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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Pure-low Temperature Waste Heat Recovery for Power Generation (2×7MW) in Guangdong Tapai Cement Co., Ltd. ("the Project" or "the Project Activity")
Version 03, 26/02/2009

A.2. Description of the project activity:

The Project Activity involves the construction of two 7MW waste heat recovery electricity generators, one for each of two new 4500t/day dry process clinker production lines already under construction at the Huizhou Longmen Cement Plant (the Longmen Plant) owned by Guangdong Tapai Group Co., Ltd. (Tapai Group), and situated in Longmen County of Guangdong Province, PR China. The Project Activity will recover and use the waste heat from the rotating kilns of the cement clinker lines and lead to the mitigation of greenhouse gas emissions through the generation of electricity which will be used to displace electricity imported to the cement plant from the Southern China Power Grid.

The completed generators are expected to produce in the region of 86,400 MWh per year, 8% of which will be used in the Project Activity, and the remainder, 79,488 MWh, will be available for use by the cement plant, which should meet approximately 28% of the plant's needs. Displacement of this amount of electricity from the local grid will lead to a reduction in greenhouse gas emissions by the grid-connected generation facilities of approximately 67,040 tCO_2/year, leading to a total reduction of 469,280 tCO_2 over the first seven-year crediting period.

Tapai Group is the largest cement manufacturer in Guangdong Province, operating nine large and medium sized clinker and cement production plants with a total production capacity of 8 million tonnes per year. The Longmen Plant is one of those cement factories and is currently undergoing comprehensive redevelopment. The redevelopment involves the replacement of both the old clinker lines with two new, more efficient 4,500 t/day dry process clinker production lines. The redevelopment work started in 2005 and will be completed in 2008. Alongside, but separately to, the redevelopment of the Longmen Plant, Tapai Group have proposed and implemented the installation of power generation facilities that will utilise the waste heat from the plant. Whilst the installation of waste heat-based generation facilities at cement plants is strongly encouraged in national policies and regulations, there are no laws requiring installation as such.

The Project will contribute to sustainable development in the following ways:

Job creation: The Project Activity will lead to the creation of new job opportunities.

Reduction in GHG emissions: Generation of electricity using waste heat will allow the displacement of electricity generated by the local grid which mostly uses fossil fuel sources for its power.

Reduction of fossil fuel use: The Project Activity will reduce reliance on imported fossil fuels, which will contribute to increasing China's energy security, and will also improve local air quality as it will reduce the emissions of SO_2 and NO_x associated with fossil fuel use.

Pollution reduction: The Project Activity will lead to a reduction in the amount of dust present in the stack gas from the cement plant and thus reduce the discharge of dust into the local environment.

Sustainable development: The Project will make efficient use of the waste heat from both new cement lines, generating power and, in the process, reducing energy wastage at the plant, reducing the demand on fossil fuel-heavy grid based power generation, and easing environmental pressure caused by pollution from the plant. Construction of the Project, therefore, conforms to national industrial policies for energy saving and clean production.

A.3. Project participants:

Name of Party involved(*) ((host) indicates a host Party)	Private and/ or Public entity(ies) Project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered a project participant (Yes/ No)
China (host)	Guangdong Tapai Group Co., Ltd.	No
Japan (buyer's country)	Mitsubishi UFJ Securities Co., Ltd.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

China

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

Guangdong Province

A.4.1.3. City/Town/Community etc:

Longmen County

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

The Project site is located at Guangdong Tapai Group Co., Ltd.'s Huizhou Longmen Cement Plant in Longmen County of Guangdong Province, PR China. It lies 200 km away from Guangzhou, 160 km from Shenzhen, and 90 km from Huizhou. To the north of the Project site runs the Jinlong highway, and to the east the Zenglong highway. The geographical coordinates are latitude 23º 38' N and longitude 114º 20' E.

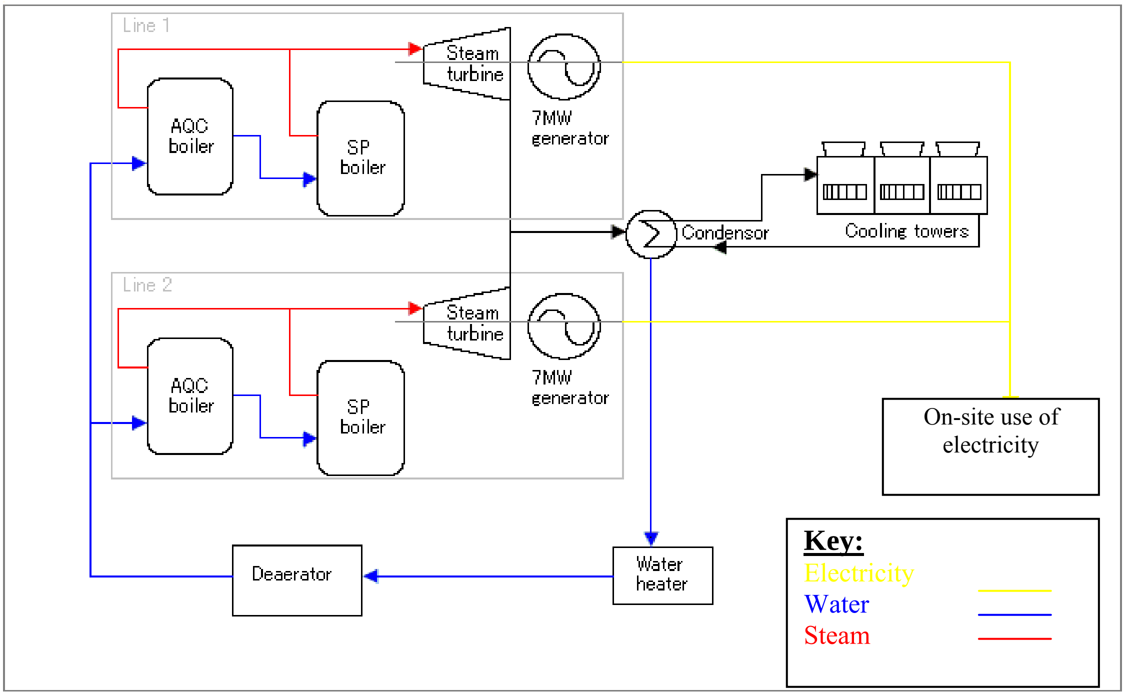
A.4.2. Category(ies) of project activity:

The Project comes under sectoral scopes 1 and 4, "Energy industries (renewable / non-renewable sources)" and "Manufacturing industries", respectively.

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

In the absence of the Project Activity, the cement plant would have vented the waste heat from the kiln into the atmosphere. The redevelopment work on the clinker lines did not originally include WHR and, as described in greater detail below, the baseline scenario involves the venting of waste heat

and the importation of electricity from the regional grid. The waste heat recovery facilities to be installed under the Project Activity include an AQC boiler and an SP boiler at the front and rear, respectively, of the kiln in each of the two new dry process production lines. The steam generated by the boilers will be used to rotate two 7000kW steam-additional condensing turbines which will, in turn, power two 10.5kV/7000kVA generator sets. An auxiliary workshop will also be built containing water-filtering and cooling systems. The equipment will be purchased from Zhongxin Company Lyoyang, a Chinese manufacturer. The process diagram is as follows:



The following table lists the equipment and material flows to be used in the Waste Heat Plant:

I Waste Heat Utilization Part	
1) The kiln rear waste heat boiler (SP boiler)	2 sets
Inlet waste gas amount:	340,000Nm^3/h
Temperature for inlet waste gas:	330ºC
Dustiness degree for inlet waste gas:	80g/ Nm^3
Temperature for outlet waste gas :	230ºC
Total air leakage rate:	≤5%
Ash cleaning way:	Mechanical vibrating
2) The kiln entry waste heat boiler (AQC boiler)	2 sets
Inlet waste gas amount:	180,000Nm^3/h
Temperature for inlet waste gas:	350ºC
Dustiness degree for inlet waste gas:	≤8g/ Nm^3 (out from the dust pre-cleaning device)
Temperature for outlet waste gas :	≤100ºC

Total air leakage rate:	≤5%
II Steam Turbine and Generator System	
1) Condensing steam turbine engine	2 sets
Rated power:	7000kW
Standard rate speed:	3000r/min
Steam pressure of control valve:	1.6MPa
Steam temperature of control valve:	320ºC
Steam pressure of gulp valve:	0.35MPa
2) Generator	2 sets
Rated power:	7000kVA
Voltage of outgoing line:	10500V
Standard rate speed:	3000r/min
3) Condensed water pump	2 sets
4) Water feed pump of boiler	2 sets
III Chemical water treatment system (including Phase II)	
Including activated carbon filter, soft water device, soft water tank and etc., each with 2 sets (of which one for Phase I and the other for Phase II).	
Design output:	15 t/h
IV Circulating Cooling Water System	
1) Cooling tower	4sets
2) circulating cooling water pump	5 sets
V The Kiln Rear Ash Transferring System	2 sets
VI The Kiln Entry Settling Chamber and Ash Transferring System	2 sets
VII Electrical Equipment	2 sets
VIII Thermodynamic control equipment	2 sets
IX Steam water pipelines	

The Specifications of the Waste Heat Plant are as follows:

No.	Specification	Unit	Parameter
1	Installed capacity	kW	2×7000
2	Average power	kW	2×6000
3	Annual operating hours of cement plant	h	7200
4	Operating rate relative to kiln	%	90.9
5	Power generation per year	GWh	2×43.2
6	Electricity demand of project activity	%	~8
7	Power supply per year	GWh	2×39.74

The equipment to be installed will be provided by a Chinese manufacturer, Zhongxin Company Luoyang Electric Generating Equipment Factory. There will be no technology transfer from Annex I countries. The main equipment in the Project Activity is expected to have an effective operational lifetime of 25 years.

Contribution towards reductions in local pollution:

The utilization of waste heat greatly reduces thermal energy release into the local environment. In addition to this, the air-quenching chamber (AQC) and suspension pre-heater (SP) boilers lead to the precipitation of dust in exhaust gases, thus improving the dust precipitator efficiency at both kiln entry and exit, reducing the discharge of dust into the local atmosphere.

Additionally, the electricity generated will reduce reliance on the grid-connected power plants which supplied the Project site with electricity in the baseline, of which a large number are fossil fuel-based generation plants.

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

The Project selects the renewable, 7-year crediting period option, and is expected to achieve emission reductions of, on average, 67,040 tonnes of CO_2e per year over the first period, leading to a total saving of 469,280 tCO_2e over the course of the crediting period.

