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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

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Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China

Version 7, 29/09/2008

The revision history of the PDD is included as following:

Version	Date	Main revisions
Version 1	07/25/2007	The first draft version of the PDD
Version 2	13/08/2007	1. Add Henan Qinbei 2×600MW super-critical coal fired power plant as the second sample alternative for determi nation of baseline power plant. 2. When the EF_{BM} emission factor of the Central China grid is finally selected as the lowest for calculation of the project emission reduction, the calculation formulae of leakage is simplified conservatively, although finally the leakage was taken as zero due to negative value as resulted from the calculation. 3. Complementary demonstration on additionality. 4. Improve the Excel spreadsheets for the levelised cost calculation and comparison among the baseline alternatives, and for the project IRR calculation and sensitivity analysis, that are to be provided for validation by the DOE.
Version 3	15/12/2007	1. Update the data of the grid baseline emission factor calculation according to new data announced by the China's DNA at its CDM official Website, and the resulted emission reductions accordingly. 2. Update the monitoring plan, based on real circumstance in the Zhumadian Zhongyuan NGCC power plant.
Version 4	24/03/2008	1.Update the sample alternative for the levelised cost calculation and comparison among the baseline alternatives, 2. Correct the starting date of the project activity. 3. Partly revised based on the comments by the DOE during the validation process. 4. Some financial data updated from FSR 2004 march version to FSR 2004 May version.
Version 5	01/07/2008	1. Applicable AM0029 methodology is updated from version 01 to version 03. 2. "Tool to Calculate the Emission Factor for an Electricity System", Version 01 is used for calculation of grid baseline OM, BM and CM emission factors, 3. Additionality is demonstrated by using the latest version of the "Tool for the demonstration and assessment of additionality", Version 05.
Version 6	18/09/2008	Revised according to the second validation protocol given by the DOE on 25 August 2008.
Version 7	29/09/2008	Revised according to DOE's questions on 28 Sep. 2008.

A.2. Description of the project activity:

>> Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China (hereafter refers to as the Project or the proposed project) is located in Zhumadian City, Henan Province, China. The designed installed capacity of the Project is 2×377.2MW, which is aimed at electricity generation of 2,640.4000GWh annually with 2,584.4235GWh electricity per year to be delivered to the Central China Power Grid (CCPG) *via* Henan Provincial grid that the Project is connected to. The Project will consume 522.62×10^6 Nm^3 natural gas per year for power generation, without using other fuels. The first set of the unit was put into testing operation in November 2006.

The Central China Power Grid, under which the proposed project is covered, is dominated by coal-fired power plants. The electricity generated by using natural gas which is clean energy with less carbon content, in the project site, can displace electricity generated by coal-fired thermal power plants which would have been built otherwise. Thus the proposed project activity can reduce CO_2 emissions accrued from the CCPG. The estimated annual GHG emission reductions are 858,165 tCO_2e.

By adopting advanced clean and efficient power technology NGCC[1] (Natural Gas fired Combined-Cycle) using natural gas, the project activity will offer the remarkable environmental and economic benefits and will contribute to the local sustainable development in the following aspects:

- Optimize the electricity generation mix of the CCPG, especially for the southern Henan area; enhance the capacity of the peak load dispatching and electricity supply reliability for the grid; and improve the holistic economic benefit of the grid as a whole. So the proposed project activity is in line with China's energy policy with regard to improving energy mix, increasing energy efficiency and diversifying energy supply.
- By offering clean electricity with natural gas as low carbon content fuel, the project can mitigate the air pollution and CO_2 emissions caused by the coal-fired power plants, and improve the quality of the atmosphere environment effectively as well as save the land use.
- The project activity is in line with the "West Development" strategy and "West-to-East natural gas transmission" energy supply strategy in China, and could be propitious to the transformation of west resources advantage to economic advantage.
- It can certainly boost and strengthen the technology transfer of natural gas combined cycle power technology and its localised application and diffusion in China.

A.3. Project participants:

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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)
P.R. China (Host)	Henan Zhongyuan Gas Power Company Ltd.	No
Sweden	Carbon Asset Management Sweden AB	No

For more details please refer to Annex 1.

A.4. Technical description of the project activity:

[1] NGCC is the abbreviation of "Natural Gas fired Combined Cycle" power technology. An alternative CCGT is the abbreviation of "Combined Cycle Gas Turbine" power technology. Both refer to the same natural gas fired gas-steam combined cycle power technology.

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>> P.R. China

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

>> Henan Province

A.4.1.3. City/Town/Community etc:

>> Zhumadian City

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

>> The proposed project is located at the planned industrial zone in the southeast corner of the Zhumadian City, Henan Province, China. The project site is 5 km southeast to the city centre; 2.8 km east to Beijing-Zhuhai Highway; 1.5km south to Lian Jiang He River; 1.8km north to the Zhumadian - Xincai County Road. More particularly, the project site is located at 350m northwest to the Zhouwan Village; 240m west to the Runing Road (in planning); east close to the 300KT Methanol project site, and 220m south to Xiaozhuyuan Village. The Yunan branch gas pipeline sub-station is just located in the northeast side of the project site. (Note: Yunan means the southern part of the Henan Province)

The geographic coordinate of the project site is situated as:
North-west corner: East longitude 114°03'39" North latitude 32°57'31"
South-west corner: East longitude 114°03'39" North latitude 32°57'22"
South-east corner: East longitude 114°03'52" North latitude 32°57'22"
North-east corner: East longitude 114°03'52" North latitude 32°57'31"

The geographic coordinate of the mark points within the project site are situated as

1 # Cooling tower: East longitude 114°03'41" North latitude 32°57'24"

2 # Cooling tower: East longitude 114°03'46" North latitude 32°57'24"

1 # Boiler stack: East longitude 114°03'48" North latitude 32°57'27"

2 # Boiler stack: East longitude 114°03'48" North latitude 32°57'29"

The geographical location of the project site is shown in the maps in the Fig. 1 and Fig. 2 below.

Fig. 1 The location of Henan Province in China
Source: http://www.59edu.com/Article/UploadFiles/200710/20071015092606747.jpg

Fig.2: Geographic Location of Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China (2×377.2MW in Henan Zhongyuan Gas Power Co. Ltd.)

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

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Sectoral Scope: 1 Energy industries (non-renewable sources)

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

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The NGCC technology adopted in the proposed project consists of two phases of combined dynamic cycles: the first phase takes place in the gas turbine where the high temperature gas with about 1400^oC generated by the natural gas combustion can power to rotate a coupled AC power generator to generate electricity - this is the Gas Cycle. In the second phase, the exhausted gas discharged from the gas turbine with about 600^oC can generate steam with 540^oC temperature and 10.67MPa pressure in a heat recovery boiler, which then expands in the followed up steam turbine to generate electric power in the AC power generator again - this is the Steam Cycle. Two phases of the cycles is combined to generate electricity with quite high efficiency. The NGCC Power Technology is one of the advanced clean and efficient power technology in the world, whose multiple advantages can be summarised as following:

- Much high efficiency over conventional coal fired steam power generator units. The conversion efficiency of the state-of-art NGCC units could reach 58%[2].
- Requirements for less land and water resources than coal fired power plant.
- Fast start up and stop off with good flexibility of operation. It can improve the operation performance of the power grid and enhance the flexibility of the peak load dispatching.
- Higher operation reliability with 85%-95% availability factor. It can improve the safety of the power grid.
- Better environmental performance. The emission of the natural gas combustion is very little; whose CO_2 emission factor is less than about half of the coal.

China has not yet held design and manufacture technology for NGCC equipment over 350MW grade, which needs import from abroad through international bidding. By competitive bidding, Shanghai Electrical Group-German Siemens Company consortium won the tender of the project, so that by using the advanced Siemens technology, the whole set of the F9 grade gas turbine, steam turbine and generator equipment package are manufactured jointly by the Company consortium in Shanghai and German Siemens respectively, and the waste heat recovery boiler is made in China. These equipments are technologically matured and advanced and can keep the advanced level in the Country for a long period in the future. According to the China's principle, i.e. "combination of technology transfer with equipment trade", and "exchange of equipment market for technology", the import of the manufacture technology for the main gas turbine equipment and the NGCC power station design technology constituted as an integrated part of the whole bidding contract. Therefore the proposed project fully meets the eligibility requirement of CDM for promoting technology transfer.

The electricity generated is delivered to the Central China Power Grid through 500 kV transmission line.

The natural gas consumed as fuel in this project come from "West-to-East natural gas transmission Pipeline" (via Southern Henan branch pipeline). The project owner has already invested in the branch

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[2] Quoted from: *Huang Qili**, "*Development Direction for the Electric Power Technologies and Equipment in China*", 《China's Electric Power Industry Management》, page 39, Issue. 11, 2003: "Since the last half century, the heavy duty gas turbine technology has been developed in the world with the conversion efficiency being increased from 20% to 38% (in 2000) and the capacity of the single gas turbine unit being enlarged from 100MW to 300MW. Nowadays the efficiency of the state-of-art G type 300 MW gas turbine with inlet temperature 1500°C could reach 38.5%, and up to 58%~60% when in combined cycle."
*/: Huang Qili, Prof. , Academician, Chinese Academy of Engineering.

pipeline construction. Furthermore, the long-term natural gas supply contract has been signed with the natural gas pipeline company, to guarantee the reliability and stability of the natural gas supply.

The technical performance indicators of the advanced technologies employed in the project are listed the table below (data source: the Feasibility Study Report of the project).

No.	Indicator Description	Units	Data
1.0	Gross output power at full load under ISO conditions	MW	2×402.5[3]
2.0	Gross thermal efficiency at full load	kJ/kWh	6170
3.0	**Gas Turbine**		
3.1	Manufacturer and Country of origin	Siemens Co. in Germany	
3.2	Type		TCF1
3.3	Rated speed	rpm	3,000
3.4	Flow rate of flue gas at the gas turbine	t/h	2396.5
3.5	Temperature of flue gas at the gas turbine	°C	586.5
3.6	Gas turbine output	MW	243.4
4.0	**Steam Turbine**		
4.1	Manufacturer and Country of origin	Shanghai Steam Turbine Co., Ltd	
4.2	Type		TCF1
4.3	Rated Speed	rpm	3,000
4.4	Performance data under design conditions		
4.5	Steam turbine output	MW	133.8
4.4.1	A) Steam Pressure (MPa.a)		
	HP: 12.185, IP: 2.903, LP: 0.33		
4.4.2	B) Steam Temperature (°C)		
	HP: 564.4, IP: 549.4, LP: 237		
4.4.3	C) Main Steam Flow Rate (t/h)		
	HP: 260.104, IP: 308.19, LP: 43.132		
4.4.4	D) Exhaust Pressure	kPa.a	5.89/4.96
5.0	**HRSG in Combined Cycle**		
5.1	Manufacturer and Country of origin	Wuhan Boiler Manufacture Co.	
5.2	Feed water temperature of HRSG	°C	55
5.3	Output of generator	MVA	478
6.0	**Generator**		
6.1	Manufacturer and country of origin	Shanghai Elec. Group Co.	
6.2	Rated voltage	kV	21
6.3	Rated current	A	13142
6.4	Power factor		0.85
6.5	Number of phases		3
6.6	Rated frequency	Hz	50
6.7	Rated speed	rpm	3000
6.8	Total output for one set	MW	377.2

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

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[3] "technical specifications" in the equipment purchase contract

The renewable crediting period is selected for the proposed project with the first crediting period being of 7 years (2009.01.01-2015.12.31) which will be renewed for a maximum of two further periods of 7 years each. The total emission reductions by the project activity over the first crediting period are estimated as 6,007,155 tCO_2e and the annually averaged GHG emission reductions by the project activity is estimated as 858,165 tCO_2e/a. as shown in the table below.

Years	**Annual estimation of emission reductions in tonne of CO_2e**
2009	858,165
2010	858,165
2011	858,165
2012	858,165
2013	858,165
2014	858,165
2015	858,165
Total estimated reductions (tCO_2e) over the 1st crediting period	6,007,155
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tCO_2e)	858,165

A.4.5. Public funding of the project activity:

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No public official development assistant funding from Annex 1 Party country is involved in this project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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The approved baseline methodology AM0029, Version 03: "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and the approved monitoring methodology AM0029, Version 03: "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel" are applied to the project activity. The AM0029 also uses the "Tool to Calculate the Emission Factor for an Electricity System", Version 01 and "Tool for the Demonstration and Assessment of Additionality", Version 05 agreed by CDM EB.

More information about the methodology and the methodological tools can be found on the website: http://cdm.unfccc.int/methodologies/approved.

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

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The proposed project activity meets the applicability conditions of AM0029: "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas", Version 03 for the following reasons:

- The proposed project activities are aimed at construction and operation of a new natural gas fired NGCC power plant and electricity generated is delivered to the connected Central China Power Grid. According to the FSR page 36, the project will not have oil fired back up system, which means the project has no auxiliary fuels.
- The geographical/physical boundaries of the Central China Power Grid which the proposed project is connected to, are clearly defined by China's DNA and the baseline emission factor of the grid is also determined by the China's DNA, based on the national statistical publication, i.e. "China Electric Power Yearbook" and "China Energy Statistics Yearbook" which is publicly available. The relevant information is published on the official CDM website of the National Development and Reformation Committee (NDRC) which is China's DNA. For more information please refer to the "Notice on Determination of China Regional Power Grid Baseline Emission Factor" at the web site[4].
- The natural gas consumed in the proposed project comes from "West-to-East natural gas transmission Pipeline" (via Southern-Henan branch pipeline), and the gas supply is sufficiently available according to the FSR. The natural gas sales agreement between the PO and China Petroleum and Natural Gas Co. Ltd. was signed on 18 May 2008 and the contract can guarantee the natural gas supply to meet the gas demand of the project activity. Moreover, the China Petroleum and Natural Gas Co. Ltd. has agreed to include the amount of natural gas required by the Project in its gas supply and distribution plan for "the West to East natural gas transmission pipeline." (see "Answer letter on use of natural gas requested by the Henan Zhongyuan gas power plant", Document No. Shiyoujihan [2003]78.)

To conclude, the approved baseline and monitoring methodology AM0029, Version 03 is applicable to the proposed project activity.

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

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The project boundary of the proposed project activity includes the geographical and physical boundary of the project site itself and all power plants connected physically to the identified baseline grid (see below), i.e. the project electricity grid system. According to the guidance in the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, and the delineation on the regional grid system boundaries as published by the China's DNA[5] i.e. the NDRC on July 18, 2008, the Central China Power Grid (CCPG) to which the proposed project is connected to is identified as the baseline grid, i.e. the project electricity system which consists of the following provincial power grid: Henan, Hubei, Hunan, Jiangxi, Sichuan and Chongqing.

According to the AM0029, Version 03, in the calculation of project emissions, only CO_2 emissions from fossil fuel combustion at the project plant are considered. In the calculation of baseline emissions, only CO_2 emissions from fossil fuel combustion in power plants in the baseline grid are considered.

The GHG emissions by sources included in or excluded from the project boundary are listed as follows:

	Sources	Gas	Included?	Justification/Explanation
Baseline	Fossil fuel fired Power plants in baseline grid	CO_2	Yes	Main emission source
		CH_4	No	Excluded from simplification, conservative
		N_2O	No	Excluded from simplification, conservative

[4] http://cdm.ccchina.gov.cn/web/index.asp, Jult 18, 2008.
[5] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf, July 18, 2008

Project Activity	On-site fuel combustion due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Excluded from simplification.
		N_2O	No	Excluded from simplification.

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

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According to the AM0029, Version 03, the following steps are used to define the baseline scenario:

Step 1: Identify plausible baseline scenarios.

In this step, all type of possible realistic and credible power plants alternatives within the CCPG grid boundary (as defined by using "Tool to calculate emission factor for an electricity system") that provide outputs or services comparable with the proposed CDM project will be identified. Alternatives to be analysed for this project include:

(a) The project activity not implemented as a CDM project;
(b) Power generation using natural gas, but adopting the technology of simple cycle gas turbine is used instead of gas-steam combined cycle unit;
(c) Power generation technologies using energy sources other than natural gas;
(d) Import of electricity from connected grids, including the possibility of new interconnections.

For the **alternative (a)**, of course, technologically comparing with the proposed project self, it no doubt is a possible and realistic alternative that provide the same outputs or services. However, the levelised cost analysis in the next step 2 and the benchmark investment analysis in Section B.5 below show that in the absence of CDM, the project is lack of economic attractiveness, due to high capital cost of the imported equipments with certain technical risk and financial barriers, higher natural gas price and comparatively lower bus-bar tariff. So the alternative (a) is a plausible, but would not be an economically most attractive alternative scenario.

"For the **alternative (b)**, the electricity efficiency of natural gas fired single cycle power technology employed in the peak load power plant is much lower than that of the NGCC one. It is assessed in the approved FSR of the proposed project[6] that for the 9F grade gas turbine power units operated under the single cycle condition for peak loading, the rated LHV thermal efficiency η=39.0%, equivalent to 9250 kJ/kWh of the heat intensity, whereas when operated under the combined cycle condition, the rated LHV thermal efficiency η=57.15%, equivalent to 6300kJ/kWh of the heat intensity. This assessment is also supported by an overview on the Application of Gas Turbine Power Generation Technology published in 《China Power》, Sept. 18, 2006[7], that in recent years the natural gas single cycle technology has been developed to the scale of 250-300MW unit capacity with its thermal efficiency up to 38%-39.5%. Moreover, the gas-steam combined cycle power technology can achieve higher thermal efficiency up to 58%-60%. As comparison operation of the NG single cycle technology will certainly result in high operation cost and large waste of expensive gas energy. Thus the single cycle power technology based alternative (b) has already been abandoned in the FSR by its conclusion: "Given the current tariff level prevailing in the electric power market and the competition mode in China, the power grid would not accept the higher electricity bus bar tariff option offered by the power units operated under the single

[6] See the Section 5.2 Selection of gas turbine units options for installation, Approved FSR of the proposed project (F2801K-A-01), Page 59, May, 2004.

[7] "Assessment on the Application of Gas Turbine Power Generation Technology", Sept. 18, 2006, Source: 《China Power》, http://www.chinapower.com.cn/article/1046/art1046090.asp

cycle condition”. Therefore the alternative (b) is not a technologically and economically attractive alternative.

For the **alternative (c),** how selecting power generation technologies using energy sources other than natural gas needs to take into account, within the Central China Power Grid, the hydro-power, nuclear power, coal fired power and oil fired power options, etc. which could provide realistic, feasible and comparable electricity generation capacity and load dispatching capacity. Also, we need to consider if these alternative options could be of help with electricity supply balance and load regulation balance as well as economic and safety operation for the entire power grid.

According to China electric power yearbook 2006 the relevant power plant technologies that **have recently been constructed** within CCPG include hydro power, fuel-fired power plant, wind power and other generation technologies.

According to China electric power yearbook 2006 the types of the technology of power plants **under construction** are hydro power, fuel-fired power, wind power, nuclear power, solar and biomass power plants.

According to the 11th Five-Year Plan for Energy Development of China (see evidence CL4-3), the development of coal fired power plants, wind and hydro power plants, nuclear power plants, solar and biomass power plants are the **planned power plant** technologies for the 2007-2012. Therefore all relevant power plant technologies that have recently been constructed or are under construction or are being planned in the project boundary are hydro power, wind power, nuclear power, solar power, biomass power and fuel-fired power generation technologies.

