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

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

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

Title: Tianjin Zhenxing Cement Waste Heat Recovery for Power Generation Project
Version: 02
Date: 04/06/2009

Version	Date	Description
1	14/05/2008	Draft for GSP
2	04/06/2009	Revised in response to the DOE's request

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

The Tianjin Zhenxing Cement Waste Heat Recovery for Power Generation Project (hereinafter referred to as *the project*) is located in Beichen Economic Development Area, Tianjin City, and is invested and operated by Tianjin Zhenxing Cement Co., Ltd (hereinafter referred to as *the project owner*), which possesses two 2,000 t/d cement clinker production lines with total designed capacity of 1,460,000 tons of clinker annually. Currently, all the power demand of the project owner is satisfied by the North China Power Grid (Hereinafter referred to *NCPG*), and the waste heat generated in calcination process is not utilized but directly vented into the atmosphere.

The project will recover and utilize the waste heat of the exit gases from Air Quenching Coolers (AQC) and Suspension Pre-heaters (SP) of two 2,000 t/d clinker production lines for power generation. The waste heat based power plant consists of two 4.5 MW steam turbines and generators, 2 AQC boilers, and 2 SP boilers. The installed capacity of the power plant is 2×4.5 MW, and the annual net power generation is 52,974 MWh once the project is put into operation. The generated electricity is expected to meet 25~30% of the project owner's total power demand.

According to *China Electric Power Yearbook*, power generated from thermal power plants connected to the NCPG has constituted approximately 99% of its total generation in the last 5 years (see Table B.1). Thus, the project will achieve emission reductions by supplying zero-emission electricity to the NCPG which is currently dominated by thermal power. The net electricity generated by the project will displace the equivalent amount of grid power, and greenhouse gas (GHG) emissions will consequently be reduced. The annual emission reductions of the project are expected to be 54,575 tCO_2e.

The project would considerably contribute to sustainable development of the local areas. Various environmental and social benefits associated with the project activity include:

1. Increasing power supply and promoting development of the local economy;
2. Reducing the power grid's reliance on fossil fuel based power sources and the emissions of CO_2 by supplying zero-emission energy to the grid;
3. Reducing emissions of SO_2 and NO_x by displacing electricity from thermal power plants;
4. Providing job opportunities (several permanent staff positions during operation);
5. Improving the energy efficiency of cement production, and thus contributing to construct an environment-friendly society.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be in indicated using the following tabular format.		
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)	Tianjin Zhenxing Cement Co., Ltd	No
The United Kingdom of Great Britain and Northern Ireland	Arreon Carbon UK Ltd	No
The United Kingdom of Great Britain and Northern Ireland	Credit Suisse International	No

For more detailed contact information on participants in the project activities, please refer to 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.:

Tianjin City

A.4.1.3. City/Town/Community etc:

Shuangjie Town, Beichen District

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

The project is supposed to be implemented in Beichen Economic Development Area which is located in northern metro area of Tianjin City, P. R. China. The longitude and latitude of the project site is 117º07′33"E, 39º16′41"N. The GPS coordinates are taken in the generator room of the project. The project site is 2 km away from the Outer Ring Road, and 19 km away from the Yixingbu Exit of Jing-Jin-Tang Highway.

The geographical location of the project is detailed in the maps below:


Tianjin
City
Heilongjiang
Jilin
Liaoning
BEIJING
Tianjin
Xinjiang
Gansu
Inner Mongolia
Hebei
Ningxia
Qinghai
Shanxi
Shandong
Shaanxi
Henan
Jiangsu
Tibet
Shanghai
Sichuan
Hubei
Anhui
Zhejiang
Chongqing
Jiangxi
Hunan
Guizhou
Fujian
Yunnan
Guangxi
Taiwan
Guangdong
Hong Kong
Islands of
South China Sea
Hainan
Islands of South China Sea

Figure A.1. Geographical location of the project in China and Tianjin City

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

1. Type and category(ies) of the small-scale project activity

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. According to categorization of Appendix B to the simplified modalities and procedures for small-scale CDM modalities, the project type and category are defined as follows:

Type: III - Other project activities;
Category: III.Q - Waste gas based energy systems

2. Technology employed in the project activity

The proposed project adopts low-temperature waste heat recovery for power generation technology. The waste heat recovering and power generating system consists of 2 AQC boilers, 2 SP boilers, and two condensing steam turbo-generator sets. All boilers are made by Nantong Wanda Boiler Co., Ltd. The condensing steam turbines and the generators are made by Hangzhou CHINEN Steam Turbine Power Co., Ltd. All equipment is made in China, and thus there is no technology transfer involved in this project.

Table A.1 Equipments Employed by the Project Activity

No.	Equipment	Amount	Technical Parameters	
1	AQC Boiler #1	1	Inlet Gas Flow Rate: Inlet Gas Temperature: Outlet Gas Temperature: Main Steam Production:	115,000 Nm^3/h 360 ºC 84 ºC 340 ºC - 1.25 MPa - 11.3 t/h
2	AQC Boiler #2	1	Inlet Gas Flow Rate: Inlet Gas Temperature: Outlet Gas Temperature: Main Steam Production:	95000 Nm^3/h 360 ºC 77 ºC 340 ºC - 1.25 MPa - 8.4 t/h
3	SP Boiler #1	1	Inlet Gas Flow Rate: Inlet Gas Temperature: Outlet Gas Temperature: Steam Production:	151010 Nm^3/h 320 ºC 224 ºC 300 ºC - 1.25 MPa - 9.5 t/h
4	SP Boiler #2	1	Inlet Gas Flow Rate: Inlet Gas Temperature: Outlet Gas Temperature: Steam Production:	156400 Nm^3/h 344 ºC 225 ºC 320 ºC - 1.25 MPa - 12.2 t/h
5	Condensing Steam Turbine	2	Type: Rated Capacity: Rated Speed: Main Steam:	BN4.5 - 1.25 4.5 MW 3000 r/min 320 ºC - 1.25 MPa
6	Generator	2	Type: Rated Capacity: Rated Speed: Outlet Voltage：	QF4.5 - 2 4.5 MW 3000 r/min 6.3 kV

The operational lifetime of the main equipment is estimated to be 30 years.

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

A renewable crediting period of 7×3 years is chosen for this project. During the first 7-year crediting period, the average annual emission reductions will be 54,575 tCO_2e, accumulating to a total emission reductions of 382,025 tCO_2e. The first crediting period is expected to start on September 1st, 2009.

Years	Annual estimation of emission reductions in tonnes of CO_2e
2009 (September - December)	18,193
2010	54,575
2011	54,575
2012	54,575
2013	54,575
2014	54,575
2015	54,575
2016 (January - August)	36,386
Total estimated reductions (tonnes of CO_2e)	382,025
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	54,575

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

No public funding from parties included in Annex I is available to the project activity.

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

According to paragraph 2 of Appendix C to the simplified modalities and procedures for small-scale CDM project activities, a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants;
- In the same project category and technology;
- Registered within the previous two years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity.

The project participants confirm that none of the above mentioned conditions is applicable to this project activity. The project proponents further confirm that they have not registered any small-scale CDM activity or applied to register another small-scale CDM project activity within the same project boundary, in the same project category and technology/measure.

SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline and monitoring methodology applied in the proposed project activity is AMS-III.Q, "Waste gas based energy systems" (version 01, EB35, 2007).

Methodology AMS-III.Q also refers to:

1. "Appendix B of the simplified modalities and procedures for small-scale CDM project activities" (version 07, November 2005),
http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf

2. Methodology AMS-I.C, "Thermal energy for the user with or without electricity" (version 13, 2008),
http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_YL0327DQSKVFXYQREWRT3VNR58402G

3. Methodology AMS-I.D, "Grid connected renewable electricity generation" (version 13, 2007),
http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_PHPV5WESACMBTJ2YY54GAJYSIEI3HD

4. "Tool to calculate the emission factor for an electricity system" (version 01.1, 2008), and
http://cdm.unfccc.int/Reference/tools/ls/meth_tool07_v01_1.pdf
5. "Tool to calculate project emissions from electricity consumption" (version 01, 2007).
http://cdm.unfccc.int/Reference/Guidclarif/EB32_repan10_Tool_electricity_comsuption_ver01.pdf

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

The proposed project activity is neither a renewable energy project nor an energy efficiency improvement project. Instead, it is to utilize waste heat at existing facilities as an energy source for generation of electricity, and the recovery of waste heat is a new initiative in an existing practice. As a result, the project type and category is type III - Other project activities and Category III.Q - Waste gas based energy systems. The annual emission reductions achieved by the proposed project are estimated to be 54,575 tCO_2e and capped at no more than 60,000 tCO_2 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.

In addition, the proposed project meets all applicability conditions of methodology AMS-III.Q, as shown below:

Applicable conditions of methodology AMS-III.Q	The proposed project activity
1. The energy produced with the recovered waste gas/heat or waste pressure should be measurable.	The energy generated in the project activity will be used for power generation, and the electricity generated is measurable using electricity meters.
2. 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.	All energy generated in the project activity will be used within the cement plant by the project owner.
3. The waste gas/pressure utilized in the project activity would have been flared or released into the atmosphere in the absence of the project activity.	The waste heat utilized in the project activity was released into the atmosphere prior to the start of the project activity. And it could be proved by the process plant manufacturer's original diagram of the clinker production lines before the WHR project was implemented.

It could be concluded from above analysis, methodology AMS III.Q is applicable for the proposed project activity.

