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

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SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Sulige Natural Gas based Power Generation Project
Version number of the document: 05
Date: 01/12/2007

A.2. Description of the project activity:

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Sulige Natural Gas based Power Generation Project (hereafter referred to as the Project) is sited within Dabuchake Town[1], Wushen Banner, Erdos City, Inner Mongolia Autonomous Region, P.R.China. The Project is a peak regulation power plant including installation of two sets of 175 MW air-cooling gas-steam combined cycle power generation equipments which use natural gas to generate electricity. Annual consumption of natural gas by the Project is 247.8 million Nm^3. It is estimated that the feed-in electricity to the North China Grid from the Project is approximately 1,196 GWh per year via two 220 kV outlet circuits.

The Project satisfies the national energy policy that requires adjusting and optimizing energy mix, enhancing energy security and achieving diversified energy supply. The Project will not only supply low-carbon electricity by means of utilization of natural gas, but also contribute to sustainable development of the local community, the host country and the world by means of:

- reducing GHG emissions compared to a business-as-usual scenario;
- compared with coal-fired power plant which installs desulphurizing equipment and has a commensurate scale to the Project, the Project can reduce water consumption for about 67%, and reduce emissions of 509 tons of SO_2, 3,876 tons of NO_X, 148 tons of CO, 221 tons of total suspending particle and 81.0 thousand tons of ash per year[2];
- improving reliability and safety of power supply in local grid as a peak regulation power plant;
- promoting and strengthening transfer of gas-steam combined cycle power generation technology and knowledge;
- Creating employment opportunities during construction of the Project and creating 100 positions for local people during operation of the Project.

The approval letter on the Feasibility Study Report and the EIA report were issued by the end of 2004. At the same time, CDM consultation agreement was signed by the project owner. Then, the Project started construction on April 18th, 2005.

A.3. Project participants:

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Project participants to the project activity are the following:

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1 The Dabuchake Town has been incorporated with the Galutu Town in 2006. (http://www.ordosagri.gov.cn/news/about.asp?id=4731).
2 *Environmental Cost Analysis of Power Plant*, Lu Hua, Zhou Hao, Environmental Protection, 2004.4.

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)	Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia (Project owner)	No
Japan	Chubu Electric Power Co., Inc.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

>>
The Host Country is the People's Republic of China.

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

>>
Inner Mongolia Autonomous Region

A.4.1.3. City/Town/Community etc:

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Dabuchake Town, Wushen Banner, Erdos City

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

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The Project is sited within Dabuchake Town, Wushen Banner, Erdos City, Inner Mongolia Autonomous Region, P.R.China. It is 6 km southwest to the downtown of Dabuchake Town and 0.8 km to the Wu-Tao Road from Wushen Banner to Taoli Town.

Wushen Banner is located in the central area of Inner Mongolia Autonomous Region, southeast to the downtown of Erdos City, neighbored to Yulin City in southeast, neighbored to Etuokeqian Banner and Etuoke Banner in west and neighbored to Hangjin Banner and Yijinhuoluo Banner in north. Dabuchake Town is located in the central area of Wushen Banner, 480 km south to Huhehaote City. The Project has geographical coordinates with east longitude of 108º50'25″ and north latitude of 38º36' 10″. Figure 1 is a map showing the location of the Project.

Figure 1. Map showing the location of the Project

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

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This category would fall within sectoral scope 1: energy industries (non-renewable energy).

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

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The Project includes the installation of two sets of 175 MW gas-steam combined cycle power generation equipments. Annual consumption of natural gas by the Project is 247.8 million Nm^3. It is estimated that the feed-in electricity to the North China Grid from the Project is approximately 1,196 GWh per year via two 220 kV outlet circuits.

The gas generation technology adopted by the Project is from GE of United States and Brush of United Kingdom. The implementation of the Project will promote technology transfer from abroad of advanced gas-steam combined cycle power generation technology. Key technical indicators of the key equipments used in the Project are illustrated in Table 1.