Firstly, nuclear power provides base load and not peak load as the project does. China’s Government established a new guideline on proactive development of nuclear power in 2004, and the NDRC announced《Medium & Long Term Nuclear Power Development Plan (2005-2020)》in Oct. 2007[8], with a target to reach 40GW installed nuclear power capacity in operation by 2020, while other 18GW capacity under construction. After 2020 the nuclear power would have further development in China, based on the long term energy demand forecasting. Up to March 2008, 6 nuclear power stations with 11 sets of power unit and 9.068 GW installed capacity in total have been built and put into operation, and other 12 sets of power unit with 11.9 GW capacity in total are under construction (Guandong LinAo Phase II, Zhejiang Qingshan Phase II Expansion, Liaoning Hongyanhe Phase I and Fujian Ningde Phase I). According to the Medium & Long Term Nuclear Power Plan, all the new, follow up new/expansion nuclear power stations are concentrated in the provinces along coastline with comparatively developed economy but lack of coal resource supply. So far there is no nuclear power construction plan to be implemented under the CCPG, especially Henan province. On the other hand it should be indicated that nuclear power stations as large scale pillar power sources normally operate under base load rather than peak load. So from technical point of view, nuclear power is not an appropriate alternative for the NGCC which is peak loading power plant.

The wind power, solar power and biomass power can also be excluded because they can not provide similar peak load regulation service and the un-commercialized technology.

[8] 《Medium & Long Term Nuclear Power Development Plan (2005-2020)》, please access http://www.ndrc.gov.cn/gzdt/W020071102332040700553.pdf

Secondly, for the oil fuel, considering the increasing shortage of domestic oil supply in China and the very high oil price booming in the international oil market, the construction of oil-fired power plants is surely unfeasible[9].

Thirdly, in view from the CCPG, the Zhumadian service area which is located at the terminal end of the Henan provincial power grid, is lack of large electricity supply source and is weak in load dispatching capacity. So the CCPG needs for more flexible peak load dispatching power source in Zhumadian service area. As far as hydro power is concerned, although there are Xiao Langdi and San Menxia hydro power stations in Henan provincial power grid, which could undertake part of the peak load capacity, their share is relatively small. While in the southern part of the CCPG, there are rich hydro power resources available, but having limited peak load dispatching capacity, and need long distance transmission of hydro electricity via CCPG.

For the Three Gorge hydro power project, its peak load dispatching capacity is comparatively smaller in the Summer than in other seasons, due to influenced by the Summer flood season. Whereas the electricity supply by the Three Gorge Hydro Power Co. is directly and separately controlled by the State Power Grid Co. and the Three Gorge hydro power project usually supplies the electricity to Henan Province for summer base load operation. It will make the peak load dispatching difficult for Henan power grid in the summer season.

Furthermore, the hydro resources in Henan Province is very limited[10], it is very difficult to develop the hydropower station with similar output as the proposed project. Therefore hydropower plant could not be a realistic and plausible alternative.

Actually in 2002, the top difference rate between peak and off-peak load appearing in the Henan provincial grid reached 44.76%, exceeding the economic dispatching capacity of the whole thermal power units in the grid. Therefore the CCPG needs for developing new peak load dispatching power sources in Henan.

Henan power grid is dominated by coal-fired power plants, and the newly installed capacities are mainly the coal-fired units. From 2001 to 2005, the share from fossil fuel fired electricity generation in the total generation mix was 95.51% in 2001, 94.58% in 2002, 94.6% in 2003, 94.08% in 2004 and 95.2% in 2005, respectively. Therefore building a coal-fired power plant with de-SOx and peak load regulation function is one of the baseline alternatives. In terms of the law and regulation aspects, considering "*The Notice on relevant requirements regarding the project planning and construction of coal fired power plants*" issued by NDRC of China (file No. NDRC-Energy [2004]864)[11] which stated that "*the unit capacity to be selected for power construction should be in principle 600MW and above*", thus 600 MW coal fired sub-critical and super-critical power plants could be the alternatives in absence of this proposed project.

For the **alternative (d)**, the national electric power statistics data show that the State Grid Company exported electricity from the CCPG to other regional grid every year rather than import to CCPG. Therefore it is expected that the **alternative (d)** that intends to import electricity from other regional grids, for instance, from SCPG and ECPG, to the CCPG in absence of the proposed project, would not be accepted by the State Grid Company. Thus it is not a feasible alternative.

In summary, alternative (a) and alternative (c) are the plausible alternative scenarios in the absence of the proposed project activity.

In the next step the economically most attractive baseline alternative will be identified among those alternatives remained from screening as mentioned above.

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[9] http://www.china5e.com/dissertation/policy/20060816101935.html
[10] http://www.hnssw.com.cn/hnswyewu/szy/szygb.htm
[11] http://www.chinavalue.net/wiki/showcontent.aspx?titleid=61239

Step 2: Identify the economically most attractive baseline scenario alternative.

According to the AM0029, Version 03, the economically most attractive baseline scenario alternative is identified using investment analysis. Given that all alternatives remaining after Step 1 are alternative (a) and (c), that are fossil-fuel-fired power plants operated within the same regional power grid (CCPG), and can deliver the same type of services (electricity supply) with comparable quality, properties under the same electricity tariff and taxation policy circumstances, and therefore that may present the costs of per unit electricity generation which are comparable with each other, thus the levelised cost in Yuan RMB/ kWh could be used as a suitable financial indicator for investment analysis. Include all relevant costs (including the investment cost, fuel costs and operation and maintenance costs, etc.) The basic levelised cost approach used in this PDD is based on Appendix 5: "Cost Estimation Methodology" in "Projected Costs of Generating Electricity" 2005 update, published by NEA, IEA and OECD[12]. The formula applied to calculate the levelised electricity generation cost (EGC) is the following:

$$EGC = \frac{\sum_t \frac{(I_t + M_t + F_t)}{(1+r)^t}}{\sum_t \frac{E_t}{(1+r)^t}} \quad (1)$$

Where:

- *EGC:* Average lifetime levelised electricity generation cost per kWh.
- I_t: Capital expenditure in the year t.
- M_t: Operation and maintenance expenditures in the year t.
- F_t: Fuel expenditure in the year t.
- E_t: Electricity generation in the year t.
- *r:* Discount rate.

Here, in line with the description in step 1, two newly built coal-fired power plants, i.e. Hunan Dadang Huayin Lenshuijiang Jinzhushan 2×600MW sub-critical coal-fired power plant and Henan Huaneng Qinbei 2×600MW super-critical coal-fired power plant, their operations of which are dispatched under the CCPG, are selected as sample for further analysis below, considering the availability of data and information. The relevant assumptions and parameters used for calculation of EGC of those alternative power technologies are listed in Table 1 both in Yuan RMB and in US$ as following, assuming 7.88 Yuan RMB/US$ of the exchange rate:

Table 1 Parameters and assumptions for the alternative coal-fired power plants (in Yuan RMB)

Item	Unit	Hunan Jinzhu-shan sub-critical (2×600MW)	Henan Qinbei super-critical (2×600MW)	Henan Zhongyuan Gas Power Plant (2×377.2MW)
Operation lifetime	Year	19	22	20
Generation per year	GWh	5400	6250.2	2640.4
Fixed asset Investment per MW	Yuan/MW	3777	5571.1	3116.6
Materials fee	Yuan/MWh	5.17	10	5.999
O&M expenditure	Yuan/MWh	26.3	31.71	272.29
Water fee	Yuan/MWh	1	0.68	0.682

[12] Appendix 5: "*Cost Estimation Methodology*" in "*Projected Costs of Generating Electricity*", Page 174, Expert Group co-chaired by Dr. Gert van Uitert from the Netherlands and Prof. Alfred Voss from Germany, published by NEA, IEA and OECD, 2005 update

Employee	Person	457		106
Fuel consumption	gce/kWh	307	281.26	0.19793 (Nm^3/kWh)
Fuel Price	Yuan/tce	317.07	442	1.1798 (Yuan/Nm^3, without VAT)
Annual operating hours	Hour	4500	5500	3500*4
Commissioning date	Year	Mar.2006, # 1 unit xxx. 2007, # 2 unit	Nov.,2006	June 2007, # 1 unit Dec 2007, # 2 unit

Source:
1) Feasibility study report on Hunan Dadang Huayin Lenshuijiang Jinzhushan 2×600MW sub-critical power project (0100-8001-006-1), May, 2004.
2) Case study and PDD study report for Huaneng Qinbei 2×600 MW super-critical coal-fired power plant, See the second progress report on "The Study on the Methodologies and its Application of Clean Development Mechanism in China", Task II: Case Study, Case I, provided by GCCI, Tsinghua University. Feb. 29, 2004.
3) Feasibility study report on Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China, F2801K-A-01. March, 2004.
4) Henan Zhongyuan Gas Power Plant is designed to be a peak loading power plant, for which the main power units are imported, for which the annual operation hour is designed to be 3500h. So the power plant will operate mainly in the peak load period under the CCPG. In summer, the plant will operate in all peak load periods as shown in the typical daily power balance sheet. In winter, the plant will operate partly in the peak load period, partly in the off-peak load period. Also in the electricity balance Table for Henan power grid (2003~ 2010) (Table 2.3.5), the electricity generation by natural gas power plant is based on 3500h/y of its annual utilization hour. Please refer to FSR No. F2801K-A-01, Section 2.3.4 and 2.3.5 (P25) in detail.

Based on the above parameters and assumption and levelised cost calculation formula, the levelised cost for the relevant generation technologies are calculated and listed in the Table 2 (both in Yuan RMB and in US$) with sensitivity analysis and comparison with 2×377.2MW NGCC units of the proposed project.

Table 2 Result and sensitive analysis of levelised cost (Unit: Yuan/KWh)

Technology	Levelised Cost	Changing in Load Factor		Changing in Fuel Price	
	RMB/kWh	10%	-10%	10%	-10%
Hunan Jinzhushan 2×600 MW Sub-critical coal fired power	0.2349	0.2254	0.2466	0.2447	0.2252
Huaneng Qinbei 2×600 MW Super-critical coal fired power	0.2481	0.2379	0.2607	0.2606	0.2357
Henan Zhongyuan 2×377.2 MW Gas Power Plant	0.3687	0.3353	0.4096	0.3905	0.3470

Table 2 Result and sensitive analysis of levelised cost (Unit: US$/KWh)

Technology	Levelised Cost	Changing in Load Factor		Changing in Fuel Price	
	US$/kWh	10%	-10%	10%	-10%
Hunan Jinzhushan 2×600 MW Sub-critical coal fired power	0.02981	0.02860	0.03129	0.03105	0.02858

Huaneng Qinbei 2×600 MW Super-critical coal fired power	0.03148	0.03019	0.03308	0.03307	0.02991
Henan Zhongyuan 2×377.2 MW Gas Power Plant	0.04679	0.04255	0.05198	0.04956	0.04403

According to the AM0029, Version 03, the baseline alternatives with the best financial indicator, i.e. the lowest levelised cost, can be pre-selected as the most plausible baseline scenario. Therefore the alternative (c), representing by Hunan Jinzhushan 2×600 MW sub-critical coal-fired power plant with the lowest levelised cost as shown above, has been pre-selected as the most plausible baseline scenario. The sensitive analysis in the previous Table 2 also sufficiently confirms and supports the conclusion that the Hunan Jinzhushan 2×600 MW sub-critical coal-fired power plant always has the lowest levelised cost among those alternatives within the reasonable variations range of the key assumptions (such as load factor and fuel price), then the Hunan Jinzhushan 2×600 MW sub-critical coal-fired power plant, i.e. the most economically attractive alternative, is selected as the most plausible baseline scenario, whose coal intensity per unit electricity generation is 307gce/KWh, with electricity generation efficiency 40.02%, (327.29gce/kWh per unit electricity delivered with electricity supply efficiency 37.54% at 6.2% of the self service rate). (Source: Feasibility study report on Hunan Dadang Huayin Lenshuijiang Jinzhushan 2×600MW sub-critical power project (0100-8001-006-1), May, 2004).

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):

>> The main equipment import contract of the project was signed and came into force on 6 June 2005, and the civil construction work for the #1 waste heat boiler of the first 377.2MW NGCC unit started on 10 Aug. 2005, thus the starting date of the project activity is before the expected date of submission for validation by the DOE (Dec. 2007). In accordance with the specific guidelines for completing the CDM-PDD given by the CDM EB, we provided the following evidence to show that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

Earlier in April 2003, with great interesting, the project proponent learnt firstly the concept of the Clean Development Mechanism (CDM) from the NDRC official CDM Website, where a brief introduction on World Bank's National Strategy Study (NSS) Project: CDM Methodologies and their Application in China (in short: China CDM Country Study Project) was published on March 23, 2003[13]. Further the project proponent learnt more deeply the case study report of the World Bank's NSS Project, named "Gas-Steam Combined Cycle Power Project (Phase II) in Beijing No.3 Thermal Power Plant (BJ3TPP)" [14], which was provided by GCCI, Tsinghua University as the leading implementation institute of the China CDM Country Study Project, and got clearly understanding that with the same project type as the case study of the NGCC at BJ3TPP, the CERs revenue from CDM could also help the proposed project with overcoming the investment and financing barriers facing to the Project. Chronological list of key activities associated with the project activity demonstrating serious consideration of CDM in the decision to proceed with the project activity：

Date	Event	Evidence
March 2004	The project owner Henan Zhongyuan Gas Power Company Ltd. (hereafter refers to as the	Study report and internal memo

[13] http://cdm.ccchina.gov.cn/web/main.asp?ColumnId=7, 2003.03.23.

[14] PDD Study Report file named: WB-GTZ-CDM-PDD-Task2-Case3(GasCC)-031022.doc, 2003.10.27; Case Study Report file named: Masterfile case3(CC)-040222.doc, 2004.02.22.

	PO) got the information of another NG project, Beijing third thermal power plant, which was a CDM case study by World Bank, from Prof. Liu in Tsinghua University Jan. 2004. The PO informed its departments to study the materials in March 2004.	
10 May 2004	The PO had a board meeting, deciding that the CDM should be seized to improve the low investment income rate	Board meeting minutes
10 May 2004	The PO established a CDM work team	Internal memo
12 Oct., 2004	The purchase order of the key equipments was signed between Henan Zhongyuan Gas Power Co., Ltd, China National Technical Import & Export Corp. and Sec-Led Consortium. However the contract will come into force under several conditions[15].	The equipment purchase contract with the signatures of four parties: Henan Zhongyuan Gas Power Co., Ltd., Shanghai Electric (Group) Corp., China National Technical Import & Export Co. and SIEMENS AG
3 April 2005	the PO invited Prof. Liu in Tsinghua University to be the CDM consultant for the proposed project	Invitation letter
6 June 2005	The main equipment import contract between Henan Zhumadian Zhongyuan Gas Power Plant, China National Technical Import & Export Co. (CNTIC) and Shanghai Electric Group Co. (SEC)-SIEMENS Consortium came into force (Contract No. 04DE01GTA01XC0015, please refer to CNTIC Document No. G17ZY/11, 06/06/ 2005)	Letter from China National Technical Import & Export Co. (CNTIC)
On 13 April 2006, the methodology panel approved the methodology at its meeting from 4th to 7th of April 2006 and AM0029 was approved in May 2006 by the EB.		
14 Aug. 2006 and 17 Nov. 2006	Two CDM work meetings for the project were held on 14 of August and 17 November 2006	Electronic memos from Professor Liu
9 March 2007	The ERPA got signed	ERPA

[15] For the purchase of equipment, China National Technical Import and Export Corporation is the commercial agent. An agreement for the equipment bidding and purchase entrust was signed between Henan Zhongyuan Gas Power Co., Ltd. and China National Technical Import and Export Corporation. The agreement has also been submitted with the answer. In the agreement it states the conditions under which the contract will come into force in clause 5.2: “Part A shall open bank letter of guarantee to secure the amount on contract price，and settle all contract payment as per under conditions described . In case part A fails to open bank letter of guarantee as per Clause 5, Part B shall not undertake any obligations under this contract. Before the contract comes to effect, Part A shall submit a municipal or provincial bank letter of guarantee or confirmed with the Part B as the beneficiary on full amount of contract price.” (part A is Henan Zhongyuan Gas Power Co., Ltd. and part B is China National Technical Import and Export Corporation). China National Technical Import & Export Corporation shall act as the commercial agent of the Buyer for the execution of the Equipment purchase Contract. China National Technical Import & Export Corporation shall not undertake the material rights and obligations of the Buyer under the Contract. The bank letter of guarantee from China Development Bank to China National Technical Import & Export Corporation was issued on 3 June 2005. After that the contract came into force on 6 June 2005.

April 2007	The draft version PDD was finished on 5 April 2007. But there was still some information lacking and the commercial negotiations delayed the efficient PDD development.	internal communication between the seller and the buyer
June 2007	#1 unit went into operation	Operational data
5 Sept. 2007	The Project was on GSP 1	UNFCCC
Dec. 2007	2# unit went into operation	Operational data
18 May 2008	The natural gas sales agreement between the PO and China Petroleum and Natural Gas Co. Ltd. was signed.	Agreement

The evidences have been provided to the DOE.

According to the AM0029, Version 03, the demonstration and assessment of additionality comprises the following three steps for the project concerned:

Step 1: Benchmark investment analysis.

In line with the AM0029, Version 03, by applying sub-step 2b (Option III: Apply benchmark analysis), sub-step 2c (Calculation and comparison of financial indicators), and sub-step 2d (Sensitivity Analysis) of the latest version of the "Tool for demonstration assessment and of additionality" (Version 05) agreed by the CDM Executive Board, it could be demonstrated that the proposed CDM project activity is unlikely to be financially attractive, as following:

Sub-step 1a. Apply benchmark analysis.

During the feasibility study on this NGCC project proposed, the project's economic performance analysis was carried out based on *"The Economical assessment method and parameters for capital construction project, the 2nd edition" and "The detailed rules for implementation of the economical assessment method used for electric power project construction (test version)" issued by the Electric Power Planning and Design Institute under the Electric Power Industry Ministry, Document No.:DianGuiJing No.2 (1994)*, Meanwhile, during the CDM PDD development for many electricity generation related project activities in China, 《*the Interim Measures for Economic Evaluation on Electric Power Technical Reconstruction Project*》, issued by the State Power Corporation, dated on Sept.10th, 2002, (Document No. GuoDianFa[2002]623) are widely applied as a recognized industrial standard in the electric power sector for both electric power construction projects and reconstruction projects in China[16]. Based on these documents the project benchmark value of IRR (Without VAT), for power projects was set to be 8%. Thus in the CDM PDD for the proposed project, the 8% of IRR benchmark value was adopted, which was consistent with that IRR benchmark value used in the FSR 2004 May version.

Sub-step 1b. Calculation and comparison of financial indicators.

The main parameters and assumptions used for calculation of the financial indicators are listed in the table 3 below.

Table 3 Main parameters for calculation of financial indicators (in Yuan RMB)

Parameters	Unit	Amount	Source

[16] In "The Economical Assessment Method and Parameters for Capital Construction Project", the 3rd edition , published by the NDRC and the Ministry of Construction in July 2006, the project IRR without VAT for the natural gas fired power plants is specified as 9%. However this new IRR may be applicable only for the projects with FSR or PDD development starting from July 2006 and after, when the new edition enters into force.

Installed Capacity	MW	2×377.2	Feasibility Study
Total Investment (static)	Mln Yuan	2351.18	Feasibility Study
Annual operation hour	hour	3500	Feasibility Study
Estimated electricity generated annually	MWh	2,640,400	Feasibility Study
Estimated electricity delivered to the gird	MWh	2,584,424	Feasibility Study
The electricity bus-bar tariff (w/t VAT) (with VAT)	Yuan/KWh	0.363 0.424	Feasibility Study
Exchange rate	Yuan /$US	7.88	Exchange at that time
CERs Price	US/tCO_2	11	Refer to carbon trade market
VAT rate for electricity	%	17	Feasibility Study, Tax law
VAT rate for natural gas	%	13	Tax Law
Tax rate for natural gas transportation	%	7	Tax Law
Income tax rate	%	33	Feasibility Study
City Construction Tax Rate	%	7	Feasibility Study
Education Addition Tax Rate	%	3	Feasibility Study
Project life time	Year	21	Feasibility Study
O & M cost, including:	10K Yuan	73059	Calculated
Water cost	10K Yuan	180	Feasibility Study
Material cost	10K Yuan	1584	Feasibility Study
Maintenance cost	10K Yuan	6171	Feasibility Study
Labour cost	10K Yuan	297	Feasibility Study
Fuel cost	10K Yuan	61658.9	Calculated
Other cost	10K Yuan	3168	FSR
Fuel price (without VAT)	Yuan /Nm^3	1.1798	FSR+NDRC/DRC approved price*1
Gas intensity	Nm^3/MWh	197.93	Feasibility Study

Source: Feasibility study report on Zhumadian Zhongyuan Gas-Steam Combined Cycle Power Project in Henan China, No. F2801K-A-01, Henan Provincial Electric Power Design Institute, May 2004.