B.3. Description of the project boundary:

The spatial extent of the project boundary comprises the clinker production lines where the waste heat is generated, the waste heat based power plant, and the power plants connected physically to the NCPG. The NCPG covers Beijing, Tianjin, Shanxi, Hebei, Shandong, and Inner Mongolia.

	Source	**Gas**	**Included or not?**	**Justification / Explanation**
Baseline	Grid electricity generation from the NCPG	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	Supplemental fossil fuel consumption at the project plant	CO_2	No	No supplemental fossil fuel is consumed in the project activity.
		CH_4	No	No supplemental fossil fuel is consumed in the project activity.
		N_2O	No	No supplemental fossil fuel is consumed in the project activity.
	Supplemental electricity consumption	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

B.4. Description of baseline and its development:

For the use of waste heat, the realistic and credible alternatives include:

W1: Waste gas is directly vented to atmosphere without incineration.	It is not applicable since no waste gas is involved in the project activity.
W2: Waste heat is released to the atmosphere.	It is the current practice at the cement production facilities in the project area. The waste heat to be utilized in the proposed project activity would not be used in the absence of the project activity, and would be released into the atmosphere. As a result, this is a feasible alternative.
W3: Waste heat is sold as an energy source.	It is not feasible since there are no users of heat located near the cement production facility. Therefore, transport of heat over long distances is not economical.
W4: Waste heat is used for meeting energy demand.	This is the proposed project activity not undertaken as a CDM project activity in terms of use of waste heat for power generation. As proven in section B.5, this alternative is not feasible because it will face investment barriers.

All realistic and credible alternatives for power generation include:

P1: Proposed project activity not undertaken as a CDM project activity.	As shown in section B.5, this alternative is not feasible because it will face investment barriers.
P2: On-site or off-site existing/new fossil fuel fired cogeneration plant.	It is not applicable since no heat generation is involved in the project activity.
P3: On-site or off-site existing/new renewable energy based cogeneration plant.	It is not applicable since no heat generation is involved in the project activity.
P4: On-site or off-site existing/new fossil fuel based existing captive or identified plant.	There is no on-site or off-site existing fossil fuel based existing captive or identified plant. In areas covered by major regional power grids, construction of thermal power plants with single capacity less than 135 MW is prohibited by Chinese Government[1]. As a result, this alternative does not comply with legal and regulatory requirements, and thus is not feasible.
P5: On-site or off-site existing/new renewable energy based existing captive or identified plant.	This alternative is not feasible since the project is located in urban areas where no sufficient renewable energy resources (hydro, wind, biomass) are available for establishment of a

[1] Source: General Office of the State Council (2002), Notice of the General Office of the State Council concerning the Strict Prohibition of the Construction of Thermal Power Units with a Capacity of 135MW or Below, Guo Ban Fa Ming Dian [2002] Document No.6, http://www.gov.cn/gongbao/content/2002/content_61480.htm .

	power plant.
P6: Sourced Grid-connected power plants.	This alternative is feasible as the current practice at cement production facilities in the project area.
P7: Captive Electricity generation from waste gas.	It is not applicable since no waste gas is involved in the project activity.
P8: Cogeneration from waste gas.	It is not applicable since neither waste gas nor heat generation is involved in the project activity.

As analyzed above, it could be concluded that the baseline scenario of the project activity is the combination of alternatives W1 and P4, i.e., **the continuation of current situation with the project owner continuing to import electricity from the NCPG and venting the waste heat into the atmosphere**.

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:

As per EB 41/Annex 46, the major events related to the implementation as well as the serious prior CDM consideration of the project are tabulated as follows:

Time	Project Implementation	CDM Development	Remarks
May - July, 2005	A 6 MW WHR for power generation project was approved by the local government.		The predecessor of the proposed project.
Since then …	The implementation of the project failed to start due to the financing problems the project owner faced.		
April 27th - 28th, 2006		The project owner participated in the CDM seminar for Chinese cement industry.	The awareness of CDM by the project owner.
May 9th, 2006		A General Manager's office meeting was held, in which the importance of CDM on the WHR project was confirmed.	
May 25th, 2006		The yearly meeting of the board of directors of the project owner was held, and it was determined that the CDM application of the WHR project should be started to alleviate the financing barriers the project faced.	The CDM was officially considered by the project owner.
January 9th, 2007		The CDM term sheet was signed between the project owner and the CER buyer, Arreon Carbon.	
April 2007	The feasibility study of the project was re-conducted		

Time	Project Implementation	CDM Development	Remarks
	because of the improvement in technology and equipment of WHR for power generation projects in China. As a result, the installed capacity of the proposed project was increased to 9 MW.		
May 15th, 2007	The FSR of the project was approved.		
June 18th, 2007	The EIA of the project was approved.		
June 28th, 2007		The yearly meeting of board of directors of the project owner was held, and the importance of CDM on the project was further confirmed.	The importance of CDM was officially confirmed.
August 6th, 2007	Considering the CDM potential and the positive environmental impact of the project, the China Industrial Bank agreed to offer a loan to finance the project.		The investment barrier was overcome by the CDM incentives.
September 18, 2007	The loan contract was signed between the China Industrial Bank and the project owner.		
September 2007		The application materials were submitted for approval by the Chinese DNA.	
October 23rd, 2007	Main equipment contract of the project was signed.		**The start date of the project activity as per Glossary of CDM terms.**
December 2007		The Emission Reduction Purchase Agreement of the project was signed by all project participants.	
January 18th, 2008		The LOA was issued by the Chinese DNA.	
March 10th, 2008	Construction of the project started.		
March 2008		Negotiation of the DOE validation contract started.	
March - April 2008		The LOAs were issued by the UK DNA.	
April 2008		The DOE validation contract was signed.	

Time	Project Implementation	CDM Development	Remarks
May 28th, 2008		GSP process of the project started.	
July 2nd, 2008		On-site visit by the DOE was completed.	

As seen above, both the serious CDM consideration prior to the project start date and the real and continuing actions to taken to secure the CDM status for the project in parallel with its implementation are clearly presented.

As per Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, an explanation shall be provided to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a. Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
b. Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
c. Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
d. Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The proposed project faces other barriers, specifically the limited access to financial resources, which is detailed as follows.

d. Other barriers: limited access to financial resources

Since the second clinker production line was put into operation in 2004, the Tianjin Zhenxing Cement Co., Ltd. has considered the construction of the waste heat recovery for power generation project because of its positive environmental impact and social benefit. The environmental impact assessment and the feasibility study of the project were carried out and approved by the local government[2]. However, due to the lack of funding, the project has never been initiated and has been on hold indefinitely.

The total investment of the project activity is RMB 59.54 millions of which only 35% can be raised by the project owner itself. In year 2006, the net cash flow from operation was RMB 36.79 millions and the net profit was only RMB 1.49 millions, which was far from sufficient to cover the total investment of the project. Moreover, due to the fierce competition in the cement industry in China, the project owner has been operating at low profit since it was founded and has to agree to sell its product on credit. For the project owner, the average period for collecting the payment of bills was 182 days in 2006[3]. Consequently,

[2] Jin Huanbao Xukebiao [2005]217, by Tianjin Environmental Protection Bureau, July 2005; Jinjing Jigai Touzi Xuke [2006]3, by Tianjin Economic Committee, May 2006.

[3] The Audit report on the annual financial statement of the Tianjin Zhenxing Cement Co., Ltd. in 2006, by Beijing Xinghua Accounting Firm, (2007) Jing Kuai Xing Shenzi #1-35.

the project owner was unable to finance the project independently, and the project has to be financed from other sources, e.g., banks.

However, the Chinese cement industry is on the brink of over-capacity and in danger of over-investment, as per China Banking Regulation Commission[4]. As a result, a stricter loan policy was applied for cement enterprises in China. According to the policy, a series of requirements were set forward to squeeze the loan provided to the cement enterprises. For the project owner, its loan application was declined by the Beichen Sub-branch, Tianjin Branch, China Construction Bank, which is the main bank that the project owner does business with, as well as several other banks. The declination resulted from factors such as the project owner's currently large amount of loan not repaid, poor debt/equity ratio, and inability to provide sufficient collateral.

Great barriers also exist for the project owner to raise funds in capital markets. The project owner is neither listed in domestic security markets nor in foreign security exchanges, which makes it impossible to finance the project from stocks. The project owner has no access to Chinese bond market under the current strict regulations[5]. As to industrial investment funds in China, the relevant regulations are still in a prolonged legislation process and not available to most enterprises[6].

From the above analysis it is clear that the project owner is confronted with great financial barriers both in capital markets and from banks loans. This situation will not change in the foreseeable future.

When the project owner began to learn about CDM in early 2006 they were still seeking investment solutions for the project. The additional revenues from CDM could shorten the returning period and thus increase the financial attractiveness of the project. In consideration of the CDM potential and the positive environmental impact of the project, a final agreement was reached between the project owner and the China Industrial Bank which granted a loan of RMB 30 millions to the project owner in September 2007.

As shown above, CDM did alleviate the barrier of limited access to financial resources that prevents the proposed project activity from occurring, and thus the project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline Emissions

As per paragraph 9 of methodology AMS-III.Q (version 01), "For computing the emissions in the baseline the procedure provided in paragraphs 6 to 13 of AMS I.C shall be used".

As analyzed in sections B.4 and B.5, in baseline scenario the electricity is supplied from the NCPG. Thus, as per paragraph 9 of methodology AMS-I.C (version 13), "Baseline emissions for electricity supplied from the grid shall be calculated as the amount of electricity produced with the renewable technology (GWh) multiplied by the CO_2 emission factor of that grid. The emission factor for grid electricity shall be

[4] Yin Jian Fa[2006]47, http://law.baidu.com/pages/chinalawinfo/8/17/bf8d4ad1d3fea96f01187a33c332789f_0.html

[5] http://www.smelz.gov.cn/news/57514.htm

[6] http://finance.sina.com.cn/money/fundco/20061117/06483086593.shtml

calculated as per the procedures detailed in AMS I.D.”.