Years	**Annual estimation of emission reductions in tonnes CO_2e**
Year 1	67,040
Year 2	67,040
Year 3	67,040
Year 4	67,040
Year 5	67,040
Year 6	67,040
Year 7	67,040
Total estimated reductions (tonnes CO_2)	**469,280**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**67,040**

A.4.5. Public funding of the project activity:

There is no public funding from any Annex 1 country.

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:

This section was prepared using ACM0012, Version 02, "Consolidated baseline methodology for GHG emissions reductions for waste gas or waste heat or waste pressure based energy system", and referring as necessary to the latest versions of the tool to calculate the emission factor for an electricity system (version 1), and the tool for the demonstration and assessment of additionality (version 5).

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

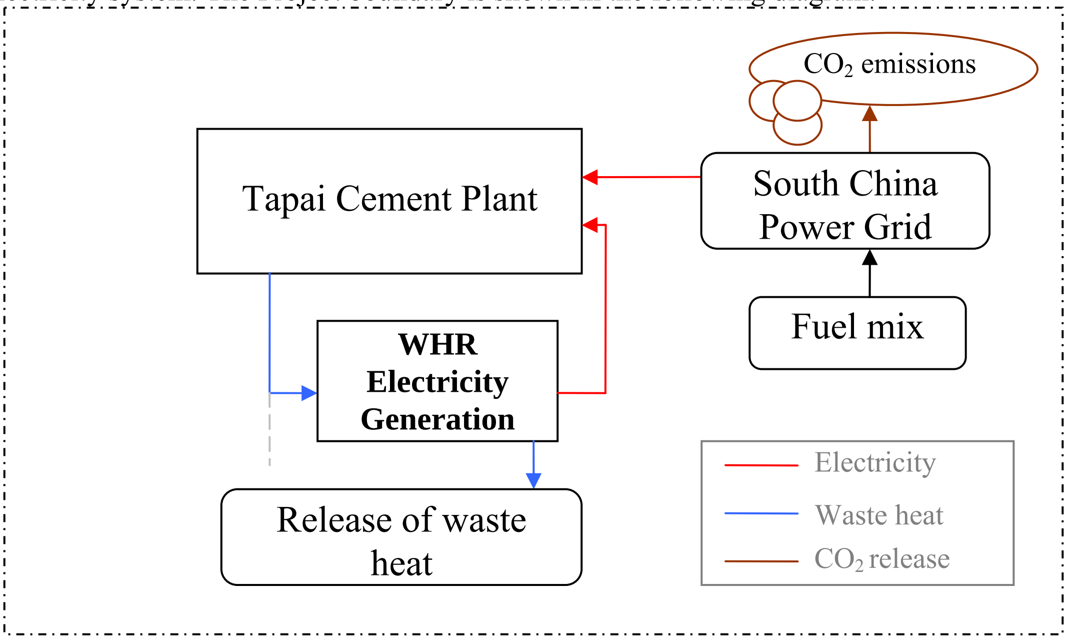
The methodology ACM0012 is applicable to projects that bring about greenhouse gas emission reductions by utilizing, among other things, waste heat in an energy system. This Project Activity comes under the Type-1 electricity generation class of the methodology, and involves the generation of electricity by the utilization of waste heat generated in the clinker making process (i.e. in the cement kilns) that would have been released into the atmosphere in the absence of the Project Activity. The electricity generated will displace electricity sourced from the Southern China Power Grid.
The following conditions applicability conditions are met:

1) Energy generated in the project activity may be used within the industrial facility or exported outside the industrial facility.	All the electricity generated under the project activity will be used on site. No electricity is exported to the grid in the baseline or project scenarios. Electricity generated under the project activity will displace energy supplied by the Southern China Power Grid.
2) Energy in the project activity can be generated by the owner of the industrial facility producing the waste gas/heat or by a third party (e.g. ESCO) within the industrial facility.	The plant owners themselves will carry out the Project. The energy utilized in the Project Activity is generated and used on-site. There is no existing on-site electricity generation facility.
3) Regulations do not constrain the industrial facility generating waste gas from using the fossil fuels being used prior to the implementation of the project activity.	The current practice of coal use in clinker production in the cement industry is legal under China's national regulations, and will remain so for the foreseeable future.
4) The methodology covers both new and existing facilities. For existing facilities, the methodology applies to existing capacity. If capacity expansion is planned, the added capacity must be treated as a new facility.	The plant is currently undergoing a capacity expansion which will be complete in early 2008. Capacity under the Project Activity will be taken to be that of the plant once expansion has been completed.
5) The waste gas/pressure utilized in the project activity was flared or released into the atmosphere in the absence of the project activity at existing facility.	Waste heat would be released into the atmosphere in the absence of the Project Activity. The process plant manufacturer's specifications will be supplied to the DOE at verification to confirm this.
6) The credits are claimed by the generator of energy using waste gas/heat/pressure.	Yes, the cement factory will be using the energy generated from the waste heat and will be claiming the CER credits.
7) Waste gas/pressure that is released under abnormal operation (emergencies / shut down) of the plant shall not be accounted for.	The Project will be run on the waste heat produced under normal operation conditions

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

In accordance with the methodology, the physical extent of the Project Boundary includes the industrial facility where waste heat is generated, the facility where electricity is generated, and the facility where the generated electricity is used. Therefore, this includes the kilns generating the waste heat, the heat recovery boilers, the electricity generator units and their associated auxiliary facilities, and all power plants connected to the Southern China Power Grid. According to the grid-related data released on the Chinese DNA's website, the Southern China Power Grid includes Guangdong, Guangxi, Yunnan, and Guizhou.

The spatial extent of the electricity grid is as defined in the tool to calculate the emission factor for an electricity system. The Project boundary is shown in the following diagram:



The key monitoring items in the Project Activity are denoted by the coloured arrows in the above diagram. The quantity of waste heat released from the end of each kiln will be monitored, together with the waste heat released from the WHR electricity generation equipment by meters located in the relevant locations on-site, with the data retrievable from a central control room.

Total electricity imports from the grid, electricity generation by the project activity and also the electricity demand of the project activity will be monitored in the relevant locations onsite using meters that can be monitored from the central control room.

The waste heat can be used as is, and will not require any treatment. The Project Activity will not require any supplemental fossil fuel consumption. At certain times, such as when shutting down and starting up for maintenance purposes, electricity supplied by the grid may be required; however, imports from the grid to the equipment installed under the Project Activity are not included in CER calculations, in line with the methodology.

The following table describes which emissions are included and which are omitted from the Project emissions calculations.

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	Supplemental electricity consumption	CO_2	Included	Included in line with the methodology; however, will be zero as Project will generate its own electricity under normal operating conditions.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Project emissions from cleaning of gas	CO_2	Excluded	Project will use baseline equipment; therefore, no increase in emissions will result from this source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Supplemental fossil fuel consumption at the project plant	CO_2	Excluded	Excluded because Project will not lead to additional use of fossil fuel
		CH_4	Excluded	Excluded because Project will not lead to additional use of fossil fuel
		N_2O	Excluded	Excluded because Project will not lead to additional use of fossil fuel

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

When identifying the baseline scenario, the most realistic and credible options for waste heat use in the absence of the project activity, and power generation in the absence of the project activity were considered.

Step 1 - Defining the most plausible baseline scenario

The facility at the Project site is where the waste heat is generated, the energy is produced and the energy is consumed.

For the use of waste heat, the realistic and credible alternatives are as follows:
W1 Waste heat is released into the atmosphere
W2 Waste heat is sold as an energy source
W3 Waste heat is used for meeting energy demand

For power generation, the realistic and credible alternatives are as follows:

P1 Proposed project activity not undertaken as a CDM project activity
P2 On-site or off-site existing/new fossil-fuel-fired or renewable cogeneration plant
P3 On-site or off-site existing/new fossil fuel based existing captive or identified plant
P4 On-site or off-site existing/new renewable energy based existing captive or identified plant
P5 Sourced Grid-connected power plants
P6 Captive electricity generation from waste heat at a lower efficiency than the Project Activity

In the case of waste heat, W1, the continuation of current practice, is feasible Because there are no legal requirements for cement plants to utilize the waste heat, and the practice is by far the most common in the province, as well as in China.

Whilst expensive infrastructure could be installed to capture the waste heat to export it from the plant, as is described by W2, there are no other major heat users in the vicinity to make this worthwhile. Whilst there are a number of small potential users in the vicinity who could utilize a small fraction of the waste heat, such as the plant offices and local housing, this demand is very limited, therefore, the small scale and seasonal nature of such use would not make it economically feasible to invest in the necessary infrastructure.

In the case of W3, the factory already recycles as much of the heat into its various processes as is economical, such as the drying of raw materials and the pre-heating of coal, and further increases in this recycling are not likely to occur given the high costs of installation of equipment and the relatively small gains that could be made.

It is clear that, in the absence of the Project activity, the most likely scenario for waste heat is the current practice of venting it directly into the atmosphere.

In the case of power generation, P1 is not a realistic scenario because the Project activity requires supplementary income from the sale of CERs to overcome the barriers to implementation described in further detail in section B.5 below.

P2 is not applicable since the Project only involves power generation.

P3 would not be feasible as the construction and operation of a fossil fuel fired power plant below 135 MW in capacity is not permitted under current Chinese regulations for areas connected to large grids.

P4 would face barriers to implementation because the area lacks the necessary resources and infrastructure to provide biomass or biogas on a significant enough scale for the plant. Wind and water resources in the area are also not plentiful enough to warrant investment in renewable energy generation facilities, without some form of additional revenue.

P5, electricity demand continuing to be met by the grid, is a feasible scenario.

P6, a lower efficiency of waste heat capture than that which is proposed under the Project Activity, would still require significant investment not just in boilers, turbines and generators, but also in monitoring equipment and control facilities. The investment and technology barriers would be too great for the plant to consider without an additional revenue stream as is shown by the fact that this project requires CDM revenue to be implemented.

The most likely alternatives of those listed above are options W1 and P5: the waste heat is released into the atmosphere and the electricity needs of the plant are met fully by the grid. The Project activity is, therefore, fully in-line with the requirements of ACM0012.

Step 2 – Identify the fuel to be used in the baseline

The fuel to be used in the baseline scenario is the mix of fuels currently used by the power generators connected to the local grid.

Step 3 and Step 4 of the methodology are completed in section B.5. below.

Given that the Project concerns the generation of electricity only, and that the most likely baseline options for the Project are W1 and P5 (waste heat is released into the atmosphere, and power is sourced from grid-connected power plants), of the scenarios described in ACM0012, the Project is best described by scenario 1, "electricity is obtained from the grid". Baseline emissions are calculated accordingly.