*1/: i) "NDRC Office's reply letter on price of natural gas used for power generation in Henan, which is pipelined from gas fields in west to east.", Document No.: FaGaiBanJiage [2004]1964, 2004.10.28: The natural gas price was 1.1 Yuan/Nm^3 in which 0.48 Yuan component was the gas field benchmark price and 0.62 Yuan component was the natural gas transportation (west to east) price. The VAT is not refundable.

ii) "NDRC notice on adjustment of the gas field benchmark price for natural gas pipelined from the West to the East", Document No. Fagaijiage[2005] 439, March 19, 2005: the gas field benchmark price is raised from 0.48 to 0.52 Yuan/Nm^3, increasing by 0.04Yuan/Nm^3.

iii) "Henan DRC notice on the Yunan sub-pipeline natural gas transportation price", document No. [2004]1653, 8 September 2004: the natural gas transportation price from "west to east" pipeline to "Yunan Gas pipeline, Zhumadian City" is 0.15Yuan/ Nm^3.

As in line with the analysis in Step 1 of Section B.4, based on Table 3 above, in case without CERs revenue, the IRR of the proposed project is 3.86%, which is much low in comparing with 8%, the benchmark value of IRR, thus the proposed project is not financially attractive because of its low profitability.

In the Table 4 below the comparison between the IRR with and without CERs revenue has been made. It shows that the CER revenue would remarkably improve the financial performance, for instance the IRR would be increased from 3.86% to 8.22%, beyond the 8% of the benchmark IRR value, when

10US/tCO_2$ of CERs price is assumed. It means CDM could help the proposed project with overcoming the investment and financial barriers to the considerable extent.

Table 4 Comparison of financial indicator IRR with and without CER revenue

Project	Unit	Without CERs	Benchmark IRR	With CERs
Full investment IRR	%	3.86	8.00	8.22*

Note */: at CERs price of 11 US/tCO_2$; While at CERS price 10 US/tCO_2$, IRR=7.85%.

Sub-step 1c. Sensitivity Analysis.

Five parameter factors are considered in the following sensitivity analysis:
1) Total static investment.
2) Annual operation and maintenance cost.
3) Electricity price (bus-bar tariff).
4) Natural gas price (without VAT/tax)
5) Electricity generation (operation hours)

Assuming the above five factors vary within the range of -10%-+10%, the IRR of the proposed project (without CERs revenue) varies to different extent, as shown in Table 5 and Figure 3. The electricity price, natural gas price and electricity generation (annual operation hours) are the most sensitive and important factor affecting the financial attractiveness of the proposed project. The annual O&M cost is the second critical factor to the financial attractiveness. The impact of the total investment change is the moderate.

Table 5 Sensitivity analysis on IRR of the project activity

Range of variation	-0.10	-0.05	0.00	0.05	0.10
Total static investment	5.00%	4.41%	3.86%	3.35%	2.87%
Annual O&M cost	6.99%	5.55%	3.86%	1.91%	-0.43%
Electricity price (w/t VAT)	-1.77%	1.32%	3.86%	5.95%	7.65%
Natural gas price (w/t VAT/tax)	6.57%	5.30%	3.86%	2.24%	0.33%
Electricity generation (operation hours)	-1.75%	1.34%	3.86%	5.92%	7.59%

It can be seen from the Table 5, that when the total static investment, annual O&M cost (mainly including gas cost) and natural gas price reduce by 10%, or the electricity generation (operation hours) and electricity price increases by 10%, the IRR would be still lower than the IRR benchmark value 8%. It shows that within ranges of the reasonable variation in these sensitive parameters, the conclusion that the proposed project activity is still not financially attractive is robust. Moreover, it should be noted that the natural gas price and the electricity tariff are sensitive parameters under strict control by the state authority, and may increase along with the inflation of Commodity Price Index (CPI). In practice, the current electricity bus-bar tariff executed by the power grid Co. or the current natural gas supply price executed by the local natural gas pipeline Co. are even lower or higher than the government approved price respectively. And during recent years the natural gas price has been increasing. Therefore within the reasonably variation range of these parameters, it is almost impossible for the electricity tariff parameters to have the variation by above +10%, or for the natural gas price parameter to have the variation by lower than –10%.

If the electricity generation increases by 10% the IRR will be near to the benchmark. However this is unlikely for the following reasons. Essentially gas-fired power plants are generally reserved and provide peak loading service to power grid, due to relatively expensive natural gas price and imported gas turbines and generators in China as well as its good technological performance for peak load regulation, compared to coal fired power plants which dominate the Chinese power grids. Therefore 3500hrs is the

standard design of operation hours for natural gas project according to "Thermal Power Engineering Design Reference Cost Index (2005 Edition)", issued by China Institute of Power Planning and Design. Thus the standard designed 3500 hour/year for the proposed project which is defined as a peak load regulation power plant, has also been properly adopted in the FSR No. F2801K-A-01, as explained in its Section 2.3.4 and in the electricity balance Table 2.3.5 (P25): Determination on annual utilization hours for electricity generation of the plant. And the same is also used in IRR analysis.

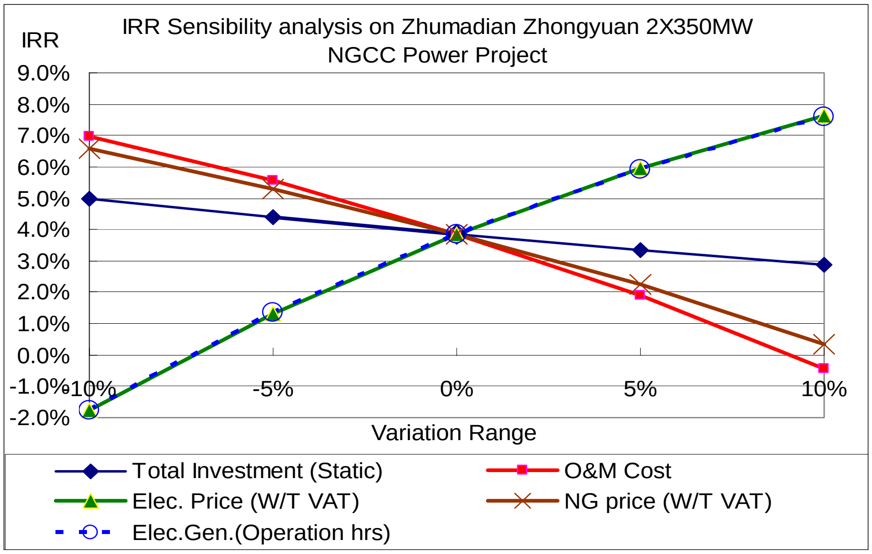

Fig.3 Sensitivity analysis of the Project

Actually the operation status of the plant under the CCPG is in peak load in 2007: In Summer, the plant operated in all peak load periods as shown in the typical daily power balance sheet. In Winter, the plant operated partly in the peak load period, partly in the off-peak load period. This value is common practice for natural gas power projects in China, for example, it was applied in the financial analysis in the PDDs for the registered Sulige Natural Gas plant (http://cdm.unfccc.int/Projects/DB/TUEV-SUED1184339707.46/view) and the registered Yuyao Natural Gas plant (http://cdm.unfccc.int/Projects/DB/DNV-CUK1183455647.94/view). Furthermore according to the article "the Characteristics and foreground of natural gas power technology"[17], the operation hours amount to 3500 as a peak load power plant and the operation hours will be less is acting as the back up power plant as the power grid. And according to the article "To solve the current problem in the operation of natural gas power plants in China"[18], the annual power generation quota set by the power grid is very low and the operation hours for the peak load natural gas power plants are normally 1700-3500 hours.

In other words, the IRR of proposed project is always lower than the benchmark value 8% of the IRR, and it demonstrated that the conclusion on lack of financial attractiveness of the proposed project is sufficiently valid.

To conclude, without the CERs revenue and the electricity sales price subsidy, the proposed project activity is lack of financially attractiveness. So in absence of the CDM with CERs revenue, the project owner will hence face prohibitive financial barriers and associated risks, which will result in hindering further operation activities of the NGCC power project.

[17] http://www.chinapower.com.cn/article/1046/art1046081.asp
[18] http://www.oilnews.com.cn/gb/misc/2002-10/18/content_135818.htm

Step 2: Common practice analysis.

Sub-step 2a. Analyze other activities similar to the proposed project activity.

The region to be analyzed should be the province of Henan because the equipment cost, the price of coal, natural gas and electricity are different from province to province. References and examples showing the difference between the various provinces and "the price of coal, natural gas and electricity are different from province to province":

1. http://cdb.serc.gov.cn/UploadImages/20081142072290.doc, showing the electricity sales price for power plants in different provinces in CCPG are different. For example, the electricity price for coal fired power plants selling electricity in central China region is: in Hubei Province o.351Yuan/kWh, Hunan Province 0.369Yuan/kWh, Jiangxi Province 0.357Yuan/kWh, Henan Province 0.321Yuan/kWh, Sichuan Province 0.318Yuan/kWh, Chongqing City 0.312Yuan/kWh.
2. http://www.coalprice.cn/news/coal_hq/coal_hq/2008-1-14/20081141627056730.htm, showing the coal prices in different provinces are different. For example, in central China region, the coal price in Hunan Province is 338Yuan/ton, in Sichuan Province is 400Yuan/ton, in Henan Province Xuchang City is 370Yuan/ton.

The natural gas price is composed of the gas field benchmark price and the natural gas transportation price (main pipeline and sub-pipeline). The different location of the projects results in different natural gas price. Thus the projects in different provinces have different natural gas price for power generation. For example, the NG price for power plants in Wuhan City (in Hubei Province, another province is Central China Region) is 1.40Yuan/m3[19] while the NG for the proposed project is 1.29Yuan/m3.

The following similar projects exist in Henan Province:

- Henan Zhongyuan Gas Power Plant (2×377.2MW)
- Zhengzhou natural gas power plant (2×390MW)

Sub-step 2b. Discuss any similar options that are occurring.

The first one is the project itself and the second one is registered as a CDM project.

Therefore it is proven that NGCC technology is not the common practice and therefore the proposed project is additional.

Step 3: The Impact of the CDM registration[20]

As mentioned above in the step 1, once the project activity is validated and registered as CDM activity, the financial revenue from the CERs sales will remarkably increase the investment internal rate of return (IRR) which would be rather low otherwise, thus enable the proposed project activity to win the attractiveness financially.

Meanwhile, the common practice analysis in the step 2 as above has demonstrated that NGCC projects do not possess the common practice in China's power market, and are applying for the CDM registration

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[19] http://www.wuhan.gov.cn/publish/wuhan/zwpd/gwgg/bmwj/wjj/2006-06-0935974.html

[20] AM0029 Version 03 methodology requires three steps in reference to the latest version of "Tool for the demonstration and assessment of additionality". However one of the three steps, i.e. Step 3: "The impact of the CDM registration" has been removed in the Version 5 of the Tool (in Version 2, it was listed as step 5). Also the Tool Version 5 required to integrating the removed content of the step into the previous steps regarding the investment analysis and barrier analysis. Here we still keep the step 3 required by the AM0029, and provide necessary demonstration.

with a strong view to overcome and mitigate the financial and technical barriers by means of the CDM revenue and incentive.

Moreover, CDM registration will assist the proposed project in realizing its implementation, in promoting the target of technology transfer under the way of "exchange of equipment market for technology" as mentioned above. As return, the advanced technology transfer brought about by the Project and other projects together enhanced the eligibility qualification of the proposed project for registration as CDM further.

Conclusion: the proposed project activity is of additionality.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Step I: Calculate Baseline Emission

Sub-step Ia Calculate Baseline Emission Factor ($EF_{BL,CO2}$)
The baseline emission is the annual net electricity delivered by the project activity in year y ($EG_{PJ,y}$)[21] multiplies the baseline CO_2 emission factor($EF_{BL,CO2,y}$), as follows:

$$BE_y = EG_{pj,y} \times EF_{BL,CO2,y} \qquad (2)$$

$$EG_{pj,y} = W_{pj} \times Hour_{pj,y} \times (1 - e_{pj,y}) \qquad (2.1)$$

where:

W_{pj}:	Project's designed installed capacity (2×377.2MW)
$Hour_{pj,y}$	Project's designed annual operation hours (3500 hours)
$e_{pj,y}$	Project's designed self service rate (2.12%)

According to AM0029, version 03, the baseline emission factor $EF_{BL,CO2}$, is selected from the lowest emission factor among the following three options:

Option 1: The build margin ($EF_{grid,BM,y}$), calculated according to the "Tool to Calculate the Emission Factor for an Electricity System", Version 01; and

Option 2: The combined margin ($EF_{grid,CM,y}$), calculated according to the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, using a 50:50 OM/BM weight, then $EF_{grid,CM,y} = 0.5EF_{grid,BM,y} + 0.5EF_{grid,OM,y}$, where $EF_{grid,OM,y}$ is the operational margin calculated according to the "Tool to Calculate the Emission Factor for an Electricity System", Version 01.

Option 3: The emission factor of the technology (and fuel) identified as the most likely baseline scenario under Section B 4, step 2 "Identification of the baseline scenario" and calculated as follows:

[21] The proposed project is a kind of peak load power plant. During the off-peak period, the project plant will purchase the electricity fed down from the grid to the project site, called as from-grid electricity in short. And the electricity delivered actually to the grid is called as to-grid electricity in short. So the net electricity delivered by the project activity mentioned here is the difference between actual to-grid electricity and the from-grid electricity, see below in detail.

$$EF_{BL,CO_2,Option3} = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6GJ/MWh \qquad (3)$$

Where,

COEF$_{BL}$: the emission coefficient (tCO_2e/GJ) of the fuel in baseline scenario, based on national average fuel data, if available; otherwise IPCC defaults can be used.

η_{BL}: energy conversion efficiency of the baseline power technology, estimated in the baseline scenario analysis as above.

As described in Section B.4, the Hunan Jinzhushan 2×600 MW sub-critical coal-fired power plant has been identified as the most likely baseline alternative, then ***COEF$_{BL}$*** should be corresponding to the CO_2 emission coefficient for fuel coal combustion in coal fired electric power stations, i.e.:

$$COEF_{BL} = COEF_{\mathrm{Coal}}(tCO_2e/GJ) \qquad (4)$$

Where:

***COEF$_{Coal}$*:** the emission coefficient for coal combustion in electric power stations in tCO_2/GJ. Due to in China's DNA CDM official website the national average fuel data based emission coefficients for each type of fuel are not available, thus the 2006 IPCC default value is used, i.e. 94,600 $kgCO_2/TJ$. (please see 2006 IPCC Guidelines for National GHG Inventories, Volume 2 Energy, Chapter 2, Table 2.2, P16-17) .

Then the formula (3) can be presented as following:

$$EF_{BL,CO_2,Option3}(tCO_2/MWh) = COEF_{Coal}(kgCO_2/TJ) \times \frac{3.6}{\eta_{BL}} \times (GJ/MWh) \qquad (5)$$

Where:

COEF$_{,Coal}$: the CO_2 emission coefficient for coal combustion in electric power stations, (94,600 $kgCO_2/TJ$ =0.0946 tCO_2/GJ)

η_{BL}: the energy conversion efficiency of the most likely baseline technology as identified in previous step, i.e. Hunan Jinzhushan (2×600MW) sub-critical coal-fired power plant in the B.4 section of the PDD. Here η_{BL}=37.54% is the net electricity generation (electricity supply) efficiency, equivalent to its coal intensity per unit of net electricity generated (electricity delivered) 327.29gce/kWh. (Note: coal intensity per unit electricity generated is 307 gce/kWh, with equivalent electricity generation efficiency of 40.02%).

As mentioned above, the Central China power grid (CCPG) is selected as the electric power system boundary of the project activity. And in accordance with the "Tool to Calculate the Emission Factor for an Electricity System", Version 01 and the electricity statistical data availability in China, China's DNA confirmed the calculation approaches and the results regarding the China regional power grid baseline emission factors[22]. Therefore the PDD of the proposed project adopts the relevant approaches and results relating to the Central China power gird, which are presented as following:

Sub-step Ia.1: Identify the relevant electric power system (EF$_{grid,OM,y}$)

As identified in Section B.3. according to the guidance in the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, and the delineation on the regional grid system boundaries as published by the China's DNA i.e. the NDRC on July 18, 2008, the Central China Power Grid (CCPG) to

[22] "Notice on determination of China's power grid baseline emission factors", 18 July, 2008, (http://cdm.ccchina.gov.cn)

which the proposed project is connected to is identified as the baseline grid, i.e. the project electricity system which consists of the following provincial power grid: Henan, Hubei, Hunan, Jiangxi, Sichuan and Chongqing.

Sub-step Ia.2: Select an operating margin (OM) method.

According to the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, the following four alternative methods could be used to calculate the OM emission factor ($\boldsymbol{EF_{grid,OM,y}}$):

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

Any of the four methods can be used, however, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: i) average of the five most recent years, or ii) based on long-term averages for hydroelectricity production.

The Simple OM method is selected for the proposed project for the following reasons:

1) Given that in the current electricity market in China, the inter-regional load dispatch is implemented by the State Grid Company, and the regional load dispatch is implemented by the respective regional grid companies. And the electricity is sold by the electric power companies to the grids on competitive basis. So such electric power dispatch data and the annual load duration hour curve data at grid level, as well as the annual electricity generation data disaggregated at power plant level, are not publicly available, as being considered as commercially confidential. Therefore the b) Simple adjusted OM method and c) Dispatch Data Analysis OM method are not applicable.
2) For the recent 5 years (2000-2005), where in case the data are available, the annual electricity generations for low cost/must run resources (mainly hydro power) constituted less than 50% of the total in the Central China Power Grid as such: 36.1%, 33.7%, 33.7%, 40.1% and 38.3% for 2000, 2002, 2003, 2004 and 2005 respectively. (Source: China Energy Statistics Yearbook, 2006 Edition, Page 40-41). Therefore, it meets the applicability condition for the Simple OM method, and thus the d) Average OM method is not applicable.

As conclusion, the Simple OM method is used to calculate the OM emission factor for the CCPG baseline.

The simple OM emission factors can be calculated using either of the two following data vintages for years(s) y:

- Ex-ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex-post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

Here considering up to two years of time lag of the officially published energy and electricity statistical data availability in China, we prefer to use the *ex-ante* option to calculate the OM emission factor which is thus not required to be monitored and recalculated during the crediting period for this project activity.

Sub-step Ia.3: Calculate the Operating Margin emission factor ($EF_{grid,OM,y}$) according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. It may be calculated by using the formula of Option A or Option B or Option C as provided in the Tool, depending on the details of electricity statistical data availability. However in China the statistical data necessary for Option A and Option B, i.e. the annual fuel consump-

tion and/or net electricity generation disaggregated at power plant/unit level within the grid, are not publically available, but for Option C. Hence the Option C is used, which is 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 (i.e. CCPG), and the CCPG also meets the applicability condition, i.e. only renewable power generation (mainly hydropower) is considered as low-cost/must-run power sources and the quantity of hydro-electricity supplied to the grid is known, please refer to the notice announced by the DNA of China as mentioned above.