In consideration of capping, as per methodology AMS-III.Q, the baseline emissions should be calculated as follows:

$$BE_y = f_{cap} * EG_{PJ,y} * EF_{grid,y} \quad (1)$$

Where:

BE_y	baseline emissions during the year y in tCO_2e
$EG_{PJ,y}$	the quantity of electricity generated in the project activity, which in the absence of the project activity would have been sourced from the NCPG during the year y in MWh.
$EF_{grid,y}$	the CO_2 emission factor for the NCPG during the year y in tCO_2/MWh
f_{cap}	Energy that would have been produced in project year y using waste gas/heat generated in base year expressed as a fraction of total energy produced using waste gas in year y. The ratio is 1 if the waste gas/heat/pressure generated in project year y is same or less then that generated in base year.

As per paragraph 9 of methodology AMS-I.D (version 13), “For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner as:

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

OR

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.”

Option (a) is taken to calculate the combined margin (CM) of the NCPG, as per the latest version of the “Tool to calculate the emission factor for an electricity system”, in the following steps:

Step 1. Identify the relevant electric power system.

As per Chinese DNA, the project electricity system is the North China Power Grid (NCPG)[7]. The NCPG covers Beijing City, Tianjin City, Shanxi Province, Shandong Province, Hebei Province, and Inner Mongolia Autonomous Region.

Additionally, electricity is imported to the NCPG from the Northeast China Power Grid (NECPG) in China. Conservatively, the CO_2 emission factor for net electricity imports from the NECPG is calculated as the weighted average operating margin emission rate of the NECPG (details in Table A3.14, Annex 3).

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

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[7] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a). Simple OM, or
(b). Simple adjusted OM, or
(c). Dispatch Data Analysis OM, or
(d). Average OM.

The simple OM method (option a) is used because low-cost/must-run resources constitute less than 50% of total grid generation for the NCPG in average of the five most recent years, as shown in Table B.1:

Table B.1. Power generation mix of the NCPG for the most recent five years

Energy Source	2001	2002	2003	2004	2005
Total Power Generation (GWh)	361119	407544	461653	530804	607782
Total Low-cost/must run resources (Hydro)	2927	3455	3798	3758	4093
Total Low-cost/must run resources (Others)	126	170	181	274	458
Low-cost/must run resources out of total grid generation (%)	0.85	0.89	0.86	0.76	0.75

For the simple OM, the emissions factor can be calculated using either of the two following data vintages:

(1) 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
(2) 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 throughout all crediting periods.

Based on the most recent statistics available of the project activity at the time of PDD submission, the first data vintage (ex-ante) for the calculation of the simple OM emission factor was chosen for this project.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit4 (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C).

Since the data on fuel consumption and net electricity generation of any single power plant is not available in China, Option C is taken. Therefore, the simple OM emission factor 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:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad (2)$$

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)
$EF_{CO2,i,y}$	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 three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

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

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

1. The five power plants that have been built most recently, or
2. The power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Because the second option has a sample group that comprises greater annual generation, it is taken to build sample group m.

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of

submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is chosen in this project.

Step 5. Calculate the build margin emission factor.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (3)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m 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

However, the issue of data availability needs to be addressed again. Currently, it is very difficult to get the capacity margin data of power plants in China, since these data as well as the generation and fuel consumption data of each power plant are regarded as commercial secrets or only for internal use. According to the guidance from the CDM EB for a deviation from the baseline methodology AM0005[8], the following deviation was adopted to calculate the BM emission factor:

(1) Use of 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 in order to estimate the build margin (BM).
(2) Use of capacity additions to estimate the BM emission factor for grid electricity.
(3) Use of weights estimated using installed capacity in place of annual electricity generation.

The following method is adopted for the BM calculation. The first step is to use the most recently available data on the energy balance to calculate the proportion of CO_2 emissions from solid, liquid, and

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

gas fuels used for power generation in total CO_2 emissions for the NCPG in 2005. Then this proportion is applied as a weight and combined with the emission factors of the best commercially available technologies to calculate the thermal emission factor of the NCPG. Finally, the BM factor of the NCPG can be determined by multiplying its thermal emission factor by the capacity-weighted share of thermal power in the newly added 20% of the installed capacity.

1. Calculate the proportion of CO_2 emissions from solid, liquid, and gas fuels used for power generation in total CO_2 emissions for the NCPG in the base year (2005)

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} FC_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} FC_{i,j,y} \times COEF_{i,j}} \quad (4)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} FC_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} FC_{i,j,y} \times COEF_{i,j}} \quad (5)$$

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

Where:

λ_i	percentage of CO_2 emissions caused by any given type of fuels in total CO_2 emissions
$FC_{i,j,y}$	the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y
$COEF_{i,j,y}$	the CO_2 emission coefficient of fuel i (tCO_2e/ mass or volume unit of the fuel), taking into account the carbon content of the fuels (coal, oil and gas) used by relevant power sources j and the percent oxidation of the fuel in year(s) y
COAL, OIL and GAS	set of coal, liquid and gas fuels

2. Calculate corresponding thermal emission factor

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

$EF_{Coal, Adv}$, $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$ are the emission factors of the best commercially available technology for coal, oil and gas fired power generators. In China, as per the Chinese DNA, the most advanced commercially available technology of coal fired plants has the average ASCC (Assumed Standard Coal Consumption) value of 343.33 gce/kWh. The best commercially available technology for oil and gas fired plants has an average ASCC value of 258 gce/kWh.[9]

[9] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf

Table B.2. Emission factors for the best commercially available thermal power-generating technology in China.

	ASCC (gce/kWh)	NCV (MJ/tce)	Emission Factor (tc/TJ)	OXID (%)	CO_2 Emission Factor (tCO_2/MWh)
	A	B	C	D	E=A*B*C*D*44/12/10^9
$EF_{Coal,Adv}$	343.33	29271	25.8	100	0.9508
$EF_{Gas,Adv}$	258	29271	15.3	100	0.4237
$EF_{Oil,Adv}$	258	29271	21.1	100	0.5843

3. Calculate the BM emission factor of the NCPG

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \qquad (8)$$

Where:

CAP_{Total} the total newly added capacity
$CAP_{Thermal}$ the newly added thermal power capacity

Step 6. Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \qquad (9)$$

Where:

$EF_{grid,BM,y}$ 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)
w_{OM} Weighting of operating margin emissions factor (%)
w_{BM} Weighting of build margin emissions factor (%)

As per “Tool to calculate the emission factor for an electricity system”, for projects other than wind and solar power generation projects, w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period.

Capping of baseline emissions: calculation of f_{cap}

As per methodology AMS III.Q, the baseline emissions should be capped irrespective of planned/ unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuel types and quantity resulting in increase in waste gas generation, and the cap can be estimated using the two methods described below.

Method 1. The baseline emissions are capped at the maximum quantity of waste gas flared/combusted or waste heat released into the atmosphere under normal operation conditions in the last 3 years previous to the start of the project activity.

Method 2. The manufacturer's data for the facility shall be used to estimate the amount of waste gas/heat/pressure that the industrial facility generates per unit of product generated by the process that generates waste gas/heat/pressure (either the product of a section of the plant or product of entire plant, whichever is more representative). In case any modification is carried out by project proponent or in case the manufacturer's data is not available, an assessment should be carried out by independent qualified/certified external process experts such as a chartered engineer to estimate a conservative quantity of waste gas generated by plant per unit of product manufactured by the process generating waste gas/heat/pressure.

Since no monitoring data required for method 1 are available, method 2 is adopted to calculate the capping factor.

$$f_{cap} = \frac{Q_{WG,BL}}{Q_{WG,y}} \quad (10)$$

$$Q_{WG,BL} = Q_{BL,product} \times q_{WG,product} \quad (11)$$

Where:

$Q_{WG,BL}$	Quantity of waste heat generated prior to the start of the project activity. (MWh/yr)
$Q_{WG,y}$	Quantity of waste heat used for energy generation during year y (MWh/yr)
$Q_{BL,product}$	Production by process that most logically relates to waste heat generation in baseline, which is clinker production process in the project activity (tons/yr). This is estimated based on 3 years average prior to start of project activity.
$q_{WG,product}$	Amount of waste heat the clinker production lines generate per unit of clinker generated by the process that generates waste heat (MWh/ton of clinker)

An assessment will be carried out by independent qualified/certified external process experts to estimate a conservative quantity of waste heat generated per unit of clinker produced.

Project Emissions

Since there are no auxiliary fuels used in the project activity, the project emissions are only due to on-site consumption of electricity. As per methodology AMS-III.Q, it should be calculated as per "Tool to calculate project emissions from electricity consumption", as follows:

$$PE_y = EC_{PJ,y} * EF_{CO2,EL,y} * (1 + TDL_y) \quad (12)$$

Where:

PE_y	Project emissions due to project activity in year y (tCO_2e)
$EC_{PJ,y}$	Additional electricity consumed in year y as a result of the implementation of the project activity (MWh)
$EF_{CO2,EL,y}$	CO_2 emission factor for electricity consumed by the project activity in year y, which is the emission factor of the NCPG (tCO_2/MWh)
TDL_y	the average technical transmission and distribution losses in the NCPG in year y for the voltage level at which electricity is obtained from the NCPG at the project site

Leakage

No leakage is applicable under this methodology.