Table 1. Key technical indicators of the key equipments of the Project

	Equipment	Type	Manufacture
1	Gas turbine	PG9171E, air-cooling	GE, United States
2	Gas turbine generator	QFR-135-2, air-cooling, (GE and Brush technology)	Nanjing Turbine and Electric Machinery (Group) Co., Ltd.
3	Steam turbine	LZN60-5.7/0.58	
4	Steam turbine generator	QFW-60-2, air-cooling	

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

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Renewable crediting period (7yrs×3) is adopted by the Project. It is expected that the project activities will generate emission reductions for about 593,981 tCO_2e per year over the first 7-year crediting period from Sep., 15th 2007 to Sep., 14th 2014.

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Sep., to Dec., 2007	173,244
2008	593,981
2009	593,981
2010	593,981
2011	593,981
2012	593,981
2013	593,981
Jan., to Sep., 2014	420,737
Total estimated reductions (tonnes of CO_2e)	**4,157,867**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	593,981

A.4.5. Public funding of the project activity:

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There is no public funding from Annex I Parties for this Project.

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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AM0029.ver 01 –Approved baseline methodology AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and approved monitoring methodology AM0029 "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel".

ACM0002.ver 06 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources".

The *Tool for the Demonstration and Assessment of Additionality* ver 02[3].

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

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Approved baseline methodology AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and approved monitoring methodology AM0029 "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel" are applicable to the Project for all conditions were satisfied by the Project. Detailed analysis is listed as follows:

• *Condition: The project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant*[4].
Analysis: The project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant and no other fuel besides natural gas is used in the Project.

• *Condition: The geographical/ physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available.*
Analysis: Electricity generated by the Project will be supplied to the North China Grid. With reference to the *Notification on Determining Baseline Emission Factor of China's Grid* issued by Chinese DNA on December 15th, 2006 on http://cdm.ccchina.gov.cn, the geographical/ physical boundaries of the North China Grid can be clearly identified and information pertaining to the grid and used to estimate baseline emissions is publicly available.

• *Condition: Natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity*[5].

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3 Since *Tool for the Demonstration and Assessment of Additionality* ver 03 does not include Step 5 which is required by methodology AM0029, consider of the similarities between *Tool ver 02* and *Tool ver 03*, *Tool ver 02* is applied for the Project.
4 Natural gas should be the primary fuel. Small amounts of other startup or auxiliary fuels should be used, but can comprise no more than 1% of total fuel use.
5 In some situations, there could be price-inelastic supply constraints (e.g. limited resources without possibility of expansion during the crediting period) that could mean that a project activity displaces natural gas that would otherwise be used elsewhere in an economy, thus leading to possible leakage. Hence, it is important for the project proponent to document that supply limitations will not result in significant leakage as indicated here.

Analysis: Natural gas required by the Project is adequately available at the project site, the main reason is that natural gas can be sufficiently provided and future capacity additions of national gas based power generation are limited. The Project is located in Wushen Banner of Erdos City. The gas field of Erdos Basin is the largest terrestrial world-level gas field found in China up to now with a recoverable reserve reaching 608.073 billion m^3. Being an important component of the gas field of Erdos Basin, Wushen Banner has four world-level large and super large natural gas fields each having a recoverable reserve of more than 100 billion m^3. Erdos City and Wushen Banner can provide about 3.6 billion m^3 natural gas per year for natural gas projects, among which 0.8 billion m^3/year are committed to be wholly supplied for power generation[6], far more than the natural gas of 0.25 billion m^3/year required by the Project. In the meanwhile, although Erdos City is planning to construct a 1800 MW natural gas power generation project[7], and supply of 3.6 billion m^3 natural gas per year is adequate to meet the requirement of the plan, the fact that the bus-bar tariff is too low and the price of natural gas is increasing[8] has hindered the development progress of natural gas power generation project. To sum up, future capacity additions of natural gas power generation project with a commensurate scale to the Project will not be restricted due to the utilization of natural gas by the Project.

The Project fulfils all the applicable conditions of methodology AM0029, therefore methodology AM0029 is applied to the Project to determine baseline scenario, estimate emission reductions and draft monitoring plan.

According to methodology AM0029, the emission factor of baseline grid electricity displaced by net electricity supply of the Project is calculated as per ACM0002, the additionality of the Project is demonstrated and assessed by using the *Tool for the Demonstration and Assessment of Additionality* ver 02 approved by CDM EB.