For Option C, the formula to calculate the Simple OM emission factor is following (in tCO_2/MWh):

$$EF_{grid,OM,simple,y} = \frac{\sum_{i,j} FC_{i,j,y} * NCV_{i,y} * EF_{CO2,i,y}}{\sum_{j} EG_{j,y}} \qquad (6)$$

Where,

$EF_{grid,OM,simple,y}$	= Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,j,y}$	= Amount of fossil fuel type *i* consumed by all power plants in the provincial grid *j* under in the project electricity system (CCPG), not including low-cost/ must-run power plants/units, in year *y* (in t or m^3 unit)
$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/t or m^3)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$EG_{j,y}$	= Net electricity generated and delivered to the grid by all power plants serving the provincial grid system *j* under the CCPG system, not including low-cost/must-run power plants/units, in year *y* (MWh)
i	= All fossil fuel types combusted in power sources in the project electricity system CCPG in year *y*
j	= the subscript of the provincial power grid under the CCPG
y	= the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option), following the guidance on data vintage in Sub-step Ia.2, i.e. 2003, 2004 and 2005.

$EG_{j,y}$ is equal to $EGG_{j,y}$ deducted from the self-service electricity consumed by the plants, as following:

$$EG_{j,y} = EGG_{j,y} \times (1 - e_{j,y}), \qquad (7)$$

Where,

$\boldsymbol{EGG_{j,y}}$**:**	= the gross electricity generated by source *j* in year *y,*
$\boldsymbol{e_{j,y}}$ **:**	= the average plant self-service rate of the thermal power plants in provincial grid *j.*

For the proposed project activity, the statistical data on aggregated electricity generation, the associated fuel consumption, average self service rate which are publicly available by fuel types *i* and by provincial grid *j* covered under the CCPG, could be used. In this case, the average generation efficiencies (gce/kWh) and average emission factors of each fuel type can be used. The data sources come from ***China's Electric Power Yearbook*** between 2005 and 2007 Editions, and ***China Energy Statistical Yearbook*** from 2003 to 2005 Editions. The fuel consumption data shows that coal almost dominate the thermal power generation mix in the Central China Power Grid.

Based on the latest 3 years data available for (2004-2006) the OM emission factors were calculated for each year respectively. Then the $\boldsymbol{EF_{grid,OM,y}}$ of the CCPG was calculated by weighted average over the full generation, which resulted in 1.2783 tCO_2e/MWh. For more details please refer to Annex 3 Table A3-2 to A3-7.

Sub-step Ia.4. Identify the sample group m of power units to be included in the build margin (BM)

Based on the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, the sample group *m* of the recent capacity addition to be included in the build margin (BM) could be selected according to the following criteria:

The sample group *m* is built based on most recent information available on plants already built (or be on building) at the time of CDM-PDD submission for validation by DOE.
This sample group *m* includes one of the follows:

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

The project participants should take the bigger annual total generation from the two selections as the sample group *m*.

Given that the available electric power statistical data that are publically published are that aggregated at the provincial grid level, without detailed at the plants/unit level in China, the 22 nd EB meeting agreed the following deviation approaches, see below, in which the above option b), i.e. "20%" option is selected to build the sample group *m* for calculation of BM emission factor.

Thus, in the case of this proposed project, the aggregated recent capacity addition data and other relative data are summed up from six provincial power grids covered under the CCCPG. The data sources came from the *China's Electric Power Year Book*, 2005 to 2007 Editions, and *China's Energy Statistical Yearbook*, 2005 to 2007 Editions.

The Table A3-11 to Table A3-13 in Annex 3 containing the installed capacity during 2004 and 2006 for the CCPG, indicated that, compared to the total capacity in 2006, total accumulated newly added capacity comprise 17.48% for 2004, and 25.96% for 2005. Therefore the "20%" value falls in the range of 2002 to 2005. Thus the newly added capacity from 2005 to 2006 is selected as the sample group *m* to calculate BM emission factor. For more details please refer to the Table A3-14 in Annex 3.

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

Option 1 (ex-ante). For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2 (ex-post). For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*. For the second crediting period, the build margin emissions factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In the PDD of the proposed project activity, the Option 1 (ex-ante) is selected and the annual monitoring and BM update *ex-post* are not needed accordingly.

Sub-step Ia.5. Calculate the Build Margin emission factor ($EF_{grid,BM,y}$)

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \tag{8}$$

Where

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

Based on the guidance of the Tool to calculate the emission factor for an electricity system, and taken into account the extent of disaggregation for the available statistical data of electricity generation and fuel consumption, the $\boldsymbol{EF_{EL,m,y}}$ could be determined as per the guidance in step 3 (a) for the simple OM, using options B2 as below:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} * 3.6}{\eta_{m,y}} \tag{9}$$

where,

$EF_{CO2,m,i,y}$	= Average CO_2 emission factor of fuel type i used in power unit m in year *y* (tCO_2/GJ)
$\eta_{m,y}$	= Average net energy conversion efficiency of power unit m in year *y* (%).

Given that the available electric power statistical data published in China are those aggregated at the provincial grid level, not detailed at the plants/unit level, the 22 nd EB meeting agreed the following deviation approaches for calculation of BM emission factor as below:

1) Use the efficiency level of the best technology commercially available in the provincial/ regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM). For the estimation of the operating margin (OM) the average emission factor for the grid for each fuel type can be used.

2) Use of capacity additions during last several years for estimating the build margin emission factor for grid electricity. (i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity).

3) Use of weights estimated using installed capacity in place of annual electricity generation, (which could be used to calculate BM baseline emission factor).

That is, firstly, calculate the newly added capacity and the composition of every power generation technologies, then calculate the weight of each type newly added capacity, finally calculate the emission factor by using the efficiency level of the best technology commercially available in the national grid of China.

It should be noted that the currently available statistical data on the annual installed capacity are mainly categorised as thermal electric power and hydro-power, without further separating the coal, oil and gas fired installed capacity from the thermal power capacity data. Thus an alternative calculation process are

as follows: firstly, calculate the proportions λ_i of the CO_2 emissions from solid (coal), liquid (oil) and gas (gas) fuel consumed for power generation to the total CO_2 emission from the total thermal power generation, based on the latest energy balance table data for the five provinces covered under the CCPG. Secondly, based on the emission factors in line with the efficiency level of the best technology commercially available in China's power grid for each fuel type, take the proportions λ_i as weight and calculate the weighted average emission factor for the thermal power in the power grid concerned. Finally, multiply the thermal power emission factor with the weight of thermal power capacity in the "20%" capacity addition, then the result is the BM emission factor of the power grid.

The detailed steps and formulas are as follows:

Step a: calculate the proportion λ_i of the CO_2 emission of solid, liquid and gas fuel type consumed for power generation to the total CO_2 emission from the total thermal power generation.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (10)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (11)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (12)$$

Where:

$F_{i,j,y}$: = the amount of fuel i (in unit t or Nm^3) consumed by relevant power sources in provincial grid j in year y;

$COEF_{i,j,y}$: = the CO_2 emission coefficient of fuel i (tCO_2 /t or Nm^3), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y,

COAL, OIL and *GAS* is the footnote set of the solid fuel, liquid fuel and gas fuel, respectively.

For more details please refer to Table A3-8 in Annex 3.

Step b: calculate the emission factor $EF_{Thermal}$ of the corresponding thermal power.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \qquad (13)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are the emission factors in line with the efficiency level of the best technology commercially available in China's power grid for each fuel type respectively.

Based on the Notice unveiled by China's DNA regarding the statistical survey on the newly built thermal power projects during the Fifteen Plan Period in our country, we define the best coal fired power technology commercially available in China's power grid as the homemade 600 MW sub-critical coal fired generator units. And the best oil and gas fired power technology commercially available in China's power grid is defined as 200 MW combined cycle unit (the efficiency level technology is equivalent to 9E

type unit of GE Company). The detailed data on the best efficient technologies and the corresponding emission factor are listed in the following table: (Table A3-9 in Annex 3)

Type of power plants	Parameter	Fuel intensity of elec. supply (gce/kWh)	Electricity supply efficiency (%)	Fuel emission factor (tc/TJ)	OXID	Emission factor (tCO_2/MWh)
			A	B	C	D=3.6/A/1000×B×C×44/12
Coal power plant	$EF_{Coal,Adv}$	329.94	37.28%	25.8	1	**0.9135**
Oil power plant	$EF_{Oil,Adv}$	252	48.81%	21.1	1	**0.5706**
Gas power plant	$EF_{Gas,Adv}$	252	48.81%	15.3	1	**0.4138**

Source: Notice on determination of China regional power grid baseline emission factor, published by Chain's DNA in July 18, 2008.

Step c: calculate the $EF_{BL,BM,y}$ of the grid:

$$EF_{BL,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \tag{14}$$

Where:

CAP_{Total} is the total newly capacity addition, $CAP_{Thermal}$ is the newly capacity addition of thermal power plants.

The $EF_{grid,BM,y}$ of the Central China power grid is 0.7156 tCO_2/MWh.
For more details please refer to Table A3-14 in Annex 3.

Sub-step Ia.6: Calculate the Combined Margin emission factor ($EF_{grid,CM,y}$)

The combined margin ($EF_{grid,CM,y}$) is calculated according to the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, using a 50%/50% of w_{OM}/w_{BM} weight factor:

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} \tag{15}$$

Sub-step Ia.7: Calculate the Baseline Emission Factor ($EF_{BL,CO2}$)

Then the baseline emission factor can be determined by selecting the minimum among three options as follows:

$$EF_{BL,CO_2} = \min(EF_{grid,BM}, EF_{grid,CM}, EF_{BL,CO_2,Option3}) \tag{16}$$

Sub-step Ib Calculate Baseline Emission (BE_y)

Once the baseline emission factor is determined, the baseline emissions can be calculated by multiplying the electricity delivered to the grid in year y by the project plant ($EG_{pj,y}$) with the baseline emission factor $EF_{BL,CO2}$:

$$BE_y = EG_{pj,y} \times EF_{BL,CO_2} \tag{17}$$

where $\boldsymbol{EG_{pj,y}}$ is the annual net electricity delivered to the grid by the project activity, which is the actual annual to-grid electricity minus the annual from-grid electricity. See below in detail.

Step II: Calculate Project Emission (PE_y)

According to the AM0029 version 03, the project emission is from the on-site combustion of natural gas to generate electricity. The project does not use auxiliary fuel and the fuel for starting the gas turbine is the natural gas directly, thus the CO_2 emissions from electricity generation are calculated as follows:

$$PE_y = FC_{NG,y} \times COEF_{NG,y} \quad (18)$$

Where

$\boldsymbol{FC_{NG,y}}$: = the total volume of NG combusted in the project plant (Nm^3) in year y.

$\boldsymbol{COEF_{NG,y}}$: = the CO_2 emission coefficient (tCO_2/Nm^3) in year y for NG.

The emission coefficient of NG is calculated as follows:

$$COEF_{NG,y} = NCV_{NG,y} \times EF_{CO2,NG,y} \times OXID_{NG} \quad (19)$$

Where:

$\boldsymbol{NCV_{NG,y}}$ = the net calorific value of NG (MJ/Nm^3), determined by the fuel supplier in year *y* as 33.812 MJ/Nm^3.

$\boldsymbol{EF_{CO2,NG,y}}$ = the CO_2 emission factor per unit of heat value of NG in year *y*, taken from IPCC default value 15.3tC/TJ.

$\boldsymbol{OXID_{NG}}$: the oxidation rate of NG, the IPCC default value 100% is used.

Step III: Calculate Leakage (LE_y)

Leakage may result from upstream processes of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring. In according to the AM0029 version 03, in case no LNG is used in the project plant, so only leakage emission sources from using natural gas are considered:

$\boldsymbol{LE_{CH4,y}}$: Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity (i.e. under baseline scenario), which can be calculated based on following steps:

Sub step IIIa Calculate the upstream fugitive CH_4 emission factor ($EF_{BL,upstream,CH4}$) in baseline scenario

According to the AM0029 Version 03, the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the project activity should be consistent with the baseline emission factor ($EF_{BL,CO2}$) in above equation (2). As described in Section B 6.3 below, the option 1: the $\boldsymbol{EF_{grid,BM,y}}$ emission factor which is 0.659224tCO_2e/MWh calculated based on the "Tool to Calculate the Emission Factor for an Electricity System", Version 01, is the minimum one among those of three options (option 1 is BM, option 2 is CM and option 3 is the Hunan Jinzhushan 2×600 MW sub-critical coal-fired power plant with the lowest levelised unit generation cost, which has been identified in Section B.4 as the most plausible baseline scenario). Thus the option 1's emission factor is selected as baseline emission factor in calculation of the project emission reductions. Thus the corresponding upstream fugitive CH_4 emission factor can be calculated as follows:

$$EF_{BL,upstream,CH4} = \frac{\sum_{j\in m}\sum_{k} FF_{j,k} \times EF_{k,upstream,CH4}}{\sum_{j\in m}\sum_{k} EG_{j,k}} \qquad (20)$$

Where:

$EF_{BL,upstream,CH4}$: the emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 of per MWh electricity generation in the selected baseline options as mentioned above.

$EF_{k,upstream,CH4}$: the emission factor for upstream fugitive methane emissions from fossil fuel k (coal or oil) in t CH_4 per MJ fuel produced. In the case that the option 1, i.e. the BM emission factor of the CCPG is selected as the baseline scenario for calculation of the project emission reduction, k could refer to coal, oil or gas fuel used in power plants included in the build margin. In this case the AM0029 default value of the $EF_{k,upstream,CH4}$ could be used. For instance, when *k=coal*, $EF_{coal,upstream,CH4}$ is 13.4tCH_4/ktcoal. It is equivalent to 0.64 tCH_4/TJ, assuming 5000Kcal net calorific value for 1kg coal and 1Cal= 4.18 Joule), when *k=oil,* it is 0.041tCH4/TJ, and when *k=N.G.,*it is 0.296 tCH_4/TJ;

j: subscript *j* refers to newly added capacities of the provincial grid *j*, included in the build margin sample group *m*.

$FF_{j,k}$: Quantity of fuel of type *k* (a coal or oil type) combusted annually by the capacity addition in the provincial grid *j* included in the build margin sample group *m*, in MJ.

EG_j: Electricity generated annually by the capacity addition in the provincial grid *j* included in the build margin sample group *m*, in MWh/a

Since $EF_{BL,upstream,CH4}$ is determined based on the option 1, i.e. the build margin, its calculation is consistent with the calculation formulae of the build margin CO_2 emission factor within the same sample group *m* of recently added capacities and with the data on fuel combustion and electricity generation being used. And the values for *FF* and *EG* are those already determined through the application of the "Tool to Calculate the Emission Factor for an Electricity System", Version 01.

Also it should be noted that when the CDM EB agreed deviation approaches are adopted as mentioned above, here the subscript *j* does not refer to individual power plants, but instead, the aggregated electric power sources under the provincial grid *j*.

Based these understanding, the formula (20) could be represented as:

$$EF_{BL,upstream,CH4} = \frac{\sum_{j\in m,k}(EG_{j,k} \times EFF_{adv,k} \times EF_{k,upstream,CH4})}{\sum_{j\in m,k}(EG_{j,k})} \qquad (20.1)$$

k= coal, oil, NG and *hydro, of which subscript k does not include hydro in the items of numerator*

Where:

Fuel consumption $FF_{j,k} = EG_{j,k} \times EFF_{j,k}$, which describes that the *k* type fuel consumption is equal to the product of $EG_{j,k}$, i.e. the electricity generated annually and $EFF_{j,k}$, i.e. the fuel intensity per unit electricity, both by the k type recently built capacities in provincial grid *j* in the build margin sample group *m*, ***k=coal, oil or gas***.

Considering the "Tool to Calculate the Emission Factor for an Electricity System", Version 01 and the deviation approach agreed by the CDM EB for calculation of the BM emission factor for proposed CDM projects in China, we replace the fuel intensity $EFF_{j,k}$ by using $EFF_{adv,k}$, i.e. the efficiency level of the

best technology commercially available in the country or in the regional grid for each *k* type fuel as a conservative proxy. That is:

taking $\boldsymbol{FF_{j,k} = EG_{j,k} \times EFF_{adv,k} \leq EG_{j,k} \times EFF_{j,k}}$, ***k=coal, oil, N.G***. Please see Table A3-9,Annex 3 in detail.

Similarly, given that the current statistical data publicly available on installed electric power capacity each year in the provincial power grids are mainly categorised as fossil fuel fired thermal power, hydro power and nuclear power etc., without further disaggregated by fuel types, as coal fired power, oil fired power and gas fired power, so following the approach that was endorsed by China' DNA, by which the $\boldsymbol{\lambda_k}$ weight factor parameters (*k=coal, oil or gas*) were introduced, when calculating the grid baseline BM CO_2 emission factor, the similar $\boldsymbol{\lambda_{k,CH4}}$ weight factor parameters (*k=coal, oil or gas*) were also introduced, when calculating the grid baseline emission factor of upstream fugitive CH_4 emission factor.

The calculation approach is summarised as follows: *firstly,* calculate the weight factor parameters $\boldsymbol{\lambda_{k,CH4}}$ which are defined as the ratio of upstream fugitive CH_4 emissions from solid (coal), liquid (oil) and gas (gas) fuel consumed for power generation respectively to the total upstream fugitive CH_4 emission from the total thermal power generation, based on the latest energy balance table data for the five provinces covered under the CCPG. *Secondly,* calculate the emission factors of upstream fugitive CH_4 emissions, $\boldsymbol{EF_{k,adv,CH4}}$ (tCH_4/MWh) in line with the efficiency level of the best power technology commercially available in China's power grid for each fuel type ***k***, and then take the ratio $\boldsymbol{\lambda_{k,CH4}}$ as weight factor to calculate the weighted average upstream CH_4 emission factor $\boldsymbol{EF_{thermal,Upstream,CH4}}$ for the thermal power capacity as a whole in the power grid concerned. *Finally,* according to the deviation approach as agreed by the CDM EB, multiplying the thermal power upstream CH_4 emission factor with the ratio of thermal power capacity addition to the "20%" total capacity addition within the grid BM sample group m, then the result is the baseline emission factor for upstream fugitive methane emissions, $\boldsymbol{EF_{BL,upstream,CH4}}$ in tCH_4/MWh electricity generation in the selected grid baseline BM options as mentioned above.

The three steps and associated calculation formulae are as follows:

Step$_{CH4}$ a): calculate the weight factor parameters $\boldsymbol{\lambda_{k,CH4}}$ which is defined as the ratio of the upstream CH_4 emissions associated with solid, liquid and gas fuel type consumed for power generation respectively to the total upstream CH_4 emissions for the total thermal power generation in the grid.

$$\lambda_{Coal,CH4} = \frac{\sum_{k \in COAL,j} F_{k,j,y} \times COEF_{k,j,CH4}}{\sum_{k,j} F_{k,j,y} \times COEF_{k,j,CH4}} \qquad (20.2)$$

$$\lambda_{Oil,CH4} = \frac{\sum_{k \in OIL,j} F_{k,j,y} \times COEF_{k,j,CH4}}{\sum_{k,j} F_{k,j,y} \times COEF_{k,j,CH4}} \qquad (20.3)$$

$$\lambda_{Gas,CH4} = \frac{\sum_{k \in GAS,j} F_{k,j,y} \times COEF_{k,j,CH4}}{\sum_{k,j} F_{k,j,y} \times COEF_{k,j,CH4}} \qquad (20.4)$$

where:

$F_{k,j,y}$: the amount of *k* type fuel (in unit t or Nm^3) consumed by relevant electric power sources in provincial grid *j* in year *y*,

$COEF_{k,j,CH4}$: the upstream fugitive CH_4 emission coefficient of *k* type fuel (tCH_4/TJ) used by relevant power sources in provincial grid *j*,

COAL, OIL and *GAS* are the subscript sets of the solid fuel, liquid fuel and gas fuel, respectively.

For more details please refer to Table A3-8 (CH4) in Annex 3.