Emission Reductions

Emission reductions due to the project activity during the year y are calculated as follows:

$$ER_y = BE_y - PE_y \quad (13)$$

Where:

ER_y the total emission reductions during the year y in tCO_2e
PE_y the emissions from the project activity during the year y in tCO_2e
BE_y the baseline emissions for the project activity during the year y in tCO_2e

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

Data / Parameter:	$FC_{i,y}$, $FC_{i,j,y}$
Data unit:	ton or liter or cubic miter
Description:	Amount of fossil fuel type i consumed (by relevant power sources j) in the project electricity system, NCPG, in year y
Source of data used:	*China Energy Statistical Yearbook*
Value applied:	Listed in Tables A3.2 - A3.4, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are quoted from *China Energy Statistical Yearbook*, 2004, 2005, and 2006.
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/ton (or litre or cubic meter)
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	*China Energy Statistical Yearbook*
Value applied:	Listed in Table A3.2, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are reported on *China Energy Statistical Yearbook 2006*, p. 288.
Any comment:	

Data / Parameter:	$EF_{CO2, i ,y}$
Data unit:	tC/TJ
Description:	CO_2 emission factor of fossil fuel type i in year y
Source of data used:	IPCC
Value applied:	Listed in Table A3.2, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are reported on *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Table 1.3, Chapter 1, Volume 2, p. 1.21.
Any comment:	

Data / Parameter:	EG_y, $EG_{m,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the project electricity system (by power unit m), NCPG, in year y
Source of data used:	*China Electric Power Yearbook*
Value applied:	Listed in Tables A3.5 - A3.7, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are quoted from *China Electric Power Yearbook*, 2003, 2004, 2005, and 2006.
Any comment:	

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	The capacity of power source j in year y
Source of data used:	*China Electric Power Yearbook*
Value applied:	Listed in Tables A3.18 - A3.20, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are quoted from *China Electric Power Yearbook*, 2004, 2005, and 2006.
Any comment:	

Data / Parameter:	Aux. Power $Rate_{j, y}$
Data unit:	%
Description:	Aux. Power Rate of power source j in year y
Source of data used:	*China Electric Power Yearbook*
Value applied:	Listed in Tables A3.5 - A3.7, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are quoted from *China Electric Power Yearbook*, 2004, 2005, and 2006.
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of fuel i
Source of data used:	IPCC
Value applied:	Listed in Table A3.2, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are reported on *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories:* Table 1.4, Chapter 1, Volume 2, p. 1.23.
Any comment:	

Data / Parameter:	$ASCC_{coal}$
Data unit:	gce/kWh
Description:	Assumed standard coal consumption for the most advanced commercially available coal-fired power generation technology in China
Source of data used:	Official publication of Chinese DNA http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf
Value applied:	343.33
Justification of the choice of data or description of measurement methods and procedures actually applied :	Chinese DNA-published data are used.
Any comment:	

Data / Parameter:	$ASCC_{Turbine}$
Data unit:	gce/kWh
Description:	Assumed standard coal consumption for the most advanced commercially available gas- and oil-fired power generation technology in China
Source of data used:	Official publication of Chinese DNA http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf
Value applied:	258
Justification of the choice of data or description of measurement methods and procedures actually applied :	Chinese DNA-published data are used.
Any comment:	

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2/MWh
Description:	Operation margin emission factor of the NCPG
Source of data used:	Calculated based on published data provided by Chinese DNA
Value applied:	1.1208
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated. See Tables A3.1 - A3.15, Annex 3
Any comment:	Shall be updated according to DNA's latest publication.

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin emission factor of the NCPG
Source of data used:	Calculated based on published data provided by Chinese DNA
Value applied:	0.9397
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated. See Tables A3.16 - A3.21, Annex 3
Any comment:	Shall be updated according to DNA's latest publication.

Data / Parameter:	$Q_{BL,product}$
Data unit:	Tons/yr
Description:	Annual clinker production in the baseline
Source of data used:	Production records of the project participant
Value applied:	1,293,094
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is estimated based on 3-year average prior to start of project activity: 2004: 1,158,413 2005: 1,240,342 2006: 1,480,527
Any comment:	

Data / Parameter:	$q_{WG,product}$
Data unit:	Nm^3/ton of clinker
Description:	Amount of waste heat the clinker production lines generate per unit of clinker generated by the process that generates waste heat
Source of data used:	Assessment by Tianjin Cement Industry Design & Research Institute
Value applied:	3179
Justification of the choice of data or description of measurement methods and procedures actually applied:	Estimated by independent qualified/certified external process experts
Any comment:	

Data / Parameter:	$Q_{WG,BL}$
Data unit:	Nm^3/yr
Description:	Quantity of waste heat generated prior to the start of the project activity.
Source of data used:	Calculated
Value applied:	4.11×10^9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated based on $Q_{BL,product}$ and $q_{WG,product}$
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions

The raw data and calculation of simple OM and BM emission factors of the NCPG are detailed in Tables 3A.2-3A.21, Annex 3. As shown, the average simple OM in the most recent three years is 1.1208 tCO_2/MWh, and the BM of the base year (2005) is 0.9397 tCO_2/MWh.

As per equation (9), the baseline emission factor is calculated as the weighted average of OM and BM emission factors:

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

= 0.5 × (1.1208 + 0.9397) = 1.0303 tCO_2/MWh

According to external expert's evaluation, which was based on the on-site measurement carried out during the feasibility study phase of the project, the total quantity of waste heat generated for the two clinker production lines in the baseline scenario is 578,000 Nm^3/hr. On the other hand, the designed average daily clinker production capacity of the two clinker production lines is 4,000 t/d, which is based on a load factor of 91.7% (i.e., 22 hours/day) due to the expectable regular maintenance, repairing, etc., of the clinker production facilities. In other words, during any full operational day, the designed total daily clinker production should be 4,000/22×24=4,363.63 t. Thus, the $q_{WG,product}$ is calculated as follows:

$q_{WG,product}$ = 578,000/(4,000/22) = 3,179 Nm^3/t[10]

And as per the production records of the project owner, the 3-year average clinker production prior to start of project activity is 1,293,094 tons. Therefore, the $Q_{WG,BL}$ is:

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

= 1,293,094 × 3,179 = 4.11×10^9 Nm^3/yr

. On the other hand, $Q_{WG,y}$ is expected to be 3.73×10^9 Nm^3/yr, as per the Feasibility Study Report of the project. Since the value in base year is greater than that in project year, f_{cap} is bigger than 1(about 1.10), but has to set to be 1 now and will be adjusted based on the actual $Q_{WG,y}$ once the project plant is operational.

As per the Feasibility Study Report of the project activity, the net electricity generation of the project activity is expected to be 52,974 MWh annually. Thus, the baseline emissions are calculated as follows:

$$BE_y = f_{cap} * EG_{PJ,y} * EF_{grid,y}$$

= 1×52,974×1.0303 = 54,579 tCO_2e/yr

Project emissions

As a pure low-temperature waste heat based power generation project, no supplemental fuel is used in the

[10] The assessment carried out by Tianjin Cement Industry Design & Research Institute, December 2008.

project activity. It is estimated by the project participants that the consumption of grid electricity by the project activity is 3 MWh per year, and the emission factor of the NCPG is 1.0303 tCO_2/MWh. Therefore, the project emissions are claculated as follows:

$PE_y = EC_{PJ,y} * EF_{CO2,EL,y} * (1 + TDL_y)$ = 3×1.0303×(1+20%) = 4 tCO_2e/yr

Emission Reductions

As per equation (13), emission reductions of the project activity are calculated as follows:

$ER_y = BE_y - PE_y$ = 54,579 - 4 =54,575 tCO_2e/year

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

Year	Estimation of project emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009 (September - December)	1	18,193	0	18,192
2010	4	54,579	0	54,575
2011	4	54,579	0	54,575
2012	4	54,579	0	54,575
2013	4	54,579	0	54,575
2014	4	54,579	0	54,575
2015	4	54,579	0	54,575
2016 (January - August)	3	36,386	0	36,383
Total (tonnes of CO_2e)	28	382,053	0	382,025

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

B.7.1. Data and parameters monitored:

Data / Parameter:	$Q_{WG,y}$
Data unit:	Nm^3/yr
Description:	The quantity of waste heat utilized in the project activity during the year y
Source of data to be used:	Continuous on-site measurements
Value of data:	3.73×10^9
Description of measurement methods and procedures to be applied:	It will be directly measured by project participants through an appropriate metering device (e.g. turbine flow meter, thermometer, and pressure sensor).
QA/QC procedures to be applied:	The meters will undergo maintenance/ calibration according to the relevant industrial standards.
Any comment:	

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Quantity of electricity supplied by the project activity during the year y.
Source of data to be used:	Continuous on-site measurements
Value of data:	52,974
Description of measurement methods and procedures to be applied:	It will be measured continuously by electricity meters.
QA/QC procedures to be applied:	The electricity meters will undergo maintenance/ calibration according to the industry standards. Sales records and purchase receipts will be used for crosschecking. During the time of calibration and maintenance, backup equipment should be used for monitoring.
Any comment:	

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity during the year *y*
Source of data to be used:	On-site measurements
Value of data:	3
Description of measurement methods and procedures to be applied:	It will be measured continuously by electricity meters.
QA/QC procedures to be applied:	The quantity will be cross-checked with electricity purchase receipts.
Any comment:	

Data / Parameter:	$EF_{CO2\ EL,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for electricity consumed by the project activity in year y
Source of data to be used:	Choose one of the following options: a) Calculate the combined margin emission factor of the grid; b) Use a conservative default value of 1.3 tCO_2/MWh.
Value of data:	1.0303
Description of measurement methods and procedures to be applied:	The first option is taken. The combined margin emission factor of the NCPG, determined according to the latest approved version of the “Tool to calculate emission factor for an electricity system”, is used.
QA/QC procedures to be applied:	Updated annually.
Any comment:	

Data / Parameter:	TDL_y
Data unit:	%
Description:	Average technical transmission and distribution losses in the NCPG in year y for the voltage level at which electricity is obtained from the NCPG at the project site
Source of data to be used:	Choose one of the following options: a) Use recent, accurate and reliable data available within the host country; b) Use a default value of 20%.
Value of data:	20
Description of measurement methods and procedures to be applied:	The second option, i.e., a fixed value, is taken.
QA/QC procedures to be applied:	N. A.
Any comment:	

B.7.2 Description of the monitoring plan:

For baseline emissions, monitoring is based on requirements of SSC methodology AMS-III.Q, "Waste gas based energy systems". For project emissions determination, "Tool to calculate project emissions from electricity consumption" is used.