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):

Construction of the two new 4500 t/day dry process clinker production lines began in April 2005. One was commissioned in August 2007, and the other in April 2008. Installation of the waste heat recovery and energy generation equipment was implemented as a separate project to the clinker line construction. Initial feasibility study work was completed in October 2005 and from an early stage the Project Developer considered CDM a key part of its plans, as evidenced by the Board's decision to apply for CDM on January 17th, 2006. In March 2006 the Project Developer applied for, but was refused a bank loan from the China Construction Bank, despite the inclusion of CDM revenue. Whilst the rejection letter from the bank was received on the March 20th, 2006, the refusal had been confirmed beforehand by the Project Developer, as is common in China. Given the refusal, the Project Developer was then left with no option but to seek financing on unattractive terms from the equipment provider.

Project timeline (in order of occurrence)	**Date**	**Reference**
Feasibility Study	October 2005	Feasibility Study
Bank loan application	Application: Mar 6th, 2006 Rejection letter: Mar 20th, 2006	Bank loan rejection letter, China Construction Bank
Signing of construction contract for CDM Phase I (Project start date)	Mar 18th 2006	Phase I construction contract
Start date of Phase I	Apr 1st, 2007	Plant operation records
Signing of construction contract for CDM Phase II	Sep 15th, 2007	Phase II construction contract
Start date of Phase II	Nov 1st, 2008	Plant operation records

CDM timeline (in order of occurrence)	**Date**	**Reference**
Board decision to apply for CDM	Jan 17th, 2006	Board meeting minutes
Hiring of Guangzhou Institute of Energy Engineering (GIEC)	Jun 18th, 2006	Consulting contract between Tapai Cement & GIEC
Publication of PIN by GIEC	Apr 4, 2007	PIN

Hiring of Mitsubishi UFJ Securities as CDM consultant	Aug 1st, 2007	Consulting contract between GIEC & Mitsubishi UFJ Securities
Stakeholders' consultation	Sep 1st 2007	Stakeholders' meeting minutes
Hiring of DOE	Mar 1st, 2008	Contract with DOE
PDD published for public comments	Apr 11th, 2008	UNFCCC website
Site visit by DOE	May 7-8, 2008	DOE records
Application for China DNA approval, first review meeting	Oct 30th, 2008	NDRC website
Application for China DNA approval, second review meeting	Dec 30th, 2008	NDRC website

The contract with the construction company for the first phase of the Project (the WHR equipment for the first clinker line), was signed on March 18th, 2006, and also included the terms of this lending facility for that phase. Construction started shortly afterwards and was complete one year on in April 2007. The contract for the second phase, signed on September 15th, 2007, similarly included the terms of the lending facility for the WHR facilities to be constructed for the second clinker line. The construction of the second phase started shortly thereafter and was completed in summer 2008, with full operation beginning in November 2008.

Prohibitive barriers that the Project activity faces are clearly identified using the tool for the demonstration and assessment of additionality. The following steps from the additionality tool are completed below:

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations
STEP 3 – Barrier analysis
STEP 4 – Common practice analysis

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 use(s) of waste heat;
- Existing or new captive power generation on-site or off-site using other energy sources than waste heat;
- Electricity is imported from the grid (BAU);
- A mix of captive power and imports from the grid;
- Proposed project activity not undertaken as a CDM project activity.

Sub-step 1b. Enforcement of applicable laws and regulations

All scenarios are in compliance with applicable laws and regulations.

As described in section B.4 above, the cement factory already utilizes as much of the waste heat as is economical, and also there is no potential customer in the region for its waste heat. There are no existing on-site or off-site generation plants supplying the site, and the construction, operation and fuel costs of such a site are too high to warrant investment.

Therefore, the only plausible alternatives to the Project Activity are:

- Business as usual: electricity is imported from the grid, and
- The proposed project activity not undertaken as a CDM project activity.

Step 3 – Barrier Analysis

The Project faces various investment and technological barriers that are described below.

- **Investment barriers**

  At the end of 2005, China's cement production capacity stood at 1.287 billion tonnes[1], however, the actual cement production of that year was 1.064 billion tonnes[2]. There is clearly, therefore, a large excess of capacity in the country, making the market very competitive and placing significant downward pressure on the price that producers can charge. Furthermore, the recent national directive for banks to cut lending to industries with overcapacity[3] has led to a tightening of available credit lines.

  In this highly competitive climate, Tapai Group instigated a program to redevelop the two clinker production lines at the Longmen Plant. At a total cost of 923 million Yuan, 60% of the financing for which was in the form of loans, both of the old clinker production lines at the plant are being replaced with two new, more efficient lines.

  Separately to this redevelopment, the Project Developer sought the implementation of the waste heat recovery project. As detailed in the technology barrier section below, Tapai Group have no

[1] http://news.xinhuanet.com/fortune/2006-05/08/content_4520155.htm
[2] http://www.51report.com/research/detail/7256816.html
[3] Credit policy for cement sector (2006 Revised edition), General guidelines for loans of China Construction Bank and the Basic Access for Cement industry of China National Development Bank

experience of operating the WHR technology used in the Project Activity. This lack of experience proved a significant barrier in applying for a loan. On top of that, there is a lack of technical capacity among lenders. This difficulty in securing a loan facility required the Project Developer to obtain a loan on unfavourable terms from the equipment provider.

As regards alternative financing channels, Tapai Group have no access to alternatives to Chinese Banks. Access to international markets is severely restricted for Chinese companies seeking to raise capital, and, furthermore, Tapai Group lack the necessary experience of dealing in such markets.

Tapai Group's existing level of borrowing, the constrained revenues from the highly competitive market, their lack of experience in implementing WHR projects, a lack of technical knowledge and experience of lending to such projects among banks, and a general reluctance among Chinese banks to lend to projects in industries with overcapacity, made the additional revenue available through the CDM an essential part of making the financial plans for this Project attractive.

- **Technological barriers**

  In terms of the equipment, given the credit squeeze, Tapai Group opted to purchase equipment from a Chinese manufacturer. The steam turbines of imported equipment use a lower steam inlet pressure, increasing the efficiency of steam use and thus increasing the efficiency of electricity generation. Chinese domestic technology was developed in 1996 and according to a recent study on energy efficiency in the China Cement industry[5], is currently available from only three companies. In terms of the estimated 25-year lifespan of the Project Activity, there are real risks associated with the Chinese equipment given the lack of a proven track record over a similar period.

  The Chinese equipment has a lower efficiency, producing around 30kWh less per tonne of clinker, and has higher operating costs and likelihood of malfunction than the 40% more expensive, but better performing equipment available from overseas.[4] Therefore, the Project developer is taking on greater risks than they would otherwise if they purchased the more advanced foreign-made equipment.

  Furthermore, this is the first low-temperature waste heat recovery project that Tapai Group have implemented at any of their cement plants. They, therefore, have no experience in the operation and maintenance of such equipment, and the risk of problems which impact on normal operation is greater as a result.

  The technological barriers referred to above add significant risk which is unquantifiable in monetary terms as it is impossible to know to what degree they will affect the operation of the WHR plant. Given these extra risks, Tapai Group's management would not have proceeded with the Project Activity in the absence of the additional revenue available through CDM. However, despite these greater risks and the additional operating and management costs that the Project carries because it was restricted in choice to Chinese equipment, the potential revenue obtainable through CDM increased the attractiveness of the Project enough for it to be implemented.

Sub-step 3b Show how the identified barriers would not prevent the implementation of at least one of the alternatives:

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[4] Energy Efficiency Policy and CO_2 in China's Industry: Tapping the Potential, Wang Yanjia, 2006

In the event that the Project Developer chose not to implement the Project Activity (BAU: Electricity is imported from the grid), then the investment barriers and technological barriers would cease to be obstacles to the operation of the plant, as the electricity would be bought as and when required from the grid which has many different facilities using equipment with a proven track record, and with minimal, well-understood risks.

Step 4 – Common practice analysis

At present there are approximately 5,177 cement plants in operation in China. Plants with rotary kilns number 3744, while plants with shaft kilns number 1433. Only approximately 300 plants have a production capacity of more than 5000 t/d, while approximately 1700 plants have a capacity of 1000 ~ 5000t/d. However, despite national policies promoting the adoption of low temperature waste heat recovery technology (through, for example, the China Medium and Long Term Energy Conservation Plan), Chinese cement plants have not widely adopted it.[5]

In a study of the implementation of low-temperature waste heat recovery technology among Chinese cement manufacturers performed by the Tianjing Cement Industrial Design Institute in 2007, only twenty-one plants had such technology installed (see list below). Those plants that do utilize the technology have generally received funding for the activity through various bodies such as the Japanese New Energy Development Organization (NEDO), and the Green Aid Programme, or they are CDM projects and gain revenue through the sale of CERs. Even though certain projects have been implemented as examples to industry, one as early as 1998, it is clear that similar activities to the Project are still not widespread in China.

Furthermore, of the plants identified by the Institute, only three are to be found in the South China Grid region of Guangdong, Guangxi, Guizhou and Yunnan. In fact, none are to be found in Guangdong province meaning the Project can be considered the first of its kind in cement plants in its region.

[5] Energy Efficiency Improvement Opportunities for the Cement Industry, Worrell, E. *et al.*, 2008

Table: Overview of waste-heat utilization projects at cement plants in China as of 2007

Name of the company	Province	Cement production	Installed capacity	Operational date
Hailuo Group Ningguo Cement Manufacturing	An'hui	4000t/d	6480kW	Feb 1998
Shanghai Wan'an Enterprise	Shanghai	1200t/d	2500kW	May 2003
Guangxi Liuzhou Cement Manufacturing	Guangxi	4000t/d	6000kW	July 2004
Zhejiang Shenhe Cement Stock Company	Zhejiang	2500t/d	3000kW	March 2005
Zhejiang Qinglongshan Cement Stock Company	Zhejiang	1200t/d+2500t/d	2×3000kW	June 2005
Zhejiang Changxing Xiaopuzhongsheng Cement Co., Ltd.	Zhejiang	2500t/d	3000kW	June 2005
Zhejiang Changxing Meishanzhongshengjiancai Co., Ltd.	Zhejiang	5000t/d	6000kW	July 2005
Zhejiang Sanshi Cement Stock Co., Ltd.	Zhejiang	2500t/d+5000t/d	3000kW+6 000kW	Sep.2005
Zhejiang Zhongxinyuan Cement Co., Ltd.	Zhejiang	2500t/d	3000kW	Nov.2005
Zhejiang Haolong Jiancai Co., Ltd.	Zhejiang	1200t/d	1500kW	Jan.2006
Hainan Sanyahuashengtianya Cement Co., Ltd.	Hainan	5000t/d	6000kW	May 2006
Shandong Zibo Donghua Cement Company	Shandong	5000t/d	6000kw	Nov.2006
Shanxi Tiaheyuhua Cement Co., Ltd.	Shanxi	1200t/d	2500kW	Nov.2006
Sichuan Shuangma Yibin Power Energy Co., Ltd.	Sichuan	2500t/d	3000kW	Dec.2006
Beijing Cement Manufacturing Co., Ltd.	Beijing	2000t/d+3000t/d	7500kW	Dec.2006
Gansu Pulianshan Cement Stock Co. Ltd.	Gansu	2×2200t/d	6000kW	Nov.2006
Zhejiang Hongshi Cement Stock Co., Ltd.	Zhejiang	2×2500t/d+5000t/d	2×7500kW	Dec.2006
Hebei Luquanquzhai Cement Co., Ltd.	Hebei	2 ×2500t/d	2×4500kw	Dec.2006
Zhejiang Zhengda Cement Stock Co., Ltd.	Zhejiang	1200t/d	2500kw	Nov.2006
Jiangxi Gaoanhongshi Cement Co. Ltd.	Jianxi	5000t/d	9000kw	Feb.2007
Anhui Huaibei Mining Group Manufacturing	Anhui	2500t/d	4500t/d	March 2007
Guangxi Huarun Cement (Nanping) Co. Ltd. (First phase)	Guangxi	5000t/d	7500kw	Under construction
Anhui Hedei Sanshi Cement Co., Ltd.	Anhui	5000t/d	9000kw	Under construction
Zhejiang Jiandei Sanshi Cement Co., Ltd.	Zhejiang	5000t/d	9000kw	Under construction