Step$_{CH4}$ b: calculate the weighted averaged upstream fugitive CH_4 emission factor for the corresponding thermal electric power, $EF_{Thermal,\ Upstream,CH4}$:

$$EF_{Thermal,Upstream,CH4} = \lambda_{Coal,CH4} \times EF_{Coal,Adv,CH4} + \lambda_{Oi,CH4} \times EF_{Oil,Adv,CH4} + \lambda_{Gas,CH4} \times EF_{Gas,Adv,CH4} \quad (20.5)$$

Where:

$EF_{Coal,Adv,CH4}$, $EF_{Oil,Adv,CH4}$ and $EF_{Gas,Adv,CH4}$ are the upstream fugitive CH_4 emission factors in line with the efficiency level of the best power technology commercially available in China's power grid for each fuel type respectively. (see Table A3-9 (CH4) in Annex 3)

Step$_{CH4}$ c: Calculate the $EF_{BL,upstream,CH4}$ in the context of CCPG grid BM:

$$EF_{BL,Upstream,CH4} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal,Upstream,CH4} \quad (20.6)$$

Following the guidance of the tool to calculate the emission factor of the electricity system and the deviation approach agreed by the CDM EB for calculation of grid baseline BM CO_2 emission factor, by which newly installed capacity could be used to replace electricity generation for estimating the weight factor, which will be used to calculate the $EF_{BL,upstream,CH4}$.

Here CAP_{Total} is the total recent capacity addition; $CAP_{Thermal}$ is the recent capacity addition of thermal power plants within the CCPG grid BM sample group *m*.

For more details please refer to the formula(15) and Table A3-14, Table A3-10 (CH4) in Annex 3.

Sub step IIIb Calculate Fugitive Methane Emissions ($LE_{CH4,y}$)

To estimated the fugitive methane emissions, one can multiply the *NG* quantity consumed by the project in year y with an emission factor for fugitive CH_4 emissions ($EF_{NG,upstream,CH4}$) due to *NG* consumption and subtract the fugitive CH_4 emissions occurring from fossil fuels used in the selected baseline power plant in the absence of the project activity, as follows:

$$LE_{CH_4,y} = \left[FC_y \times NCV_y \times EF_{NG,upstream,CH4} - EGG_{PJ,y} \times EF_{BL,upstream,CH4}\right] \times GWP_{CH_4} \quad (21)$$

Where:

$LE_{CH4,y}$:	Leakage emissions due to fugitive upstream CH_4 emissions in the year y in tCO_2e.
FC_y:	Total volume of NG combusted in the project plant (Nm^3) in year y.
$NCV_{NG,y}$:	Net calorific value of NG (GJ/ Nm^3), which is determined by the fuel supplier.
$EF_{NG,upstream,CH4}$:	Emission factor for upstream fugitive methane emissions from production of gas in tCH_4/ Nm^3. The Table 2 of the Methodology AM0029 suggested several default fugitive CH_4 associated with different regions. In this PDD, the default value 296 tCH_4/PJ for the rest countries, including China is adopted[23], excepting for USA & Canada, Europe, Former Soviet Union/East European Countries.
$EGG_{PJ,y}$:	Electricity generation in the project plant during year y in MWh.
$EF_{BL,upstream,CH4}$:	The emission factor determined in step$_{CH4}$ c above for upstream fugitive methane emissions occurring in the absence of the project activity in tCH_4/MWh.
GWP_{CH4}:	Global warming potential of methane valid for the relevant commitment period, and the value is 21.

[23] Volume 3 of the 1996 Revised IPCC Guidelines, Table 1-63 and 1-64, p. 1.130 and 1.131

Sub step IIIc Calculate CO_2 leakage (LE_y)

The leakage can be calculated as follows:

$$LE_y = LE_{CH_4,y} \qquad (22)$$

Where,

LE_y: Leakage emissions due to the project in year y in tCO_2e.
$LE_{CH4,y}$: Leakage emissions due to fugitive upstream CH_4 emissions in the year y in tCO_2e.

Step IV: Calculate Emission Reduction (ER_y)

The emission reduction of the proposed project can be calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad (23)$$

Where:

ER_y: emission reduction in year y in tCO_2e.
BE_y: emission in the baseline scenario in year y in tCO_2e.
PE_y: emission in the project activity in year y in tCO_2e.
LE_y: leakage emission in the year y in tCO_2e.

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

Data / Parameter:	***$COEF_{BL\ (coal)}$***
Data unit:	tCO_2/GJ
Description:	The emission coefficient of the fuel (coal) in baseline scenario,
Source of data used:	2006 IPCC Guidelines for National GHG Inventories, Volume 2 Energy, Chapter 2, Table 2.2, P16-17
Value applied:	0.946
Justification of the choice of data or description of measurement methods and procedures actually applied :	No local values available
Any comment:	

Data / Parameter:	***W_{pj}***
Data unit:	MW
Description:	The NGCC Project's designed installed capacity
Source of data used:	The NGCC Project Feasibility Study Report: F2801K-A-01,P191,
Value applied:	754.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The designed unit capacity is 377.2MW, based on which the annual electricity generated and delivered were calculated for the proposed project.
Any comment:	

Data / Parameter:	*$Hour_{pj,y}$*
Data unit:	Hour

Description:	The NGCC Project's designed annual operation hours
Source of data used:	The NGCC Project Feasibility Study Report: F2801K-A-01
Value applied:	3500
Justification of the choice of data or description of measurement methods and procedures actually applied :	This project is designed for operation mainly under peak load, so the annual operation hours are about 3500 hours only.
Any comment:	

Data / Parameter:	$e_{pj,y}$
Data unit:	None
Description:	The NGCC Project's designed self service rate
Source of data used:	The NGCC Project Feasibility Study Report: F2801K-A-01,
Value applied:	2.12%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on the project's feasibility study report.
Any comment:	

Data / Parameter:	$EG_{pj,y}$
Data unit:	MWh
Description:	The annual average electricity delivered by the NGCC project to the grid
Source of data used:	The NGCC Project Feasibility Study Report: No. F2801K-A-01,P191
Value applied:	2584423.50
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated based on the feasibility study report: $EG_{pj,y} = W_{pj} \times Hour_{pj,y} \times (1 - e_{pj,y})$ The actual electricity delivered will be monitored ex post according to the monitoring plan, after the project put into commission. See monitoring plan part in detail.
Any comment:	

Data / Parameter:	NCV_i
Data unit:	MJ/t or MJ/Nm^3
Description:	Net calorific value (energy content) per mass or volume unit of a fuel *i*.
Source of data used:	For coal and fuel oil, NCV taken from "China Energy Statistical Yearbook", 2006 Edition, P287. For natural gas, NCV taken from the feasibility study report provided by the NGCC plant. (Please see B.7.1. section below in detail)
Value applied:	20908 for coal, 41816 for oil, 33.812 MJ/Nm^3 for natural gas
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the AM0029,version 03 and "Tool to Calculate the Emission Factor for an Electricity System", Version 01. The data is used to calculate the emission coefficient of the fuel
Any comment:	The uncertainty of the data is low.

Data / Parameter:	$OXID_i$,

Data unit:	None
Description:	Oxidation factor of the fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy, Chapter I, Table 1.3 and 1.4, Page 1.21-1.24
Value applied:	Varies for each type of fuel, 1.00 for coal, 1.00 for fuel oil, 1.00 for gas
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the AM0029,version 03 and the "Tool to Calculate the Emission Factor for an Electricity System", Version 01. The data is used to calculate the emission coefficient of the fuel
Any comment:	The uncertainty of the data is low.

Data / Parameter:	$EF_{CO2,i,}$
Data unit:	tC/TJ
Description:	CO_2 emission factor per unit of energy of the fuel *i*.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy, Chapter I, Table 1.3 and 1.4, Page 1.21-1.24
Value applied:	Varies for each type of fuel, 25.8 for coal, 21.1 for oil, 15.3 for gas
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the AM0029, version 03 and the "Tool to Calculate the Emission Factor for an Electricity System", Version 01. The data is used to calculate the emission coefficient of the fuel
Any comment:	Through unit conversion, $EF_{CO2,i,}$=25.80 tC/TJ=0.0946 tCO_2/GJ

Data / Parameter:	η_{BL}
Data unit:	None
Description:	Electricity supply efficiency level for the most likely baseline technology as identified in Section B4, i.e. Hunan Jinzhushan 2×600 MW sub-critical coal fired power plant.
Source of data used:	Feasibility study report of the selected Hunan Jinzhushan 2×600MW sub-critical coal fired power plant.
Value applied:	37.54%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Taking levelised cost as financial indicator for comparative analysis and with sensitivity analysis, to determine that this power technology has the lowest generation cost among the several alternative technologies. Then it is identified as the economically most attractive baseline technology. It is satisfied with AM0029 requirement and the data used is reasonable.
Any comment:	The electricity supply efficiency is equivalent to the energy intensity per unit of electricity supplied, i.e. 327.29gce/kWh for the power plant.

Data / Parameter:	$F_{i,j,y}$
Data unit:	t or Nm^3
Description:	Amount of fuel type i consumed by relevant power sources in provincial grid *j* delivering $EG_{j,y}$ to the connected power grid (the CCPG) in years y, not including the low-cost/must-run power resources, such as hydro power and nuclear power.
Source of data used:	China Energy Statistics Yearbook 2002 to 2006 Editions
Value applied:	Varies from different fuel type, year and province, see Annex 3
Justification of the choice of	The choice of data satisfies the guidance in the "Tool to Calculate the

data or description of measurement methods and procedures actually applied :	Emission Factor for an Electricity System", Version 01. The data is used to calculate emission factor of OM
Any comment:	The uncertainty of the data is low

Data / Parameter:	$EGG_{j,y}$
Data unit:	MWh
Description:	Amount of electricity generated by relevant power sources in provincial grid *j,* under the CCPG in year *y*, excluding low-cost/must-run power resources, such as hydropower and nuclear power.
Source of data used:	China Electric Power Yearbook 2003, 2004, 2005 and 2006 Edition
Value applied:	Varies from different fuel type, year and province, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the "Tool to Calculate the Emission Factor for an Electricity System", Version 01. The data is used to calculate OM emission factor.
Any comment:	The uncertainty of the data is low

Data / Parameter:	$e_{j,y}$
Data unit:	%
Description:	Average self service rate of the relevant power sources in provincial grid j, under the CCPG in years *y*, aggregated by thermal power and hydro power respectively.
Source of data used:	China Energy Statistical Yearbook, 2003, 2004, 2005 and 2006 Edition
Value applied:	Varies from different fuel type, year and province, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the "Tool to Calculate the Emission Factor for an Electricity System", Version 01. The data is used to calculate electricity delivered by power sources in provincial grid *j* under the CCPG in year *y*: $EG_{j,y} = EGG_{j,y} \times (1 - e_{j,y})$
Any comment:	The data is from the national authoritative statistical year book and the uncertainty of the data is low.

Data / Parameter:	$CAP_{i,j,y}$
Data unit:	MW
Description:	Installed generation capacity with type *i*, in year *y* and in the provincial grid *j*
Source of data used:	China Electric Power Yearbook 2003, 2004, 2005 and 2006 Edition
Value applied:	Varies with province and year
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the "Tool to Calculate the Emission Factor for an Electricity System", Version 01 and the deviation approach agreed by the CDM EB for calculation of BM emission factor in China. The data is used to calculate the BM emission factor.
Any comment:	The uncertainty of the data is low

Data / Parameter:	$EFF_{i,Adv}$
Data unit:	gce/kWh
Description:	The efficiency level of the best technology commercially available in China's power grid for fuel type i, representing as fuel energy intensity

	per unit of electricity delivered to the grid.
Source of data used:	Notice on determination of China regional power grid baseline emission factor, published by the China' DNA (NDRC) in July 18, 2008, see the official CDM Web site.
Value applied:	329.94 for coal (efficiency 37.28%), 252 for oil & gas (efficiency 48.81%)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the "Tool to Calculate the Emission Factor for an Electricity System", Version 01 and the deviation approach agreed by the CDM EB for calculation of BM emission factor in China.. The data is used to calculate the BM emission factor.
Any comment:	The uncertainty of the data is low

Data / Parameter:	$EC_{NG,y}$
Data unit:	Nm^3
Description:	Natural gas consumption by the project activity in year *y*.
Source of data used:	The NGCC power project's feasibility study report No. F2801K-A-01, P38
Value applied:	522,620,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data of annual natural gas consumption is in consistence with the annual electricity generation $EGG_{pj,y}$ (2,640,400.00 MWh) and the gas intensity per kWh electricity generation (197.93 Nm^3/MWh).
Any comment:	

Data / Parameter:	$EF_{Coal,upstream,CH4}$
Data unit:	t CH_4/kt coal or tCH_4/MJ
Description:	Emission factor for upstream fugitive methane emissions from coal production
Source of data used:	Revised 1996 IPCC Guideline Vol.3, default value, as required by AM0029, version 03.
Value applied:	13.4 t CH_4/kt coal
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since 95% of the coal in China are produced by well mining underground, so the default value for underground mining 13.4 tCH_4/kt coal is used.
Any comment:	

Data / Parameter:	$EF_{NG,upstream,CH4}$
Data unit:	t CH_4/PJ
Description:	Emission Factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system.
Source of data used:	Revised IPCC 1996 Guidance default value, Table 1-63 and 1-64, p.1.130 and p.1.131
Value applied:	296
Justification of the choice of	Recommended by AM0029, version 03.. The default value for the rest

data or description of measurement methods and procedures actually applied :	countries, including China is adopted, except for USA, Canada, Europe, and the former Soviet Union and the east European countries.
Any comment:	

Data / Parameter:	$EF_{Oil,upstream,CH4}$
Data unit:	t CH_4/PJ
Description:	Emission Factor for upstream fugitive methane emissions of crude oil from production, transport, refining and storage processes.
Source of data used:	Revised IPCC 1996 Guidance default value, Tables 1-60 to 1-64, p. 1.129 - 1.131
Value applied:	4.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value is recommended by the AM0029, version 03. in its Table 2 Default emission factors for fugitive CH_4 upstream emissions.
Any comment:	

Data / Parameter:	GWP_{CH4}
Data unit:	t CO_2e/t CH_4
Description:	Global Warming Potential for methane
Source of data used:	“1995 IPCC GWP Value” proposed by the IPCC Second Assessment Report
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Adopted by the Decision 2/UNFCCC COP3 and by Article 5, Term 3 of Kyoto Protocol. Effective and applicable during the first commitment period of the Kyoto Protocol.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

According to the AM0029 Version 03 and calculation formulae described in Section B 6.1, the emission reductions can be ex-ante calculated as follows:

Step I: Calculated baseline emission

Sub-step Ia Calculate baseline emission factor ($EF_{BL,CO2}$)

$EF_{grid,BM,y}$ = 0.7156 tCO_2e/MWh, see also Section B.6.2

$EF_{grid,OM,y}$ = 1.2783 tCO_2e/MWh, see also Section B.6.2

$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y}$ =0.9970 tCO_2e/MWh

$$EF_{BL,CO_2,Option\,3}(tCO_2/MWh) = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6 GJ/MWh$$

$$EF_{BL,CO_2,Option\,3} = COEF_{Coal} \times \frac{1}{10^6} \times \frac{3.6}{\eta_{BL}} \times (GJ/MWh)$$

= 94600×1/1000000×3.6/0.375375 =0.9072537 tCO_2e/MWh.

Then $EF_{BL,CO_2} = \min(EF_{grid,BM,y}, EF_{grid,CM,y}, EF_{BL,CO_2,Option3})$ = 0.7156 tCO_2e/MWh.

The Option 1) $\boldsymbol{EF_{grid,BM,y}}$ is selected as the baseline emission factor.

Sub-step Ib Calculate baseline emission (BE_y)

$\boldsymbol{BE_y = EG_{pj,y} \times EF_{BL,CO2}}$=2,584,423.5×0.7156= 1,849,498tCO_2e/year

Assumption for EG: based on estimations in the Feasibility Study Report.

Assumption for EF: Has been defined as BM. The actual BM will be the one available from the NDRC site at the time of verification.

Step II Calculate Project Emission (PE_y)

$$PE_y = FC_{NG,y} \times COEF_{NG,y}$$

$$COEF_{NG,y} = NCV_{NG,y} \times EF_{CO2,NG,y} \times OXID_{NG} = 33.812 \times 15.3 \times 100\% \times 44/12/1000000$$

$$= 0.001896853 \ tCO_2e/Nm^3$$

$\boldsymbol{PE_y}$= 522620000Nm^3×0.001896853 tCO_2e/Nm^3 = 991,333 tCO_2e/year

Step III Calculate Leakage (LE_y)

Sub step IIIa Calculate the upstream fugitive CH_4 emission factor ($EF_{BL,upstream,CH4}$) in baseline scenario

1) The weight factor parameters $\lambda_{k,CH4}$ which is the ratio of the upstream CH_4 emissions associated with solid, liquid and gas fuel type consumed for power generation respectively to the total upstream CH_4 emissions for the total thermal power generation in the grid.

$\lambda_{coal,CH4}$=99.19%, $\lambda_{oil,CH4}$ = 0.001%, and $\lambda_{gas,CH4}$ = 0.806%;

Please refer Table A3 - 8 (CH4), Annex 3 in detail.

2) Calculate $EF_{Coal,Adv,CH4}$, $EF_{Oil,Adv,CH4}$ and $EF_{Gas,Adv,CH4}$: the upstream fugitive CH4 emission factors in line with the efficiency level of the best power technology commercially available in China's power grid for each fuel type respectively. (Please refer Table A3-9 (CH4) in Annex 3.)

$\boldsymbol{EF_{Coal,Adv,CH4}}$=0.00618 tCH_4/MWh; $\boldsymbol{EF_{Oil,Adv,CH4}}$=0.00003 tCH_4/MWh, and

$\boldsymbol{EF_{Gas,Adv,CH4}}$=0.00218 tCH_4/MWh; Please refer Table A3-9 (CH4), Annex 3 in detail.

3) Calculate the weighted averaged upstream fugitive CH_4 emission factor for the corresponding thermal electric power, $EF_{Thermal,Upstream,CH4}$:

$$EF_{Thermal,Upstream,CH4} = \lambda_{Coal,CH4} \times EF_{Coal,Adv,CH4} + \lambda_{Oi,CH4} \times EF_{Oil,Adv,CH4} + \lambda_{Gas,CH4} \times EF_{Gas,Adv,CH4}$$

= 99.19%×0.00618+0.001%×0.00003+0.806%×0.00218

=0.0061480 tCH_4/MWh; Please refer Table A3-10 (CH4), Annex 3 in detail.

4) Calculate the $\boldsymbol{EF_{BL,upstream,CH4}}$ in the context of CCPG grid BM:

$$EF_{BL,Upstream,CH4} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal,Upstream,CH4}$$

= 78.954%×0.0061480 = 0.0048541 tCH_4/MWh, Please refer Table A3-10 (CH4), Annex 3 in detail.

Sub step IIIb Calculate Fugitive Methane Emissions ($LE_{CH4,y}$)

$$LE_{CH_4,y} = \left[FC_y \times NCV_{NG,y} \times EF_{NG,upstream,CH4} - EGG_{PJ,y} \times EF_{BL,upstream,CH4}\right] \times GWP_{CH_4}$$

= [522620000×33.812×296/1000000000 - 2640400 ×0.0048541] ×21

= -159308.94 tCO_2e.

According to the methodology, negative leakage should be considered as zero.