1. Operational and management structure of the monitoring team

The project owner is Tianjin Zhenxing Cement Co., Ltd. The staff from this company will conduct the monitoring procedures based on the monitoring methodology chosen for the proposed project activity. The chosen monitoring methodology is thought to be most accurate and conservative which guarantees that the recording of the emission reductions is valid and verifiable.

There will be a CDM department in charge of the whole monitoring process. The department will be led by a CDM project director, and will also include a CDM manager and a monitoring team. The management structure of the CDM department is as follows:

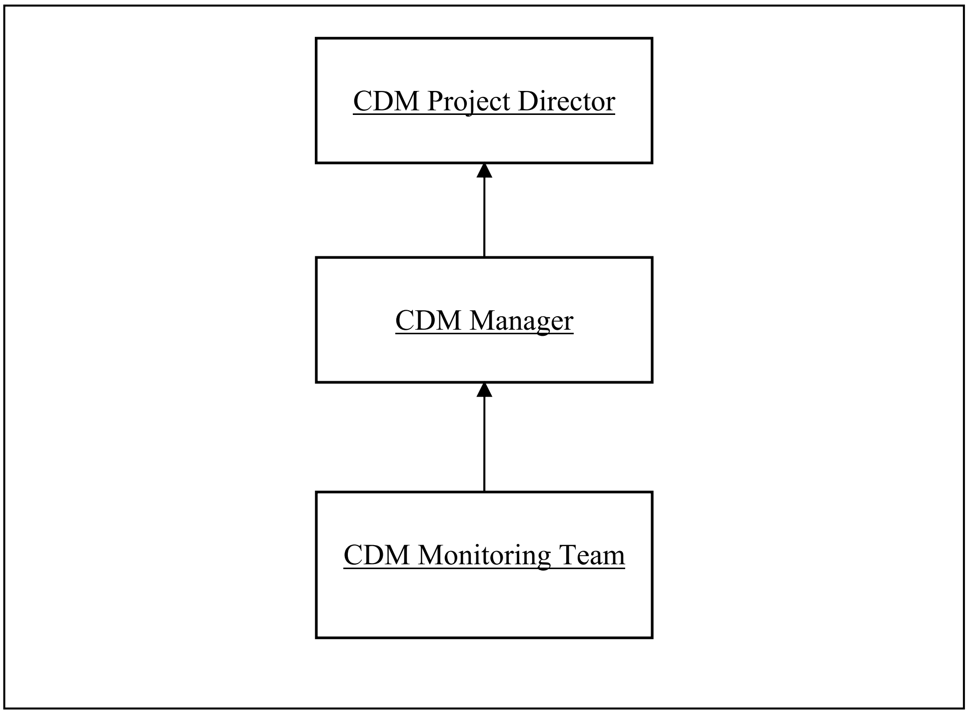


Figure B.1. Management structure for monitoring the emission reductions

CDM Project Director

It is served by a chief officer of the Tianjin Zhenxing Cement Co., Ltd who will take charge of the management of the CDM project, take responsibility for Chinese DNA and stakeholders, and take charge of the coordination with Annex I countries and the DOE.

CDM Manager

He/she will take charge of the operation and management of the proposed CDM project, data collection of the monitoring records, CER calculations, and cooperation with DOE validation and verification.

CDM Monitoring Team

They will take charge of the regular monitoring work, including monitoring of raw data, data aggregation and processing, statistic and storage of the processed data, calibration and maintenance of the measurement equipments.

2. Monitoring requirements

The proposed project owner will maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to maintain the information required for an audit of the emission reductions. These records and monitoring systems can allow the selected DOE to verify project performance and emission reductions.

Emission reductions will be achieved through avoiding electricity generation from fossil fuels. Therefore, the net electricity generated in the project is the most important parameter to be monitored. Furthermore, the additional electricity consumption due to the project activity should also be monitored.

3. Monitoring process and responsibilities

3.1 Electricity generated

Two main electricity meters (M7 and M8) will be installed at the project plant to measure the net electricity generated by the project, and another two meters (M5 and M6) will serve as crosscheck of the main meters. In addition, two more meters (M1 and M2) will be installed to measure the total electricity generated. The type and accuracy of these meters can be found in Figure B.2. All of the meters will be maintained and calibrated regularly according to the relevant national standard. Calibration testing records will be maintained for verification.

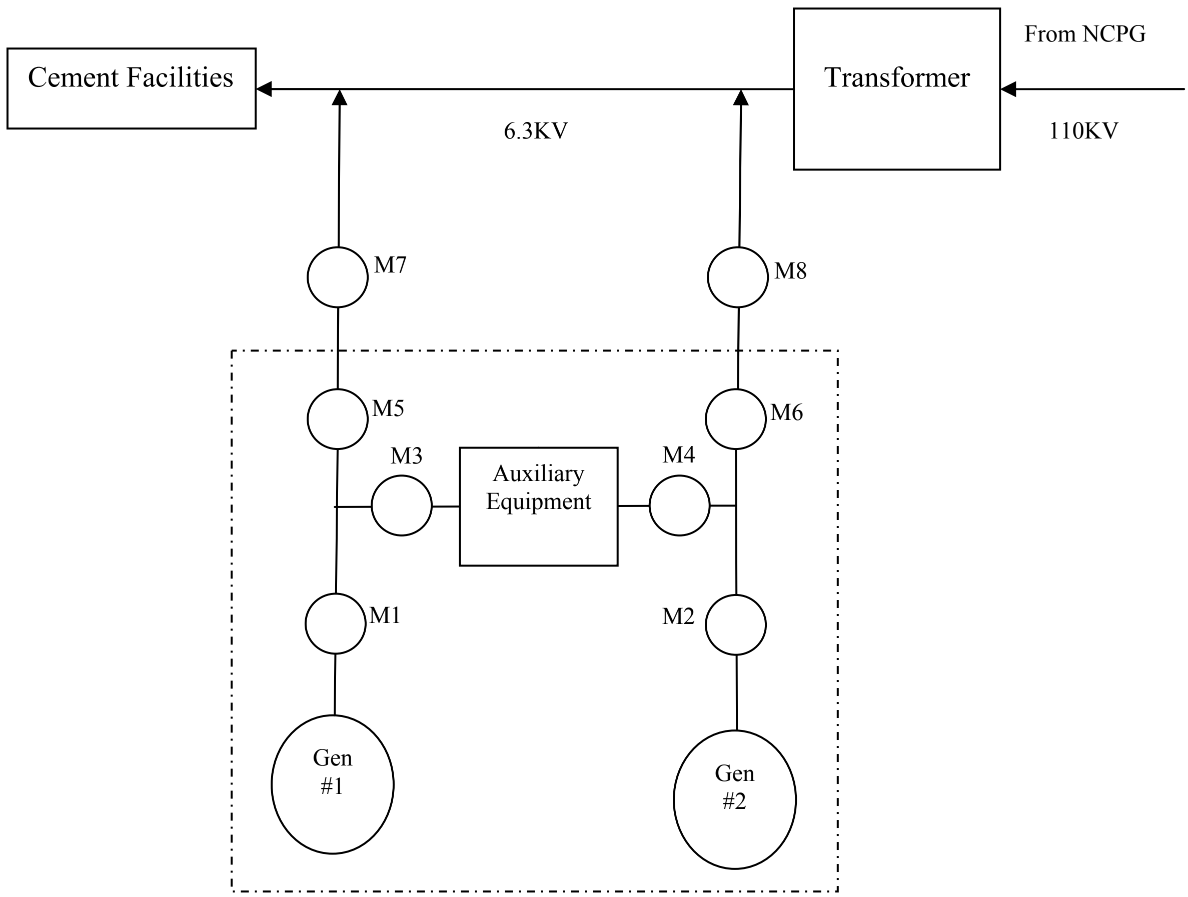
3.2 Electricity consumed

Electricity consumption due to the project activity is also measured through M7 and M8, and crosschecked by M5 and M6 since all of the 4 meters are bi-directional. The auxiliary electricity consumption at the project plant will be measured by another two electricity meters (M3 and M4). The readings of M1, M2, M3, and M4 can also be used to crosscheck the records of M7 and M8.

3.3 Amount of energy contained in the waste heat

Metering devices will be installed for both clinker production lines within the project boundary to monitor the energy contained in the waste heat. The waste energy will be measured through the waste heat flue gas by turbine flow meters, compensated by the temperature difference between the boiler inlets and outlets, and the dynamic pressure.

The meter installation diagram of the project activity is shown as follows.



