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:

Angang Waste Gas Recovery and Generation Project

Version 6.1 21/11/2008, revised according to DOE comments.

PDD history (ACM0004):
Version 1.0, 01/03/2007, GSP version
Version 2.0, 01/09/2007, updated following DOE site visit and receipt of DOE CAR & CR list
Version 3.0, 26/10/2007, revised according to comments from DOE
Version 4.0, 06/12/2007, revised according to comments from DOE
Version 5.0, 28/12/2007, revised according to comments from DOE
Version 5.1, 03/02/2008, updated following further DOE comments
Version 5.2, 05/03/2008, updated following further DOE comments
Version 6.0 26/06/2008, revised according to new methodology ACM0012 (version 2) from ACM0004, resubmitted for GSP on 30/07/2008

A.2. Description of the project activity:

Anyang Iron and Steel Co., Ltd. (AIS) is a large manufacturer of pig iron, steel, and steel products headquartered in Henan Province of China. The objective of the Angang Waste Gas Recovery and Generation Project (hereafter referred to as the Project) is to recover the surplus combustible waste gas from the AIS facility, located in Yindu District of Anyang City and to utilize the waste gas to generate electricity. The waste gas comes primarily from the facility's blast furnaces, with some additional surplus gas from steel converters and coke ovens. The electricity is totally consumed on site by the iron and steel production process. The Project comprises the waste gas recovery system and three steam generation units with installation capacity of 30MW, 7.5MW and 6 MW. In the absence of the project, all electric power demand was met through imports from the Central China Power Grid (CCPG) as there is no captive power generation.

The project's total installed capacity is 43.5MW. It utilizes 878 million Nm^3 of waste gas annually and supply 280.5 GWh of power. In normal operation blast furnace gas is available up to 8400h and coke oven gas up to 8760h.The power generators will operate 7000h per year due to fluctuating gas quality and quantity and ongoing maintenance requirements. According to the gas balance of AIS, 13.4% of total combustible waste gas generated by AIS iron and steel production is flared and released to the atmosphere unused. In other words, 141,704 Nm^3 of combustible waste gas is flared per hour and released to atmosphere. Therefore, the Project could take full advantage of unused waste gas to generate power. The power would displace electricity imported from the Central China Power Grid (CCPG), which is dominated by fossil fuel-fired power plants, and reduce an estimated 273,066 tons of CO_2e per year.

Besides the GHG emission reductions, the Project would contribute to local and national sustainable development through:

- Reduction of air pollutants of coal fired power plants such as SO_2 and TSP;
- Reduction of fossil fuel-based energy consumption, thus improving energy efficiency;
- Improvement of energy mix and energy security;
- Creating employment opportunities for the local community;
- Promoting implementation of similar activities in the region.

The estimated investment required for the Project is 233 million RMB, of which the majority is provided by loans.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
China (host)	Anyang Iron & Steel Co., Ltd.	No
United Kingdom of Great Britain and Northern Ireland	Noble Carbon Credits Limited (private entity)	No
United Kingdom of Great Britain and Northern Ireland	Camco International Limited (private entity)	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-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.

Note: *When the PDD is filled in support of a proposed new methodology (form CDM-NM),* at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

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.:

Henan Province

A.4.1.3. City/Town/Community etc:

Yindu District, Anyang City

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 within the AIS steel mill, which is located in Yindu District, Anyang City, Henan Province, China. The geographical coordinates are east longitude 114°10′29.9″, and north latitude 36°3′56.4.” The location of the Project is shown in the following maps.

MAP OF CHINA

MAP OF HENAN PROVINCE

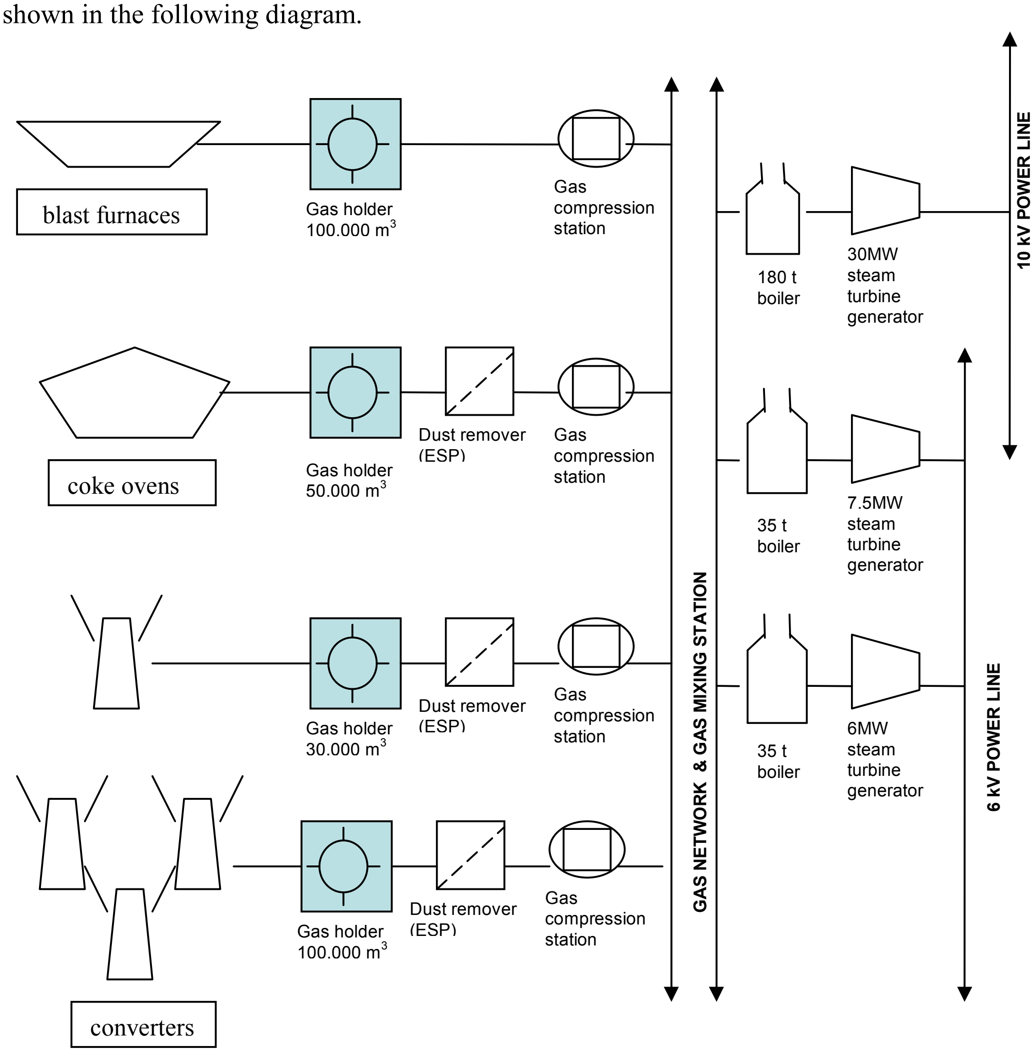
Henan map source: http://www.maps-of-china.com/henan-s-ow.shtml

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

The Project falls into sectoral scope 1: Energy Industries and scope 4: Manufacturing Industries

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

This Project recovers and cleans the waste gas from blast furnaces, steel converters, and coke ovens, and utilizes it for electric power generation. Primarily blast furnace gas (BFG) is used, along with other waste gases. The converter gas is surplus, mixed combustible waste gas that is a by-product of the steelmaking process and the coke oven gas comes from the on-site coke plants and is used for ignition. The Project equipment consists of the waste gas recovery system and the steam turbine generation system, as shown in the following diagram.



The gas generated from the 100t converter is delivered to a 30,000 m^3 Wiggins Gasholder and then filtered in the dust remover. After being compressed in the gas compressor station, it is delivered to the AIS gas network via a gas mix station. The gas generated from the three 150t converters and the coke ovens is treated similarly, with the only difference being that the gas holder is a 100,000 m^3 Wiggins Gasholder and a 50,000 m^3 Gasholder respectively. The gas is delivered to the gas network and gas mixing station and then sent to the three sets of boilers and turbines as depicted above.

Power from the 30MW unit is sent via a 10.5kV power line of the Meiyuan 220kV substation and power from the 7.5MW and 6MW units is sent via a 6.3kV power line of the Xiqu 110kV substation. The total installed capacity is 43.5MW, and the generation is completely consumed by the AIS facility itself, offsetting power currently purchased from the grid. The key equipments are as follows.

Boilers:
One 180t/h gas-fired boiler; three 35t/h gas-fired boilers, including one for backup (not pictured).
Rated steam pressure: 3.82MPa
Rated steam temperature: 450℃
Inlet water temperature: 104℃
Flue gas temperature: ≤160℃
Boiler Heat Efficiency: ~87%

Steam turbines:
Three steam turbines with capacity of 30MW, 7.5MW and 6MW.
Rated speed: 3000r/min
Main steam pressure: 3.43MPa (absolute value)
Main steam temperature: 435℃
Rated exhaust steam pressure: ~0.015MPa (absolute value)
Cooling water temperature: 34℃.

Generators:
Three steam generators with capacity of 30MW, 7.5MW and 6MW.
Out-going voltage is 10.5kV and 6.3kV

Equipment suppliers:
All the equipment adopted by the Project is manufactured domestically in China. The 30MW steam turbine supplier is Qing Dao Jie Neng Gas Turbine Co. Ltd. and the generator is from Shan Dong Ji Nan Generator Manufacturing Plant. The 7.5MW turbine and generator supplier is Hang Zhou Gas Turbine Co. Ltd. The 6MW turbine and generator supplier is Luo Yang Generator Manufacturing Plant.

Training:
Because the equipment is advanced technology in China, the project owner must conduct training for its employees who are responsible for operating and maintaining the equipment. Training is conducted for a period of one month, training eight personnel per generator unit as follows:
- 30MW unit: Qing Dao Jie Neng Gas Turbine Co. Ltd.
- 7.5MW unit: Hang Zhou Gas Turbine Co. Ltd.
- 6.0 MW unit: Luo Yang Generator Manufacturing Plant

Four main topics of training:
1. Principles of steam turbine
2. Structure and property of steam turbine
3. Operation and maintenance of steam turbine
4. Handling of accidents with steam turbine

Implementation schedule:
Construction of the 30MW steam turbine generator began in April 2007, and was completed in November 2007. The 7.5MW and 6MW units started construction in May 2007, and were completed in November 2007. All three units were operational at the end of December 2007.

During periodic maintenance and in case of emergencies when the power generation equipment will be shut down, AIS will import power from the CCPG.