$LE_y = LE_{CH4,y} = 0$ tCO_2e

Step IV: Calculate Emission Reduction

$ER_y = BE_y - PE_y - LE_y$ =1,849,498 –991,333 – 0 = 858,165 tCO_2e/year

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

The 7×3 renewable crediting period is used for the proposed project, for the first crediting period, the ex-ante estimated emission reductions are summarized as in the table below:

Year	Estimation of Baseline emissions (tonnes of CO_2e)	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009	1,849,498	991,333	0.00	858,165
2010	1,849,498	991,333	0.00	858,165
2011	1,849,498	991,333	0.00	858,165
2012	1,849,498	991,333	0.00	858,165
2013	1,849,498	991,333	0.00	858,165
2014	1,849,498	991,333	0.00	858,165
2015	1,849,498	991,333	0.00	858,165
Total (tCO_2e)	12,946,286	6,939,331	0.00	6,007,155

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$FC_{NG,y}$
Data unit:	Nm^3
Description:	Annual quantity of natural gas consumed in project activity
Source of data to be used:	NG flow meter reading at the project boundary
Value of data applied for the purpose of calculating expected emission	522,620,000

reductions in section B.6	
Description of measurement methods and procedures to be applied:	The NG flow rate will be monitored continuously both by supplier and project owner. The monitoring data of the NG consumption will be aggregated automatically and recorded daily.
QA/QC procedures to be applied:	The total NG consumption will be monitored both at supplier and project side for cross-checking. Natural gas flow meters installed will be subject to regular maintenance, calibration and testing to ensure accuracy and good operation condition (in accordance with stipulation of the meter supplier). The monitoring readings will be double checked with the receipt by the gas supply company
Any comment:	

Data / Parameter:	$NCV_{NG,y}$
Data unit:	MJ/Nm^3
Description:	Net Calorific Value of NG
Source of data to be used:	Specific value on natural gas resource, published periodically by the Petro China Company Ltd. on its Website.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	33.812
Description of measurement methods and procedures to be applied:	This $NCV_{NG,y}$ value is measured by the Petro China Company Ltd., based on the content and the LHV of the natural gas resource from “West to East natural gas transmission project” under NTP conditions, which means the volume Nm^3 of NG was measured under atmosphere pressure 101.32kPa, and at temperature 20°C.
QA/QC procedures to be applied:	None
Any comment:	

Data / Parameter:	$OXID_{i,}$
Data unit:	None
Description:	Oxidation factor of the fuel i = Natural gas
Source of data used:	“2006 IPCC Guidelines for National Greenhouse Gas Inventories” Volume 2 Energy, Chapter 1, Table 1.3 and 1.4, Page 1.21-1.24 (Please refer to Annex 3)
Value of data applied for the purpose of calculating expected emission reductions in section B.6	1.00 for gas, etc.
Description of measurement methods and procedures to be applied:	IPCC 2006 Edition default value is used.
QA/QC procedures to be applied:	None
Any comment:	

Data / Parameter:	$EF_{CO2,NG,y,}$
Data unit:	tC/TJ
Description:	CO_2 emission factor per unit of energy of the fuel natural gas
Source of data used:	"2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy, Chapter I, Table 1.3 and Table1.4 in Page 1.21-1.24.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	15.30
Description of measurement methods and procedures to be applied:	Use default value in new edition of IPCC 2006,
QA/QC procedures to be applied:	None
Any comment:	Unit Conversion: $EF_{CO2,NG,y}$=15.30 tC/TJ=0.0561 tCO_2/GJ

Data / Parameter:	$COEF_{NG,y,}$
Data unit:	tCO_2/Nm^3
Description:	CO_2 emission coefficient in year y for natural gas.
Source of data used:	Calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0.001896853
Description of measurement methods and procedures to be applied:	$COEF_{NG,y} = NCV_{NG,y} \times EF_{CO2,NG,y} \times OXID_{NG}$
QA/QC procedures to be applied:	None
Any comment:	

Data / Parameter:	$PE_{y,}$
Data unit:	tCO_2e
Description:	CO_2 emissions from the power plant of the project due to combustion of natural gas fuel in y year.
Source of data used:	Calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.6	991,333
Description of measurement methods and procedures to be applied:	$PE_y = FC_{NG,y} \times COEF_{NG,y}$
QA/QC procedures to be applied:	None
Any comment:	

Data / Parameter:	$EG_{net\ pj,y}$ (Gateway meters No.1 and meter No.3)

Data unit:	MWh
Description:	The actual annual net electricity delivered by the project activity, measured by the meters No.1and No.3 at the monitoring point.
Source of data to be used:	Reading at project boundary by electricity energy meter with bidirectional reading function, and the electricity purchase receipt from the power grid company.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	2,584,423.5
Description of measurement methods and procedures to be applied:	The electricity flow will be measured by the electricity meter continuously and recorded daily and monthly. Data will be archived by the computer centre, and kept for 2 years following the end of the crediting period by means of electronic and paper backup.
QA/QC procedures to be applied:	The electricity output will be monitored and recorded at the on-site computer control centre. The record of electricity delivered and the receipt of the electricity purchase will be cross-checked by both the project owner and the power grid company. The electricity flow meters installed will be subject to regular maintenance, calibration and testing to ensure accuracy and good operation condition (in accordance with national industrial standard).
Any comment:	The Project is a kind of power plant operating under peak load dispatching, which would need certain amount electricity fed from the grid via 500KV and 110KV lines, in case in standby status during off peak load period (and then start up). This amount of electricity is fed from grid through two ways, measured by meter No.1and No.3 respectively. Therefore the annual net electricity delivered to the grid can be calculated by deducting that from-grid electricity measured at the monitoring point by the bi-directional meter No.1 and the from-grid electricity via start up transformer, measured by the meter No.3, from the actual to-grid electricity reading by the bidirectional meter No.1 of the project**.**

Data / Parameter:	***m***
Data unit:	
Description:	a sample group m including recent capacity additions in the CCPG that comprise 20% of the total installed capacity in year y.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG).
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Please refer to Table A3-14 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	The latest value available at the DNA website at the time of verification will be used.
QA/QC procedures to be applied:	None
Any comment:	Data source from China's DNA and national official statistical data on electric power with lower uncertainty.

Data / Parameter:	$F_{i,j,y}$
Data unit:	t or Nm^3
Description:	Fossil fuel *i* consumption in year y for electricity generation in province *j* which is covered under CCPG. Used for calculation of λ_i and $EF_{BM,y}$
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG).
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Please refer to Table A3-8 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	The latest value available at the DNA website at the time of verification will be used.
QA/QC procedures to be applied:	
Any comment:	Data source from China's DNA and national official statistical data on electric power with lower uncertainty.

Data / Parameter:	$COEF_{i,j}$
Data unit:	tCO_2/t or Nm^3
Description:	The CO_2 emission factor for fuel type *i* in Province *j*, taking into account the carbon content of the fuels used and the percent oxidation of the fuel. Used for calculation of λ_i and $EF_{BM,y}$
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG).
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Please refer to Table A3-8 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	$COEF_{i,j} = NCV_{i,j} \times EF_{CO2,i,j} \times OXID_{i,j}$
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$\lambda_{Coal}, \lambda_{Oil}, \lambda_{Gas}$
Data unit:	
Description:	The ratio λ_i of the CO_2 emission of solid (coal), liquid (oil) and gas fuel (gas) type consumed for power generation to the total CO_2 emission from the total thermal power generation under CCPG.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG)
Value of data applied for the purpose of calculating expected emission reductions in section B.6	λ_{Coal} =98.54%, λ_{Oil} =0.12%, λ_{Gas} =1.34%. Please refer to Table A3-8 in PDD Annex 3 in detail.

Description of measurement methods and procedures to be applied:	$\lambda_{Coal} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$, $\lambda_{Oil} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$, $\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$
Data unit:	tCO_2/MWh
Description:	The emission factors in line with the efficiency level of the best technology commercially available in China's power grid for each fuel type as coal, oil and gas respectively.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG)
Value of data applied for the purpose of calculating expected emission reductions in section B.6	$EF_{Coal,Adv}$ =0.9135, $EF_{Oil,Adv}$=0.5706, $EF_{Gas,Adv}$=0.4138 Please refer to Table A3-9 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	$EF_{Coal,Adv} = \frac{3.6}{\eta_{Coal,Adv}} \times \frac{1}{1000} \times EF_{Coal}(tC/TJ) \times OXID_{Coal} \times \frac{44}{12}$ For $EF_{Oil,Adv}$ or $EF_{Gas,Adv}$, simply change foot index *Coal* to *Oil* or *Gas*
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$EF_{Thermal}$
Data unit:	tCO_2/MWh
Description:	The weighted averaged emission factor $EF_{Thermal}$ of the thermal power capacity under CCPG
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG)
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0.9064 Please refer to Table A3-10 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	CAP_{Total}
Data unit:	MW
Description:	The total newly capacity addition in the sample group ***m*** during years y – y+3 under the CCPG.
Source of data to be used:	China's DNA CDM official Website:

	http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG)
Value of data applied for the purpose of calculating expected emission reductions in section B.6	**29886.60** Please refer to Table A3-11 to A3 - 14 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	Original ***CAP*** data for each province and each year are given in China Electric Power Yearbook.
QA/QC procedures to be applied:	None
Any comment:	See Above

Data / Parameter:	$CAP_{Thermal}$
Data unit:	MW
Description:	The newly capacity addition of thermal power in the sample group ***m*** during years y - y+3 under the CCPG.
Source of data to be used:	China's DNA CDM official Website: http://cdm.ccchina.gov.cn/website/cdm/ (for the part of CCPG)
Value of data applied for the purpose of calculating expected emission reductions in section B.6	16490.80 Please refer to Table A3-14 in PDD Annex 3 in detail.
Description of measurement methods and procedures to be applied:	Original $CAP_{Thermal}$ data for each province and each year are given in China Electric Power Yearbook, 2003, 2004, 2005 and 2006 editions.
QA/QC procedures to be applied:	None
Any comment:	See above

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build marginal emission factor of the CCPG during the project operation period
Source of data to be used:	CDM website of China DNA, http://cdm.ccchina.gov.cn/website/cdm/ (The part for the Central China Power Grid)
Value of data applied for the purpose of calculating expe-cted emission reductions in section B.6	0.7156 Taken from official CDM Website of China DNA: "Notice on determina-tion of China's power grid baseline emission factors" (July 18, 2008)
Description of measurement methods and procedures to be applied:	$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$ According to AM0029, Version 03, the baseline emissions will be calcu-lated by determining the baseline emission factor as the lowest one among three options: option 1- $EF_{grid,BM,y}$, option 2- $EF_{grid,CM,y}$, and option 3- that for the most likely baseline technology identified in B.4. This determi-nation will be made once at the validation stage based on an ex ante assess-ment. If either option 1 ($EF_{grid,BM,y}$) or option 2 ($EF_{grid,CM,y}$) are selected, they will be estimated ex post. In the context of the project where

	$EF_{grid,BM,y}$ is selected as the baseline emission factor, the $EF_{grid,BM,y}$ is included in the annual monitoring plan, and will be updated ex post, as the $EF_{grid,BM,y}$ value is renewed by China's DNA at its CDM Website annually. In other words, for the verification, the latest value available at the DNA website at the time of verification will be used.
QA/QC procedures to be applied:	None
Any comment:	Data is from China DNA and an official national electric statistic data source with low uncertainty

B.7.2 Description of the monitoring plan:

The general objective of the monitoring plan is to provide actual, credible, complete, consistent and transparent monitoring and calculation process and accurate data regarding the emission reductions accrued by the proposed project activities to the DOE, so that based on which the real, measurable and long term global environmental benefits relating to the GHG emission reductions can be verified and certified.

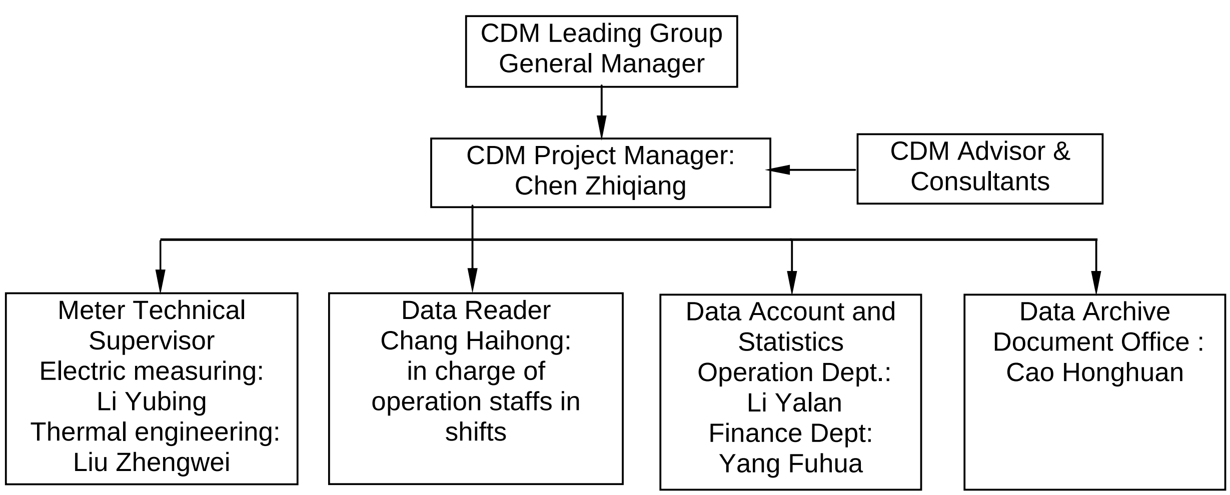
The project participant must establish a reliable, transparent and complete data monitoring system, which has a set of functions of data acquirement, measurement, treatment, recording, archiving, reporting and tracking.

The project participant should also establish monitoring management institution and monitoring team with duty and responsibility being clearly assigned and authorized, as well as quality control and quality assurance system.

The owner of the proposed project is responsible for the implementation of the monitoring plan.

1. Monitoring institution

The CDM Leading Group that will be set up internally by the Henan Zhongyuan Gas Power Plant, is dedicated to be in charge of implementation and management of the whole monitoring plan. The CDM leading group director and all members will be trained and supported by the CDM project advisor & consultant entity technically. The General Manager of the Company will be authorized to lead and supervise over the CDM Leading Group. The institutional structure and the duty allocation of the CDM group are shown as follows (Note: when the responsible person quit, a new staff trained will be assigned):



Data Reader, i.e. the on-duty (in shift) staffs in the Operation Department, are responsible for the data monitoring and recording in the log book daily, especially the electricity generated, electricity delivered to the grid and the quantity of natural gas consumed every day.

Data Account, i.e. the statistical staffs in the Operation Department and Finance Department, are in charge of data accounting, statistical treatment as well as calculation of GHG emission reduction based on the monitoring data, which will be aggregated and reported to CDM Project Manager monthly. After checking and ensuring without material mistake, this data will be archived and also sent to Director of the Data Archive Office and Finance Department which will make financial clearance with power Grid Company and natural gas Supply Company on the electricity sale the gas payment respectively. The receipts will be archived and managed by the Director of Finance Department.

Meter Supervisor, i.e. technicians specialised in electric measuring/thermal engineering, are responsible for the daily maintenance and supervising over the periodic calibration for the electricity energy meters and the natural gas flow meters. The procedure and the period of the calibration must be carried out in line with the monitoring plan.

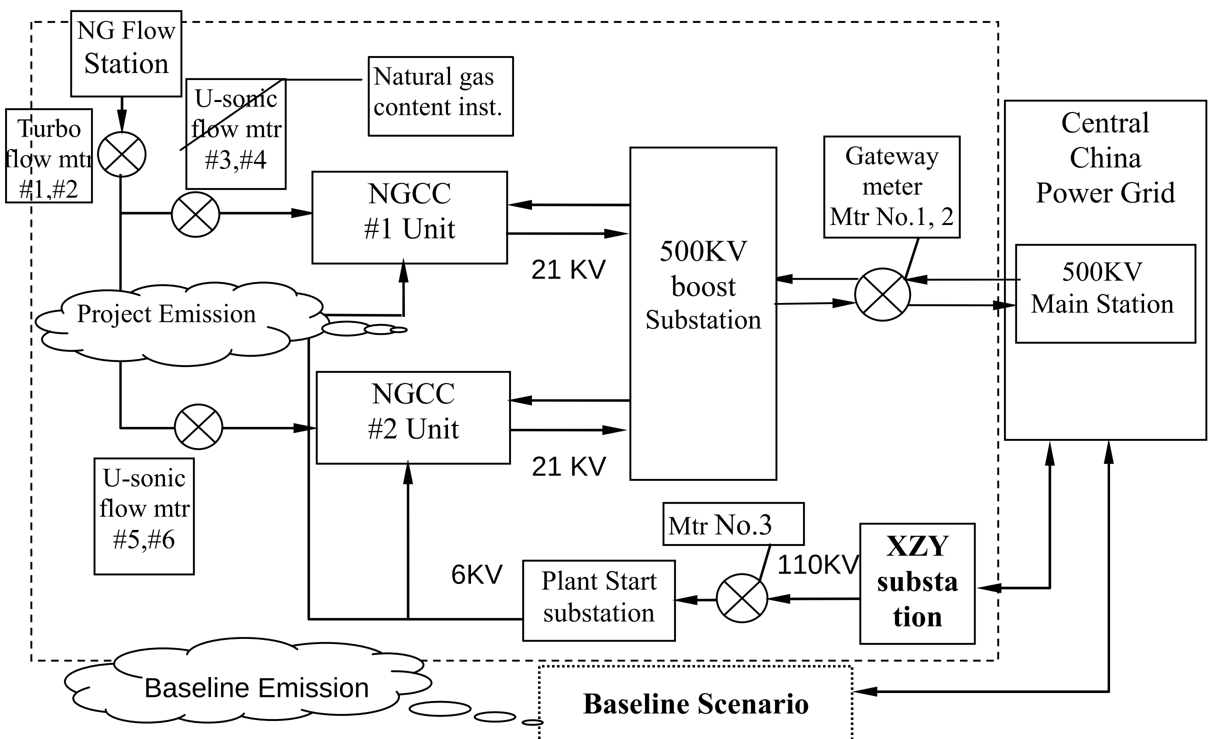
2. The data to be monitored

The key data to be monitored during the project operation, including to-grid electricity delivered to the grid, and from-grid electricity, quantity of the natural gas consumed and NCV of the natural gas, as well as the baseline CCPG grid emission factors EF_{BM}, EF_{OM} and EF_{CM}., in case they are selected as baseline emission factor to calculate the project's emission reductions.

3 The equipments for monitoring and their installation

3.1 The sketch map of the metering points

The monitoring points are distributed in the project site as shown in the chart below:



3.2 The equipments for monitoring electricity delivered to the grid

The electricity energy meters are installed according to "The Technical Management Rules for Electricity Energy Meter Installation" (DL/T448-2000) issued by the State Economic and Trade Commission of the People's Republic of China, on the 3rd Nov. 2000, and are tested by Henan Electric Power Test Institute, and then checked for acceptance by both Zhongyuan Gas Power Plant and Henan Provincial Electric Power Company against the Rules, prior to the meter put into operation.

Serving mainly as a peak-load dispatching power plant, the two generating units of the Zhongyuan Gas Power Plant will be sometime in a standby status during the course of operation, therefore, the Plant needs to purchase electricity fed from the Central China Power Grid for its self service in the plant site. This amount of the from-grid electricity will be measured by the meters No. 1 and No. 2. Meanwhile, in order to ensure safety starting up and shut down by the units and to meet the electricity consumption needs by the plant when in standby status, an additional backup electricity source is connected from the substation of the Zhumadian electric power company via 110KV line. This amount of the from-grid electricity will be measured by the meters No.3.

There are six electricity energy meters which are installed in the Zhongyuan Gas Power Plant for monitoring at different metering points:

The Gateway meter No.1 and No.2 are installed on the Plant side of the 500KV main substation for continuously and automatically measuring the to-grid electricity delivered to the grid by both #1 and #2 units and the from-grid electricity purchased by both #1 and #2 units fed from 500KV grid system. The amount of to-grid electricity is based on the metering data from the Gateway meter No.1 and No.2. The dual meters are set up, one is the primary meter and another is the backup one, both have the same type, specification and accuracy, running simultaneously. Under the normal case, the readings from meter No.1 (primary meter) is taken for billing of the to-grid electricity. In case the meter No.1 is detected in fault, the backup meter No.2 will replace the No.1 for billing. As mentioned above, these two meters have reverse metering function to measure the from-grid electricity purchased and fed from the grid when the #1 and #2 generating units are in standby status.