M1 M2: Total electricity generated; Type: DSSD25; Accuracy: 0.5
M3 M4: Auxiliary electricity; Type: DSSD25-F; Accuracy: 0.5
M5 M6: Net electricity generated and electricity consumed (Crosscheck Meter); Type: DSSD25; Accuracy: 0.5
M7 M8: Net electricity generated and electricity consumed (Gateway Meter); Type: DSSD178; Accuracy: 0.5S

Figure B.2. Installation scheme of electricity meters

4. Data management

The CDM manager and the monitoring team members should be trained on implementing the monitoring process before the project plant is put into operation, which ensures that they have fully understood their responsibilities and the requirements of the monitoring plan. To implement the monitoring plan, the monitoring team member on shift will record readings of all electricity meters continuously and fill the data into the records sheet on site. None of the original data and records can be altered or missed. At least one copy of every record must be kept to guarantee that original records will be available for the entire

crediting period. It is the CDM manager's responsibility to make the backup copies. The CDM manager must check and verify the records sheet weekly and then report it to the CDM director.

5. QA&QC

The quality assurance and quality control process for recording, maintaining and archiving data should be ensured through the CDM mechanism in terms of the need for verification of the emissions on an annual basis according to PDD and Monitoring Report.

All the above parameters monitored under monitoring plan will be kept for 2 years after the end of the crediting period or the last issuances of CERs for this project activity, whichever occurs later.

The monitored data will be presented to the verification agency or DOE to whom verification of emission reduction is assigned.

Necessary formats / tables / log sheets etc will be developed by the project participants for monitoring and recording of the data and will be made part of the registered monitoring protocol.

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

Date of completion of baseline and monitoring study: 14/05/2008

Xingyi GONG and Mengnan LI
Arreon Carbon UK Ltd (Project Participant)
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Hailong NIU and Jie LOU
Tianjin Zhenxing Cement Co. Ltd (Project Participant)
Beichen Economic Development Area, Yinheqiaobei
Beichen District, Tianjin City 300400
P.R. China

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:

23/10/2007 (date of main equipment contract)

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

20 years and 0 months

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

C.2.1. Renewable crediting period

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

01/09/2009

C.2.1.2. Length of the first crediting period:

7 years and 0 month.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

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 Environmental Impact Assessment (EIA) report of the proposed project has been carried out by Tianjin Environmental Science Research & Design Institute. The report was approved by the local authority - Tianjin Environmental Protection Bureau on June 18th 2007, with the approval number of Jin Huanbao Xukebiao [2007]148.

Followed is a brief summary of the environmental impacts of the project.

Air

The major issue during the instruction phase of the project is dust. However, its impact on the ambient air quality is insignificant and short-termed. Once the project is in operation no air pollutants are expected to be released. After going through the waste boilers, waste gases are carried through sealed pipelines and treated by dust cleaner. It is predicted that the emissions of air pollutants will meet the requirements detailed in Table 1 of the *Emission Standard of Air Pollutants for Cement Industry* (GB4915-2004). As a result, the proposed project activity will not influence the air quality.

Waste water

Both industrial and residential waste water will be produced by the project activity. The quantity of industrial waste water discharged is 19.5 m^3/hr, of which 16 m^3/hr comes from the waste water generated in the water circulation system and 3.5 m^3/hr comes from waste water generated in chemical-processing facilities and boilers. The daily quantity of residential waste water produced is 0.4 m^3/hr. All of the waste water generated in the project activity is not toxic and will be treated at the cement plant before being recycled. For instance, the treated industrial waste water will be used in the humidifying tower. Therefore, no discharge of waste water takes place in the project, and thus the impact of the project activity on local aqua-environment will not be significant.

Noise

Noise sources mainly include equipment such as pumps, turbines, generators, the deaerator, and the cooling towers. Pumps, turbines, and generators are all placed indoors. Low-noise equipment is employed in the deaerator and the cooling towers. Moreover, the project plant is located in the center of the cement plant, which makes it far from the boundaries of the cement plant. 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).*

Solid waste

The ash generated in the project activity will all be utilized in cement production. Residential garbage generated in the project activity will be disposed by the environmental sanitation agencies. Thus, it is believed that no negative impact on the local environment will exist.

Ecological Impact

The proposed project is located in industrial area where no wildwood and endangered species exist. As analyzed above, the emissions of all types of pollutants in the project meet the requirements of national standard. Therefore, the project will not have long-term and destructive impact on the surrounding ecological 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:

As analyzed above, the emissions of various kinds of pollutants in the project meet national standards. The project will not have any significant negative impacts on the surrounding environment.

SECTION E. Stakeholders' comments

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

As the first cement waste heat recovery project in Tianjin City, the project was encouraged and approved by the local government. In addition, a public survey was conducted in August 2007 targeted at local residents living and working near the project site for public comments from stakeholders of the proposed project.

A total of 80 questionnaires were distributed based on the principle of representation and randomness in order that the public opinions and concerns are reflected. All of the 80 questionnaires were returned. The background information of the interviewees is as follows:

Table E.1. Background information of the respondents

Item				
Gender	Male		Female	
	72%		28%	
Age	<30	30-40	40-50	>50
	31%	40%	16%	13%
Educational level	College or above	Senior high school	Junior high school	Elementary school or below
	65%	34%	1%	0%

It can be seen that the respondents are adequately representative in terms of gender, age, and educational level. And their attitudes towards the impacts of the project should be a comprehensive reflection of the attitudes of all local residents possibly affected by the project activity. The opinions and suggestions by the stakeholders were recorded and are available upon request.

The questions were:

1. Have you heard of the proposed project?
2. What do you know about the project?
3. Do you agree to the implementation of the project?
4. Do you think there is any positive impact of the project? If so, what it is?
5. Do you think there is any negative impact of the project? If so, what it is?
6. Would you like to contribute to the project?
7. What do you think the main environmental problems in the local area are currently?
8. Do you think the implementation of the project will improve the local environment?

E.2. Summary of the comments received:

No relocation will be needed due to the project activity. All of the stakeholders investigated in the survey know the project to a certain extent and all of them not only support but also would like to contribute to the implementation of the project. Besides, more than 90% of the stakeholders investigated believe that the project activity will either benefit the project owner or increase local job opportunities, and 100% believe that the project will either improve or, at least, do no harm to the overall local environment. In

addition, 88% of the stakeholders are concerned that the project will not have any negative impact, whereas the other 12% think that implementation of the project may result in either noise pollution or water pollution or both.

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

In response to the above-mentioned issues addressed by the small portion of the interviewed stakeholders, in September 2007, the project owner organized a follow-up meeting in which all the related individual stakeholders were invited and present. In the meeting, the corresponding actions, which actually have already been incorporated in the project designing, to be taken to ease the stakeholders' concerns in noise and water pollution were explained in details by the project owner. And it turned out that all of the invited stakeholders reached consensus that no harmful environmental impact would be caused by the project activity.

As demonstrated, there were no significant objections to the project in the survey. As a result, there will be no major change on design, construction, and operation of the proposed project. The project owner will strictly obey all environmental laws and regulations, and do their best to improve the local ecological environment.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from parties included in Annex I is available to the project activity.

Annex 3

BASELINE INFORMATION

Table A3.1. Electricity generation in each province of the NCPG in the most recent 5 years

Province	Generation of 2003 (GWh)			Generation of 2004 (GWh)			Generation of 2005 (GWh)		
	Thermal	Hydro	Other	Thermal	Hydro	Other	Thermal	Hydro	Other
Beijing	18609	678		18579	347		20880	452	149
Tianjin	32191	9		33952	0		36993	0	7
Hebei	108261	504	37	124970	525	40	134348	310	25
Shanxi	93962	1890		104926	2032		128785	2150	
Inner Mongolia	65106	697	144	80427	813	218	92345	1181	157
Shandong	139547	19		163918	41	16	189880	0	120
Total	457675	3798	181	526772	3758	274	603231	4093	458

Province	Generation of 2001 (GWh)			Generation of 2002 (GWh)		
	Thermal	Hydro	Other	Thermal	Hydro	Other
Beijing	17391	275		17886	466	
Tianjin	22166	9		27263	12	
Hebei	92865	312	17	100970	410	36
Shanxi	69419	1680		82256	1878	
Inner Mongolia	45821	620	109	51382	674	134
Shandong	110404	31		124162	15	
Total	358066	2927	126	403919	3455	170

Data Source:

China Electric Power Yearbook 2006, p.568
China Electric Power Yearbook 2005, p.474
China Electric Power Yearbook 2004, p.671
China Electric Power Yearbook 2003, p.585
China Electric Power Yearbook 2002, p.617

Table A3.2. Total CO_2 Emissions of the NCPG in 2003

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
									(tc/TJ)	(%)	(MJ/t,km^3)	K=G*H*I*J *44/12/10000 (Mass Unit)
		A	B	C	D	E	F	F=A+B+C +D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	10^4t	714.73	1052.74	5482.64	4528.5	3949.32	6808	**22535.94**	25.8	100	20908	445737636
Cleaned Coal	10^4t						9.41	**9.41**	25.8	100	26344	234511
Other Washed Coal	10^4t	6.31		67.28	208.21		450.9	**732.7**	25.8	100	8363	5796681
Coke	10^4t					2.8		**2.8**	25.8	100	28435	75319
COG	10^8m^3	0.24	1.71		0.9	0.21	0.02	**3.08**	12.1	100	16726	228560
Other Gas	10^8m^3	16.92		10.63		10.32	1.56	**39.43**	12.1	100	5227	914400
Crude Oil	10^4t						29.68	**29.68**	20	100	41816	910139
Gasoline	10^4t						0.01	**0.01**	18.9	100	43070	298
Diesel	10^4t	0.29	1.35	4		2.91	5.4	**13.95**	20.2	100	42652	440693
Fuel Oil	10^4t	13.95	0.02	1.11		0.65	10.07	**25.8**	21.1	100	41816	834672
LPG	10^4t							**0**	17.2	100	50179	0
Refinery Gas	10^4t			0.27			0.83	**1.1**	18.2	100	46055	33807
NG	10^8m^3		0.5				1.08	**1.58**	15.3	100	38931	345077
Other Petroleum Products	10^4t							**0**	20	100	38369	0
Other Coking Products	10^4t							**0**	25.8	100	28435	0
Other Energy	10^4tce	9.83					39.21	**49.04**	0	0	0	0
Subtotal												455551793

