PLG	10⁴t							<b>0</b>	17.2	100	50179	0.00
Refinery Gas	10⁴t	0.71	3.41	1.76	0.78			<b>6.66</b>	15.7	100	46055	176572.11
Natural Gas	10⁸m³						3	<b>3</b>	15.3	100	38931	655208.73
Other Petroleum products	10⁴t							<b>0</b>	20	100	38369	0.00
Other Coking Products	10⁴t				1.5			<b>1.5</b>	25.8	100	28435	40349.27
Other Energy	10⁴t		2.88		1.74	32.8		<b>37.42</b>	0	100	0	0.00
<b>Total</b>												<b>360,323,575.39</b>
Thermal power enerated	10⁹KW h	300	1315.9	477	399	175.84	372.02					
Station service power consumption rate	%	6.48	7.32	2.51	5.00	8.05	4.27					
Thermal power supply	10⁹KW h	280.56	1219.57	465.03	379.05	161.68	356.13	2862.03				

OM of Central China Power Grid in 2003(tCO₂e/MWh)= 1.258978



Table 3-5 Weighted average Operation Margin emission factor

Year	$EF_{OM, simple, y}$ (tCO <sub>2</sub> e/MWh)	$GEN_y$ (MWh)	CO <sub>2</sub> emission (tCO <sub>2</sub> e)
2003	1.222947	225,987,719	276,371,085
2004	1.389288	249,074,186	346,035,810
2005	1.258978	286,203,305	360,323,575
Total		761,265,210	982,730,470
Weighted average OM of Central China Power Grid 2003-2005			1.2909

2. Calculation of  $BM$  emission factorTable 3-6  $EF_{Coal, Adv}$ ,  $EF_{Coal, Adv}$  and  $EF_{Oil Adv}$ 

	parameter	Efficient	Carbon Emission factor (tc/TJ)	Oxidation	Emission factor tCO <sub>2</sub> /MWh
		A	B	C	$D=3.6/A/1000 \times B \times C \times 44/12$
Coal-fired power plant	$EF_{Coal, Adv}$	35.82%	25.8	1	0.9508
Gas-fired power plant	$EF_{Gas Adv}$	47.67%	15.3	1	0.4237
Oil-fired power plant	$EF_{Oil Adv}$	47.67%	21.1	1	0.5843

Table 3-7 Calculation of  $\lambda_{Coal}$ ,  $\lambda_{Oil}$  and  $\lambda_{Gas}$ 

		Hennan	Hubei	Hunan	Jiangxi	Chongqing	Sichuan	Total	Carbon emission factor	Calorific Value	Oxidation	Emissions
Fuel type	unit	A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J*44/12
Raw Coal	10 <sup>4</sup> t	7638.87	2732.15	1712.27	1869.29	875.4	2999.77	17827.75	25.8	100%	209	352,614,497
Clean Coal	10 <sup>4</sup> t	0	0	0	0.02	0	0	0.02	25.8	100%	263	498
Other Washed Coal	10 <sup>4</sup> t	138.12	0	0	0	89.99	0	228.11	25.8	100%	83.63	1,804,669
Coke	10 <sup>4</sup> t	25.95	0	106.5	0	0	0	132.45	29.2	100%	284.35	4,032,362
<b>Sub-total</b>												<b>358,452,026</b>
Crude Oil	10 <sup>4</sup> t	0.82	0.36	0	0	0	0	1.18	20	100%	418.16	36,185
Gasoline	10 <sup>4</sup> t	0.02	0	0	0	0.02	0	0.04	18.9	100%	430.7	1,194
Kerosene	10 <sup>4</sup> t	0	0	0	0	0	0	0	19.6	100%	430.7	0
Diesel	10 <sup>4</sup> t	3.03	2.39	1.39	1.3	1.38	0	9.49	20.2	100%	426.52	299,798
Fuel Oil	10 <sup>4</sup> t	0.29	3.15	1.68	0.64	0.89	2.22	8.87	21.1	100%	418.16	286,959
Other Petroleum Products	10 <sup>4</sup> t	0	0	0	0	0	0	0	20	100%	383.69	0
<b>Sub-total</b>												<b>624,136</b>
Natural gas	10 <sup>8</sup> m <sup>3</sup>	0	0	0	0	0	3	3	15.3	100%	389.31	655,209
Coke Gas	10 <sup>8</sup> m <sup>3</sup>	0	1.15	0	0	0.36	0	1.51	12.1	100%	167.26	112,054
Other Gas	10 <sup>8</sup> m <sup>3</sup>	10.2	0	0	0	3.12	0	13.32	12.1	100%	52.27	308,897
PLG	10 <sup>4</sup> t	0	0	0	0	0	0	0	17.2	100%	50179	0
Refinery Gas	10 <sup>4</sup> t	3.41	1.76	0.78	0.71	0	0	6.66	15.7	100%	460.55	176,572
<b>Sub-total</b>												<b>1,252,731</b>
<b>Total</b>												<b>360,328,893</b>