The meter No.3 installed on high voltage side of the 110KV/6KV transformer at project site is used for automatically measuring the from-grid electricity purchased and fed from the grid via this transformer, in case the electricity is needed for starting up the power units. In the normal case, the readings from meter No.3 is taken for billing of the from-grid electricity. In case the meter No.3 is detected in fault, the alternative meter with the same technical specification installed within the Xiao Zhuyuan Substation will be used for measuring and billing instead of the meter No.3. Such alternative approach is conservative. Therefore under the normal operation status, the total net electricity delivered to the grid is calculated by deducting the electricity fed from the grid reading at the meter No.1 and No.3, from the net electricity delivered to the grid reading at the meter No.1.

The whole electricity monitoring system employed in the project is a remote electricity billing system, which is used for billing the electricity trading between the Henan Zhongyuan Gas Power Plant and the power grid the project is connected to. This system can monitor and control the electricity measuring parameters at each monitoring points with accuracy and reliably. The system can collect, transmit, process and archive mass information on electricity generated by using EDAD2001 electricity data acquisition unit at the plant end via dedicated load dispatching data network at the Henan Provincial Power Co. Meanwhile the information on electricity delivered to the grid and purchased from the grid by the plant can be searched and shared for statistical analysis at the plant end via the electricity energy information query system at the Henan Provincial Power Co.

In the electricity energy monitoring system, the meters' accuracy and error ranges are listed in the table below:

Meter No.	Accuracy	Error range
No.1	0.2S	±0.2%
No.2	0.2S	±0.2%
No.3	0.2S	±0.2%

3.3 Monitoring equipment and instrument for natural gas consumed

The natural gas measure system will be configured and installed according to "Technical requirements of measuring systems for natural gas"(GB/T18603-2001); The real-flow testing and checking will be carried out by the qualified measurement technology verification institution authorized by Chinese government, in accordance with the provisions of the national metrology specification JJG198 "The Rules for Speed-flow Meter Verification".

The main gas metering point is set up in front of the natural gas delivery point, where two Turbo type gas flow meters are installed (#1 and #2 meter), one of which is for back up (#2 meter). Meanwhile, behind the natural gas delivery point, two ultrasonic gas flow meters (#3 and #4 meter as backup) are installed before the gas inlet for # 1 unit. Similarly, #5 and #6 ultrasonic gas flow meter are installed in the same way for #2 Unit. In case the working ultrasonic gas flow meter is detected in fault, the system will alarm automatically, then the system prompt start up the standby backup ultrasonic gas flow meter and close the faulted ultrasonic gas flow meter.

The project owner will sign the gas purchase agreement with the gas supplier, i.e. Henan Yunan Gas Pipeline Co. Ltd., under which the natural gas supply monitoring will be implemented in detail. The project owner ensures that the DOE verifier can obtain the meter reading records and the testing records generated during calibration, since the project owner has got the permission from the Henan Yunan Gas Pipeline Co. Ltd.

3.4 Natural gas NCV analysis devices

For the measurement of natural gas flowing at the point of measurement, the gas composition analysis is carried out by one set of on-line gas chromatography analyzer by acquiring the gas sample from the continuous operated sampling line which is linked with the gas flow. The calibration and testing for on-line gas chromatography will be carried out by the qualified measurement technology verification institution authorized by Chinese government in accordance with the China's national standards GB/T-13610.

4. Data collection

4.1 Data collection on electricity delivered to the grid and purchased from the grid

The procedures of monitoring electricity delivered to the grid and purchased from the grid by the project activity are as follows:

1) The representatives from the project owner and the grid company will read the gateway meter and the buck up meter regularly and the data will be recorded for monitoring, verifying, billing and cross checking;

2) The project owner will record the net amount of electricity delivered to the grid, that is the electricity delivered to the grid less electricity purchased from the grid by the project owner;

In case the reading data difference between the primary and the backup meters is beyond the allowance range or the meter is found to be not functional, the amount of electricity supplied to the grid will be

determined by the following methods:
1) Firstly, the third-party arbitration agency designated by the grid company and the owners will read the data from the check meters which are installed at the output of both #1 and #2 generation units, and calculate the amount of electricity supplied to the grid based on the historical line losses rate, unless the agency identifies that the check meter is inaccurate;

2) In case the check meter's accuracy is not acceptable by standard or its operation does not meet the required standard, an appropriate and conservative method for estimation of the electricity supplied to the grid will be designed jointly by the project owner and the power plant, and justify the reasonableness and the conservativeness of the alternative method to verifying DOE by providing sufficient evidence.

3) If no agreement on the estimate method is reached between the project owners and the grid company, the arbitration procedures should be applied to determine the consistency of the estimate method.

4.2 The data collection on amount of natural gas consumed and the NCV analysis results

According to "the Measurement Law of PRC", natural gas is measured by volume under the standard condition of 20°C (293.15K) and absolute pressure 101.325KPa (one standard atmospheric pressure). The gas supplier and the project owner verify the amount of natural gas supplied and consumed based on the reading from the measuring equipment currently installed at the Zhmadian gas supply terminal, which are approved by both site. The natural gas consumption will be recorded daily and will be billing weekly, which is cross checked with purchase invoices. The project owner will preserve all relevant documents and records on the natural gas measurement.

The project owners can monitor the quality of the natural gas supplied, based on the remote on-line data monitoring meter system at any time.

4.3 The data collection for calculation of grid baseline emissions factor

The data for calculating grid baseline emissions factors are taken from the latest source available from the official website of the China's DNA, i.e. NDRC.

The principal of the CDM group of the project company is required to provide the latest annual data available to the verifying DOE to assist the verification and certification for the ex-post calculating the baseline emission factors.

5. Calibration

5.1 Calibration of meters
The project owner will entrust a qualified institution to carry out on-site calibration for gate meter, in compliance with "The Technical Management Rules for Electricity Energy Meter Installation" (DL/T448-2000), in order to secure the quality of the meter calibration and the accuracy of electricity measurement. The frequency of the meter calibration will be once a year.

After the electricity energy measurement devices (meters) are on site tested and checked, they must be sealed. And both the project owner and the grid company must present for the joint checking and sealing, and no any party can unseal or alter meters in the absence of another party (or its authorized representative).

All the meters installed shall be tested by CCG within 10 days after the following case happening:
i) The metering difference between the primary and backup meters is detected to be larger than the allowable error,

ii) The repair of the meter due to its failure to operate in accordance with the specifications.

(1) Calibration plan for the electricity energy meters in the electricity energy monitoring system: Once a year.
(2) Calibration procedure for the monitoring meters: as mentioned above...
(3) Possible unexpected cases and the emergency responses

No.	Unexpected case	Emergency response measure	Note
01	Voltage lose of power supply at data acquiring device	Measuring the power supply voltage, try to find out the cause, remove the troubles, resume electricity supply ASAP, reducing the losses of electricity lose.	
02	Voltage lose of power supply at the electricity energy meter	Measuring the power supply voltage at the electricity energy meter and the electric circuit, try to find out the cause, and remove the troubles,	
03	Strike a light at electric current terminal	Shorting the current circuit, try to find out the cause, and remove the troubles,	
04	Short circuit of the voltage loop	Turn off the small switch at the electric pressure mutual inductor	
05	Fault in communication system	Measuring the voltage at the communication terminals, try to find out the cause, and remove the troubles,	

5.2 Calibrations of natural gas metering devices

The project owners will sign agreement with authorized and qualified institution for calibration and testing on the precision of the gas metering devices, in order to ensure the monitoring accuracy on the natural gas consumption. The calibration and testing for the natural gas metering devices will be conducted by the gas supplier periodically, according to the national measurement standard and regulation.

6. Data management

The CDM Leading Group assigned by the project owner will archive the monitoring data electronically by the end of each month. The electronic files will be saved and backup with CD, and be printed out as hard copies. Physical documentation such as paper-based maps, diagrams, forms and environmental assessment will be collated in a central place, together with this monitoring plan. In order to facilitate auditor's reference, monitoring results will be indexed. All paper-based information will be stored by the CDM Group and kept at least two copies. All these data should be kept until two years after the end of the crediting period.

7. Verification and Certification

The verification and certification of the Project is expected to implement at least once per year. Project owner should offer all data and documents of monitoring as well as the monitoring report to DOE.

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 baseline and monitoring methodology was completed on 01 July, 2008 by Global Climate Change Institute (GCCI) of Tsinghua University, which is not the project participant.

The persons involved in baseline and monitoring methodology study are listed as follows:

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In cooperation with
Accord Global Environment Technology Company Ltd., Beijing:

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:

06/06/2005[24]

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

\>> 20

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

C.2.1. Renewable crediting period

\>> 7×3 year

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

\>> 01/03/2009

C.2.1.2. Length of the first crediting period:

\>> 7 years

C.2.2. Fixed crediting period:

Not applicable.

C.2.2.1. Starting date:

\>> Not applicable.

C.2.2.2. Length:

\>> Not applicable.

[24] On 6 June, 2005: the main equipment import contract between Henan Zhumadian Zhongyuan Gas Power Plant, China National Technical Import and Export Corporation (CNTIC) and Shanghai Electric Group Co. (SEC)-SIEMENS Consortium came into force (Contract No. 04DE01GTA01XC0015, please refer to CNTIC Document No. G17ZY/11, 06/06/2005); On 10 Aug. 2005: the civil construction work of the project started by pouring down first tank of concrete for the # 1 waste heat boiler of the #1 power unit of the project; in June 2007: #1 power unit put into testing operation, and then in December 2007: #2 power unit put into testing operation.

SECTION D. Environmental impacts

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D.1. Documentation on the analysis of the environmental impacts, including trans-boundary impacts:

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The EIA report has been approved by the China State Environment Protection Administration on 25 May 2004 (Huan Ping [2004]170). The project uses natural gas as fuel and the main pollutions are exhaust gas, exhaust water, noise from the units operation, no-ash/slag and de-ash waste water discharged from the plant. After taking pollutant disposal measures, the adverse impacts on the environmental due to project construction and operation can be reduced effectively. So this project is environmentally feasible.

Construction Period

The major air pollutant during the construction period is dust. Several measures such as dust fall by watering, and avoiding civil engineering in large windy weather, are undertaken to reduce dust generation. The daily life waste water during the construction period will be aggregated and disposed at the disposal station and discharged when reaching the relevant standard. The industrial and the daily life solid waste will be collected and treated in centralised way. In general, the environmental impacts during the construction period are temporal and not significant.

Operation Period

The major air pollutant of the proposed project during operation period is NO_x, the emissions of SO_2 and TSP is very slight and negligible comparing with conventional coal fired power plant. The proposed project will adopt dry-type low NO_x burner, which could reduce NO_x emissions significantly. The NO_x emission concentration at the outlet of the gas turbine is expected to be lower than 25ppm, which meets the requirement of "Pollutant Emission Standard of Thermal Power Plant" (GB13223-1996). It is shown that, in comparison with the coal fired power plant with the same capacity, the project will reduce SO_2 emission by 99.4%, NO_x emission by 78.3%, dust emission by 99.9%, thus the project construction and operation will have a little impact on the air environmental quality around the plant site.

Consequently there is no trans-boundary environmental impacts are involved with the project activity.

A small quantity of the industrial and the daily life solid waste generated during the plant operation will be collected periodically and brought into the local solid waste treatment system.

Production waste water mainly comprises of the waste water from circulating cooling tower, chemical acidic/basic waste water and daily life waste water, etc. Waste water from cooling tower will be reused after being lead to the water saving station; After being neutralized and reaching the standard in the disposal pool, the acidic/basic waste water will be discharged directly to the local drainage channel; The daily life waste water will be discharged to the residential waste water disposing system at local area after being disposed at the first-stage septic tank, without adverse impact on the environment. Hydrochloric acid is considered temporarily to the cleanout design for the boiler, and the waste liquid from cleanout of boiler will be disposed by the cleaning company.

The noises of gas-steam combined cycle units mainly come from the running of facilities such as gas turbine, steam turbine, generating units, water-feeding pump, cycle water pump and cooling tower. A part of workshop with lots of noises will take use of sound absorption materials or set up sound insulation workroom. Doors and windows of controlling room of the plant area and office buildings will be avoided

to face strong sound source and will be utilized sound absorption materials as possible. Appropriate grass and tree planting in the plant area will also be utilized to debase the noises' effect on environment.

Under normal circumstances, the plant will go down to all daytime noise standards after take the noise control measures. The maximum distance with environment noise exceeding standard out of the south and east of the plant boundary are 70m and 20m, where the exceeding value does not exceed 5dB (A) and 2dB(A) respectively. Because there are roads and open land out of the south boundary and the railway and brick factory out of the east boundary, with no sensitive point, so it has little effect on the environment.

In summary, the project uses natural gas as fuel, with high energy efficiency and small pollutant emissions, and therefore in line with the national industrial policy. After taking measures to control the pollutants, the project meets the national and Beijing environmental standards with little impact on the environment; so the construction of this project is feasible from the perspective of environmental protection.

The environmental assessment and comment as well as the feasibility conclusion as summarised above were provided prior to the construction period of the project. The project was put into commission in Dec. 2005. The results of the environmental monitoring during the project construction and operation shows that the project activity actually reach the environmental quality standards as specified by the environmental protection authority of Henan and the Chinese central government.

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:

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Not applicable, since the construction and operation of the proposed project have no significant environmental impacts.

SECTION E. Stakeholders' comments

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

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The stakeholders identified for the Project are the residents near the Project and local government. In the investigation, implemented during April/2007, 50 questionnaires are distributed and 48 questionnaires are returned, 31 male clients and 17 female clients, with 96% response rate. The questionnaire includes:

- The positive effects cause of construction and operation of the Project;
- The negative effects cause of construction and operation of the Project;
- The negative effects are tolerably or not
- Any suggestion for mitigating the identified negative effects; and
- The stakeholder's attitude to the implementation of the Project;

E.2. Summary of the comments received:

>>

Based on the 48 returned questionnaires, the summary of the comments are listed as follows:

1) Most of respondents know the information of the Project, 100% respondents support the implementation of the Project, no against response found;

2) 71% respondents believe the Project will offer more job opportunities; meantime, more than 60% respondents believe that the electricity price will decrease and local employment situation will be promoted by the Project; furthermore, more than 40% respondents believe the Project will improve the electricity supply;
3) Based on the questionnaires, the main negative effect is noise which got 90% responses. The stakeholders suggested that the project owner should make reasonable job shifts and avoiding noise work during night time, some stakeholders advise the project owner adopting advanced construction and operation equipments for reducing noise. Some respondents worry about air and water pollution due to implement the Project. Few respondents believe the construction safety should be taken serial recognition by project owner.
4) All respondents believe these negative effects above are tolerably.

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

>>

The Project owner take account the problems provided in the questionnaires as following:

1) For the noise problem, the Project will observe the relevant laws and regulations strictly such as Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise. Furthermore, the project owner will adopt other noise decrease measures, for instance, using advanced engineering technologies and equipments; reasonable arrangement for job shift; prohibiting noise work and vehicle hooting during night time.
2) For pollution problem, the project owner will observe the Environmental Impact Assessment Report and relevant laws for pollution controlling, meantime, the pollution mitigating measures in the Environmental Impact Assessment Report will be adopted strictly.
3) For the safety problem, the project owner will adopt relevant national safety standard during construction and operation. Furthermore, all the staffs will take safety training and gain relevant safety equipments.

In conclusion, the Project obtained support from local stakeholders thus modification and adjustment on design, construction and operation of the Project are unnecessary.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public official development assistant fund involved in the proposed project.

Annex 3

BASELINE INFORMATION

This PDD adopted those BM and OM emission factors for the Central China Power Grid (CCPG) in China that constitute the part of BM and OM emission factors for all regional power grid in China, as published at China's DNA Web Site on July 18, 2008. For more detailed information regarding the OM and BM emission factors, please refer to the following Web Site:

http://cdm.ccchina.gov.cn/web/index.asp, especially:

- http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf on calculation of grid baseline emission factors in China (including Central China Power Grid);
- http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1888.pdf on calculation of grid baseline OM emission factors in China;
- http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.pdf on calculation of grid baseline BM emission factors in China.

The following Tables provided the summary of the results (including Data, Data sources and basic procedures of the calculations) by applying the "Tool to Calculate the Emission Factor for an Electricity System", Version 01. The baseline emissions of the Project were calculated based on these CM, BM and CM emission factors for CCPG that are published by China DNA at its official CDM Web site as mentioned above.

Table List:

Table A3 - 1 NCV, OXID and potential emission factor of the fuel

Fuel type	**Emission coefficient (FF)**	**Rate of OXID**	**Net Calorie Value (NCV)**
Unit	**(tc/TJ)**	**(%)**	**(MJ/t,km^3)**
No.	**H**	**I**	**J**
Raw Coal	25.8	100	20908 MJ/t
Clean coal	25.8	100	26344 MJ/t
Other washed coal [12/]	25.8	100	8363 MJ/t
Coke	29.2	100	28435 MJ/t
Coke oven gas [14/]	12.1	100	16726 MJ/km^3
Other coal gas [15/]	12.1	100	5227 MJ/km^3
Crude oil	20	100	41816 MJ/t
Gasoline	18.9	100	43070 MJ/t
Diesel	20.2	100	42652 MJ/t
Fuel oil	21.1	100	41816 MJ/t
Liquefied Petroleum Gas	17.2	100	50179 MJ/t
Refinery gas	15.7	100	46055 MJ/t
Natural gas	15.3	100	38931 MJ/km^3
Other petroleum product [13/]	20	100	38369 MJ/t
Other coke product	25.8	100	28435 MJ/t
Other energy	0	100	0

*/: For liquet and solid fuel measured with mass unit t, and for gas fuel measured with volume unit km^3,
Data sources:

1) The Low level heat value of each type of fuels are taken from《China Energy Statistical Yearbook》2007 Edition, p287.
2) The potential emission factors and OXID rate of each type of fuels are taken from "2006 IPCC Guidelines for National Greenhouse Gas Inventories", Volume 2 Energy, Chapter 1, Page 1.21-1.24, Table 1.3 and Table 1.4.
3) The data sources on electricity generation, installed capacity and the self service rate, etc. needed for calculation of OM and BM emission factors are from《China Electric Power Yearbook》, 2002-2007 Editions.
4) Fueltypes and fuel consumption data for calculation of OM are from 《China Energy Statistical Yearbook》, 2005-2007 Editions

12/: Source:《China Energy Statistical Yearbook》2007, p287, calculated by using the NCV of washed coal. It is conservative, due to the average NCV of coal sludge is higher than the washed coal.
13/: The NCV value of other petroleum products are not available in 《China Energy Statistical Yearbook》, the value used here is estimated based on its real amount and its coal equivalent value available in the energy balance tables. the converted NCV is 38369 kJ/kg,equivalent to 1.3108 tce/t.

14/: Source:《China Energy Statistical Yearbook》2007, p287, take the lower value of the range from 16726 to 17981 kJ/m3 for the NCV of the Coke Oven Gas.

15/: Source:《China Energy Statistical Yearbook》 2007, p287, take the lower value of coal based gases.