Anhui Huainan Mining Group Cement Manufacturing	Anhui	2×2500t/d	9000kw	Under construction
Shandong Longkouconglin Group Cement Manufacturing	Shandong	2500t/d	3000kw	Under construction
Guotou Hainan Cement Co., Ltd.	Hainan	2×2500t/d	8800kw	Under construction
Hunan Pingtang Cement Co., Ltd.	Hunan	2500t/d	3000kw	Under construction
Jiangsu Henglai Cement Co., Ltd.	Jiangsu	2500t/d+5000t/d	4500kw+7500kw	Under construction
Guangxi Huarun Cement (Nanping) Co., Ltd. (Second phase)	Guangxi	2×5000t/d	2×7500kw	Under construction
Guangxi Huarun Cement (Guigang) Co., Ltd.	Guangxi	2×5000t/d	18000kw	Under construction
Guangxi Huarun Cement (Hongheshui) Co., Ltd.	Guangxi	2500t/d+3200t/d	9000kw	Under construction
Guangxi Huarun Cement (Nanjing) Co., Ltd.	Guangxi	5000t/d	7500kw	Under construction
Henan Mengdian Group Cement Co., Ltd.	Henan	3×3000t/d	2×7500kw	Under construction
Zhejiang Ningbo Shujiang Cement Co, Ltd.	Zhejiang	2500t/d	4500kw	Under construction
Zhejiang Jinshou Cement Co., Ltd.	Zhejiang	2500t/d	4500kw	Under construction
Huibei Jinglan Cement Co., Ltd.	Ningxia	2000t/d	4500kw	Under construction
Yixing Tiansheng Cement Co., Ltd.	Jiangsu	2500t/d	4500kw	Under construction
Henan Weihuitianrui Cement Co., Ltd.	Henan	5000t/d	9000kw	Under design
Shanxi Xinfengweidun Cement Co., Ltd.	Shanxi	1500t/d+2500t/d	7500kw	Under design
Ningxia Qingtongxia Cement Co., Ltd.	Ningsia	1000t/d+2500t/d	6000kw	Under design
Hangzhou Meiya Cement Co., Ltd.	Zhejiang	2500t/d	4500kw	Under design
Liuzhou Yufeng Group Cement Co. , Ltd.	Guangxi	2500t/d	6000kw	Under design
Zhejiang Yulang Cement Co. , Ltd.	Zhejiang	1000t/d+2000t/d+2500t/d	10000kw	Under design
Xinjiang Tianshan Group Cement Co. , Ltd.	Xinjiang	2500t/d	4500kw	Under design
Hainan Sanya Huashengtianya Cement Co., Ltd.	Hainan	5000t/d (Second phase)	12000kw	Under design

It is clear that, this Project fulfils the requirements of additionality, as described by the additionality tool, as it would not have been implemented without additional funding, such as the revenue stream available from CDM.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Of the Project scenarios mentioned in the methodology, the Project activity corresponds to scenario 1 under Generation of Electricity Only. In accordance with the methodology, emissions reductions are calculated as described below:

Baseline Emissions

Baseline emissions for the Project Activity are the emissions from grid-generated electricity that is to be displaced by electricity generated under the Project Activity. There is no alternative power generation source at the cement factory. There is no flaring in the baseline; therefore, emissions from such a source are not relevant. The calculations are performed as follows:

$BE_y = BE_{elec,y}$

Where:

BE_y is the total baseline emissions in the year y in tons CO_2

$BE_{elec,y}$ is the baseline emissions from electricity during the year y in tons CO_2

Baseline emissions from electricity that is displaced by the project activity ($BE_{elec,y}$)

The emissions from the grid-electricity displaced in year *y* are calculated as follows:

$$BE_{elec,y} = f_{cap} \times f_{wg} \times \sum_{j} \sum_{i} (EG_{i,j,y} \times EF_{elec,i,j,y})$$

Where:

EG_y is the electricity supplied by the Project Activity to the cement plant that, in the absence of the Project Activity, would have been supplied by the Southern China Power Grid, expressed in MWh;

$EF_{elec,y}$ is the CO_2 emission factor for the Southern China Power Grid, in tCO_2/MWh;

f_{cap} is the cap for the volume of waste heat generated by the project activity in year y, calculated as described in method-2 of the methodology;

f_{wg} is the fraction of electricity produced using waste heat in the project activity.

As directed in the methodology, the emissions factor for the electricity grid is calculated according to the tool to calculate the emission factor for an electricity system, since the electricity generated from the waste heat will displace electricity that would have been generated by other power plants in the baseline grid. The calculation procedures are as follows:

STEP 1. Identify the relevant electric power system

The Chinese DNA - Office of Climate Change under the National Development and Reform Commission - has published a delineation of the project electricity system and connected electricity system[6]. According to the delineation, the local grid to which the Project activity is connected is the Southern China Power Grid.

STEP 2. Select an operating margin (OM) method

Dispatch data is unavailable for the Southern China Power Grid; therefore, this PDD selects option (a), the Simple OM method, to calculate this parameter.[7] As shown in the table below, low-cost/must-run resources constitute less than 50% of total Southern China Power Grid generation, averaged over the five most recent years.

Year	Low-cost/must-run generation (10^8 kWh)	Total Generation (10^8 kWh)	%
2001	7,718,207	23,874,820	32.3
2002	9,113,500	27,630,300	33.0
2003	10,036,900	32,314,900	31.1
2004	11,270,300	37,627,700	30.0
2005	12,852,000	41,540,900	30.9

Source: China Electric Power Yearbooks 2002, 2003, 2004, 2005 and 2006

In calculating the simple OM, the ex-ante option of a 3-year generation-weighted average is chosen, and is based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, thus removing the requirement to monitor and recalculate the emissions factor during the crediting period. For the calculation, 2003, 2004 and 2005 are chosen as the data for these is the most recent.

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 generation power plants serving the system, not including low-cost/must-run power plants/units. It is calculated 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) because the necessary data for option A or option B is not available, nuclear and renewable power generation are considered as low-cost/ must-run power sources and the quantity of electricity supplied to the grid by these sources is known. Electricity imports are treated as one power plant.

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[6] http://cdm.ccchina.gov.cn/web/index.asp

[7] The fact that the low-cost/must-run resources constitute less than 50% of total grid generation in the exporting grid is shown in annex 3. In calculating the simple operating margin emission factor of the exporting grid, the ex-ante option is applied.

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

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{grid,y}$	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

Since the plant specific data for the Southern China Power Grid is not available, the capacity addition from one year to the next and the efficiency of the best available technology are used as a basis for determining the build margin of the grid, as clarified by the CDM Executive Board[8]. The build margin emission factor will be calculated *ex-ante* based on the most recent information available at the time of CDM-PDD submission to the DOE for validation and applied during the first crediting period. For the second crediting period, the build margin emission factor will be updated based on the most recent information available 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 will be used (Option 1).

STEP 5. Calculate the build margin emission factor

The procedure to calculate the Build Margin emission factor conservatively is as follows:

1) Using the latest available statistical data determine the two years with added capacity closest to 20% (above 20%)

- The capacity of each previous year x is compared with the capacity of the most recent year.

$$\text{Capacity increase}(\%) = \left(\frac{\text{Capacity of the most recent year}}{\text{Capacity of the year x}} - 1\right) \times 100$$

- Select the year of which the capacity increase is closest to and above 20% for the build margin emission factor calculation

2) Calculate the build margin emission factor for that year with the efficiency of the best available technology

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

- Calculate the emission factor of each fuel source with the efficiency of the best available technology. For each fuel source, emission factor is calculated as follows:

$$\text{Emission factor} = 3.6 / \text{Best efficiency} / 1000 \times CO_2 \times \text{Oxidation factor}$$

- Calculate the weight of each emission source as the ratio of emission by source to total emission in the most recent year

$$\text{Weight for each fuel} = \frac{CO_2 \text{ Emission by each fuel}}{\text{Total } CO_2 \text{ emission}}$$

- Calculate the emission factor for thermal power generation.[9]

$$\text{Emission factor for thermal power} = \sum_i \text{emission factor}_i \times \text{Weight}_i$$

- Calculate the capacity addition ratio of each energy source (j: thermal, hydro, nuclear, wind, etc) between the most recent year and the selected year in step 1)

$$\text{Capacity addition ratio}_j = \frac{\text{Capacity addition}_j}{\text{Total capacity addition}}$$

$$\text{Capacity addition}_j = \text{Capacity of the most recent year}_j - \text{Capacity of the year selected}_j$$

- Calculate the Build Margin emission factor

$$EF_{BM} = \sum \text{emission factor}_j \times \text{capacity addition ratio}_j$$

STEP 6. Calculate the combined margin emission factor

The combined margin emission factor is calculated as follows:

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

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 (%)

The following default values will be applied for w_{OM} and w_{BM}:

- $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period.

[9] Emission factor of 0 will be applied for the emission factors other than thermal power generation.

Capping of baseline emissions

To introduce an element of conservativeness, the PDD caps baseline emissions irrespective of planned/unplanned or actual increases in output of the plant, changes in operational parameters and practices, changes in fuels type and quantity resulting in increased waste gas generation.