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

The Project will use a fixed crediting of 10 years. The estimated annual emission reductions are 273,066t CO_2e, or 2,730,660 tCO_2e over the entire crediting period, as shown below[1].

Year	Annual estimation of emission reductions in tonnes of CO_2e
2009	273,066
2010	273,066
2011	273,066
2012	273,066
2013	273,066
2014	273,066
2015	273,066
2016	273,066
2017	273,066
2018	273,066
Total estimated reductions (tonnes of CO_2e)	**2,730,660**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	273,066

A.4.5. Public funding of the project activity:

There is no public funding of this Project.

[1] The exact quantity for 2009 and 2018-19 may vary depending on the final registration date

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:

The following methodology is used:

Approved consolidated baseline and monitoring methodology ACM0012 (version 2) "Consolidated baseline methodology for GHG emission reductions for waste gas or waste heat or waste pressure based energy system".

The "Tool to calculate the emission factor for an electricity system" version 1, (EB 35) is used to calculate the emission factor.

The "Tool for the Demonstration and Assessment of Additionality", Version 5, (EB 39) is used to demonstrate the additionality of the project activity.

More information could be found at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html .

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

The Project activity meets the applicability criteria of the selected methodology ACM0012, because:

Methodology applicability criteria	Project activity in accordance with the applicability criteria
The Project utilizes waste gas as an energy source for generation of electricity.	
If project activity is use of waste pressure to generate electricity, electricity generated using waste gas pressure should be measurable.	**N/A** Because the Project uses waste gas, not waste pressure.
Energy generated in the project activity may be used within the industrial facility or exported outside the industrial facility.	**Pass.** The electricity generated by the Project activity is used within the industrial facility of AIS.
The electricity generated in the project may be exported to the grid.	**Pass.** All electricity generated by the Project activity is used within the industrial facility of AIS. Although the Power System in the plant which this proposed Project is connected to is connected to the CCPG, no electricity generated in the Project will be exported to the grid.
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.	**Pass.** Electricity in the Project activity is generated by AIS which is the owner of the industrial facility.

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.	**Pass.** There are no mandatory regulations that restrict AIS (who are generating the waste gas) from using fossil fuels prior to the implementation of the proposed Project.
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.	**Pass.** The Project utilizes the waste gas produced by existing blast furnaces, coke ovens, and converters of AIS for generation, and there is no expansion planned.
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.	**Pass.** In the absence of the Project activity the surplus waste gas would be flared and released in to the atmosphere. This can be proven by the historical gas balance sheets from AIS.
The credits are claimed by the generator of energy using waste gas/heat/pressure. In case the energy is exported to other facilities an agreement is signed by the owners of the project energy generation plant with recipient plant that the emission reductions would not be claimed by recipient plant for using a zero-emission energy source.	**Pass.** The emission reductions generated will belong to AIS, who operate both the waste gas generation facilities and the output energy recipient plants; therefore, there is no need for agreement.
For those facilities and recipients, included in the project boundary, which prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods: The remaining lifetime of equipments currently being used; and the credit period	**Pass.** The credit period of 10 years is chosen because it is shorter than the remaining lifetime of equipments currently being used.
Waste gas/pressure that is released under abnormal operation (emergencies shut down) of the plant shall not be accounted for.	**Pass.** Credit will not be claimed when the waste gas is released under abnormal operation.
Cogeneration of energy is from combined heat and power and not combined cycle mode of electricity generation.	**N.A.** This Project activity is not a cogeneration project.

It may therefore be concluded that the project meets all applicability criteria of the methodology ACM0012 and so this methodology is applicable to the proposed Project.

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

As per ACM0012, the geographical extent project boundary shall include the following:

1. The industrial facility where waste gas is generated

For this proposed project, the industrial facility where waste gas is generated comprises the blast furnaces, coke ovens, and the converters.

2. **The facility where process heat in element process/steam/electricity is generated (generator of process heat/stream/electricity). Equipment providing auxiliary heat to the waste heat recovery process shall be included within the project boundary;**

For this proposed Project, the boundary includes the facility where electricity is generated, including the boilers, the turbine and the generator and all other auxiliary equipment of this proposed Project.

3. **The facility/s where the process heat in element process/steam/electricity is used (the recipient plant(s)) and /or grid where electricity is exported, if applicable.**

For this proposed Project, the facility where electricity used is AIS Power System, which is connected to the CCPG. Based on the "*Tool to calculate the emission factor for an electricity system" version 1,* the spatial extent of the Project is the power plants that are physically connected through transmission and distribution lines to the Project activity. As China has published a delineation of the Project electricity system and connected electricity system, we use the CCPG as the Project electricity system, which includes Henan province, Hubei province, Hunan province, Jiangxi province, Sichuan province and Chongqing.

The following table illustrates which emissions sources are included and which are excluded from the Project boundary for determination of baseline scenario and project emissions.

	Source	**Gas**	**Included ?**	**Justification / Explanation**
Baseline	Electricity generation, grid or captive source	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	fossil fuel consumption in boiler for thermal energy	CO_2	Excluded	No fossil fuels will be burnt in boilers.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Fossil fuel consumption in cogeneration plant	CO_2	Excluded	No cogeneration plant in project activity
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Baseline emissions from generation of steam used in the	CO_2	Excluded	No steam used in flaring activity
		CH_4	Excluded	Excluded for simplification. This is conservative.

	flaring process, if any	N_2O	Excluded	Excluded for simplification. This is conservative.
Project activity	Supplemental fossil fuel consumption at the project plant	CO_2	Excluded	No auxiliary fuels will be used in the project.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Supplemental electricity consumption.	CO_2	Included	Considered in the calculation of baseline emissions, the supplemental electricity is included in the auxiliary electricity consumption.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Project emission from cleaning of gas	CO_2	Excluded	Considered in the calculation of baseline emissions, the electricity used for cleaning of gas is included in the auxiliary electricity consumption.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.

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

The baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s). Realistic and credible alternatives are determined for:

- Waste gas use in the absence of the project activity; and
- Power generation in the absence of the project activity

Step 1: Define the most plausible baseline scenario for the generation of electricity using the following baseline options and combinations

For the use of waste gas, the realistic and credible baseline alternatives are:

W1 Waste gas is directly vented to atmosphere without incineration;
W2 Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere
W3 Waste gas/heat is sold as an energy source;
W4 Waste gas/heat/pressure is used for meeting energy demand.

For W1: **Waste gas is directly vented to atmosphere without incineration**. Directly venting waste gas to the atmosphere without incineration is in conflict with the relevant item in the Gas Security Regulations for Industrial Enterprises GB6222-2005, which requires that surplus gas is flared before

being vented. The waste gas in the Project consists of blast furnace gas, coke oven gas and converter gas, which are highly toxic and explosive. It is common practice in the iron and steel industry for the waste gas to be flared by a specified incineration facility. Thus W1 is excluded from further consideration.

For W2: **Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere.** This baseline scenario option is in compliance with relevant Chinese laws and regulations and is also the status quo of the Project proponent in the pre-project scenario.

For W3: **Waste gas is sold as an energy source.** Residential users are forbidden to use waste gases generated from AIS facility directly for safety reasons, because:

- The carbon monoxide concentration of blast furnace gas is 20-26% and of converter gas is 57.5%,, which is higher than the upper limit of 10% for the manufactured gas standard;
- The heat value of blast furnace gas is 3,140±209KJ/m^3 and of Converter gas is 7,538±419KJ/m^3, which is lower than the lower limit of 14,700MJ/m^3 for the manufactured gas standard;

Therefore, only large industrial users are permitted to use these waste gases. However, there are no other large industrial users in the local area. Therefore, the waste gas cannot be sold as an energy source. The scenario W3 is not plausible, and not a plausible baseline scenario.

For W4, **Waste gas is used for meeting energy demand.** According to the gas balance sheet, we can find that the waste gas utilized in this Project is surplus waste gas after satisfying the manufacturing demand of AIS. In the absence of the Project activity it would be flared and released in to atmosphere. However, there is potential demand for using waste gas for power generation. This is also in compliance with national laws and regulations, but is not compulsory under national or local governmental laws. Therefore, this scenario is a plausible baseline alternative and it will be further discussed in step 3 and section B.5.

From the above analysis we can conclude that the scenario W2 (Waste gas is released directly to the atmosphere after incineration) and W4 (Waste gas is used for meeting energy demand) are plausible baseline scenarios for the use of the waste gas.

As to power generation, there are eight baseline alternatives detailed in the methodology, namely:

P1 Proposed project activity not undertaken as a CDM project activity;
P2 On-site or off-site existing/new fossil fuel fired cogeneration plant;
P3 On-site or off-site existing/new renewable energy based cogeneration plant;
P4 On-site or off-site existing/new fossil fuel based existing captive or identified plant;
P5 On-site or off-site existing/new renewable energy based existing captive or identified plant;
P6 Sourced Grid-connected power plants;
P7 Captive Electricity generation from waste gas (if project activity is captive generation with waste gas, this scenario represents captive generation with lower efficiency than the project activity.);
P8 Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity).

For P1, **Proposed project activity not undertaken as a CDM project activity**. This alternative is in compliance with Chinese current applicable laws and regulations and is therefore a realistic and credible baseline alternative.

For P2, **On-site or off-site existing/new fossil fuel fired cogeneration plant**. The proposed Project is for power generation only, therefore this option is not relevant and is excluded.

For P3, **On-site or off-site existing/new renewable energy based cogeneration plant** The proposed Project is for power generation only, therefore this option is not relevant and is excluded.

For P4, **On-site or off-site existing/new fossil fuel based existing captive or identified plant**. There is no existing fossil fuel captive power plant in AIS. Also, in terms of applicable rules and regulations, the "Notice from the General Office of the PRC State Council on Strictly Prohibiting Constructing Thermal Power Units with the Capacity under 135MW" (state council public notice [2002] No.6) prohibits the construction of fossil fuel power plants with a capacity under 135MW. In 2006, the average operation hours of thermal power plants could reach 5,612[2]hours. Considering a thermal power plant with the equivalent annual power generation as the proposed Project, the installed capacity would be 5 MW, much less than 135MW, which doesn't comply with the laws. Therefore, P4 is not plausible and realistic alternative for the Project activity.

For P5, **On-site or off-site existing/new renewable energy based existing captive or identified plant.** Since there are no usable renewable sources such as wind, water or biomass at the Project site, therefore option P5 is not plausible and realistic alternatives for the proposed Project activity.

For P6, **Sourced Grid-connected power plants.**This is the current situation and the power demand is met by the electricity delivered from the local grid which is part of the Central China Power Grid. Thus P6 is a realistic and credible baseline alternative.