Table A3 - 2 Simple Operation Margin Emission Factor Calculation for the CCPG in 2004

		Provinces and city cover by Central China Power Grid							Emission Factor (tc/TJ)	Oxid (%)	NCV (MJ/t,km^3)	CO_2 Emissions tCO_2e
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total				
Fuel type	Unit	A	B	C	D	E	F	G=A+B+C +D+E+F	H	I	J	K=G×H×I×J×44/12/X*
Raw Coal	10^4t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	17144.1	25.8	100	20908	339092605.29
Cleaned Coal	10^4t		2.34					2.34	25.8	100	26344	58316.13
Other washed coal	10^4t	48.93	104.22			89.72		242.87	25.8	100	8363	1921441.23
Coke	10^4t		109.61					109.61	29.2	100	28435	3337011.41
Coke Oven Gas	10^8m^3			1.68		0.34		2.02	12.1	100	16726	149899.53
Other Coal Gas	10^8m^3					2.61		2.61	12.1	100	5227	60527.09
Crude Oil	10^4t		0.86	0.22				1.08	20	100	41816	33118.27
Gasoline	10^4t		0.06			0.01		0.07	18.9	100	43070	2089.33
Diesel	10^4t	0.02	3.86	1.7	1.72	1.14		8.44	20.2	100	42652	266627.32
Fuel Oil	10^4t	1.09	0.19	9.55	1.38	0.48	1.68	14.37	21.1	100	41816	464893.14
PLG	10^4t							0	17.2	100	50179	0.00
Refinery Gas	10^4t	3.52	2.27					5.79	15.7	100	46055	153506.38
Natural Gas	10^8m^3						2.27	2.27	15.3	100	38931	495774.61
Other Petroleum products	10^4t							0	20	100	38369	0.00
Other Coking Products	10^4t							0	25.8	100	28435	0.00
Other Energy	10^4t		16.92		15.2	20.95		53.07	0	100	0	0.00
											Sum	346035809.73

*/: X=10000 (in Mass unit), or X=1000 (in Volume unit), the same as below.

Source：China Energy Statistical Yearbook 2005

Table A3 - 3 Thermal electric generation of the CCPG and OM in 2004

Province	Elec. generation	Self service rate	Electricity supply
	(MWh)	(%)	(MWh)
Jiangxi	30127000	7.04	28,006,059
Henan	109352000	8.19	100,396,071
Hubei	43034000	6.58	40,202,363
Hunan	37186000	7.47	34,408,206
Chongqing	16520000	11.06	14,692,888
Sichuan	34627000	9.41	31,368,599
Total	270846000	8.04	249,074,186

Source: China Electric Power Yearbook 2005

	Total emission (tCO_2)	**346,035,810**
	Total electric delivered (MWh)	**249,074,186**
2004	OM EF (tCO_2/ MWh)	**1.389288**

Table A3 - 4 Simple Operation Margin Emission Factor Calculation for the CCPG in 2005

		Provinces and city cover by Central China Power Grid							Emission Factor (tc/TJ)	Oxid (%)	NCV (MJ/t,km^3)	CO_2 Emissions tCO_2e
		Jiangxi	**Henan**	**Hubei**	**Hunan**	**Chongqing**	**Sichuan**	**Total**				
Fuel type	**Unit**	**A**	**B**	**C**	**D**	**E**	**F**	**G=A+B+C +D+E+F**	**H**	**I**	**J**	**K=G×H×I×J×44/12/X***
Raw Coal	10^4t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	20908	352614496.76
Cleaned Coal	10^4t	0.02						**0.02**	25.8	100	26344	498.43
Other washed coal	10^4t		138.12			89.99		**228.11**	25.8	100	8363	1804669.00
Coke	10^4t		25.95		105			**130.95**	29.2	100	28435	3986695.05
Coke Oven Gas	10^8m^3			1.15		0.36		**1.51**	12.1	100	16726	112053.61
Other Coal Gas	10^8m^3		10.2			3.12		**13.32**	12.1	100	5227	308896.88
Crude Oil	10^4t		0.82	0.36				**1.18**	20	100	41816	36184.78
Gasoline	10^4t		0.02			0.02		**0.04**	18.9	100	43070	1193.90
Diesel	10^4t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	42652	299797.78
Fuel Oil	10^4t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	41816	286959.09
PLG	10^4t							**0**	17.2	100	50179	0.00
Refinery Gas	10^4t	0.71	3.41	1.76	0.78			**6.66**	15.7	100	46055	176572.11
Natural Gas	10^8m^3						3	**3**	15.3	100	38931	655208.73
Other Petroleum products	10^4t							**0**	20	100	38369	0.00
Other Coking Products	10^4t				1.5			**1.5**	25.8	100	28435	40349.27
Other Energy	10^4t		2.88		1.74	32.8		**37.42**	0	100	0	0.00
											Sum	360323575.39

Source：China Energy Statistical Power Yearbook, 2006

Table A3－5 Thermal electric generation of the CCPG and OM in 2005

Province	Elec. generation (MWh)	Self service rate (%)	Electricity supply (MWh)
Jiangxi	30000000	6.48	28,056,000
Henan	131590000	7.32	121,957,612
Hubei	47700000	2.51	46,502,730
Hunan	39900000	5	37,905,000
Chongqing	17584000	8.05	16,168,488
Sichuan	37202000	4.27	35,613,475
Total	303,976,000	5.85	286,203,305

Source: China Electric Power Yearbook 2006

	Total emission (tCO_2)	**360,323,575**
	Total electric delivered (MWh)	**286,203,305**
2005	OM EF (tCO_2/ MWh)	**1.258978**

Table A3 - 6 Simple Operation Margin Emission Factor Calculation for the CCPG in 2006

		Provinces and city cover by Central China Power Grid							Emission Factor (tc/TJ)	Oxid (%)	NCV (MJ/t,km^3)	CO_2 Emissions tCO_2e
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total				
Fuel type	**Unit**	**A**	**B**	**C**	**D**	**E**	**F**	**G=A+B+C +D+E+F**	**H**	**I**	**J**	**K=G×H×I×J×44/12/X***
Raw Coal	10^4t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	**20127.82**	25.8	100	20908	398107507.69
Cleaned Coal	10^4t					5.79		**5.79**	25.8	100	26344	144295.04
Other washed coal	10^4t	4.51	104.12		8.59	79.21		**196.43**	25.8	100	8363	1554035.91
Briquet Coal	10^4t						0.01	**0.01**	26.6	100	20908	203.92
Coke	10^4t		17.23		0.32			**17.55**	29.2	100	28435	534299.34
Coke Oven Gas	10^8m^3		0.52	1.07	4.24	0.38	0.01	**6.22**	12.1	100	16726	461571.81
Other Coal Gas	10^8m^3	12.69	3.95		1.7	4.36	0.01	**22.71**	12.1	100	5227	526655.27
Crude Oil	10^4t		0.49					**0.49**	20	100	41816	15025.88
Gasoline	10^4t		0.01					**0.01**	18.9	100	43070	298.48
Diesel	10^4t	0.91	2.23	1.41	1.78	0.96		**7.29**	20.2	100	42652	230297.77
Fuel Oil	10^4t	0.51	1.26	1.31	0.8	0.57	3.49	**7.94**	21.1	100	41816	256872.06
PLG	10^4t							**0**	17.2	100	50179	0.00
Refinery Gas	10^4t	0.86	8.1	1	0.97			**10.93**	15.7	100	46055	289779.75
Natural Gas	10^8m^3			0.28		0.16	18.63	**19.07**	15.3	100	38931	4164943.49
Other Petroleum products	10^4t							**0**	20	100	38369	0.00
Other Coking Products	10^4t						0.01	**0.01**	25.8	100	28435	269.00
Other Energy	10^4t	17.45	37.36	31.55	18.29	29.35		**134**	0	100	0	0.00
											Sum	406286055.41

Source：China Energy Statistical Power Yearbook,2007

Table A3 - 7 Thermal electric generation of the CCPG and OM in 2006

Province	Elec. generation	Self service rate	Electricity supply
	(MWh)	(%)	(MWh)
Jiangxi	34449000	6.17	32,323,497
Henan	151235000	7.06	140,557,809
Hubei	54841000	2.75	53,332,873
Hunan	46408000	4.95	44,110,804
Chongqing	23487000	8.45	21,502,349
Sichuan	44193000	4.51	42,199,896
Total	34449000	6.17	32,323,497

Source: China Electric Power Yearbook 2007

Net import from NWPG to CCPG	3,028,950	MWh
Average emission factor NWPG	0.82214	tCO_2/MWh

	Total emission (tCO_2)	**408,776,276**
	Total electric delivered (MWh)	**337,056,176**
2006	OM EF (tCO_2/ MWh)	**1.212784**

Three years average OM Emission Factor over full generation	
1.27833615	tCO_2/MWh

Table A3 - 8 Data sheet for Proportion λ_i of the solid, liquid, gas fuel emission out of the total emission in CCPG in 2006

Provincial	Unit	**Jiangxi**	**Henan**	**Hubei**	**Hunan**	**Chongqing**	**Sichuan**	**Subtotal**	**NCV MJ/t,km^3**	**EF (tC/TJ)**	**OXID**	**Emission (tCO_2e)**
Fuel Type		A	B	C	D	E	F	G=A+…+F	H	I	J	K=G*H*I*J *44/12/100
Raw coal	10^4t	1926.02	8098.01	3179.79	2454.48	1184.30	3285.22	20127.82	20908	25.8	1	398,107,507.69
Clean coal	10^4t					5.79		5.79	26344	25.8	1	144,295.04
Other washed coal	10^4t	4.51	104.12		8.59	79.21		196.43	8363	25.8	1	1,554,035.91
Briquette Coke	10^4t						0.01	0.01	20908	26.6	1	203.92
Coke	10^4t		17.23		0.32			17.55	28435	29.2	1	534,299.34
Sum												**400,340,342**
Crude oil	10^4t		0.49					0.49	41816	20.00	1	15,025.88
Gasoline	10^4t		0.01					0.01	43070	18.90	1	298.48
Coal oil	10^4t							0	43070	19.60	1	0.00
Diesel	10^4t	0.91	2.23	1.41	1.78	0.96		7.29	42652	20.20	1	230,297.77
Fuel oil	10^4t	0.51	1.26	1.31	0.80	0.57	3.49	7.94	41816	21.10	1	256,872.06
Other petroleum product	10^4t							0	38369	20.00	1	0.00
Other coking product	10^4t						0.01	0.01	28435	25.80	1	269.00
Sum												**502,763**
Natural gas	10^7m^3			2.80		1.60	186.30	190.7	38931	15.3	1	4,164,943.49
Coke Oven Gas	10^7m^3		5.20	10.70	42.40	3.80	0.10	62.2	16726	12.1	1	461,571.81
Other coal gas	10^7m^3	126.90	39.50	0.00	17.00	43.60	0.10	227.1	5227	12.1	1	526,655.27
LPG	10^4t							0	50179	17.2	1	0.00
Refinery gas	10^4t	0.86	8.10	1.00	0.97			10.93	46055	15.7	1	289,779.75
Sum												**5,442,950**
Total												**406,286,055.41**

Source：China Energy Statistical Yearbook, 2007 Edition

From the above table and formulae, we can get: λ_{Coal}=98.54%, λ_{Oil}=0.124%, λ_{Gas} =1.34%.

Table A3 - 9 Emission factor and the efficiency level of the best technology commercially available in China's power grid for each fuel type coal, oil and gas

Power type by Fuel	Variable	Fuel Supply Intensity (gce/kWh)	Supply efficiency (%) A	Emission factor (tC/TJ) B	OXID % C	Emission factor (tCO_2e/MWh) D=3.6/A/1000*B*C *44/12
Coal	$EF_{Coal,Adv}$	329.94	37.28%	25.8	100	**0.9135**
Oil	$EF_{Oil,Adv}$	252	48.81%	21.1	100	**0.5706**
Gas	$EF_{Gas,Adv}$	252	48.81%	15.3	100	**0.4138**

Source: Baseline emission factor of China grid determined by the China's DNA on July 18, 2008.

Table A3 - 10 Proportion λ of the solid, liquid, gas fuel emission out of the thermal emission in CCPG and the equivalent emission factor $EF_{Thermal}$ for thermal power capacity, 2006

λ_{Coal}	λ_{Oil}	λ_{Gas}	$EF_{Thermal}$(tCO_2e/MWh) = (λ_{Coal}* $EF_{Coal,Adv}$+λ_{Oil}* $EF_{Oil,Adv}$+λ_{Gas}* $EF_{Gas,Adv}$)
98.54%	0.124%	1.340%	98.54%*0.9135+0.124%*0.5706+1.340%*0.4138 0.9064

$$EF_{Thermal} = \lambda_{coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9064(tCO_2 / MWh)$$

Table A3 - 11 Installed Capacity of the CCPG in 2006

Installed Capacity	unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal
Thermal	MW	6568	32603	11623	10715	5594	9555	76658
Hydro	MW	3288	2553	8521	8648	1979	17730	42719
Nuclear	MW	0	0	0	0	0	0	0
Wind & others	MW	0	106	0	0	0	0	106
Total	MW	9856	35262	20144	19363	7573	27285	119483

Source: China Electric Power Yearbook, 2007 Edition, in which Hubei does not cover the power capacity of the Three Gorge Hydro power

Table A3 - 12 Installed Capacity of the CCPG in 2005

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal
Thermal	MW	5906	26267.8	9526.3	7211.6	3759.5	7496	60167.2
Hydro	MW	3019	2539.9	8088.9	7905.1	1892.7	14959.6	38405.2
Nuclear	MW	0	0	0	0	0	0	0
Wind & others	MW	0	0	0	0	24	0	24
Total	MW	8925	28807.7	17615.2	15116.7	5676.2	22455.6	98596.4

Source: China Electric Power Yearbook 2006, in which Hubei does not cover the power capacity of the Three Gorge Hydro power

Table A3 - 13 Installed Capacity of the CCPG in 2004

Installed Capacity	unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal
Thermal	MW	5496	21788.5	9590.3	6779.5	3271.1	6900.3	53825.7
Hydro	MW	2549.9	2438	7415.1	7448.2	1407.9	13382.9	34642
Nuclear	MW	0	0	0	0	0	0	0
Wind & others	MW	0	0	0	0	0	0	0
Total	MW	8045.9	24226.5	17005.4	14227.7	4679	20283.2	88467.7

Source: China Electric Power Yearbook 2005

Table A3 - 14 BM calculation of the CCPG in 2006

Unit: MW	Installed Capacity in 2004	Installed Capacity in 2005	Installed Capacity in 2006	Newly Installed Capacity 04-06	Newly Installed Capacity 04-06/06 total Capacity (%)	Newly Installed Capacity 05-06	Newly Installed Capacity 05-06/06 total Capacity (%)
	A	B	C	D=(C-A)	E=(C-A)/C	F=(C-B)	G=(C-B)/C
Thermal	53825.7	60167.2	76658	22832.3	29.78%	16490.8	21.51%
Hydro	34642	38405.2	42719	8077	18.91%	4313.8	10.10%
Nuclear	0	0	0	0		0	
Wind	0	24	106	106	100.00%	82	
Total	88467.7	98596.4	119483	31015.3	25.96%	20886.6	17.48%
In the sample group m consisting of newly built capacities in 2005-2006 for BM calculation, the ratio of newly built thermal capacity to the total capacity in group m = $CAP_{thermal}/CAP_{total}$ =				78.95%	Thus sample group m for BM calculation is formed, consisting of those newly built capacity during 2005-2006 that constitute 20% of total capacity of the CCPG in 2006		

Data source: China Electric Power Yearbook 2005, 2006 and 2007 Edition

$\therefore\ EF_{BM,y} = (Cap_{Thermal}/Cap_{Total}) \times EF_{Thermal} = 78.95\% \times 0.9064 =$ 0.715639 tCO_2/MWh

Table A3－8 (CH4) Data sheet for Weight Factors λ_k calculation for upstream fugitive CH_4 emissions associated with the solid, liquid, gas fuel consumption in CCPG in 2006

Fuel Type		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	NCV, kJ/kg or kJ/m^3	EF_{CH4} (tCH_4/TJ)	Upstream CH_4 Emissions (tCH_4)
	Unit	A	B	C	D	E	F	G=A+…+F	H	I	K=G*H*I*/100
Raw Coal	10^4t	1926.02	8098.01	3179.79	2454.48	1184.30	3285.22	20127.82	20908	0.64	2,693,327.75
Clean Coal	10^4t					5.79		5.79	26344	0.64	976.20
Other washed coal	10^4t	4.51	104.12		8.59	79.21		196.43	8363	0.64	10,513.56
Xing Coke	10^4t						0.01	0.01	20980	0	0.00
Coke	10^4t		17.23		0.32			17.55	28435	0	0.00
Sum	**2,704,818**										
Crude oil	10^4t		0.49					0.49	41816	0.0041	0.84
Gasoline	10^4t		0.01					0.01	43070	0.0041	0.02
Kerosene	10^4t							0	43070	0.0041	0.00
Diesel	10^4t	0.91	2.23	1.41	1.78	0.96		7.29	42652	0.0041	12.75
Fuel oil	10^4t	0.51	1.26	1.31	0.80	0.57	3.49	7.94	41816	0.0041	13.61
Oth.Petro.Product	10^4t							0	38369	0.0041	0.00
Oth. Coke product	10^4t						0.01	0.01	28435	0	0.00
Sum											**27**
Natural gas	10^7m^3			2.80		1.60	186.30	190.7	38931	0.296	21,975.46
Coke Oven Gas	10^7m^3		5.20	10.70	42.40	3.80	0.10	62.2	16726	0	0.00
Other coal gas	10^7m^3	126.90	39.50	0.00	17.00	43.60	0.10	227.1	5227	0	0.00
LPG	10^4t							0	50179	0.0041	0.00
Refinery gas	10^4t	0.86	8.10	1.00	0.97			10.93	46055	0	0.00
Sum											**21975**
Total	**2,726,820.19**										

Source：China Energy Statistical Yearbook, 2007 Edition, From the above table and λ_k definition formulae, we can get:

$\lambda_{Coal,CH4}$ = 99.19%, $\lambda_{oil,CH4}$ = 0.001% and $\lambda_{gas,CH4}$ = 0.806%

A3 - 9(CH4) Emission factor of upstream fugitive CH_4 emissions associated with the efficiency level of the best technology commercially available in China's power grid by fuel types

	Variable	Fuel Intensity (gce/kWh)	Conversion Efficiency (%)	EF_{CH4} (tCH_4/TJ)	Emission Factor (tCH_4/MWh)
			A	B	D=3.6/A/1000*B
Coal power	$EF_{Coal,Adv,CH4}$	329.94	37.28%	0.64	**0.00618**
Gas power	$EF_{Oil,Adv,CH4}$	252	48.81%	0.0041	**0.00003**
Oil power	$EF_{Gas,Adv,CH4}$	252	48.81%	0.296	0.00218

Source: Baseline emission factor of China grid determined by the China's DNA on July 18, 2008.

Table A3 - 10 (CH4) Weight Factors λ i calculation for upstream fugitive CH4 emissions by the solid, liquid and gas fuel types and the weighted average upstream fugitive CH4 emissions factor for the thermal power in CCPG, 2006

$\lambda_{coal,CH4}$=	$\lambda_{Oil,CH4}$	$\lambda_{Gas,CH4}$	$EF_{Thermal}$(tCH_4/MWh) = ($\lambda_{Coal,CH4}$* $EF_{Coal,Adv,CH4}$+$\lambda_{Oil,CH4}$* $EF_{Oil,Adv,CH4}$ +$\lambda_{Gas,CH4}$* $EF_{Gas,Adv,CH4}$)
99.19%	0.001%	0.806%	0.0061480

$EF_{Thermal,Upstream,\ CH4} = \lambda_{Coal,CH4} \times EF_{Coal,Adv,CH4} + \lambda_{Oil,CH4} \times EF_{Oil,Adv,CH4} + \lambda_{Gas,CH4} \times EF_{Gas,Adv,CH4}$ 0.0061480

$\therefore\ EF_{BL,upstream,CH4} = (Cap_{Thermal}/Cap_{Total}) \times EF_{Thermal,Upstream,CH4} = 78.954\% \times 0.0061480 =$ 0.0048541 tCH_4/MWh

Annex 4

MONITORING PLAN

The calibration of meters & metering, the QA/QC procedure and others of the monitoring plan should be carried out with reference to the Power Purchase Agreement of the Project, the Parallel Operation Agreement of the Project and the checking and testing standard and the specification of the monitoring equipments. No other additional information.