Given the lack of historical data, the PDD selects method 2 for the calculation of the cap (f_{cap}).
Method 2: The manufacturer's data for the industrial facility shall be used to estimate the amount of waste heat the industrial facility generates per unit of product generated by the process that generates the waste heat.

The value arrived at based on the manufacturer's information shall be used to estimate the baseline cap f_{cap}. The documentation of the assessment shall be made available to the DOE for verification.

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

Where:

$Q_{WG,y}$ Quantity of waste gas generated prior to the start of the project activity (Nm^3)
$Q_{WG,BL}$ Estimated quantity of waste heat generated prior to the start of the project (Nm^3), estimated using the following equation:

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

$Q_{BL,product}$ Production of clinker in the baseline.
$q_{wg,product}$ Amount of waste heat the industrial facility generates per unit of product generated by the process that generates waste heat.

Project Activity

According to ACM0012, the project emissions (PE_y) to consider are those associated with the increased use of auxiliary fossil fuels ($PE_{AF,y}$) and the electricity consumption of gas cleaning equipment ($PE_{EL,y}$).

$$PE_y = PE_{AF,y} + PE_{EL,y}$$

Project emissions due to auxiliary fuel

The Project will not require any additional combustion of fossil fuel; emissions from this source are, therefore, considered to be zero.

Project emissions due to electricity consumption of gas cleaning equipment

The Project will be using the same gas cleaning equipment as that which would have been used in the baseline scenario so emissions from this potential source can be ignored.

As described above, Project emissions, PE_y, are therefore zero.

Leakage

No leakage is applicable under this methodology.

Emission Reductions

The project activity reduces CO_2 emissions either from the grid by using waste heat to produce electricity. As described in the methodology, the emission reduction during a given year *y*, ER_y, is calculated using the following equation:

$$ER_y = BE_y - PE_y$$

Where:

ER_y Total emissions reductions during the year y in tonnes CO_2e
PE_y Emissions from the project activity during the year y in tonnes CO_2e
BE_y Baseline emissions for the project activity during the year y in tonnes of CO_2e

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

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data used:	Chinese DNA
Value applied:	0.8434
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated based on data published by the Chinese DNA, as described in Section B.6.1
Any comment:	

Data / Parameter:	$Q_{WG,BL}$
Data unit:	$Nm^3/hour$
Description:	Quantity of waste heat (flue gas) generated prior to the start of the project activity
Source of data used:	Calculated *ex ante* from the manufacturer's specifications for the first crediting period and using actual data for any subsequent crediting periods.
Value applied:	520,000 (per production line)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated as described in method-2 for calculation of the baseline cap in the methodology, using the manufacturer's specifications, assuming production of 4,500 tonnes of clinker/day.
Any comment:	Data used to be reviewed by the DOE during validation.

Data / Parameter:	$q_{wg,product}$
Data unit:	Nm^3
Description:	Waste heat (flue gas) produced per tonne of clinker
Source of data used:	Calculated *ex ante* from the manufacturer's specifications for the first crediting period and using actual historical data for any subsequent crediting periods.

Value applied:	120
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated using $Q_{WG,BL}$ and assuming each line is producing 4,500t/day
Any comment:	Data used to be reviewed by the DOE during validation.

Data / Parameter:	$\mathbf{f_{cap}}$
Data unit:	Fraction
Description:	Cap for baseline emissions
Source of data used:	Calculation
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated using method 2 from the methodology. Manufacturer's specifications to be made available to the DOE at validation.
Any comment:	

Data / Parameter:	$\mathbf{f_{wg}}$
Data unit:	Fraction
Description:	Fraction of electricity produced by the project using waste gas
Source of data used:	Calculated *ex ante* from the manufacturers specifications
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Project will be generating electricity purely from the waste heat from the kilns. As described in the methodology, this parameter is therefore equal to 1.
Any comment:	

Data / Parameter:	$\mathbf{EF_{grid,BM,y}}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year y
Source of data used:	Calculations
Value applied:	0.6748
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated as directed in B.6.1. Calculations shown in Annex 3.
Any comment:	

Data / Parameter:	**$EF_{grid,OM,y}$**
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year y
Source of data used:	Calculations
Value applied:	1.0119
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated as directed in B.6.1. Calculations shown in Annex 3.
Any comment:	

Data / Parameter:	**w_{OM}**
Data unit:	Fraction
Description:	Weighting of operating margin emissions factor
Source of data used:	Tool to calculate the emission factor for an electricity system
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	As directed in the tool, a value of 0.5 is to be used for the first crediting period; and a value of 0.25 is to be used for the second and third crediting periods.
Any comment:	

Data / Parameter:	**w_{BM}**
Data unit:	Fraction
Description:	Weighting of build margin emissions factor
Source of data used:	Tool to calculate the emission factor for an electricity system
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	As directed in the tool, a value of 0.5 is to be used for the first crediting period; and a value of 0.75 is to be used for the second and third crediting periods.
Any comment:	

Data / Parameter:	**$Q_{BL,product}$**
Data unit:	Tonnes
Description:	Production of clinker
Source of data used:	Equal to production for the first crediting period.
Value applied:	-
Justification of the choice of data or description of measurement methods	Because the current upgrade has yet to be fully completed, applicable historical production data for clinker does not exist; therefore, for the first crediting period, this is assumed to be equivalent to actual production. For the second and third crediting periods, historical data will be used.

and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions

$BE_y = BE_{elec,y}$

Baseline emissions from electricity that is displaced by the project activity

The emissions from the grid-electricity displaced in year *y* are calculated as follows:

$$BE_{elec,y} = f_{cap} \times f_{wg} \times \sum_j \sum_i (EG_{i,j,y} \times EF_{elec,i,j,y})$$

$BE_y = 1 \times 1 \times (79{,}488 \times 0.8434)$

$= 67{,}040\ tCO_2e$

Project Activity

As described in section B.6.1., Project emissions, PE_y, are equal to zero.

Leakage

No leakage is applicable under this methodology.

Emission Reductions

$ER_y = BE_y - PE_y$

$= 67{,}040 - 0$

$= 67{,}040\ tCO_2e$

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

Year	Estimation of baseline emissions (tCO_2e)	Estimation of project emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of emission reductions (tCO_2e)
Year 1	67,040	0	0	67,040
Year 2	67,040	0	0	67,040
Year 3	67,040	0	0	67,040
Year 4	67,040	0	0	67,040
Year 5	67,040	0	0	67,040
Year 6	67,040	0	0	67,040
Year 7	67,040	0	0	67,040
TOTAL	469,280	0	0	469,280

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh/yr
Description:	The electricity supplied by the Project Activity to the cement plant
Source of data to be used:	On-site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	79,488
Description of measurement methods and procedures to be applied:	Monitored continuously, aggregated monthly
QA/QC procedures to be applied:	The energy meters will undergo maintenance / calibration to the industry standards. The total energy generated and the amount used by the Project Activity will also be measured to provide another means of verification of this amount.
Any comment:	

Data / Parameter:	**$FC_{i,y}$**
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type i consumed in the project electricity system in year y
Source of data to be used:	Office of Climate Change under the National Development and Reform Commission of China
Value of data applied for the purpose of	As described in Appendix 3.

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	These values are the official data from Chinese DNA – Office of Climate Change under the National Development and Reform Commission. This parameter is monitored once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation. (ex-ante option)
QA/QC procedures to be applied:	
Any comment:	-

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	GJ/ mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data to be used:	Office of Climate Change under the National Development and Reform Commission of China
Value of data applied for the purpose of calculating expected emission reductions in section B.5	As described in Appendix 3.
Description of measurement methods and procedures to be applied:	National average default values are used from Office of Climate Change under the National Development and Reform Commission of China. This parameter is monitored once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation. (ex-ante option)
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type i in year y
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	As described in Appendix 3. To be confirmed for each new crediting period.
Description of measurement methods and procedures to be applied:	This parameter is monitored once for each crediting period using the most recent data available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option).
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**$EG_{grid,y}$**
Data unit:	MWh
Description:	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
Source of data to be used:	Office of Climate Change under the National Development and Reform Commission of China
Value of data applied for the purpose of calculating expected emission reductions in section B.5	As described in Appendix 3. To be confirmed for each new crediting period.
Description of measurement methods and procedures to be applied:	This parameter is monitored once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation. (ex-ante option)
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**$Q_{WG,y}$**
Data unit:	Nm^3/hour
Description:	Quantity of waste heat (flue gas) used per hour for energy generation during year y
Source of data to be used:	Actual measurements. This PDD assumes it to be the same as the baseline value.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	520,000 (per production line)
Description of measurement methods and procedures to be applied:	Monitored continuously using a flow meter.
QA/QC procedures to be applied:	Measuring equipment should be calibrated on a regular basis. During calibration and maintenance, alternative equipment should be used for monitoring.
Any comment:	Monitored as part of baseline emissions capping. Assumed to be equal to $Q_{WG,y}$ in this PDD.

B.7.2 Description of the monitoring plan:

Purpose

The monitoring methodology clearly describes how to identify and collect the necessary data. The following is a summary list of the main items to be monitored:

Monitoring framework

The figure below outlines the operational and management structure that Tapai Group will implement to monitor emission reductions and any leakage effects generated by the Project Activity. The existing environmental management team at the plant will be responsible for the monitoring of all the aforementioned parameters. This team is composed of a general manager and a group of operators. The group of operators, under the supervision of the general manager, will be assigned for monitoring of different parameters on a timely basis and will perform the recording and archiving of data in an orderly manner. Monitoring reports will be forwarded to an reviewed by the general manager on a monthly basis in order to ensure the Project follows the requirements of the monitoring plan.

The performance of the Project will be reviewed and analyzed by consultants on a regular basis.

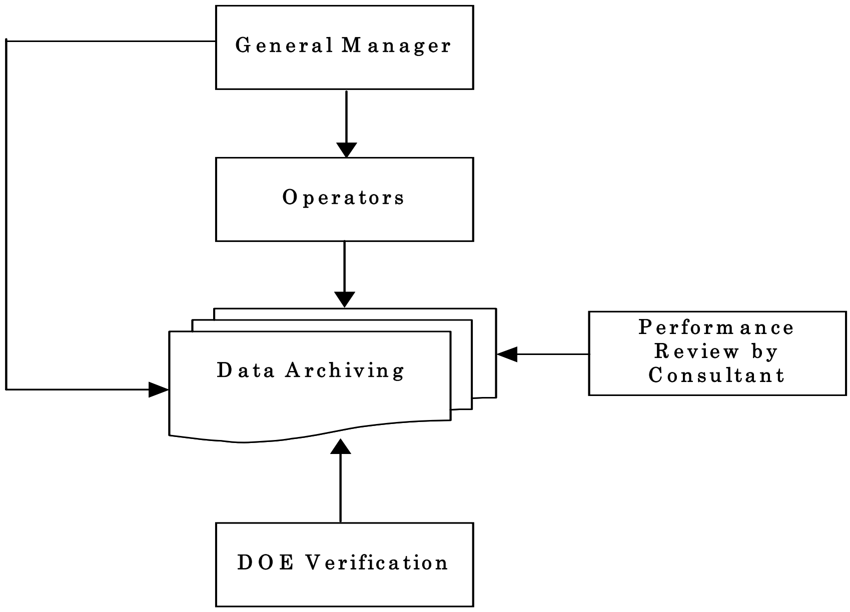

Figure: Operational and management structure for monitoring the Project activity.