For P7, **Captive Electricity generation from waste gas (if project activity is captive generation with waste gas, this scenario represents captive generation with lower efficiency than the project activity.)** The power requirement could be met by utilization of waste gas in a lower efficiency gas fired boiler. However, these options would face significant financial barriers as the financial returns from a lower efficiency boiler would be lower than for the Project (as the power and heat output would be lower and a larger system would be needed to provide a similar output to the proposed Project). Hence the scenario P7 is not feasible as baseline scenarios.

For P8 Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity). The proposed Project is for power generation only; therefore this option is not relevant and is excluded.

From the above analysis we can conclude that the scenario P1 (Proposed Project activity not undertaken as a CDM Project activity) and P6 (Sourced Grid-connected power plants) are plausible baseline scenarios for power generation.

There is no heat generation within the project activity so baselines scenarios for heat are not considered.

Scenarios W2 P1 and W4 P6 are not realistic and credible baseline scenarios. In W2 P1 the waste gas

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[2] *China Electric Power Yearbook 2007*

would be flared which means that the project activity (P1) is not possible due to the lack of available waste gas. W4 P6 would involve using the waste gas for energy demand whilst importing electricity from the grid. This would mean the gas is used for meeting heat energy demand and this is not feasible at AIS because all available heat demand is already met through manufacturing related steam generation.

In summary, there are two realistic and credible alternatives. They are:

Scenario	Baseline options		Description of situation
	Waste gas	Power	
1	W2	P6	Waste gas would be flared and released to the atmosphere, electricity is obtained from the grid.
2	W4	P1	The Proposed Project activity not undertaken as a CDM Project activity

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

In neither scenario 1 or 2 above is a choice of baseline fuel applicable. Therefore, this step is omitted.

Step 3: Step 2 and/ or Step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used to identify the most plausible baseline scenario by eliminating non-feasible options

Section B.5 demonstrates that scenario 2 identified above (Proposed activity not undertaken as a CDM activity) is clearly not economically attractive as it has an equity IRR of just 5.42%, lower than the benchmark of 13%, which means that this Project is financially unattractive to the Project owner if the Project not undertaken as CDM Project activity. Please refer to Section B.5 Step 3.

Therefore only one baseline scenario remains:

Scenario	Baseline options		Description of situation
	Waste gas	Power	
1	W2	P6	Waste gas would be flared and released to the atmosphere and electricity is obtained from the grid.

Step 4: If more than one credible and plausible scenario remain, the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario.

This step is omitted as only one baseline scenario remains.

Conclusions:
The baseline scenario of the Project is:

Baseline Scenario		Description of situation
Waste gas	Power	
W2	P6	Waste gas would be flared and released to the atmosphere and electricity is obtained from the grid

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): >>

According to ACM0012, the additionality of the project should be assessed using the latest version of the "Tool for the demonstration and assessment of additionality" (in this case version 05, EB39).

The timeline of important events in the project can be described as follows and this shows that CDM was considered as an integral part of this project right from the outset:

Jan. 6, 2006	Angang "CDM Center" establishment date
August 2006	FSR report date
Sep. 15, 2006	CADA signing date with CAMCO
Sep. 20, 2006	EIA report
Oct. 24, 2006	EIA approval
Oct. 25, 2006	FSR approval
Dec. 8, 2006	First stakeholder meeting date
Dec. 8, 2006	30MW steam turbine EPC contract signing date
Dec. 25, 2006	Second stakeholder meeting date
Jan. 12, 2007	2x 35t/h boiler Purchase Contract signing date
Jan. 16, 2007	7.5MW steam turbine Contract signing date
Jan. 24, 2007	Agriculture Bank loan agreement signing date
Mar 14, 2007	First GSP date of EN PDD acc to ACM0004
Apr 3, 2007	Site visit by TUV and CAMCO
Apr. 30, 2007	Construction commence date
May 18, 2007	Issuing date of LoA by China NDRC
Dec. 1, 2007	Full commissioning date of the project
Jul 30, 2008	Second GSP date of PDD EN acc to ACM0012

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

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

As discussed in B.4 step 1, there are only two scenario options and these are the outcome of sub-step 1a:

Scenario	Baseline options		Description of situation
	Waste gas	Power	
1	W2	P6	Waste gas would be flared and released to the atmosphere, electricity is obtained from the grid .
2	W4	P1	The Proposed project activity not undertaken as a CDM project activity

Sub-step 1b: Consistency with mandatory laws and regulations

Both of the alternative combinations W4/P1 and W4/P6 are consistent with current mandatory laws and regulations. As the Project activity is not the only alternative amongst the ones considered above then the proposed CDM project activity passes this Step.

Outcome of step 1b:
The realistic and credible alternative scenarios to the activity are the same as for sub-step 1a above

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

The Tool for the Demonstration and Assessment of Additionality suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn revenues not only from the CER sales but also from internal electricity sales, the simple cost analysis method is not appropriate.

The benchmark analysis method is used (Option III).

Sub-step 2b. Option III. Apply benchmark analysis

According to "the Methods and Parameters for Economic Assessment of Construction Projects (version3)"[3], a proposed project in the iron and steel sector is considered financially feasible only if the financial indicator surpasses the sectoral benchmark. Although the proposed project is a power generation project, AIS as an iron and steel industry enterprise requires the same return rate as an investment in their core field. Therefore the proposed project is feasible only if the IRR will surpass the

[3] Methods and Parameters for Economic Assessment of Construction Projects (version 3), published by NDRC and Construction Ministry, December 2006,

benchmark value of the iron and steel sector.

According to the "Methods and Parameters", the benchmark Equity (after tax) IRR of the iron and steel sector is 13%. Therefore, 13% is adopted as the benchmark IRR for the Project, and the calculation and comparison of financial indicators are carried out in sub-step 2c.

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

The major parameters and assumptions are listed in the following table to calculate the financial indicators of the Project.

Table 1. Parameters and Assumptions for Financial Assessment

Item	Units	Amount
Generation Capacity	MW	43.5
Total Fixed Investment	Million RMB	233.05
Ratio: Equity	%	40
Loan	%	60
Estimated annual delivered generation	GWh/a	280.5
Tariff	RMB /kWh	0.382*[4]
Annual O&M	Million RMB	72.69
VAT rate	%	17
Income tax rate	%	33
Expected CER price	€ $/tCO_2$	8
Lifetime	Years	11
CDM Crediting Period	Years	10

Fixed values for power tariff and O&M costs are used because the sector benchmark is also calculated using fixed input values. This is because in China Design Institutes are required to conduct the investment analysis of an FSR in accordance with the guidance taken from "Method and Parameters of economic assessment for project construction (Version 3)", published by the NDRC and the Ministry of Construction of China. The guidance states that tariff rates for both output and input values should be predicted at the beginning of the operation period and that these predictable tariff rates will be fixed and applied throughout the operation period.[5]

The operation and maintenance cost described here includes power and water, wage & welfare and maintenance costs as follows. Electrical power costs are included here because the revenue of the project has been calculated using gross power generation without subtracting the parasitic load of the generating plant itself:

[4] The electricity tariff of RMB0.382/kWh is based on the tariff from the approved feasibility study of RMB0.4671/kWh, minus RMB0.02/kWh for using grid system, net of 17% tax. This was established prior to publication of the real tariff (0.429 including tax) and is therefore a conservative estimate.

[5] P84 Method and Parameters (Version 3). Provided also as PDF

Power and resources	33.83 m RMB
Wage and welfare	7.27 m RMB
Repairing	18.07 m RMB
Management	13.52 m RMB
TOTAL	72.69 m RMB

Maintenance costs represent 8% of total fixed investment.
The financial indicators obtained based on the above parameters are presented in the following Table, including IRR with and without CERs revenues. Obviously, without CER revenue, the IRR of the Project is only 5.42%, well below the benchmark. Therefore, it could be concluded that the Project is not financially attractive compared to the benchmark.

With CER revenue, the IRR of the Project is greatly improved to 17.49% which is higher than the benchmark and makes the Project financially attractive.

Table 2. Comparison of Equity IRR with and without CER revenue

Item	Unit	Without CER revenue	Benchmark	With CER revenue
Total investment IRR	%	5.42	13	17.49

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

The sensitivity analysis checks whether the financial attractiveness of the Project is robust to reasonable variations in critical assumptions, in other words, if investment analysis could consistently support the conclusion that the Project undertaken without the CDM will not be financially attractive. Accordingly, IRR sensitivity to CER price is not included in the following analysis.

The following four parameters are considered in the sensitivity analysis:

1. Total investment
2. Annual generation
3. Electricity tariff
4. Annual operating cost

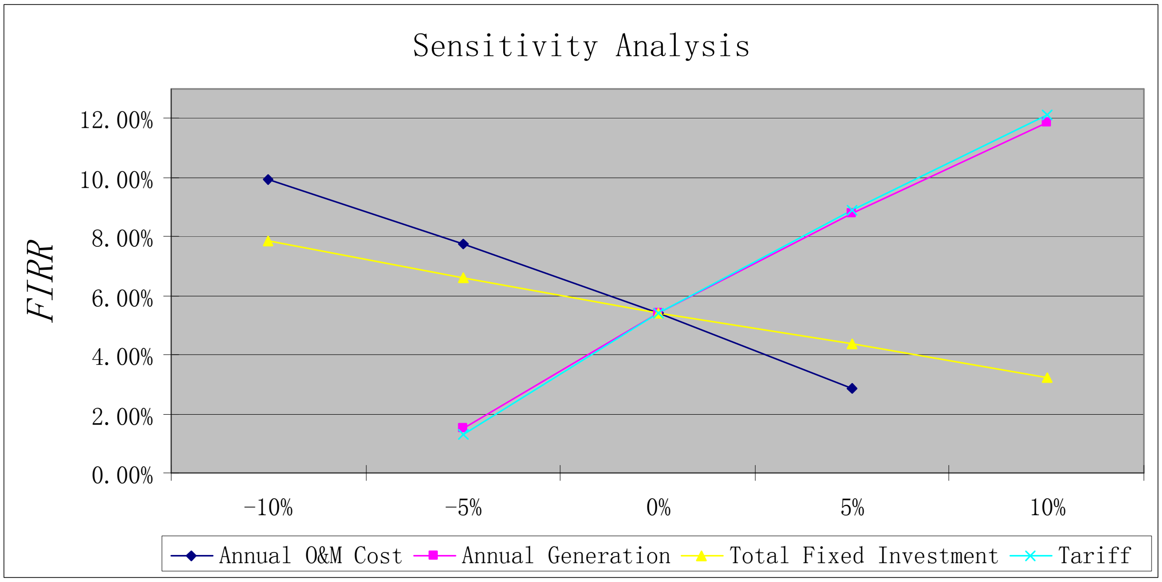


Figure 1. Sensitivity analysis of the Equity IRR

When annual generation, tariff and O&M cost decrease by 10%, the FIRR of the Project will be below zero, therefore, is not show in the above figure. According to Figure 1, even when critical parameters vary in a reasonable range, the equity IRR remains lower than the sector benchmark of 13%. The sensitivity analysis reinforces that the Project is not financially attractive without CER revenue. Moreover, the Project is very sensitive to all the indicators. Change of indicators will cause nearly the same percentage change in FIRR, which means there will be high investment risk associated with the Project.