Data and information used in the PDD of the Project are mainly from *the Feasibility Study Report* of the Project, methodology AM0029, *Report on the Analysis Data of Component of Natural gas*[9], *the Notification on Determining Baseline Emission Factor of China's Grid*[10], *China Energy Statistical Yearbook*, *China Electric Power Yearbook* and *IPCC Guidelines for National Greenhouse Gas Inventories*.

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

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According to methodology AM0029, the spatial extent of the project boundary includes the project site and all power plants connected physically to the North China Grid as defined in ACM0002.

The greenhouse gases included in or excluded from the project boundary are shown in Table 2.

6 *Reply Letter to Application of Erdos City Government to Grant Wushen Banner Natural Gas Preferential Price and Quotas* (Shiyoujihan[2003]102) and *Letter by Erdos City Government to Apply for Preferential Natural Gas Price and Quotas for Wushen Banner* (Wuzhenghan [2004]16).

7 *Agreement to Cooperate on Developing Natural Gas Power Generation Project in Erdos City* signed by Erdos City Government and Innermongolia Electricity (Group) Company Limited.

8 *Minutes on implementing the notice by NDRC of reforming the natural gas producer price formation mechanism and appropriately increasing the natural gas producer price and Opinions of Innermongolia Gas Power Generation Company Limited on Implementing the New Natural Gas Price.*

9 Provided by Geology Research Institute of the First Gas Extractor of Changqing Gas Field of PetroChina Company Limited.

10 Issued by Chinese DNA on October 17th, 2006 on http://cdm.ccchina.gov.cn.

Table 2. Overview of emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation of those fossil fuel-fired power plants connected into the North China Grid	CO_2	Yes	Main emission sources.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project activity	On-site fuel combustion due to the project activity	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

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

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According to methodology AM0029, project participants shall use the following steps to define the baseline scenario:

1. Identify plausible baseline scenarios

The identification of alternative baseline scenarios should include all possible realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity (including the proposed project activity without CDM benefits).

Relevant power plant technologies that have recently been constructed

The Project is located in Inner Mongolia Autonomous Region. According to the *China Electric Power Yearbook*, installed capacity of different power generation technologies in Inner Mongolia Autonomous Region in 2004 is summarized in Table 3 below.

Table 3. Installed Capacity in Inner Mongolia Autonomous Region in 2004

	Installed capacity
Thermal power (MW)	13641.5
Hydro power (MW)	567.9
Nuclear power (MW)	0
Wind power and others (MW)	111.7
Total (MW)	14321.2

It can be seen from Table 3 that “relevant power plant technologies that have recently been constructed” in Inner Mongolia Autonomous Region include fossil fuel fired power, hydropower and wind power and others.

Relevant power plant technologies that are under construction or are being planned

In the “*Eleventh-five” Year Plan for Energy Industry of Inner Mongolia Autonomous Region*[11] which provides guidance on the energy industry for 2006~2010, only the construction of coal fired power plants, wind power, solar power plants and biomass power plants are mentioned.

11 Http://www.xlgl.gov.cn/zwgk/jhgh/jhgh_sywgh/zzq115/200705/t20070524_11308.html.

Based on the *2004~2010 Power Plant Construction Plan of Inner Mongolia Autonomous Region* drafted by the Inner Mongolia Electric Power (Group) Co., Ltd., power plants that are under construction or are being planned in Inner Mongolia Autonomous Region besides the Project are all coal fired power plants with unit capacity of 150 MW, 200 MW, 300 MW or 600 MW. All of these projects are invested by the power plant investors within the Inner Mongolia Autonomous Region.

According to the *Directive Catalog on Industry Structure Adjustment* (2005 Edition), Degree No. 40 of NDRC (Dec. of 2005), "except for small grids in Tibet, Xinjiang, Hainan, etc., construction of conventional coal fired generators with a unit installed capacity less than 300 MW is restricted". Therefore, coal fired power plants with unit capacity less than 300 MW are excluded from plausible alternatives.