Monitoring equipment and installation

The Project Activity requires the monitoring of the following items:

- Electricity demand of the cement works and other local loads within the cement works prior to start of the project, and throughout the project.
- Waste heat use within the cement works and normal uses of waste heat in cement

production commonly practiced in the region or host country.
- Regulations and/or policy that could influence the use of waste heat and generation of power in the region.
- Project electricity generation, including:
  - The plant's electricity imports and exports.
  - Electricity demand and generation of the proposed project activity.
  - Confirmation to meet applicability conditions.

No Project emissions are considered to occur under Project Activity.

Calibration

Regular calibration will be necessary for the monitoring equipment. The necessary calibration will be performed according to the manufacturer's guidelines, or according to the applicable regulations, by a suitably skilled technician at the required frequency (at least once a year). A certificate of calibration will be provided for each piece of equipment after completion.

Data management

All data collected as part of monitoring plan should be archived electronically and be kept at least 2 years after the end of the last crediting period.

Monitoring report

A monitoring report in line with CDM regulations and the requirements of this monitoring methodology will be issued annually by the general manager.

The monitoring report will contain a summary of the whole monitoring plan, and will describe the implementation of the monitoring plan in that particular year, present the relevant results and data, and calculate emission reductions for the period.

The report will include:
- Quality assurance reports for the monitoring equipment;
- Calibration reports for the monitoring equipment (including relevant standards and regulations);
- Any maintenance and repair of monitoring equipment;
- The qualifications of the persons responsible for the monitoring and calculations;
- The tests performed and data obtained;
- Emission reduction calculations;
- A summary of the monitoring plan in that particular year;
- Any other information relevant to the monitoring plan.

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

The baseline study was completed on 03/04/2008 by:

Joseph Cairnes/Matthew Setterfield
Clean Energy Finance Committee
Mitsubishi UFJ Securities (MUS)
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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:

18/03/2006 (Date of the contract between Tapai Cement and the construction company)

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

25 years

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

C.2.1. Renewable crediting period

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

01/07/2009

C.2.1.2. Length of the first crediting period:

Seven (7) years, zero (0) months

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

The feasibility study for the Project looked in depth at the environmental effects of the Project activity. The EIA for the Project was approved by the Environmental Protection Bureau of Guangdong Province on December 24, 2006.

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

The Project Activity will involve the capture and utilization of a waste stream that was released directly into the atmosphere. That waste stream contains a significant amount of energy in the form of heat, and a large amount of dust. After implementation, the waste stream will be significantly reduced.

The following four factors were considered significant in the environmental review:

Treatment of exhaust gas: The stack gas emission points and stack gas cleaning facilities will be the same as in the baseline scenario. However, after having been used to generate electricity, the waste stream will be significantly cooler significantly improving the efficacy of the dust removal facilities, and therefore the quality of the stack gas upon release.

Noise treatment: The steam turbine and water pumps to be installed in the Project are the main producers of noise; however, they produce significantly less noise than other existing facilities at the cement plant. To reduce the noise pollution from these sources, the turbine engine room will be constructed in a shell shape. The water pumps will be installed in an enclosed environment which will allow little noise to be released. The noise pollution, when measured at the plant boundary, is very low.

Wastewater treatment: The water used to cool the equipment will be recycled. The recycling rate is very close to 100%, with the loss resulting from evaporation, and a small emission of water with a low pH from the water purification system. The Project activity will use a Neutral Pool, an acid-base neutralization device, to ensure the wastewater from the purifier meets discharge standards at the point of release.

Landscaping: Landscaping is an integral part of reducing the whole plant's environmental impact. In the redevelopment the Project entails, arbores, shrubs and grasses will be planted in the area surrounding the plant and along the nearby roads. Whilst making the area a more pleasant environment, this will also improve the local environment by adjusting temperature and humidity, whilst purifying air and mitigating noise.

As the Project significantly reduces the overall environmental impact of the cement plant, the management of the environmental issues associated with the Project can be performed by the plant's existing environmental management team.

SECTION E. Stakeholders' comments

A consultation was organized by Tapai Group to confirm the impacts of the waste heat recovery project on stakeholders. The consultation period lasted for one month, from the 20th of August to the 20th of September 2007, and consisted of the following elements:

- Announcement on the website
- A stakeholders' meeting
- A questionnaire survey

Announcement on the website

On its website, www.tapai.com, Tapai Group included information on the Project, CDM and the stakeholder consultation process, and provided a telephone number and an opportunity to post comments by e-mail.

Stakeholders' meeting

To ensure wide participation in the meeting, announcements were made on the Tapai Group website and by placing notices in the local communities. In addition to the above, further invitations were made by mail and by telephone to key stakeholders.

In addition to the three members of Project's working team, a total of twenty-two people attended the stakeholders' meeting, which was held from 14:30 to 16:30 on the 1st of September 2007 in the general meeting room of Guangdong Tapai Cement Co., Ltd. Those present included representatives from the local towns and villages, including local government representatives, members of residents' associations and interested local parties. The attendees were as follows:

Name list for participant people representatives

No.	Name	Affiliation	Position	Remark
1	Zhong Huantang	Committee for Chenguang Village	Vice director	
2	Qiu Yihe	Committee for Huangsha Village	Director	
3	Xiao Haosen	Committee for Huangsha Village	Vice director	
4	Qiu Zhaoyang	Huangsha Village	Resident	
5	Wu Yunqing	Chenguang Village	Resident	
6	Wu Guoqiang	Committee for Chenguang Village	Director	
7	Wu Xinhua	Chenguang Village	Resident	
8	Liu Zikang	Government of Pingling Town	Vice manager	
9	Chen Yongbin	Government of Pingling Town	Commissioner	
10	Qiu Xinmin	Government of Pingling Town	Vice secretary	
11	Liujian	Government of Pingling Town	Cadre member	
12	Deng Yongqiang	Huangsha Village	Resident	
13	Pengyong	Huangsha Village	Resident	
14	Qiu Yinggui	Chenguang Village	Resident	
15	Gu Weixian	Huangsha Village	Resident	
16	Qiu Weihuai	Huangsha Village	Resident	
17	Chen Zhikun	Chenguang Village	Resident	
18	Xu Weihua	Huangsha Village	Resident	
19	Song Jinghua	Huangsha Village	Resident	
20	Xu Guoan	Huangsha Village	Resident	

21	Qiu Junhui	Huangsha Village	Resident	
22	Xu Linglin	Huangsha Village	Resident	
23	Deng Liyong	Guangdong Tapai Group Co., Ltd	Manager assistant	
24	Libin	Guangdong Tapai Group Co., Ltd	Vice manager	
25	Qiu Changhua	Guangdong Tapai Group Co., Ltd	Director	

Note: the signed attendance list will be made available to the DOE.

The meeting followed the following agenda:

- Opening of the meeting;
- Introduction of the Clean Development Mechanism;
- Introduction of the Project
- Explanation of the stakeholder consultation process;
- Opportunity for comments and questions from each participant;
- Closing of the meeting.

In introducing the Project, care was taken to describe the following;

1) The technical process flow of the waste heat power generation involved in the Project;
2) A general description of the Project, including installed capacity and investment costs;
3) The conditions required for implementation of the Project under the CDM.

Picture 1: The stakeholder meeting in progress.

Questionnaire Survey

The Project Developer interviewed its staff and local residents by means of a questionnaire, and collected opinions about the Project Activity. The questionnaires will be made available to the DOE for review.

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

The comments and questions received during the stakeholders' meeting were recorded in the minutes along with the responses.

E.2. Summary of the comments received:

There were three important concerns raised by the stakeholders. They were in regard to:

1) Land acquisition;
2) Impact on the ambient environment;
3) Impact on local water resources.

After the meeting, the general consensus of the participants was of a satisfactory understanding about CDM projects and a willingness to support the implementation of the Project Activity. No negative comments were subsequently raised.

Furthermore, no negative comments were received by email through the website or by telephone. The results of the questionnaire survey were similarly positive.

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

The concerns were all answered during the stakeholder meeting, as follows:

1) Land acquisition: All of the new facilities will be installed inside the existing boundary of the cement plant. No land acquisition will be necessary.
2) Impact on the ambient environment: Since the Project Activity involves the utilisation of waste heat from the cement production process to generate electricity, there will be no additional pollution. Furthermore, the Project Activity will lead to a reduction in the dust emissions from the plant, improving the quality of the local environment. The Project will also reduce dependence of fossil fuel-derived electricity, which will lead to a reduction in associated pollutants such as NO_x and SO_2.
3) Impact on local water resources: The water cooling system to be used recycles close to 100% of the water it uses. There will be no significant discharge of wastewater, and, therefore, no impacts on the surrounding water resources.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The financial plans for the Project do not involve any public funding from Annex 1 countries.

Annex 3

BASELINE INFORMATION

Baseline calculation steps can be found in B.6.

TABLES OF OPERATING MARGING AND BUILD MARGIN CALCULATIONS

(i) Build Margin

Added capacity in the South China Grid (2003-2005):

Installed capacity in the South China Grid, 2005

Type	Unit	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	Total
Thermal power	MW	35182.6	4931.2	4758.4	9634.8	54507
Hydro power	MW	9035.7	6085.3	7993.1	7233	30347.1
Nuclear power	MW	3780	0	0	0	3780
Wind farm and others	MW	83.4	0	0	0	83.4
Total	MW	48081.7	11016.5	12751.5	16867.8	88717.5

Data source: China Electricity Yearbook 2006

Installed capacity in the South China Grid, 2004

Type	Unit	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	Total
Thermal power	MW	30172.9	4378.1	4306.9	7801.8	46659.7
Hydro power	MW	8584.6	5040.4	7058.6	6896.5	27580.1
Nuclear power	MW	3780	0	0	0	3780
Wind farm and others	MW	83.4	0	0	0	83.4
Total	MW	42620.9	9418.5	11365.5	14698.3	78103.2

Data source: China Electricity Yearbook 2005

Installed capacity in the South China Grid, 2003

Type	Unit	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	**TianShenQiao**	Total
Thermal power	MW	27231.4	3190.1	3556.8	6465.8	0	40444.1
Hydro power	MW	8107.2	4525.2	6543.2	3713.7	2520	25409.3
Nuclear power	MW	3780	0	0	0	0	3780
Wind farm and others	MW	83.4	0	0	0	0	83.4
Total	MW	39202	7715.3	10100	10179.5	2520	69716.8

Data source: China Electricity Yearbook 2004

Capacity	**2003**	2004	2005	Added between 2003-2005	
Thermal	40444.1	46659.7	54507	14062.9	74.01%
Hydro	25409.3	27580.1	30347.1	4937.8	25.99%
Nuclear	3780	3780	3780	0	0.00%
Wind	83.4	83.4	83.4	0	0.00%
Total	69716.8	78103.2	88717.5	19000.7	100.00%
% of 2005 capacity	78.58%	88.04%	100.00%		
Capacity addition	**21.42%**				

The China DNA has best-efficiency data for three types of power plant: solid-, liquid- and gas-fired. Emissions by type, and the representative emissions factor selected by the NDRC are shown below.