Outcome of step 2:
In summary, without CER revenue the Project is not financially attractive. Therefore neither the project owner nor other investors would be interesting by investing in the project. The Project is additional.

Step 4. Common practice analysis

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

There are over 10 iron and steel plants in Henan province alone, of which AIS is the largest. There is no comparable plant that recovers mixed waste gas for power generation – it is a first of a kind project in Henan.

On a regional basis, there are only two other facilities that will use mixed waste gas for power generation. Both are being undertaken on the basis of CDM support, Chongqing Iron & Steel Group in Sichuan Province and Pingxiang Iron & Steel Co., Ltd. in Jiangxi Province. A number of other facilities are utilizing just BFG to generate power, not mixed gas, and so are not directly comparable. Nevertheless they have been listed below for completeness.

Facility	Mixed Waste Gas to Power	Comments
Chongqing Iron & Steel Group, Sichuan Province	Yes	The project employs mixed waste gas for power generation; however it is being undertaken only with the support of CDM.
Pingxiang Iron & Steel Co., Ltd., Jiangxi Province	Yes	Project uses blast furnace and converter gas for power generation. It is being developed only with the support of CDM.
Wuhan Iron and Steel (Group) Corporation, Hubei Province	No (blast furnace gas main fuel, COG for ignition)	100MW power generation using blast furnace gas as main fuel; project is being developed as a CDM project and has been approved by the validator
Sichuan Chuanwei Group Co., Ltd, Sichuan province	No (blast furnace gas main fuel, COG for ignition)	24MW power generation using blast furnace gas as main fuel; project is being developed as a CDM project
Hualing Lianyuan Iron and Steel (Group) Co., Ltd, Henan Province	No (blast furnace gas main fuel, COG for ignition)	50MW power generation using blast furnace gas as main fuel; project is being developed as a CDM project and has been approved by the validator
Xiangtan Iron and Steel (Group) Corporation, Hunan Province	Yes	62MW power generation using mixed gas. The project was not constructed as a CDM project but the power tariff in Hunan province is significantly higher than for Henan province (for 2006, 0.496RMB/kWh compared to 0.429RMB/kWh). If this tariff is applied to the financial model for Anyang, the project is not conculsively additional. Furthermore Japanese loan financing was made available for part of this project[6].
Xinyu Iron and Steel Co., Ltd, Jiangxi Province	Yes	Total of 58MW power generation using waste gas, constructed in 3 phases. This was not constructed as a CDM project, but the power tariff in Jiangxi province is significantly higher than that of Henan province (for 2006, 0.506RMB/kWh[7] compared to 0.429RMB/kWh

[6] http://news.cec-ceda.org.cn/news/?id=13855

[7] Source: NRDC provincial grid selling price summary, Fagaijiage No.1521

		in Henan[8]). If this tariff is applied to the financial model for Anyang, the IRR is above the benchmark. This explains why the Xinyu project could be built in Jiangxi province without CDM revenue.

From this analysis it is clear that recovery of waste gas from steel converters, blast furnaces, and coke ovens to be combined and re-used for power generation is not common practice. Even project activities that do not make use of the converter gas, or which utilize only one type of waste gas, are being undertaken on the basis of CDM support or with other financial support. The proposed project activity cannot be considered common practice in the CCPG region.

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

As noted in Sub-step 4a., the other regional projects utilizing various types of waste gas for power generation are also being undertaken on the basis of CDM support, or benefit from other financial assistance and cannot be considered comparable to the proposed project activity. This reinforces the evidence that the proposed project faces barriers that require CDM support to overcome. This project in particular is not financially attractive and faces prohibitive barriers.

In conclusion, the Project is additional and is not the baseline scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

<u>Baseline Emissions (BEy)</u>

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

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

Where:

BE_y: are total baseline emissions during the year y in tons of CO_2;

$BE_{En,y}$: are baseline emissions from energy generated by project activity during the year y in tons of CO_2;

$BE_{flst,y}$: are baseline emissions from generation of steam, if any, using fossil fuel, that would have been used for flaring the waste gas in absence of the project activity (tCO_2e per year). This is only relevant for those project activities where in the baseline steam is used to flare the waste gas.

As in the baseline there is no steam used to flare the waste gas, $BE_{flst,y}=0$, therefore, $BE_y = BE_{En,y}$

The calculation of baseline emissions depends on the identified baseline scenario. Since the proposed project involves only generation of electricity the baseline emissions for the proposed project are:

[8] Source: NRDC provincial grid selling price summary, Fagaijiage No.1521

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

Where:

$BE_{Elec,y}$: are baseline emissions from electricity during the year y in tons of CO_2;

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

As there is no heat generation in the proposed project, so $BE_{Ther,y}$=0. Therefore $BE_{En,y} = BE_{Elec,y}$.

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

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

Where:

$BE_{Elec,y}$ are baseline emissions due to displacement of electricity during the year y in tons of CO_2;

$EG_{i,j,y}$ is the quantity of electricity supplied to the recipient j by generator, which in the absence of the project activity would have been sourced from i^{th} source (i can be either grid or identified source) during the year y in MWh. In this case auxiliary electricity consumption has already been deducted from the gross electricity generation; and

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

f_{wg} Fraction of total electricity generated by the project activity using waste gas. This fraction is 1 if the electricity generation is purely from use of waste gas. Note: for this project, electricity is purely generated from waste gas , therefore , $f_{wg} = 1$

f_{cap} Energy that would have been produced in project year y using waste gas/heat generated in base year expressed as a fraction of total energy produced using waste gas in year y. The ratio is 1 if the waste gas/heat/pressure generated in project year y is same or less then that generated in base year. The value is estimated using in the section *Capping Baseline Emissions* below.

Calculation of $EF_{Elec,gr,j,y}$

For the proposed project, the displaced electricity is supplied by a connected grid system. According to ACM0012, the CO_2 emission factor of the electricity $EF_{elec,gr,j,y}$ shall be determined following the guidance provided in the "Tool to calculate the emission factor for an electricity system".

Step 1. Identify the relevant electric power system

This is identified in section B.3. as the CCPG. For the purpose of determining the operating margin emission factor, the methodology provides following four options to determine the CO_2 emission factor:

(a) 0 tCO_2/MWh, or
(b) The weighted average operating margin (OM) emission rate of the exporting grid; or
(c) The simple operating margin emission rate of the exporting grid; or

(d) The simple adjusted operating margin emission rate of the exporting grid.

For this project activity, we choose option (b) to calculate the OM emission rate of the CCPG.

Step 2. Select an operating margin (OM) method

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

a) Simple OM
b) Simple adjusted OM
c) Dispatch data analysis OM
d) Average OM

“Simple OM” method is used for calculating Operating Margin emission factor ($EF_{OM,y}$). The reasons are as follows:

- In China, the detailed dispatch information is not publicly available;
- The CCPG is a coal-fired dominated power grid, where the installed capacity of low cost and must run plants account for 35.95%, 43.81%, 37.89%, 38.60% and 35.12% in 2002, 2003, 2004, 2005 and 2006 respectively, being below 50%.

So this option is not applicable.

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

Ex ante option: A 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

Ex post option: The year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. If the data required calculating the emission factor for year *y* is usually only available later than six months after the end of year *y*.

According to the methodology requirement, the “ex post” will be used for OM calculation of the project.

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

According to the “Tool to calculate the emission factor for an electricity system”, the Simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants/units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant/unit (Option A)
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B)
- 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)

According to the Tool, option A should be preferred and must be used if fuel consumption data is available for each power plant/unit. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost/ must-run power sources and if the quantity of electricity supplied to the grid by these sources is known.

Data on fuel consumption, power generation and average efficiency of individual power stations is not publicly available in China. Therefore, in the proposed project activity, Option C is used and the following formula is used:

$$EF_{grid,OM,simple,y} = \frac{\sum_i F_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:

$FC_{i,y}$	is the amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit),
$NCV_{i,y}$	is the net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	is the CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y	is the 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	is all fossil fuel types combusted in power sources in the project electricity system in year *y*,
y	is 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)

Based on calculation from the China DNA (see Annex 3), the OM Emission Factor of the CCPG is **1.2783tCO_2/MWh**.

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

According to the tool to calculate the emission factor for an electricity system, the sample group of power unit m used to calculate the build margin could consist of either:

(a) the set of five power plants that have been built most recently, or
(b) the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently;

The tool also states that project participants should use the set of power units that comprises the larger annual generation. In this case option (b) is used.

In terms of the vintage of the data, two options are given in the tool. In this case Option 1 is chosen: For the first crediting period, the build margin emission factor is calculated ex-ante based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Step 5: Calculate the build margin emission factor

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

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

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year *y*
m	Power units included in the build margin
y	Most recent historical years for which power generation data is available

Following guidance issued by the CDM Executive Board in response to a request for guidance from an accredited DOE on the determination of the Build Margin in methodology AM0005 in China, $EF_{BM,y}$ is calculated as the capacity weighted average emissions factor of new installed capacity rather than the generation weighted factor. Furthermore, it is suggested in the same guidance note that the efficiency level of the best technology commercially available in the provincial/regional or national grid of China is used as a conservative proxy for each fuel type in estimating the fuel consumption when calculating the Build Margin. The suggested approach is followed in the determination of the Build Margin for the purposes of this project.

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

The steps and equations are as follows:

1: Calculate percentages of CO_2 emission of power generation using solid, liquid and gas fuel in total CO_2 emission.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

Where:

$F_{i,j,}$ amount of fuel *i* (tce) consumed by power plants *m* in year *y*,
$COEF_{i,j\,y}$ CO_2 emission coefficient of fuel *i* (tCO_2 /tce), taking into account the carbon content of the fuels used by power plants *m* and the oxidation percent of the fuel in year(s) *y*,
COAL, OIL and GAS refers to coal fuel, oil fuel and gas fuel in the subscript set.

2: Calculate thermal emission factor

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

Where:
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,\,Adv}$ are emission factors corresponding to commercially optimal efficient power generation technology using coal, oil and gas.