As per methodology AM0029, based on the summarization and analysis above, all relevant power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in the official power expansion plans) are included as plausible alternatives as listed below.
Alternative a: The project activity not implemented as a CDM project;
Alternative b: Power generation using natural gas, but technologies other than that used by the project activity, including simple cycle gas turbine power plant and single cycle steam turbine power plant;
Alternative c: Power generation technologies using energy sources other than natural gas, including sub critical coal-fired power plant and super critical coal-fired power plant, oil based power generation technology and renewable power generation technology;
Alternative d: Import of electricity from the North China Grid, including the possibility of new interconnections.

As per methodology AM0029, these alternatives need not consist solely of power plants of the same capacity, load factor and operational characteristics (i.e. several smaller plants, or the share of a larger plant may be a reasonable alternative to the project activity), however they should deliver similar services (e.g. peak regulation power plant vs. base load power plant). Therefore, analysis on the four alternatives is made from the perspective of resource, technology and delivery of similar services as follows:

For Alternative a, the project activity not implemented as a CDM project is plausible baseline scenario.

For Alternative b, power generation using natural gas, but technologies other than that used by the project activity, including simple cycle gas turbine power plant and single cycle steam turbine power plant) is not feasible for the following reasons:

• Since the temperature of exhausted waste gas is relatively high when single cycle gas turbine power generation technology is adopted, waste heat in exhausted waste gas is generally recovered by install waste recovery boiler to produce steam for power generation or heat supply. Furthermore, there is no large-scale single cycle natural gas turbine power generation project operated or under construction in China[12]. Therefore, it is not practical to adopt the natural gas combustion turbine single cycle power generation technology as the baseline.
• The heat efficiency of single cycle natural gas steam turbine power generation technology is relatively low, which is only about 38%, this technology is rarely used now[13]. Therefore, adopting the natural gas steam turbine single cycle power generation technology as the baseline is not practical.

(As a new added evidence, descriptions referred in Chinese and English are all provided as one PDF document attached to this response)
12 Http://www.ntet.net.cn/html/UploadFile/2005620164910134.doc.
13 Http://www.hdrqw.com/news/20060505-31.htm.

For Alternative c, power generation technologies using energy sources other than natural gas, including sub critical coal-fired power plant and super critical coal-fired power plant, oil based power generation technology and renewable power generation technology is partly feasible, detailed analyses are listed as follows:

• According to China's regulations on electricity industry, fuel-fired power plants with a unit installed capacity of 135 MW or below are prohibited for construction in the areas covered by the large grids[14], and except for small grids in Tibet, Xinjiang, Hainan, etc., construction of conventional coal-fired generators with a unit installed capacity less than 300 MW is restricted[15]. Therefore, according to the generator capacity commonly used in China now, sub critical coal-fuel fired power generation technology with the unit installed capacity of 300 MW and 600 MW, and supercritical power generation technology with the unit installed capacity of 600 MW are selected to consider as baseline alternatives.

• Given the similarities between oil-based power project and gas-based power project in terms of peak regulation functions, oil-based gas steam combined cycle power generation technology with the same installed capacity as the Project is considered as baseline alternative.

• The Project is a power plant having a yearly peak regulation function, as a result renewable resource power generation technology in Alternative C is applicable only to hydropower projects with a yearly regulation capability. Since there is only Wanjiazhai Hydropower Project in the Inner Mongolia Power Grid has a yearly regulation capability which is under CDM development[16], renewable resource power generation technology in Alternative C is not feasible.

For Alternative d, import of electricity from the North China Grid, is feasible. Since the Project is a peak regulation power plant, import of electricity from new interconnections to undertake the function of peak regulation is not feasible. Since Alternative d could not undertake the function of peak regulation as the Project, it is not feasible.

To summarize, the possible alternatives that provide outputs or services comparable with the proposed CDM project activity include:
Alternative a: The project activity not implemented as a CDM project;
Alternative c(1): Sub critical coal-fired power plant with a unit capacity of 300 MW and 600 MW;
Alternative c(2): Super critical coal-fired power plant with a unit capacity of 600 MW;
Alternative c(3): oil based gas-steam combined cycle power generation technology.