Data Source：*China Energy Statistical Yearbook 2004*

Table A3.3. Total CO_2 Emissions of the NCPG in 2004

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
									(tc/TJ)	(%)	($MJ/t,km^3$)	K=G*H*I*J *44/12/10000 (Mass Unit)
		A	B	C	D	E	F	F=A+B+C +D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	10^4t	823.09	1410	6299.8	5213.2	4932.2	8550	**27228.29**	25.8	100	20908	538547477
Cleaned Coal	10^4t						40	**40**	25.8	100	26344	996857
Other Washed Coal	10^4t	6.48		101.04	354.17		284.22	**745.91**	25.8	100	8363	5901191
Coke	10^4t					0.22		**0.22**	25.8	100	28435	5918
COG	10^8m^3	0.55		0.54	5.32	0.4	8.73	**15.54**	12.1	100	16726	1153187
Other Gas	10^8m^3	17.74		24.25	8.2	16.47	1.41	**68.07**	12.1	100	5227	1578574
Crude Oil	10^4t							**0**	20	100	41816	0
Diesel	10^4t	0.39	0.84	4.66				**5.89**	20.2	100	42652	186070
Fuel Oil	10^4t	14.66		0.16				**14.82**	21.1	100	41816	479451
LPG	10^4t							**0**	17.2	100	50179	0
Refinery Gas	10^4t		0.55	1.42				**1.97**	18.2	100	46055	60546
NG	10^8m^3		0.37		0.19			**0.56**	15.3	100	38931	122306
Other Petroleum Products	10^4t							**0**	20	100	38369	0
Other Coking Products	10^4t							**0**	25.8	100	28435	0
Other Energy	10^4tce	9.41		34.64	109.73	4.48		**158.26**	0	0	0	0
Subtotal												549031578

Data Source：*China Energy Statistical Yearbook 2005*

Table A3.4. Total CO_2 Emissions of the NCPG in 2005

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
									(tc/TJ)	(%)	(MJ/t,km^3)	K=G*H*I*J *44/12/10000 (Mass Unit)
		A	B	C	D	E	F	F=A+B+C +D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	10^4t	897.75	1675.2	6726.5	6176.5	6277.23	10405.4	**32158.53**	25.8	100	20908	636062536
Cleaned Coal	10^4t						42.18	**42.18**	25.8	100	26344	1051186
Other Washed Coal	10^4t	6.57		167.45	373.65		108.69	**656.36**	25.8	100	8363	5192725
Coke	10^4t					0.21	0.11	**0.32**	25.8	100	28435	8608
COG	10^8m^3	0.64	0.75	0.62	21.08	0.39		**23.48**	12.1	100	16726	1742396
Other Gas	10^8m^3	16.09	7.86	38.83	9.88	18.37		**91.03**	12.1	100	5227	2111027
Crude Oil	10^4t					0.73		**0.73**	20	100	41816	22385
Gasoline	10^4t			0.01				**0.01**	18.9	100	43070	298
Diesel	10^4t	0.48		3.54		0.12		**4.14**	20.2	100	42652	130786
Fuel Oil	10^4t	12.25		0.23		0.06		**12.54**	21.1	100	41816	405690
LPG	10^4t							**0**	17.2	100	50179	0
Refinery Gas	10^4t			9.02				**9.02**	18.2	100	46055	277221
NG	10^8m^3	0.28	0.08		2.76			**3.12**	15.3	100	38931	681417
Other Petroleum Products	10^4t							**0**	20	100	38369	0
Other Coking Products	10^4t							**0**	25.8	100	28435	0
Other Energy	10^4tce	8.58		32.35	69.31	7.27	118.9	**236.41**	0	0	0	0
Subtotal												647686276

Data Source：*China Energy Statistical Yearbook 2006*

Table A3.5. Thermal Power Generation of the NCPG in 2003

Province	Generation	Aux. Rate	Net Gen.
	(MWh)	(%)	(MWh)
Beijing	18608000	7.52	17208678
Tianjin	32191000	6.79	30005231
Hebei	108261000	6.50	101224035
Shanxi	93962000	7.69	86736322
Inner Mongolia	65106000	7.66	60118880
Shandong	139547000	6.79	130071759
Total			425364906

Data Source: *China Electric Power Yearbook 2004,* pp.670-671.

Table A3.6. Thermal Power Generation of the NCPG in 2004

Province	Generation	Aux. Rate	Net Gen.
	(MWh)	(%)	(MWh)
Beijing	18579000	7.94	17103827
Tianjin	33952000	6.35	31796048
Hebei	124970000	6.50	116846950
Shanxi	104926000	7.70	96846698
Inner Mongolia	80427000	7.17	74660384
Shandong	163918000	7.32	151919202
Total			489173110

Data Source: *China Electric Power Yearbook 2005,* p.472, p.474.

Table A3.7. Thermal Power Generation of the NCPG in 2005

Province	Generation	Aux. Rate	Net Gen.
	(MWh)	(%)	(MWh)
Beijing	20880000	7.73	19265976
Tianjin	36993000	6.63	34540364
Hebei	134348000	6.57	125521336
Shanxi	128785000	7.42	119229153
Inner Mongolia	92345000	7.01	85871615
Shandong	189880000	7.14	176322568
Total			560751013

Data Source: *China Electric Power Yearbook 2006,* p.559, p.568.

Table A3.8. Total CO_2 Emissions of the NECPG in 2003

Fuel Type	Unit	Liaoning	Jilin	Heilongjiang	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
						(tc/TJ)	(%)	($MJ/t,km^3$)	H=D*E*F*G*44/12/10000 (Mass Unit)
		A	B	C	D=A+B+C	E	F	G	H=D*E*F*G*44/12/1000 (Volume Unit)
Raw Coal	10^4t	3556.51	2006.66	2763.62	**8326.79**	25.8	100	20908	164695313
Cleaned Coal	10^4t	70.83		3	**73.83**	25.8	100	26344	1839949
Other Washed Coal	10^4t	617.04	15.9	53.41	**686.35**	25.8	100	8363	5429988
Coke	10^4t				**0**	25.8	100	28435	0
COG	10^8m^3	1.66			**1.66**	12.1	100	16726	123185
Other Gas	10^8m^3	5.31			**5.31**	12.1	100	5227	123141
Crude Oil	10^4t	3.39			**3.39**	20	100	41816	103955
Diesel	10^4t	0.32	0.34		**0.66**	20.2	100	42652	20850
Fuel Oil	10^4t	14.87	0.7	4.32	**19.89**	21.1	100	41816	643474
LPG	10^4t	1.55			**1.55**	17.2	100	50179	49052
Refinery Gas	10^4t	4.03		0.46	**4.49**	18.2	100	46055	137996
NG	10^8m^3		0.04	4.47	**4.51**	15.3	100	38931	984997
Other Petroleum Products	10^4t				**0**	20	100	38369	0
Other Coking Products	10^4t				**0**	25.8	100	28435	0
Other Energy	10^4tce	29.38			**29.38**	0	0	0	0
Total									174151899

Data Source：*China Energy Statistical Yearbook 2004*

Table A3.9. Total CO_2 Emissions of the NECPG in 2004

Fuel Type	Unit	Liaoning	Jilin	Heilongjiang	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
						(tc/TJ)	(%)	(MJ/t,km^3)	H=D*E*F*G*44/12/10000 (Mass Unit)
		A	B	C	D=A+B+C	E	F	G	H=D*E*F*G*44/12/1000 (Volume Unit)
Raw Coal	10^4t	4144.2	2310.9	3084.8	**9539.9**	25.8	100	20908	188689377
Cleaned Coal	10^4t	84.75	1.09	4.88	**90.72**	25.8	100	26344	2260872
Other Washed Coal	10^4t	577.67	14.26	61	**652.93**	25.8	100	8363	5165589
Coke	10^4t				**0**	25.8	100	28435	0
COG	10^8m^3	4.83	2.91		**7.74**	12.1	100	16726	574367
Other Gas	10^8m^3	57.33	4.19		**61.52**	12.1	100	5227	1426677
Crude Oil	10^4t				**0**	20	100	41816	0
Gasoline	10^4t					18.9	100	43070	0
Diesel	10^4t	2.04	1.16	0.24	**3.44**	20.2	100	42652	108673
Fuel Oil	10^4t	12.81	1.78	2.86	**17.45**	21.1	100	41816	564536
LPG	10^4t	2.19			**2.19**	17.2	100	50179	69305
Refinery Gas	10^4t	9.79		1.14	**10.93**	18.2	100	46055	335923
NG	10^8m^3		0.03	2.53	**2.56**	15.3	100	38931	559111
Other Petroleum Products	10^4t				**0**	20	100	38369	0
Other Coking Products	10^4t				**0**	25.8	100	28435	0
Other Energy	10^4tce	26.97	5.07		**32.04**	0	0	0	0
Total									199754431