3. Calculate the BM of the Grid

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

Where:

CAP_{Total} is the new added total capacity,
$CAP_{Thermal}$ is the new added thermal power capacity.

The weighted average of coal consumption per kWh supplied of 30 new built 600 MW sub critical units in 2006 is adopted to determine the emission factor of the best advanced coal fired generation technology, which is 329.94gce/kWh. In other words, the efficiency of best advanced coal fired generation

technology is 37.28%. The maximum electricity supplied efficiency of oil and gas fired generation plants are regarded as approximate estimation of commercially optimal efficiency technology. Similarly, the fuel consumption per kWh supplied of best advanced oil and gas fired generation technology is determined to be 252gce/kWh, which means a generation efficiency of 48.81%.

The installation capacity, generation data, and average self consumption rate data are from the China Electric Power Yearbooks (2003-2007) and China Energy Statistical Yearbook (2007).
The data of fuel consumption per electricity generated and low calorific values of fuels are from the China Energy Statistical Yearbooks (2003-2007).
The $EF_{CO2,i}$ data by fuels are from Table 1-2 in P.1.6 and Table 1-4 in P.1.8 in first chapter of "2006 IPCC Guidelines for National Greenhouse Gas Inventories"

Based on calculation from the China DNA (see Annex 3), the BM Emission Factor of the CCPG is **0.6687 tCO_2/MWh**.

Step 6. Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,BM,}y$	Build 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 are used for w_{OM} and w_{BM}, according to the Tool: w_{OM} = 0.5 and w_{BM} = 0.5

In this case, for the first crediting period:

$EF_{grid,CM,y}$ = (1.2783 x 0.5) + (0.6687 x 0.5) = **0.9735 tCO_2/MWh**

Capping of baseline emissions

As a measure of conservativeness, ACM0012 requires that baseline emissions should be capped. Two methods are outlined in the methodology for calculating this. For the proposed project, method 1 is chosen as this proposed project activity is neither using waste pressure to generate electricity nor is implemented in new facility.

Method 1: The baseline emissions are capped at the maximum quantity of waste gas flared/combusted or waste heat released into the atmosphere under normal operation conditions in the 3 years previous to the project activity. According to the methodology, f_{cap} is estimated as follows:

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

Where:

$Q_{WG,BL}$ Quantity of waste gas generated prior to the start of the project activity (Nm^3);

$Q_{WG,,y}$ Quantity of waste gas generated used for energy generation during year y (Nm^3);

Based on the gas balance sheet of the AIS, the maximum quantity of waste mixed gas generated in the 3 years previous to the project activity is 136,121 Nm^3/h in year 2006, i.e. $Q_{WG,BL}$ equals to 1,143,416,400 Nm^3 per year, which will be used after satisfying the manufacturing demand in the proposed project as the main fuel and which would be flared and released in to atmosphere in the absence of the project activity.

According to the FSR of the proposed project, the Quantity of waste gas generated used for electricity generation will be 878,000,000 Nm^3 per year which will be used in the proposed project as the main fuel and which would be flared and released in to atmosphere in the absence of the project activity.

Therefore, $f_{cap} = \frac{Q_{WG,BL}}{Q_{WG,y}} = \frac{1143416400}{878000000} \succ 1$

Project Emissions (PEy)

The GHG emissions induced by the project activity can be calculated according to the following formula:

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

Where:

PE_y Project emissions due to project activity;

$PE_{AF,y}$ Project activity emissions from on-site consumption of fossil fuels by the cogeneration plant(s), in case they are used as supplementary fuels, due to non-availability of waste gas to the project activity or due to any other reason;

$PE_{El,y}$ Project activity emissions from on-site consumption of electricity for gas cleaning equipment.

1) Project emissions due to auxiliary fossil fuel

These emissions are calculated by multiplying the quantity of fossil fuels ($FF_{i,y}$) used by the recipient plant(s) with the CO_2 emission factor of the fuel type i ($EF_{CO2,i}$), as follows:

$$PE_{AF,y} = \sum FF_{i,y} \bullet NCV_i \bullet EF_{CO2,i}$$

Where:

$PE_{AF,y}$: are the emissions from the project activity in year y due to combustion of auxiliary fuel in tonnes of CO2

$FF_{i,y}$: is the quantity of fossil fuel type i combusted to supplement waste gas in the project activity during the year y, in energy or mass units

NCV_i: is the net calorific value of the fossil fuel type i combusted as supplementary fuel, in TJ per unit of energy or mass units, obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy or mass of the fuel type i in tons CO_2 obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors.

According to the Feasibility Study Report of the Project, no additional fuel will be used as auxiliary fuel, that is the $FF_{i,y}$ is equal to zero, so $PE_{AF,y}=0$.

2) Project emissions due to electricity consumption of gas cleaning equipment

$$PE_{EL,y} = EC_{PJ,y} * EF_{CO2,EL,y}$$

Where:

$EC_{PJ,y}$ is the additional consumption of electricity for gas cleaning equipment

$EF_{CO2,EL,y}$ is the CO_2 emission factor for electricity consumed by the project in year y.

For the proposed project, this is electricity purchased from the grid i.e. the CO_2 emission factor of the CCPG, as calculated above, and the electricity consumptions of gas cleaning equipment is included in the auxiliary electricity consumption.

Auxiliary electricity consumption, although monitored separately, is deducted from baseline electricity consumption.

The Project Emission is equal to zero.

<u>Leakage</u>

According to ACM0012, no leakage is applicable under this methodology.

<u>Emission Reductions (ERy)</u>

The emission reductions, ER_y, from the project activity during a given year y is the difference between the baseline emissions and project emissions (PE_y), as follows:

$$ER_y = BE_y - PE_y$$

Since the project emission and leakage are both zero, the emission reductions of the proposed project are equal to the baseline emission.

$$ER_y = BE_y$$

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

(Copy this table for each data and parameter)

Data / Parameter:	f_{wg}
Data unit:	None
Description:	Fraction of total energy generated by the project activity using waste gas
Source of data used:	Default value
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	No fossil fuel can or will be used to fire the waste gas boilers. Therefore the fraction of waste gas is always 1.
Any comment:	None

Data / Parameter:	f_{cap}
Data unit:	None
Description:	Energy that would have been produced in year *y* using waste gas generated in base year expressed as a fraction of total energy produced using waste gas in year y
Source of data used:	Last 3 years' data as baseline ; FSR expected quantity as estimation of waste gas production in year y
Value applied:	1

Justification of the choice of data or description of measurement methods and procedures actually applied :	Last 3 years data is best available for the baseline. FSR expected quantity is best estimate of expected waste gas availability during each year of project.
Any comment:	Calculation described in section B.6.1

Data / Parameter:	$Q_{WG,BL}$
Data unit:	Nm^3
Description:	Quantity of waste gas generated prior to the start of the project activity.
Source of data used:	Specification of facilities provided by specialists
Value applied:	Based on the gas balance sheet of the AIS, the maximum quantity of waste mixed gas generated in the 3 years previous to the project activity is 136,121 Nm^3/h in year 2006, i.e. 1,143,416,400 Nm^3 per year, which will be used after satisfying the inner manufacturing demand in the proposed project as the main fuel and which would be flared and released in to atmosphere in the absence of the project activity.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is from the feasibility study report and supplied by on-site specialists
Any comment:	None

Data / Parameter:	EF_y
Data unit:	tCO_2/MWh
Description:	CO_2 Emission factor of CCPG
Source of data used:	$EF_{OM,y}$ and $EF_{BM,y}$ data and calculations – see below.
Value applied:	0.9735
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data to calculate $EF_{OM,y}$ and $EF_{BM,y}$ is from official government sources, the latest data available at time of GSP. These parameters are used to calculate EF_y as an equally weighted average.
Any comment:	

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2 / MWh
Description:	CO_2 Operating Margin Emission factor of CCPG
Source of data used:	China Energy Statistical Yearbooks (2005-2007), China Electric Power

	Yearbook (2005-2007), Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	1.2783
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Operating Margin data of the CCPG is updated and published annually by the government of China. ACM0002 stipulates that the Revised 1996 IPCC Guidelines must be used. However, this calculation is based on those of the Chinese DNA's most recent published data and calculations, which use IPCC 2006 default values. Data and calculations comply with ACM0002.
Any comment:	See Annex 3 for data and calculation method.

Data / Parameter:	$EF_{BM, y}$
Data unit:	tCO_2 / MWh
Description:	CO_2 Build Margin Emission factor of CCPG
Source of data used:	China Electric Power Yearbooks (2005-2007), China Energy Statistical Yearbook (2007), The General Code for Comprehensive Energy Consumption Calculation (Chinese National Standard GB2589-90), Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.6687
Justification of the choice of data or description of measurement methods and procedures actually applied :	The relevant data of the CCPG is updated and published annually by the government of China. Because data on the five power plants built most recently are not available in China, an Executive Board-approved deviation is implemented. Accordingly, the fuel consumption for the best commercially available technology and the share of incremental installed capacity of fuel-fired power in the whole incremental installed capacity are used as parameters for BM calculation.
Any comment:	See Annex 3 for data and a description of the calculation method.

Data / Parameter:	$F_{i\,j,y}$
Data unit:	$t(m^3)$
Description:	The total amount of fossil fuels *i* used by power plants of province *j* in year *y*
Source of data used:	China Electric Statistical Yearbook
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is from official channels
Any comment:	

Data / Parameter:	$GEN_{j,y}$

Data unit:	GWh
Description:	The electricity generated by power plants of province *j* in year y
Source of data used:	China Electric Power Year
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is from official channels
Any comment:	

Data / Parameter:	$Consumption_{Aux}$
Data unit:	%
Description:	auxiliary electricity consumption rate for power plants of province *j*
Source of data used:	China Electric Power Yearbook
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is from China Electric Power Yearbook which is reliable
Any comment:	

Data / Parameter:	NCV_j
Data unit:	MJ/t (kJ/m^3)
Description:	Net caloric value
Source of data used:	IPCC
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value is used because no national specific data is publicly issued.
Any comment:	

Data / Parameter:	$EF_{co2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO2 emissions coefficient of fuels used in connected grids
Source of data used:	IPCC default vaules

Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value is used because no national specific data is publicly issued.
Any comment:	

Data / Parameter:	CAP_j
Data unit:	MW
Description:	Newly installed capacity of many kinds of fuel in CCPG
Source of data used:	China Electric Power Year Book
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is from official channels.
Any comment:	

Data / Parameter:	Eff_j
Data unit:	%
Description:	Power generation efficiency by current commercially usable technology of many kinds of fuel *i* in CCPG.
Source of data used:	China CDM DNA
Value applied:	Refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to an EB deviation, the efficiency value used is the maximum of all representative technologies. This follows a conservative principle.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Step 1 Baseline Emissions (BEy)

According to ACM0012, f_{cap}=1 if the waste gas generated in project year y is less than that generated in

the base year. And f_{wg}=1 if the electricity generation is purely from use of waste gas.