2. Identify the most economically attractive baseline scenario alternative.

According to methodology AM0029, the most economically attractive baseline scenario alternative is identified using investment analysis. Corresponding financial indicators for all alternatives remaining after step 1 should be calculated using the levelized cost of electricity generation in US$[17]/kWh as financial indicator for investment analysis.

According to the *International Comparisons of Electricity Generation by Types & Costs*[18] written by Nathan Ilten, The formula applied to calculate the levelised electricity generation cost (EGC) is the

14 Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135mw or below issued by the General Office of the State Council, decree no. 2002-6.
15 Directive Catalog on Industry Structure Adjustment (2005 Edition), Degree No. 40 of NDRC (Dec. of 2005).
16 Http://www.hjtzgs.com/hjoa/email/upfile/2006168363674813.doc.
17 Use 7.76 as exchange rate for USD/RMB in the PDD.
18 http://people.cs.uchicago.edu/~nilten/docs/final.pdf#search='International%20Comparisons%20of%20Electricity%20Generation%20by%20Types%20%26%20Costs'.

following:

$$EGC = \frac{\sum_t \left[(I_t + M_t + F_t)((1+r)^{-t}) \right]}{\sum_t \left[E_t (1+r)^{-t} \right]} \qquad (1)$$

where,

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

The relevant assumptions and parameters for Alternative a, Alternative c(1), Alternative c(2) and Alternative c(3) are listed in Table 4. And the results of the levelised electricity generation cost (EGC) are listed in Table 5.

Table 4. Parameters for the levelised electricity generation cost (EGC) for each alternative

Item	Unit	Alternative a	Alternative c(1)	Alternative c(2)	Alternative c(3)
Investment expenditure	US$/kW	495.74	466.88 (600 MW of unit capacity) 462.50 (300 MW of unit capacity)	545.75	393.81
Construction period	Years	2	3	3	1
Technical lifetime (Operation period)	Years	20	30	30	20
O&M Expenditure					
Material Expenditure	US$/MWh	0.9021	0.9021	0.9652	0.9021
Other O&M Expenditure	US$/MWh	1.5464[19]	1.9330	1.7513	1.5464[20]
Water Expenditure	US$/MWh	0	0.1289	0.0309	0
Desulfuration Expenditure	US$/MWh	0	0.1933	0.1972	0
Employee	Person/MW	0.33	0.38	0.3	0.33
Per capita manpower cost	US$/year	3866	3866	3866	3866
Rate for overhaul[21]	%	2.5	2.5	2.5	2.5
Energy Consumption for power generation[22]	-	0.20229 Nm^3/kWh	320 gCe/kWh (600 MW of unit capacity) 330 gCe/kWh (300 MW of unit capacity)	299 gCe/kWh	180 g/kWh
NCV of fuel[23]	-	35.42858 MJ/Nm^3	29271.2 MJ/tCe	29271.2 MJ/tCe	41816 MJ/t
Energy efficiency[24]	%	50.23	38.43% (600 MW of unit capacity) 37.23% (300 MW of unit capacity)	41.13%	47.83%
Fuel cost[25]	-	0.0837	34.1495 US$/t	34.1495 US$/t	347.9381 US$/t

19 Not including overhaul fees, wage and welfare.
20 Not including overhaul fees, wage and welfare.
21 Yang Xuzhong, Economic Evaluation of Electric Engineering and Tariff 1st Edition, P131, China Electric Publishing House, 2003.
22 Http://www.ccchina.gov.cn/source/fa/fa2002082803.html, the research report of *Impact of 2% Appreciation of RMB on Key Electricity Enterprises* supplied by United Securities, http://www.nanfangdaily.com.cn/southnews/sjjj/200609280667.asp.
23 The data of NCV of natural gas are provided by the natural gas supplier. The data of NCV of standard coal equivalent (Ce) and oil are obtained from the *China Energy Statistical Yearbook*. The conversion factor is adopted as 1 kcal = 4.1816 kJ (http://www.hntj.gov.cn/tjabc/tjjz/200704030061.htm).
24 Calculated based on the data of NCV of fuel and the data of energy consumption for power generation.
25 Http://www.b2btielu.com/news/qthq/2006-3/16/6253.asp (anthracite coal near coal mines), http://www.mm9mm.com/oil/lube/2006-01-13/17942.html and the *Natural Gas Purchase Agreement* of the Project.