Data source: China Energy Statistical Yearbook 2006

As per the above data and the related formulation in the PDD:  $\lambda_{Coal}=99.48$   $\lambda_{Oil}=0.17\%$ ,  $\lambda_{Gas}=0.35\%$ .

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal, Adv} + \lambda_{Oil} \times EF_{Oil, Adv} + \lambda_{Gas} \times EF_{Gas, Adv} = 0.9483$$





Table 3-8 Installed capacity of Central China Power Grid in 2002, 2003 and 2005

Years	Source Grid	Thermal power (10 <sup>4</sup> kW)	Hydropower (10 <sup>4</sup> kW)	Total (10 <sup>4</sup> kW)	Sources
2002	Jiangxi	512.88	219.74	732.62	China Electric Power Yearbook 2003, page 593
	Henan	1590.45	243.8	1834.25	
	Hubei	814.78	721.39	1536.17	
	Hunan	497.56	613.53	1111.09	
	Chongqing	300.45	119.55	420	
	Sichuan	614.2	1185.46	1799.66	
	Total	4330.32	3103.47	7433.79	
2003	Jiangxi	540.78	230.74	771.52	China Electric Power Yearbook 2004, page 709
	Henan	1763.55	243.8	2007.35	
	Hubei	817.33	1153.72	1971.05	
	Hunan	644.67	660.31	1304.99	
	Chongqing	312.62	132.98	445.6	
	Sichuan	610.4	1234.15	1844.54	
	Total	4689.35	3655.7	8345.05	
2005	Jiangxi	590.6	301.9	892.5	China Electric Power Yearbook 2006, page 571
	Henan	2626.78	253.99	2880.77	
	Hubei	952.63	808.89	1761.52	
	Hunan	721.16	790.51	1511.68	
	Chongqing	375.95	189.27	567.62	
	Sichuan	749.6	1495.96	2245.56	
	Total	6016.72	3840.52	9859.65	

Table 3-9 Increased installed capacity in Central China Power Grid from 2002 to 2005

	2002	2003	2005
Hydro Plants (MW)	31034.7	36557	38405.2
Thermal Plants (MW)	43303.2	46893.5	60167.2
Total of installed capacity (MW)	74337.9	83450.5	99695.5
Percentage of installed capacity (%)	25.44	16.29	
Fraction of newly increased thermal Plants (%)	69.52		
China Electric Power Yearbook 2003 page. 593			
China Electric Power Yearbook 2004 page. 709			
China Electric Power Yearbook 2006 page. 571			

Table 3-10 *BM* emission factor

Emission factor of thermal power (tCO <sub>2</sub> e/MWh)	Increased percentages of thermal power %	BM emission factor (tCO <sub>2</sub> e/MWh)
0.9483	69.52	0.6593

Table 3-11 Calculation of CM emission factor

OM (tCO <sub>2</sub> e/MWh)	BM (tCO <sub>2</sub> e/MWh)	CM (tCO <sub>2</sub> e/MWh)
A	B	$C=A \times 0.5 + B \times 0.5$
1.2909	0.6593	0.9751



**Annex 4**

**MONITORING INFORMATION**

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The information of monitoring is in chapter B.7.2.