The CCPG emission factor in baseline scenario is 0.9735tCO_2/MWh, which is determined *ex-ante* by the Chinese CDM DNA and will be fixed in the first crediting period. According to the feasibility study report of the proposed project, the electricity delivered by the proposed project is designed to be 280.5GWh annually

$BE_y = f_{cap} * f_{wg} * EG_y * EF_y$ = 280,500,000*0.9735 = 273,066 tCO_2e.

Step 2 Project Emissions (PE_y)

No auxiliary fossil fuel is used in the proposed project.
No additional electricity is used to clean the gas in the proposed project. All auxiliary electricity has been subtracted from the gross electricity generation figure.
Therefore, the Project Emissions (PE_y) = 0

Step 3 Leakage

According to ACM0012, no leakage is applicable under this methodology.

Step 4 Emission Reductions (ER_y)

Therefore, the annual emission reduction (ER_y) of the proposed project is estimated to be 273,066 tCO_2e.

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

The emission reduction of the Project over the 10 year fixed crediting period is estimated as follow[9]:

Year	Estimation of project activity emissions (tones of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009	0	273,066	0	273,066
2010	0	273,066	0	273,066
2011	0	273,066	0	273,066
2012	0	273,066	0	273,066
2013	0	273,066	0	273,066
2014	0	273,066	0	273,066
2015	0	273,066	0	273,066
2016	0	273,066	0	273,066
2017	0	273,066	0	273,066
2018	0	273,066	0	273,066
Total	0	2,730,660	0	2,730,660

[9] The exact quantity for 2009 and 2018-19 may vary depending on the final registration date

(tonnes of CO_2e)				

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

B.7.1 Data and parameters monitored:

Data / parameter:	$Q_{WG,y}$
Data unit:	Nm^3
Description:	Quantity of waste gas used for energy generation during year *y* (Nm^3)
Source of data:	Generators of gas
Value of data applied for the purpose of calculating expected emission reductions in section B.6	It is estimated that the surplus waste gas is 878,000,000Nm^3 per year.
Measurement procedures (if any):	Direct measurements by project owner through waste gas meters.
Monitoring frequency:	Continuously
QA/QC procedures:	The meters were calibrated and will be periodically checked according to the *Checking Regulation on JLJW01.0402-2003 and JLJW01.0501-2003* and recorded once a month.
Any comment:	

Data / Parameter:	$EG_{,i,j,y}$
Data unit:	MWh
Description:	Quantity of electricity supplied to the recipient plant *j* by the project activity during the year *y* in MWh
Source of data to be used:	Electricity meter at recipient site and generation plant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	280,500 MWh/yr
Description of measurement methods and procedures to be applied:	The total generation will be measured continuously and automatically by the Distribution Control System (DCS) of the plant at the connection point to the transformer station, which will be recorded and collected daily, and archived in electronic form every month by the CDM workgroup. The electricity meter has an accuracy rating of 0.2s. The calibration standard is JJG596-1999, and will be calibrated accordingly in a nine-step process: (1) Anti-pressure test conducted under working level frequency (50 Hz). (2) Visual inspection while switching on of electricity meter (3) Start-up test to detect movement under non-working conditions.

	(4) Electricity meter adjustment (5) Determination of basic error in electric energy measurement (6) Estimation of standard error for electric energy measurement (7) Determination of time error over the course of a day and switching among peak, flat, and bottom usage periods. (8) Determination of required quantity error (9) Determination periodic error of required quantity Data measurement: The electricity meters and DCS computer will both measure the total electricity generated. Data recording: Data will be recorded by the electricity meters (on-line) and the DCS computer. Data archiving: Data will be archived by hand (by the Data Collector) and by the DCS computer.
Monitoring frequency:	Monthly
QA/QC procedures to be applied:	The meters and DCS system will be regularly maintained following the relevant regulation and standard. Highly accurate meters (0.2s rating) will be used.
Any comment:	This quantity is already net of auxiliary used in the project activity and for gas cleaning. A back-up line will be used, in case of emergency case, and the electricity supplied, consumed by the project, by the back-up line will monitoring by a meter.

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	Quantity of electricity used as a result of the project activity
Source of data to be used:	Electricity meter at generation plant
Value of data applied for the purpose of calculating expected emission reductions in section B.5	24,000 MWh/yr
Description of measurement methods and procedures to be applied:	The total consumption will be measured continuously and automatically by the Distribution Control System (DCS) of the plant at the connection point to the transformer station, which will be recorded and collected daily, and archived in electronic form every month by the CDM workgroup. The electricity meter has an accuracy rating of 0.2s. The calibration standard is JJG596-1999, and will be calibrated accordingly in a nine-step process: (1) Anti-pressure test conducted under working level frequency (50 Hz). (2) Visual inspection while switching on of electricity meter (3) Start-up test to detect movement under non-working conditions. (4) Electricity meter adjustment (5) Determination of basic error in electric energy measurement (6) Estimation of standard error for electric energy measurement (7) Determination of time error over the course of a day and switching among peak, flat, and bottom usage periods.

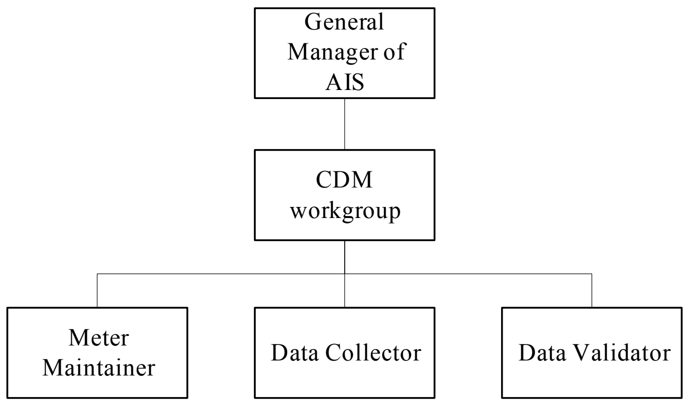
	(8) Determination of required quantity error (9) Determination periodic error of required quantity Data measurement: The electricity meters and DCS computer will both measure the total electricity consumed Data recording: Data will be recorded by the electricity meters (on-line) and the DCS computer. Data archiving: Data will be archived by hand (by the Data Collector) and by the DCS computer.
Monitoring frequency:	Monthly
QA/QC procedures to be applied:	The meters and DCS system will be regularly maintained following the relevant regulation and standard. Highly accurate meters (0.2s rating) will be used.
Any comment:	

Data / parameter:	$EF_{CO2,EL,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for electricity consumed by the project activity in year y
Source of data:	Combined Margin emission factor determined as per the "Tool to calculate the emission factor for an electricity system"
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0.9735, see Annex 3
Measurement procedures (if any):	None
Monitoring frequency:	Annual
QA/QC procedures:	None
Any comment:	Grid factor same as EF_y in Section B.6.2

B.7.2 Description of the monitoring plan:

1. Management Structure for Monitoring

A CDM workgroup will be established by the project owner to undertake the monitoring task and tackle any leakage events that may happens. The operational and management structure of the workgroup is as follows:



The data collector is responsible for taking the prescribed, regular collection of the meter readings of the monitored parameters listed in section B.7.1. He will submit the results to internal data validator.

The AIS data validator will check the validity of the data by comparing with previous recorded data and data from third party such as the Power Corporation. If a big difference does exist, it should be reported to director of the workgroup by the data validator.

The validated data will be input to the CDM data management system by the data validator, to be archived electronically.

The meter maintainer is responsible for the calibration and regular maintenance of the meters, which will be done by a third party – the Henan Measurements Bureau – as required for meters of high (0.2s) accuracy. The meters will be calibrated according to the calibration standard JJG596-1999 in a nine-step process, using a Three-phase Electric Energy Inspection instrument, model NST-3500.

(1) Anti-pressure test conducted under working level frequency (50 Hz).
(2) Visual inspection while switching on of electricity meter
(3) Start-up test to detect movement under non-working conditions.
(4) Electricity meter adjustment
(5) Determination of basic error in electric energy measurement
(6) Estimation of standard error for electric energy measurement

(7) Determination of time error over the course of a day and switching among peak, flat, and bottom usage periods.
(8) Determination of required quantity error
(9) Determination periodic error of required quantity

2. Monitoring of Generation and Plant Consumption

A Distribution Control System (DCS) integrated by control units and highly accurate measurement instruments will be installed for the Project generation system. Therefore, the total electricity generation will be measured continuously and automatically by the DCS system at the connection point to the transformer station, which will be recorded and collected daily, and archived in electronic form every month by the CDM workgroup. The auxiliary electricity includes electricity consumed by the power generation system, and also will be measured continuously and automatically. The data will be recorded and collected daily, and archived in electronic form every month by the CDM workgroup. Net Electricity supplied to the facility by the project is obtained by subtracting the auxiliary electricity from the total delivered generation of the project.

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 application of the methodology to the proposed project was completed on 26/06/2008 by the following organization and person.

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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:

08/12/06

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

10 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:

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

15/06/09 or the date of registration, whichever comes later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The environmental impacts analysis report of the Project has been approved by Environmental Protection Bureau of Henan Province. The major conclusions are presented as follows:

Waste Gas Discharge

The fuel of the Project is mixed combustible waste gas generated from iron and steel production facilities, which has been cleaned before combustion. Therefore, the dust and SO2 concentration of the flue gas, which will be released to the atmosphere via a high stack, is rather low and would comply with the national "*Emission standard of air pollutants for coal-burning oil-burning gas-fired boilers*".

Waste Water Discharge

The major pollutant in the cooling water and discharge water of water seal is dust. All the waste water and dust will be collected and treated together, which would have little impacts on local water system and could meet the requirement of "*Discharge Standard of Waste Pollutants for Ion and Steel Industry (GB13456-92)*" and "*Integrated wastewater discharge standard (GB8978-1996)*".

Solid Waste

The Project is fuelled by mixed combustible waste gas generated from iron and steel facilities, of which 32.7t/a dust will be collected for further utilization.

Noise

Noise isolation hoods will be installed in steam turbine. The control room of the Project will be noise isolated. The pump will be set in a specific pump house with a rubber connector in the outlet of the pump. The noise level in the control room will be less than 70dB (A), which complies with the "*Code for Noise Control Design of Industrial Enterprises*" of China.