		US$/Nm^3			
Load factor	-	0.40	0.63	0.65	0.40

Table 5. Results of the levelised electricity generation cost (EGC) for each alternative

Item	Unit	Alternative a	Alternative c(1)	Alternative c(2)	Alternative c(3)
EGC	US$/kWh	0.03784	0.0246 (600 MW of unit capacity) 0.0248 (300 MW of unit capacity)	0.0250	0.0797

Taking the load factor and fuel cost as the uncertainty factors, sensitivity analysis is made on levelised cost of electricity generation, and the calculation results are listed in Table 6.

Table 6. Sensitivity analysis of the levelised electricity generation cost (EGC)
for each alternative (US$/kWh)

Item	Unit	Alternative a	Alternative c(1)	Alternative c(2)	Alternative c(3)
Load factor	+10%	0.03616	0.02365 (600 MW of unit capacity) 0.02389 (300 MW of unit capacity)	0.02389	0.07839
Load factor	-10%	0.03990	0.02576 (600 MW of unit capacity) 0.02601 (300 MW of unit capacity)	0.02628	0.08134
Fuel cost	+10%	0.03954	0.02568 (600 MW of unit capacity) 0.02597 (300MW of unit capacity)	0.02599	0.08598
Fuel cost	-10%	0.03615	0.02351 (600MW of unit capacity) 0.02371 (300MW of unit capacity)	0.02394	0.07345

According to methodology AM0029, the baseline alternatives with the best financial indicator, i.e. the lowest levelised cost, can be pre selected as the most plausible scenario. It can be drawn from Table 5 and Table 6 that the 600 MW sub critical coal-fired power plant is the most plausible scenario with the lowest levelised cost. The sensitivity analysis in Table 6 confirms and supports that the 600 MW sub critical coal-fired power plant remains the least levelised cost alternatives within reasonable variations in the critical assumptions. As confirmed by the Inner Mongolia Electric Power (Group) Co., Ltd., a coal fired power plant with a 600 MW sub critical coal fired unit would be built to provide comparable service in the absence of the project activity.[26] Therefore, the 600 MW sub critical coal fired power plant is identified as the baseline scenario of the Project.

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

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According to methodology AM0029, the assessment of additionality comprises the following steps:

Step 1: Benchmark investment analysis

According to methodology AM0029, the step will demonstrate that the proposed CDM project activity is unlikely to be financially attractive by applying sub-steps 2b (Option III: Apply benchmark analysis), Sub-step 2c (Calculation and comparison of financial indicators), and 2d (Sensitivity Analysis) of the *Tool for the Demonstration and Assessment of Additionality* approved by the CDM Executive Board.

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26 Certification provided by the Inner Mongolia Electric Power (Group) Co., Ltd.

According to the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects,* the financial benchmark rate of return (after tax) adopted by the Project is 8% for the IRR of total investment. On the basis of the above benchmark, calculation and comparison of financial indicators are carried out.

Basic parameters for calculation of financial indicators of the Project are listed in Table 7.

Table 7. Basic parameters for calculation of financial indicators of the Project

Item	Value	Remark	Data source
power generation	1225	GWh	FSR13-5
auxiliary electricity consumption rate	2.39%		FSR13-5
construction period	1	year	FSR13-4
operation period	20	year	FSR13-5
bus-bar tariff (not including VAT)	0.03304	US$/kWh	Adjustment of Power Price of North China Grid Notice (2006-1228), NDRC
total investment	173.509	Million US$	Calculated as sum of “value of fixed assets” and “fluid capital”
value of fixed assets	170.812	Million US$	FSR approval
fixed assets investment	165.331	Million US$	FSR approval
interest during construction	5.481	Million US$	Calculated as the difference of “value of fixed assets” and “fixed assets investment”
fluid capital	2.697	Million US$	FSR13-80
equity of value of fixed assets	20%		FSR13-1
fluid capital loan	70%		FSR13-81
loan for value of fixed assets	80%		FSR13-1
interest of long-term loan	5.76%		FSR13-1
interest of fluid capital loan	5.31%		FSR13-1
repayment period (not including 1 year of construction)	7	year	FSR13-1
formation rate of fixed assets	95%		FSR13-86
depreciation period	15	year	FSR13-86
residual value	5%		FSR13-86
rate of amortization	5%		FSR13-86
amortization period	5	year	FSR13-86
VAT	17%		FSR13-5
income tax	33%		FSR13-5
urban maintenance and construction tax	5%		FSR13-90
surtax for education	3%		FSR13-90
natural gas consumption	202.29	Nm^3/MWh	FSR13-5
natural gas price	0.0837	US$/$Nm^3$	Natural gas purchase agreement[27]
rate for maintenance fee	2.5%		FSR13-5