Data Source：*China Energy Statistical Yearbook 2005*

Table A3.10. Total CO_2 Emissions of the NECPG in 2005

Fuel Type	Unit	Liaoning	Jilin	Heilongjiang	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
						(tc/TJ)	(%)	(MJ/t,km^3)	H=D*E*F*G*44/12/10000 (Mass Unit)
		A	B	C	D=A+B+C	E	F	G	H=D*E*F*G*44/12/1000 (Volume Unit)
Raw Coal	10^4t	4305.41	2446.13	3383.21	**10134.75**	25.8	100	20908	200454896
Cleaned Coal	10^4t				**0**	25.8	100	26344	0
Other Washed Coal	10^4t	524.74	19.26	24.16	**568.16**	25.8	100	8363	4494940
Coke	10^4t				**0**	25.8	100	28435	0
COG	10^8m^3	1.03	3.57	0.68	**5.28**	12.1	100	16726	391817
Other Gas	10^8m^3	12.62	8.37		**20.99**	12.1	100	5227	486768
Crude Oil	10^4t	1.16			**1.16**	20	100	41816	35571
Gasoline	10^4t				**0**	18.9	100	43070	0
Diesel	10^4t	1.18	1.48	0.57	**3.23**	20.2	100	42652	102039
Fuel Oil	10^4t	9.32	2.46	1.55	**13.33**	21.1	100	41816	431247
LPG	10^4t	0.12			**0.12**	17.2	100	50179	3798
Refinery Gas	10^4t	5.48		1.32	**6.8**	18.2	100	46055	208991
NG	10^8m^3		0.84	2.24	**3.08**	15.3	100	38931	672681
Other Petroleum Products	10^4t				**0**	20	100	38369	0
Other Coking Products	10^4t				**0**	25.8	100	28435	0
Other Energy	10^4tce	16.18			**16.18**	0	0	0	0
Total									207282748

Data Source：*China Energy Statistical Yearbook 2006*

Table A3.11. Total Power Generation of the NECPG in 2003

Province	Thermal Generation (MWh)	Hydro Generation (MWh)	Other Generation (MWh)	Total Generation (MWh)	Overall Aux. Rate (%)	Total Net Generation (MWh)
Liaoning	79751000	2383000	202000	82336000	7.17	76432509
Jilin	29739000	4080000	64000	33883000	7.32	31402764
Heilongjiangi	48493000	1105000		49598000	8.48	45392090
Total				165817000		153227363

Data Source: *China Electric Power Yearbook 2004*, pp.670-671.

Table A3.12. Total Power Generation of the NECPG in 2004

Province	Thermal Generation (MWh)	Thermal Aux. Rate (%)	Net Thermal Generation (MWh)	Hydro Generation (MWh)	Hydro Aux. Rate (%)	Net Hydro Generation (MWh)	Other Generation (MWh)	Total Net Generation (MWh)
Liaoning	84543000	7.21	78447450	3947000	1.33	3894505	264000	82605955
Jilin	33242000	7.68	30689014	6147000	0.75	6100898	81000	36870912
Heilongjiangi	53482000	7.84	49289011	1338000	1.27	1321007	46000	50656019
Total			158425475			11316410	391000	170132885

Data Source: *China Electric Power Yearbook 2005*, p.472, p.474.

Table A3.13. Total Power Generation of the NECPG in 2005

Province	Thermal Generation	Hydro Generation	Other Generation	Total Generation	Overall Aux. Rate	Total Net Generation
	(MWh)	(MWh)	(MWh)	(MWh)	(%)	(MWh)
Liaoning	83697000	5726000	245000	89668000	7.03	83364340
Jilin	35294000	8002000	99000	43395000	6.59	40535270
Heilongjiangi	58000000	1800000	100000	59900000	7.96	55131960
Total				192963000		179031569

Data Source: *China Electric Power Yearbook 2006,* p.559, p.568.

Table A3.14. Net Electricity Imports to the NCPG in the most recent three years

Year	From the NECPG	Average Emission Rate of the NECPG
	MWh	tCO_2/MWh
2003	4244380	1.1366
2004	4514550	1.1741
2005	23423000	1.1578

Data Source: *China Electric Power Yearbook 2005,* p.491.
http://www.sp.com.cn/zgdl/spw/12y/wsdljh.htm
http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls

Table A3.15. Calculation of OM Emission Factor of the NCPG

		Unit	Year 2003	Year 2004	Year 2005
NCPG	Generation	MWh	425364906	489173110	560751013
	CO_2 Emission	tCO_2	455551793	549031578	647686276
NECPG	Generation	MWh	4244380	4514550	23423000
	CO_2 Emission	tCO_2	4823987	5300571	27119149
Total	Generation	MWh	429609286	493687660	584174013
	CO_2 Emission	tCO_2	460375781	554332148	674805425
OM		tCO_2/MWh	1.0716	1.1228	1.1551
Average OM		tCO_2/MWh	1.1208		

Table A3.16. Emission factors for the best commercially available thermal power-generating technology in China.

	PGCC (gce/kWh)	NCV (MJ/tce)	Emission Factor (tc/TJ)	OXID (%)	CO_2 Emission Factor (tCO_2/MWh)
	A	B	C	D	$E=A*B*C*D*44/12/10^9$
$EF_{Coal,Adv}$	343.33	29271	25.8	100	0.9508
$EF_{Gas,Adv}$	258	29271	15.3	100	0.4237
$EF_{Oil,Adv}$	258	29271	21.1	100	0.5843

Table A3.17. Total CO_2 Emissions of the NCPG in 2005

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	OXID	Average NCV	CO_2 Emission (tCO_2e)
									(tc/TJ)	(%)	(MJ/t,km^3)	K=G*H*I*J *44/12/10000 (Mass Unit)
		A	B	C	D	E	F	F=A+B+C +D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	10^4t	897.75	1675.2	6726.5	6176.5	6277.23	10405.4	**32158.53**	25.8	100	20908	636062536
Cleaned Coal	10^4t						42.18	**42.18**	25.8	100	26344	1051186
Other Washed Coal	10^4t	6.57		167.45	373.65		108.69	**656.36**	25.8	100	8363	5192725
Coke	10^4t					0.21	0.11	**0.32**	25.8	100	28435	8608
Subtotal												**642315054**
COG	10^8m^3	0.64	0.75	0.62	21.08	0.39		**23.48**	12.1	100	16726	1742396
Other Gas	10^8m^3	16.09	7.86	38.83	9.88	18.37		**91.03**	12.1	100	5227	2111027
Refinery Gas	10^4t			9.02				**9.02**	18.2	100	46055	277221
NG	10^8m^3	0.28	0.08		2.76			**3.12**	15.3	100	38931	681417
Subtotal												**4812062**
Crude Oil	10^4t					0.73		**0.73**	20	100	41816	22385
Gasoline	10^4t			0.01				**0.01**	18.9	100	43070	298
Diesel	10^4t	0.48		3.54		0.12		**4.14**	20.2	100	42652	130786
Fuel Oil	10^4t	12.25		0.23		0.06		**12.54**	21.1	100	41816	405690
Subtotal												**559160**
Total												**647686276**
λ_{coal}=99.17%, λ_{gas}=0.74%, λ_{oil}=0.08%												
$EF_{Thermal} = \lambda_{coal} \times EF_{coal, Adv} + \lambda_{gas} \times EF_{gas, Adv} + \lambda_{oil} \times EF_{oil, Adv} = 0.9465$												

Data Source：*China Energy Statistical Yearbook 2006*

Table A3.18. Installed Capacity of the NCPG in 2003

Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal	MW	3347.5	6008.5	17698.7	15035.8	11421.7	30494.4	84006.6
Hydro	MW	1058.1	5.0	764.3	795.7	592.1	50.8	3266.0
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	13.5	0	76.6	0	90.1
Total	MW	4405.6	6013.5	18476.5	15831.5	12090.4	30545.2	87362.7

Data source: *China Electric Power Yearbook 2004*

Table A3.19. Installed Capacity of the NCPG in 2004

Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal	MW	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro	MW	1055.9	5.0	783.8	787.3	567.9	50.8	3250.7
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	13.5	0	111.8	12.4	137.7
Total	MW	4514.4	6013.5	20730	18480.5	14321.2	32923.6	96983.2

Data source: *China Electric Power Yearbook 2005*

Table A3.20. Installed Capacity of the NCPG in 2005

Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal	MW	3833.5	6149.9	22333.2	22246.8	19173.3	37332.0	111068.7
Hydro	MW	1025.0	5.0	784.5	783.0	567.9	50.8	3216.2
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	24.0	24.0	48.0	0	208.9	30.6	335.5
Total	MW	4882.5	6178.9	23165.7	23029.8	19950.2	37413.4	114620.4

Data source: *China Electric Power Yearbook 2006*

Table A3.21. Calculation of BM Emission Factor of the NCPG

	Installed Capacity in 2003	Installed Capacity in 2004	Installed Capacity in 2005	New Capacity Addition from 2003-2005	Share of New Capacity Addition
	A	B	C	D=C-A	
Thermal Power (MW)	84006.6	93594.9	111068.7	27062.1	99.28%
Hydro Power (MW)	3266.0	3250.7	3216.2	-49.8	-0.18%
Nuclear Power (MW)	0	0	0	0	0.00%
Wind Power (MW)	90.1	137.5	335.5	245.4	0.90%
Total (MW)	87362.7	96983.1	114620.4	27257.7	100.00%
Out of Installed Capacity in 2005	76.22%	84.61%	100%		
$EF_{BM,y}$=0.9465×99.28% = 0.9397 tCO_2/MWh					

Annex 4

MONITORING INFORMATION

No additional information is provided.

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