Additionally, further effort will be made by the Project to make the green area proportion of the plant 15%. The idle land in the plant will be taken fully advantage of for planting trees and flowers to improve environmental quality and reduce pollution. A specific department will be established to take charge of environment management of the plant. All the pollution discharged will be monitored periodically by the environmental monitoring station.

In conclusion, the Project will not have any significant environment impacts. On the contrary, by reducing fossil energy consumption for power generation, the Project will yield environmental benefits.

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

According to the EIA approved by the Environmental Protection Bureau of Henan Province, the impacts of the Project are not considered to be significant.

SECTION E. Stakeholders' comments

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

The project owner, Anyang Iron & Steel Co., Ltd. (AIS), issued an open invitation to the local community of Anyang City on November 28, 2006 to participate in a stakeholder consultation on the Angang Waste Gas Recovery and Generation Project. The invitation was conveyed through Chinese Communist Party community information distribution channels, which is a very typical and effective means of widely disseminating information to the general public.

The first meeting of the stakeholder consultation took place on December 8, 2006, at the Anyang Hotel in Anyang City. Thirty-seven community representatives responded to the invitation, including local workers, villagers, intellectuals, teachers, students and deputies to local People's Congress. The meeting was chaired by Ms. Zhao Yuqin, deputy director of AIS CDM development office. Mr. Zhang Qingyou, director of AIS CDM development office, made a presentation to introduce the plan to develop the project. A survey was distributed to participants to complete and return at a follow up meeting. The survey questions were:

1. Are you satisfied with the present local environment?
2. Do you think it is important to conduct this project?
3. Do you agree with the project being constructed?
4. Do you think the project location chosen is reasonable?
5. What is the main environmental problem addressed by the project?
6. What effect will project construction have on the environment?
7. Do you think the project construction will affect the surrounding environment?
8. Are you satisfied with environmental impact mitigation measures?
9. What do you think will be the impact of project construction on the local economy?
10. What do you think will be the impact of project construction on local employment?

Any ideas or suggestions for the project?
What do you think of any other measures we can do for the project?

The second stakeholder meeting took place on December 25, 2006 with the same group of participants. All 37 participants returned completed surveys and were invited to engage in a question and answer session and general discussion of the project

E.2. Summary of the comments received:

A summary of stakeholder views is as follows:

- Due to the energy efficiency nature of the Angang Waste Gas Recovery and Generation Project, the project would optimize industrial resource use and help to fulfil the national sustainable development strategy.
- The Project would reduce greenhouse gas emissions, therefore mitigating climate change.

- Project implementation would enhance local environmental quality and offer social benefits such as job creation within the community, diffusion of a desirable technology, and diversification of local energy mix.
- The financial benefits from CER revenue would strengthen the project's financial merits and promote success project results.
- The community representatives viewed the Project very favourably and felt the project owner should take full advantage of the opportunity to participate in CDM.

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

The meeting Chair invited those present to monitor the construction and implementation of the Angang Waste Gas Recovery and Generation Project in the future. Considering full support from local stakeholders, the project owner intends to take full advantage of the CDM opportunity to facilitate Project implementation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the Project.

Annex 3

BASELINE INFORMATION

According to the tool and the document "2008 Baseline Emission Factors for Regional Power Grids in China", released at http://cdm.ccchina.gov.cn/ on 18 July 2008, the $EF_{grid,CM,y}$, $EF_{grid,OM,y}$, and $EF_{grid,BM,y}$ of Central China Power Grid could be calculated as following:

A. Electricity Generation of Central China Power Grid (2002-2006)

Table A1. Electricity Generation of Central China Power Grid (2002-2006)

Year	Electricity Generation (Unit：10^8 kWh)					Split of low-cost/must-run resources
	Total	Hydro	Thermal	nuclear	Others	
2002	3,127.88	1,124.40	2,003.47	0.00	0.00	35.95%
2003	8,345.05	3,655.70	4,689.35	0.00	0.00	43.81%
2004	4,396.36	1,665.89	2,730.47	0.00	0.00	37.89%
2005	4,964.30	1,915.48	3,048.25	0.00	0.57	38.60%
2006	5,478.59	1,922.96	3,554.53	0.00	1.02	35.12%

Sources: China Electric Power Yearbook 2003-2007

B. Calculation of Operating Margin Emission Factor ($EF_{grid,OM,y}$)

Table B1. Electricity Generation of Central China PowerGrid in 2004

	Electricity generation of fuel-fired power plants (MWh)	Auxiliary power ratio (%)	Total Electricity Supplied to the Grid (MWh)
Jiangxi	30,127,000	7.04	28,006,059
Henan	109,352,000	8.19	100,396,071
Hubei	43,034,000	6.58	40,202,363
Hunan	37,186,000	7.47	34,408,206
Chongqing	16,520,000	11.06	14,692,888
Sichuan	34,627,000	9.41	31,368,599
Total			249,074,186

Sources: China Electric Power Yearbook 2005

Table B2. Electricity Generation of Central China Power Gridin 2005

	Electricity generation of fuel-fired power plants (MWh)	Auxiliary power ratio (%)	Total Electricity Supplied to the Grid (MWh)
Jiangxi	30,000,000	6.48	28,056,000
Henan	131,590,000	7.32	121,957,612
Hubei	47,700,000	2.51	46,502,730
Hunan	39,900,000	5.00	37,905,000
Chongqing	17,584,000	8.05	16,168,488
Sichuan	37,202,000	4.27	35,613,475
Total			286,203,305

Sources: China Electric Power Yearbook 2006

Table B3. Electricity Generation of Central China Power Grid in 2006

	Electricity generation of fuel-fired power plants (MWh)	Auxiliary power ratio (%)	Total Electricity Supplied to the Grid (MWh)
Jiangxi	34,449,000	6.17	32,323,497
Henan	151,235,000	7.06	140,557,809
Hubei	54,841,000	2.75	53,332,873
Hunan	46,408,000	4.95	44,110,804
Chongqing	23,487,000	8.45	21,502,349
Sichuan	44,193,000	4.51	42,199,896
Total			334,027,226

Sources: China Electric Power Yearbook 2007; China Energy Statistical Yearbook 2007

Table B4. Calculation of Operating Margin Emission Factor of Central China Power Grid in 2004

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chong qing E	Sichuan F	Total G=A+ … +F	Emission Factor[1] (tC/TJ) H	Average Low Caloric Value[2] (MJ/t or km^3) J	CO_2 Emission (tCO_2e) K=G*H*J*44/12/10 (mass) K=G*H*J*44/12/10 (Volume)
Raw Coal	10^4t	1,863.80	6,948.50	2,510.50	2,197.09	875.50	2,747.90	**17,144.10**	25.8	20,908	339,092,605
Cleaned coal	10^4t	0.00	2.34	0.00	0.00	0.00	0.00	**2.34**	25.8	26,344	58,316
Other Washed Coal	10^4t	48.93	104.22	0.00	0.00	89.72	0.00	**242.87**	25.8	8,363	1,921,441
Coke	10^4t	0.00	109.61	0.00	0.00	0.00	0.00	**109.61**	29.2	28,435	3,337,011
Coke Oven Gas	10^8m^3	0.00	0.00	1.68	0.00	0.34	0.00	**2.02**	12.1	16,726	149,900
Other Gas	10^8m^3	0.00	0.00	0.00	0.00	2.61	0.00	**2.61**	12.1	5,227	60,527
Crude Oil	10^4t	0.00	0.86	0.22	0.00	0.00	0.00	**1.08**	20.0	41,816	33,118
Gasoline	10^4t	0.00	0.06	0.00	0.00	0.01	0.00	**0.07**	18.9	43,070	2,089
Diesel Oil	10^4t	0.02	3.86	1.70	1.72	1.14	0.00	**8.44**	20.2	42,652	266,627
Fuel Oil	10^4t	1.09	0.19	9.55	1.38	0.48	1.68	**14.37**	21.1	41,816	464,893
PLG	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	17.2	50,179	0
Refinery Gas	10^4t	3.52	2.27	0.00	0.00	0.00	0.00	**5.79**	15.7	46,055	153,506
Natural Gas	10^8m^3	0.00	0.00	0.00	0.00	0.00	2.27	**2.27**	15.3	38,931	495,775
Other Petroleum Products	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	20	38,369	0
Other Coking Products	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	25.8	28,435	0
Other Energy	10^4t tce	0.00	16.92	0.00	15.20	20.95	0.00	**53.07**	0.0	0	0
									Total CO_2 Emission: 346,035,810		
Net electricity imported from Central China Power Grid (MWh)									**346,035,810**		
Total emission of the Central China Power Grid(tCO_2e)									**249,074,186**		
OM emission factor of the CCPG (tCO_2e/MWh)									**1.38929**		

Sources: China Electric Power Yearbook 2005

1 2006 IPCC Guidelines for National Greenhouse Gas Inventories， Volume 2 Energy, chapter 1, page 1.21-1.24, table 1.3 and 1.4.

2 China Energy Statistical Yearbook 2007, Page 287

Table B5. Calculation of Operating Margin Emission Factor of Central China Power Grid in 2005

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chong qing E	Sichuan F	Total G=A+ … +F	Emission Factor[1] (tC/TJ) H	Average Low Caloric Value[2] (MJ/t or km^3) J	CO_2 Emission (tCO_2e) K=G*H*J*44/12/10 (mass) K=G*H*J*44/12/10 (Volume)
Raw Coal	10^4t	1,869.29	7,638.87	2,732.15	1,712.27	875.4	2,999.77	**17,827.75**	25.8	20,908	352,614,497
Cleaned coal	10^4t	0.02	0.00	0.00	0.00	0.00	0.00	**0.02**	25.8	26,344	498
Other Washed Coal	10^4t	0.00	138.12	0.00	0.00	89.99	0.00	**228.11**	25.8	8,363	1,804,669
Coke	10^4t	0.00	25.95	0.00	105.00	0.00	0.00	**130.95**	29.2	28,435	3,986,695
Coke Oven Gas	10^8m^3	0.00	0.00	1.15	0.00	0.36	0.00	**1.51**	12.1	16,726	112,054
Other Gas	10^8m^3	0.00	10.20	0.00	0.00	3.12	0.00	**13.32**	12.1	5,227	308,897
Crude Oil	10^4t	0.00	0.82	0.36	0.00	0.00	0.00	**1.18**	20	41,816	36,185
Gasoline	10^4t	0.00	0.02	0.00	0.00	0.02	0.00	**0.04**	18.9	43,070	1,194
Diesel Oil	10^4t	1.30	3.03	2.39	1.39	1.38	0.00	**9.49**	20.2	42,652	299,798
Fuel Oil	10^4t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	41,816	286,959
PLG	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	17.2	50,179	0
Refinery Gas	10^4t	0.71	3.41	1.76	0.78	0.00	0.00	**6.66**	15.7	46,055	176,572
Natural Gas	10^8m^3	0.00	0.00	0.00	0.00	0.00	3.00	**3.00**	15.3	38,931	655,209
Other Petroleum Products	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	20.0	38,369	0
Other Coking Products	10^4t	0.00	0.00	0.00	1.50	0.00	0.00	**1.50**	25.8	28,435	40,349
Other Energy	10^4t tce	0.00	2.88	0.00	1.74	32.80	0.00	**37.42**	0.0	0	0
									Total CO_2 Emission: 360,323,575		
Net electricity imported from Central China Power Grid (MWh)									**360,323,575**		
Total emission of the Central China Power Grid(tCO_2e)									**286,203,305**		
OM emission factor of the CCPG (tCO_2e/MWh)									**1.25898**		