27 Also defined in the *Letter by Erdos City Government to Apply for Preferential Natural Gas Price and Quotas for Wushen Banner* (Wuzhenghan (2004)16), dated on Feb. 12th, 2004, Wushenqi Government.

staff	100	person	FSR13-5
salary	3866	US$/person/year	FSR13-5
rate of employee welfare	56%		FSR13-5
materials cost	0.9021	US$/MWh	FSR13-5
other cost	1.5464	US$/MWh	FSR13-5

In accordance with the benchmark analysis (Option III), if the financial indicators (such as IRR of total investment) of the Project are lower than the benchmark, the Project is not considered as financially attractive. According to the calculation based on the above data, without CERs sales revenues, the IRR of total investment of the Project is 1.66%, far below the benchmark (8%). Thus the Project is not financially attractive.

For the project, the following financial parameters were taken as uncertainty factors for sensitivity analysis of financial attractiveness:
- Total investment
- Annual O&M cost
- Natural gas price

The impacts of the fluctuation of total investment, annual O&M cost and natural gas price on IRR of total investment of the Project were analyzed. The results of sensitivity analysis of the three indicators are shown in Table 8 and Figure 2.

Table 8. Sensitivity analysis of financial indicators of the Project
(IRR of total investment, without CERs sales revenues)

Parameter \ Range	-10%	0	+10%
Total investment (%)	2.99	1.66	0.48
Annual O&M cost (%)	2.30	1.66	0.98
Natural gas price (%)	3.34	1.66	-0.21

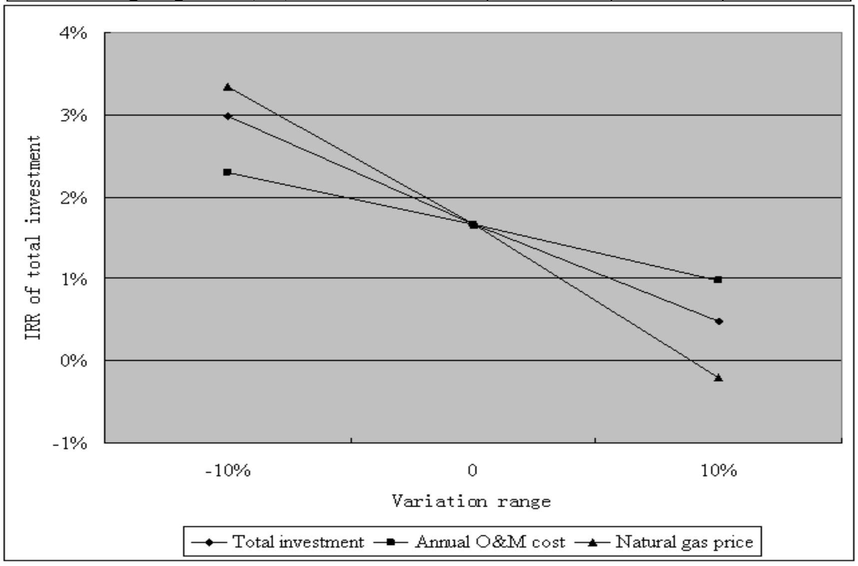

Figure 2. IRR of total investment sensitivity to different financial parameters of the Project
(without CERs sales revenues)

As shown in the sensitivity analysis, even the variation range of the uncertainty factors reaches 10%, the IRR of total investment of the Project keep far below the benchmark and the additionality of the Project would not be influenced. Therefore, the variation of uncertainty factors will not influence the additionality of the Project.