Thermal power generation in 2005

Fuel Type	CO2 Emission	
	tCO2	%
Raw coal	263442602	89.24%
Clean coal	3738	0.00%
Other washed coal	350238	0.12%
Coke	345390	0.12%
Crude oil	334556	0.11%
Gasoline	20296	0.01%
Diesel	1130639	0.38%
Fuel oil	28702703	9.72%
Other petroleum products	47833	0.02%
Natural gas	203115	0.07%
Coke oven gas	58624	0.02%
Other coal gas	413486	0.14%
Refinery gas	151211	0.05%
	295204431	100.00%

Fuel type	EF (tC/TJ)	Emissions by type
Solid	**25.8**	89.48%
Liquid	**21.1**	10.24%
Gas	**15.3**	0.28%

Best efficiency of Chinese power plants

Fuel type	Efficiency
Solid	**35.82%**
Liquid	**47.67%**
Gas	**47.67%**

Source: NDRC grid publications, 2007

Emission factor for fossil fuel

Fuel Type	Best Efficiency	Carbon emission (tC/TJ)	Oxidation factor (%)	Emission factor tCO2/MWh	Weighting
Solid	35.82%	25.8	1	0.9508	0.8507
Liquid	47.67%	21.1	1	0.5843	0.0598
Gas	47.67%	15.3	1	0.4237	0.0012
Weighted grid emission factor:					0.9117

	2003	New added	2004	2005
Total installed capacity	69716.8	19000.7	78103.2	88717.5
Thermal power installed capacity	40444.1	14062.9	46659.7	54507
Hydro power installed capacity	25409.3	4937.8	27580.1	30347.1
Total change	21.42%		11.96%	
Thermal split of new capacity		74.01%		
Weighted emission factor (tCO2/MWh)	0.9117			
Build margin emission factor	0.6748			

(ii) Operating Margin data for the South China Grid (2003, 2004, 2005)

CO2 emissions (tCO2e) for the South China Power Grid (2003):

Basic data for the South China Power Grid for 2003

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF	Oxidation factor	NCV	CO2 Emission
							(tC/TJ)	（%）	（MJ/t,km3）	I=E*F*G*H/10000*44/12（mass unit）
		A	B	C	D	E=A+B+C+D	F	G	H	I=E*F*G*H/1000*44/12 (volume unit)
Raw coal	10,000t	4491.79	831.84	2169.11	1405.27	**8898.01**	25.8	100	20908	175993455.05
Clean coal	10,000t	0.05				**0.05**	25.8	100	26344	1246.07
Other washed coal	10,000t			36.38	20.37	**56.75**	25.8	100	8363	448971.84
Coke	10,000t				0.5	**0.5**	25.8	100	28435	13449.76
Coke oven gas	10E8 m3				0.04	**0.04**	12.1	100	16726	2968.31
Other coal gas	10E8 m3	3.21			11.27	**14.48**	12.1	100	5227	335797.81
Crude oil	10,000t	6.85				**6.85**	20	100	41816	210055.71
Gasoline	10,000t	0.02				**0.02**	18.9	100	43070	596.95
Diesel	10,000t	31.9			0.76	**32.66**	20.2	100	42652	1031759.27
Fuel oil	10,000t	627.22	0.3			**627.52**	21.1	100	41816	20301304.48
LPG	10,000t					**0**	17.2	100	50179	0.00
Refinery gas	10,000t	2.85				**2.85**	18.2	100	46055	87592.00
Natural gas	10E8 m3					**0**	15.3	100	38931	0.00
Other petroleum produc	10,000t	11.35				**11.35**	20	100	38369	319357.98
Other coking products	10,000t					**0**	25.8	100	28435	0.00
Other energy	10000t ce	93.21			22.35	**115.56**	0	100	0	0.00
									Subtotal	198746555.2

《China Energy Statistics Yearbook 2004》

Thermal Power Generation, South China Power Grid (2003)

Province	Electricity Gener		On-site use	Power output
	(kWh)	（MWh）	（%）	（MWh）
Guangdong	1433.51	143351000	5.5	135466695
Guangxi	170.79	17079000	8.43	15639240.3
Guizhou	432.95	43295000	7.4	40091170
Yunnan	190.55	19055000	8.01	17528694.5
Total				208725799.8

《China Electric Power Yearbook 2004》

Imports from theCentral China Power Grid (2003)

Total power imports	11100
Average CO2 EF	0.797442253

South Grid EF Net Power Imports (2003)

Total Power Output [MWh]	208736900
Total emission, tCO2	198755406.8
EF (tCO2/TJ)	0.952181

CO2 emissions (tCO2e) for the South China Power Grid (2004):

Basic data for the South China Power Grid for 2004

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF	Oxidation factor	NCV	CO2 Emission
							(tC/TJ)	（%）	（MJ/t,km3）	I=E*F*G*H/10000*44/12（mass unit）
		A	B	C	D	E=A+B+C+D	F	G	H	I=E*F*G*H/1000*44/12 (volume unit)
Raw coal	10,000t	6017.7	1305	2643.9	1751.28	**11717.88**	25.8	100	20908	231767573.55
Clean coal	10,000t	0.21				**0.21**	25.8	100	26344	5233.50
Other washed coal	10,000t					**0**	25.8	100	8363	0.00
Coke	10,000t					**0**	25.8	100	28435	0.00
Coke oven gas	10E8 m3					**0**	12.1	100	16726	0.00
Other coal gas	10E8 m3	2.58				**2.58**	12.1	100	5227	59831.38
Crude oil	10,000t	16.89				**16.89**	20	100	41816	517932.98
Gasoline	10,000t					**0**	18.9	100	43070	0.00
Diesel	10,000t	48.88			1.83	**50.71**	20.2	100	42652	1601975.28
Fuel oil	10,000t	957.71				**957.71**	21.1	100	41816	30983494.25
LPG	10,000t					**0**	17.2	100	50179	0.00
Refinery gas	10,000t	2.86				**2.86**	18.2	100	46055	87899.34
Natural gas	10E8 m3	0.48				**0.48**	15.3	100	38931	104833.40
Other petroleum produc	10,000t	1.66				**1.66**	20	100	38369	46707.86
Other coking products	10,000t					**0**	25.8	100	28435	0.00
Other energy	10000t ce	79.42				**79.42**	0	100	0	0.00
									Subtotal	265175481.5

《China Energy Statistics Yearbook 2005》

Thermal Power Generation, South China Power Grid (2004)

Province	Electricity Gener		On-site use	Power output
	（kWh)	（MWh)	（%）	（MWh)
Guangdong	1693.89	169389000	5.42	160,208,116
Guangxi	201.43	20143000	8.33	18,465,088
Guizhou	497.2	49720000	7.06	46,209,768
Yunnan	243.22	24322000	7.56	22,483,257
Total				247,366,229

《China Electric Power Yearbook 2005》

Imports from theCentral China Power Grid (2004)

Total power imports	10951240
Average CO2 EF	0.82644843

South Grid EF Net Power Imports (2004)

Total Power Output [MWh]	258,317,469
Total emission, tCO2	274226116.6
EF (tCO2/TJ)	1.061585643

CO2 emissions (tCO2e) for the South China Power Grid (2005):

Basic data for the South China Power Grid for 2005

Fuel Type	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Subtotal E=A+B+C+D	EF (tC/TJ) F	Oxidation factor （%） G	NCV （MJ/t,km3） H	CO2 Emission I=E*F*G*H/10000*44/12（mass unit） I=E*F*G*H/1000*44/12 (volume unit)
Raw coal	10,000t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	20908	263442601.85
Clean coal	10,000t				0.15	**0.15**	25.8	100	26344	3738.21
Other washed coal	10,000t			10.39	33.88	**44.27**	25.8	100	8363	350237.59
Coke	10,000t	4.79			8.05	**12.84**	25.8	100	28435	345389.71
Coke oven gas	10E8 m3				0.79	**0.79**	12.1	100	16726	58624.07
Other coal gas	10E8 m3	1.87			15.96	**17.83**	12.1	100	5227	413485.84
Crude oil	10,000t	10.91				**10.91**	20	100	41816	334555.88
Gasoline	10,000t	0.68				**0.68**	18.9	100	43070	20296.31
Diesel	10,000t	31.96	2.02		1.81	**35.79**	20.2	100	42652	1130638.84
Fuel oil	10,000t	887.21				**887.21**	21.1	100	41816	28702703.26
LPG	10,000t					**0**	17.2	100	50179	0.00
Refinery gas	10,000t	4.92				**4.92**	18.2	100	46055	151211.46
Natural gas	10E8 m3	0.93				**0.93**	15.3	100	38931	203114.71
Other petroleum produc	10,000t	1.7				**1.7**	20	100	38369	47833.35
Other coking products	10,000t					**0**	25.8	100	28435	0.00
Other energy	10000t ce	104.66	133.15		59.72	**297.53**	0	100	0	0.00
									Subtotal	295,204,431

《China Energy Statistics Yearbook 2006》

Generation, South China Power Grid (2005)

Province	Electricity Gener（kWh)	（MWh)	On-site use（%）	Power output（MWh)
Guangdong	1764.53	176453000	5.58	166,606,923
Guangxi	250.23	25023000	7.95	23,033,672
Guizhou	584.3	58430000	7.34	54,141,238
Yunnan	272.81	27281000	6.94	25,387,699
Total				269,169,531

《China Electric Power Yearbook 2006》

Imports from theCentral China Power Grid (2005)

Total power imports	96363000
Average CO2 EF	0.771224884

South Grid EF Net Power Imports (2005)

Total Power Output [MWh]	365,532,531
Total emission, tCO2	369521974.5
EF (tCO2/TJ)	1.01091406