Sources: China Electric Power Yearbook 2006

Table B6. Calculation of Operating Margin Emission Factor of Central China Power Grid in 2006

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total G=A+ … +F	Emission Factor[1] (tC/TJ) H	Average Low Caloric Value[2] (MJ/t or km^3) J	CO_2 Emission (tCO_2e) K=G*H*J*44/12/10 (mass) K=G*H*J*44/12/10 (Volume)
Raw Coal	10^4t	1,926.02	8,098.01	3,179.79	2,454.48	1,184.30	3,285.22	**20127.82**	25.8	20,908	398,107,508
Cleaned coal	10^4t	0.00	0.00	0.00	0.00	5.79	0.00	**5.79**	25.8	26,344	144,295
Other Washed Coal	10^4t	4.51	104.12	0.00	8.59	79.21	0.00	**196.43**	25.8	8,363	1,554,036
Briquette	10^4t	0.00	0.00	0.00	0.00	0.00	0.01	**0.01**	26.6	20,908	204
Coke	10^4t	0.00	17.23	0.00	0.32	0.00	0.00	**17.55**	29.2	28,435	534,299
Coke Oven Gas	10^8m^3	0.00	0.52	1.07	4.24	0.38	0.01	**6.22**	12.1	16,726	461,572
Other Gas	10^8m^3	12.69	3.95	0.00	1.70	4.36	0.01	**22.71**	12.1	5,227	526,655
Crude Oil	10^4t	0.00	0.49	0.00	0.00	0.00	0.00	**0.49**	20.0	41,816	15,026
Gasoline	10^4t	0.00	0.01	0.00	0.00	0.00	0.00	**0.01**	18.9	43,070	298
Diesel Oil	10^4t	0.91	2.23	1.41	1.78	0.96	0.00	**7.29**	20.2	42,652	230,298
Fuel Oil	10^4t	0.51	1.26	1.31	0.80	0.57	3.49	**7.94**	21.1	41,816	256,872
PLG	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	17.2	50,179	0
Refinery Gas	10^4t	0.86	8.10	1.00	0.97	0.00	0.00	**10.93**	15.7	46,055	289,780
Natural Gas	10^8m^3	0.00	0.00	0.28	0.00	0.16	18.63	**19.07**	15.3	38,931	4,164,943
Other Petroleum Products	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	20.0	38,369	0
Other Coking Products	10^4t	0.00	0.00	0.00	0.00	0.00	0.01	**0.01**	25.8	28,435	269
Other Energy	10^4t tce	17.45	37.36	31.55	18.29	29.35	0.00	**134.00**	0.0	0	0
									Total CO_2 Emission: 406,286,055		
Net electricity imported from Central China Power Grid (MWh)									**408,776,270**		
Total emission of the Central China Power Grid(tCO_2e)									**337,056,176**		
OM emission factor of the CCPG (tCO_2e/MWh)									**1.21278**		

Sources: China Electric Power Yearbook 2007; China Energy Statistic Yearbook 2007

Table B7. Weighted-average OM emission factor of Central China Power Grid (2004-2006)

	2004	2005	2006	Weighted-average OM emission factor
Total Emission, tCO_2	346,035,810	360,323,575	408,776,270	
Total power supply, MWh	249,074,186	286,203,305	337,056,176	
OM emission factor, tCO_2/MWh	1.38929	1.25898	1.21278	**1.2783**

Therefore, $EF_{grid,OM,simple}$ could be calculated as:

$EF_{grid,OM,simple}$ = （346,035,810+ 360,323,575+408,776,270）/ (249,074,186+ 286,203,305+ 337,056,176) = **1.2783**tCO_2e/MWh

C. Calculation of the Build Margin Emission Factor ($EF_{grid,BM,y}$)

Table C1 Emission Factor of Best Technology

	Variable	Electricity supply efficiency	Emission factor of fuel (tC/TJ)	Emission factor (tCO_2/MWh)
		A	B	D=3.6/A/1000*B *44/12
Coal-based power plants	$EF_{Coal,Adv}$	37.28%	25.8	0.9135
Gas-based power plants	$EF_{Gas,Adv}$	48.81%	15.3	0.4138
Oil-based power plants	$EF_{Oil,Adv}$	48.81%	21.1	0.5706

Sources: China's grid baseline BM calculation progress, NRDC

Table C2 The Proportion Of CO_2 Emission From Solid、Liquid、Gas Fuel For Generating Electricity

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Caloric value	Emission factor	Emission
		A	B	C	D	E	F	G=A+…+F	J (KJ/kg)	H	K=G*H*J*44/12/100
Raw Coal	10^4 t	1,926.02	8,098.01	3,179.79	2,454.48	1,184.30	3,285.22	20,127.82	20,908	25.8	398,107,508
Cleaned Coal	10^4 t	0.00	0.00	0.00	0.00	5.79	0.00	5.79	26,344	25.8	144,295
Other Washed	10^4 t	4.51	104.12	0.00	8.59	79.21	0.00	196.43	8,363	25.8	1,554,036
Briquette	10^4 t	0.00	0.00	0.00	0.00	0.00	0.01	0.01	20,908	26.6	204
Coke	10^4 t	0.00	17.23	0.00	0.32	0.00	0.00	17.55	28,435	29.2	534,299
Subtotal											**400,340,342**
Crude Oil	10^4 t	0.00	0.49	0.00	0.00	0.00	0.00	0.49	41,816	20.0	15,026
Gasoline	10^4 t	0.00	0.01	0.00	0.00	0.00	0.00	0.01	43,070	18.9	298
Kerosene	10^4 t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43,070	19.6	0
Diesel Oil	10^4 t	0.91	2.23	1.41	1.78	0.96	0.00	7.29	42,652	20.2	230,298
Fuel Oil	10^4 t	0.51	1.26	1.31	0.80	0.57	3.49	7.94	41,816	21.1	256,872
Other Petroleum	10^4 t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,369	20.0	0
Other Coking	10^4 t	0.00	0.00	0.00	0.00	0.00	0.01	0.01	28,435	25.8	269
Subtotal											**502,763**
Natural Gas	10^7 m^3	0.00	0.00	2.80	0.00	1.60	190.70	190.70	38,931	15.3	4,164,943
Coke Oven Gas	10^7 m^3	0.00	5.20	10.70	42.40	3.80	62.20	62.20	16,726	12.1	461,572
Other Gas	10^7 m^3	126.90	39.50	0.00	17.00	43.60	227.10	227.10	5,227	12.1	526,655
PLG	10^4 t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,179	17.2	0
Refinery Gas	10^4 t	0.86	8.10	1.00	0.97	0.00	10.93	10.93	46,055	15.7	289,780
Subtotal											**5,442,950**
Total											**406,286,055**

Sources: China Energy Statistical Yearbook 2007

Calculate with relevant data and formulae, the value for λ_{Coal} is 98.54%the value for λ_{Oil} is 0.12% and the value for λ_{Gas} is 1.34%.

Therefore,

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =0.9064tCO_2e/MWh.

Table C3 Installed capacity of the Central China Power Grid in 2006

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Fuel-fired	MW	6,568	32,603	11,623	10,715	5,594	9,555	76,658
Hydro	MW	3,288	2,553	8,521	8,648	1,979	17,730	42,719
Nuclear	MW	0	0	0	0	0	0	0
Wind & Others	MW	0	0	0	17	24	0	41
Total	MW	9,856	35,156	20,144	19,380	7,597	27,285	119,418

Sources：China Electric Power Yearbook 2007

Table C4 Installed capacity of the Central China Power Grid in 2005

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Fuel-fired	MW	5,906.0	26,267.8	9,526.3	7,211.6	3,759.5	7,496.0	60,167.2
Hydro	MW	3,019.0	2,539.9	8,088.9	7,905.1	1,892.7	14,959.6	38,405.2
Nuclear	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind & Others	MW	0.0	0.0	0.0	0.0	24.0	0.0	24.0
Total	MW	8,925.0	28,807.7	17,615.2	15,116.7	5,676.2	22,455.6	98,596.4

Sources：China Electric Power Yearbook 2006

Table C5 Installed capacity of the Central China Power Grid in 2004

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Fuel-fired	MW	5,496.0	21,788.5	9,590.3	6,779.5	3,271.1	6,900.3	53,825.7
Hydro	MW	2,549.9	2,438.0	7,415.1	7,448.2	1,407.9	13,382.9	34,642.0
Nuclear	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind & Others	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	MW	8,045.9	24,226.5	17,005.4	14,227.7	4,679.0	20,283.2	88,467.7

Sources：China Electric Power Yearbook 2005

Table C6. Calculation of BM Emission Factor of Central China Power Grid (2004-2006), MW

	New Capacity 2004	New Capacity 2005	New Capacity 2006	New Capacity 2004-2006	Percentage of New Capacity Additions
	A	**B**	**C**	**D=C-A**	
Fuel-fired (MW)	53,825.7	60,167.2	76,658.0	22,832.3	73.77%
Hydro (MW)	34,642.0	38,405.2	42,719.0	8,077.0	26.10%
Nuclear (MW)	0.0	0.0	0.0	0.0	0.00%
Wind(MW)	0.0	24.0	41.0	41.0	0.13%
Total	88,467.7	98,596.4	119,418.0	30,950.3	**100.00%**
Percentage of Year 2006	74.08%	82.56%	100%		

$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$ =0.9064×73.77%=0.6687tCO_2/MWh。

D. Calculation of the Baseline Emission Factor ($EF_{grid,CM,y}$) in the first crediting period

$EF_{grid,CM,y}$ =0.5× $EF_{grid,OM,y}$ +0.5× $EF_{grid,BM,y}$ =0.5×1.2783+0.5×0.6687=0.9735tCO_2/MWh

Annex 4

MONITORING INFORMATION

No additional information.