3-year average OM

1.0119

OM data for South China Grid imports from the Central China Grid (2003, 2004, 2005)

Basic data for the Central China Power Grid for 2003

Fuel Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	EF	Oxidation factor	NCV	CO2 Emission tCO2e
									(tC/TJ)	(%)	(MJ/t, km3)	K=G*H*I*J/10000*44/12 (mass unit)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J/1000*44/12 (volume unit)
Raw coal	10,000t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	**13851.66**	25.8	100	20908	273971539.89
Clean coal	10,000t							**0**	25.8	100	26344	0.00
Other washed coal	10,000t	2.03	39.63			106.12		**147.78**	25.8	100	8363	1169146.40
Coke	10,000t				1.22			**1.22**	25.8	100	28435	32817.40
Coke oven gas	1E+8 m4			0.93				**0.93**	12.1	100	16726	69013.15
Other coal gas	1E+8 m4							**0**	12.1	100	5227	0.00
Crude oil	10,000t		0.5	0.24			1.2	**1.94**	20	100	41816	59490.23
Gasoline	10,000t							**0**	18.9	100	43070	0.00
Diesel	10,000t	0.52	2.54	0.69	1.21	0.77		**5.73**	20.2	100	42652	181015.94
Fuel oil	10,000t	0.42	0.25	2.17	0.54	0.28	1.2	**4.86**	21.1	100	41816	157229.00
LPG	10,000t							**0**	17.2	100	50179	0.00
Refinery gas	10,000t	1.76	6.53		0.66			**8.95**	18.2	100	46055	275069.63
Natural gas	1E+8 m4					0.04	2.2	**2.24**	15.3	100	38931	489222.52
Other petroleum p	10,000t							**0**	20	100	38369	0.00
Other coking prod	10,000t							**0**	25.8	100	28435	0.00
Other energy	10000t ce		11.04			16.2		**27.24**	0	100	0	0.00
											Subtotal	276404544.15

《China Energy Statistics Yearbook 2004》

Thermal Electricity Generation of Central China Power Grid (2003)

Province		Electricity Generation	On-site use	Power output
	(1E+8kWh)	(MWh)	(%)	(MWh)
Jiangxi	271.65	27165000	6.43	25,418,291
Henan	955.18	95518000	7.68	88,182,218
Hubei	395.32	39532000	3.81	38,025,831
Hunan	295.01	29501000	4.58	28,149,854
Chongqing	163.41	16341000	8.97	14,875,212
Sichuan	327.82	32782000	4.41	31,336,314
Subtotal				225,987,719

《China Electric Power Yearbook 2004》

Total emissions	**276,404,544**	tCO2
Total electricity	**225,987,719**	MWh
Grid EF	**1.223095**	tCO2/MWh

Basic data for the Central China Power Grid for 2004

Fuel Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	EF	Oxidation factor	NCV	CO2 Emission tCO2e
									(tC/TJ)	(%)	(MJ/t, km3)	K=G*H*I*J/10000*44/12 (mass unit)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J/1000*44/12 (volume unit)
Raw coal	10,000t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	**17144.1**	25.8	100	20908	339092605.29
Clean coal	10,000t		2.34					**2.34**	25.8	100	26344	58316.13
Other washed coal	10,000t	48.93	104.22			89.72		**242.87**	25.8	100	8363	1921441.23
Coke	10,000t		109.61					**109.61**	25.8	100	28435	2948455.29
Coke oven gas	1E+8 m4			1.68		0.34		**2.02**	12.1	100	16726	149899.53
Other coal gas	1E+8 m4					2.61		**2.61**	12.1	100	5227	60527.09
Crude oil	10,000t		0.86	0.22				**1.08**	20	100	41816	33118.27
Gasoline	10,000t		0.06			0.01		**0.07**	18.9	100	43070	2089.33
Diesel	10,000t	0.02	3.86	1.7	1.72	1.14		**8.44**	20.2	100	42652	266627.32
Fuel oil	10,000t	1.09	0.19	9.55	1.38	0.48	1.68	**14.37**	21.1	100	41816	464893.14
LPG	10,000t							**0**	17.2	100	50179	0.00
Refinery gas	10,000t	3.52	2.27					**5.79**	18.2	100	46055	177950.07
Natural gas	1E+8 m4						2.27	**2.27**	15.3	100	38931	495774.61
Other petroleum p	10,000t							**0**	20	100	38369	0.00
Other coking prod	10,000t							**0**	25.8	100	28435	0.00
Other energy	10000t ce		16.92		15.2	20.95		**53.07**	0	100	0	0.00
											Subtotal	345671697.30

《China Energy Statistics Yearbook 2005》

Thermal Electricity Generation of Central China Power Grid (2004)

Province		Electricity Generation	On-site use	Power output
	(1E+8kWh)	(MWh)	(%)	(MWh)
Jiangxi	301.27	30127000	7.04	28,006,059
Henan	1093.52	109352000	8.19	100,396,071
Hubei	430.34	43034000	6.58	40,202,363
Hunan	371.86	37186000	7.47	34,408,206
Chongqing	165.2	16520000	11.06	14,692,888
Sichuan	346.27	34627000	9.41	31,368,599
Subtotal				249,074,186

《China Electric Power Yearbook 2005》

Total emissions	**345,671,697**	tCO2
Total electricity	**249,074,186**	MWh
Grid EF	**1.387826**	tCO2/MWh

Basic data for the Central China Power Grid for 2005

Fuel Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	EF	Oxidation factor	NCV	CO2 Emission tCO2e
									(tC/TJ)	(%)	(MJ/t, km3)	K=G*H*I*J/10000*44/12 (mass unit)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J/1000*44/12 (volume unit)
Raw coal	10,000t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	20908	352614496.76
Clean coal	10,000t	0.02						**0.02**	25.8	100	26344	498.43
Other washed coal	10,000t		138.12			89.99		**228.11**	25.8	100	8363	1804669.00
Coke	10,000t		25.95		105			**130.95**	25.8	100	28435	3522490.83
Coke oven gas	1E+8 m4			1.15		0.36		**1.51**	12.1	100	16726	112053.61
Other coal gas	1E+8 m4		10.2			3.12		**13.32**	12.1	100	5227	308896.88
Crude oil	10,000t		0.82	0.36				**1.18**	20	100	41816	36184.78
Gasoline	10,000t		0.02			0.02		**0.04**	18.9	100	43070	1193.90
Diesel	10,000t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	42652	299797.78
Fuel oil	10,000t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	41816	286959.09
LPG	10,000t							**0**	17.2	100	50179	0.00
Refinery gas	10,000t	0.71	3.41	1.76	0.78			**6.66**	18.2	100	46055	204688.68
Natural gas	1E+8 m4						3	**3**	15.3	100	38931	655208.73
Other petroleum p	10,000t							**0**	20	100	38369	0.00
Other coking prod	10,000t				1.5			**1.5**	25.8	100	28435	40349.27
Other energy	10000t ce		2.88		1.74	32.8		**37.42**	0	100	0	0.00
											小计	359887487.74

《China Energy Statistics Yearbook 2006》

Thermal Electricity Generation of Central China Power Grid (2005)

Province		Electricity Generation	On-site use	Power output
	(1E+8kWh)	(MWh)	(%)	(MWh)
Jiangxi	300	30000000	6.48	28,056,000
Henan	1315.9	131590000	7.32	121,957,612
Hubei	477	47700000	2.51	46,502,730
Hunan	399	39900000	5	37,905,000
Chongqing	175.84	17584000	8.05	16,168,488
Sichuan	372.02	37202000	4.27	35,613,475
Subtotal				286,203,305

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Total emissions	**359,887,488**	tCO2
Total electricity	**286,203,305**	MWh
Grid EF	**1.257454**	tCO2/MWh

Central China Grid Generation and Supply Data, 2003

Province	Total generation (1E+8kWh)	Total generation (MWh)	Parasitic use (%)	Supplied to grid (MWh)	Hydro generation (1E+8kWh)	Thermal generation (1E+8kWh)	Other (MWh)	Total (MWh)
Jiangxi	310.29	31029000	6.43	29,033,835	38.64	271.65		
Henan	1009.75	100975000	7.68	93,220,120	54.57	955.18		
Hubei	783.07	78307000	3.81	75,323,503	387.75	395.32		
Hunan	539.02	53902000	4.58	51,433,288	244.01	295.01		
Chongqing	202.92	20292000	8.97	18,471,808	39.51	163.41		
Sichuan	827.82	82782000	4.41	79,131,314	500	327.82		
Total（MWh）				346,613,868				346,613,868

《China Electric Power Yearbook 2004》

Central China Grid Generation and Supply Data, 2004

Province	Thermal generation (1E+8kWh)	Thermal generation (MWh)	Parasitic use (%)	Supplied to grid (MWh)	Hydro generation (1E+8kWh)	Hydro generation (MWh)	Parasitic use (%)	Supplied to grid (MWh)	Other (MWh)	Total (MWh)
Jiangxi	301.27	30127000	7.04	28,006,059	38.9	3890000	1.2	3843320		
Henan	1093.52	109352000	8.19	100,396,071	68.84	6884000	0.43	6854398.8		
Hubei	430.34	43034000	6.58	40,202,363	695.12	69512000	0.12	69428585.6		
Hunan	371.86	37186000	7.47	34,408,206	242.36	24236000	0.51	24112396.4		
Chongqing	165.2	16520000	11.06	14,692,888	56.7	5670000	2.09	5551497	725000	
Sichuan	346.27	34627000	9.41	31,368,599	589.02	58902000	0.39	58672282.2		
Total（MWh）				249,074,186				168,462,480	725,000	418,261,666

《China Electric Power Yearbook 2005》

Central China Grid Generation and Supply Data, 2005

Province	Total generation (1E+8kWh)	Total generation (MWh)	Parasitic use (%)	Supplied to grid (MWh)	Hydro generation (1E+8kWh)	Thermal generation (1E+8kWh)	Other (MWh)	Total (MWh)
Jiangxi	350	35000000	6.48	32,732,000	50	300		
Henan	1382.9	138300000	7.32	128,176,440	67	1315.9	10000	
Hubei	1291	129100000	2.51	125,859,590	814	477		
Hunan	640	64000000	5	60,800,000	241	399		
Chongqing	236.2	23620000	8.05	21,718,590	60.36	175.84		
Sichuan	1017	101700000	4.27	97,357,410	644.98	372.02		
Total（MWh）				466,644,030				466,644,030

《China Electric Power Yearbook 2006》

Average OM 2003	0.79744
Average OM 2004	0.82645
Average OM 2005	0.77122

Annex 4

MONITORING INFORMATION

No further information is provided in this annex.

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