Step 2: Common practice analysis.

According to methodology AM0029, this step will demonstrate that the project activity is not a common practice in the relevant country and sector by applying Step 4 (common practice Analysis) of the *Tool for the Demonstration and Assessment of Additionality* agreed by the CDM Executive Board.

Sub-step 2a. Analyze other activities similar to the project activity:
The only natural gas power generation project with a commensurate scale to the Project which has been constructed and put into operation in North China is the Phase I project of Jingfeng Thermal Power Plant.

Sub-step 2b. Discuss any similar options that are occurring:
The Phase I project of Jingfeng Thermal Power Plant is one of the cases of *The Study on the Methodology and its Application of Clean Development Mechanism in China* (*WB NSS Study Project*) which is not common practice[28].

After completion of construction, the Project will become the first natural gas based gas steam combined cycle power project in Inner Mongolia Autonomous Region. Although the Project is the Phase I of 1800 MW natural gas power generation project planned by Wushen Banner, due to the too low bus-bar tariff and increasing natural gas as well as the absence of preferential policy support, it is very difficult to invest in new natural gas power generation project at the Project site[29]. Therefore, the Project is not a common practice.

Step 3: Impact of CDM registration

According to methodology AM0029, this step will describe the impact of the registration of the project activity by applying Step 5 (Impact of CDM registration) of the *Tool for the Demonstration and Assessment of Additionality* agreed by the CDM Executive Board.

When deciding to invest in the Project, the Project owner has aware that the Project is financially unattractive due to its poor financial indicators[30] and has consider of CERs sales revenues. During construction period of the Project, financial indicators of the Project drastically deteriorate due to the increasing of natural gas price and unavailable of referential tariff. If the Project can be successfully registered as a CDM project, the following impacts will result:

- strengthen investors confident by guarantee the loan payback, supplement the bus-bar tariff of the Project and improve the financial indicators of the Project;
- The project owner can apply for subsidy, preferential bus-bar tariff and preferential tax policy by means of the clean and environmental protection image as well as the international influence associated with CDM project in order to further improve the financial indicators of the Project.

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28 *Clean Development Mechanism in China* published by Tsinghua Press in 2004.
29 *Minutes on implementing the notice by NDRC of reforming the natural gas tariff determination mechanism and appropriately increasing the natural gas tariff* and *Idea of Sulige Fuel Gas Power Generation Co., Ltd of Inner Mongolia on implementing new natural gas price.*
30 *Feasibility Study Report* of the Project.

Considering of the CERs sales revenues (calculated on the assumption that CERs price is EURO 10/tCO_2e [31]), the IRR of total investment of the Project will be significantly improved, as shown in Table 9.

Table 9. Comparison of IRR of total investment of the Project with and without CERs sales revenues

	Without CERs sales revenues	**Consider of CERs sales revenues**
IRR of total investment(%)	1.66	8.04

Without CERs sales revenues, the IRR of total investment of the Project is far below the benchmark while considering of the CERs sales revenues, the IRR of total investment of the Project will be significantly improved to reach the benchmark. Therefore the Project satisfies the requirement of additionality.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The methodology AM0029 is applied in the context of the Project in the following four steps:

- First, calculate the baseline GHG emissions;
- Second, calculate the project GHG emissions;
- Third, calculate the project leakage;
- Fourth, calculate the emission reductions.

I. Calculate the baseline GHG emissions

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline CO_2 emission factor ($EF_{BL,CO2,y}$), as follows:

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

In order to address this uncertainty in a conservative manner, project participants shall use for $EF_{BL,CO2,y}$ the lowest emission factor among the following three options:

Option 1. The build margin, calculated according to ACM0002; and

Option 2. The combined margin, calculated according to ACM0002, using a 50/50 OM/BM weight.

Option 3. The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above, and calculated as follows:

$$EF_{BL,CO2}(tCO2/MWh) = \frac{COEF_{BL}}{\eta_{BL}} * 3.6GJ/MWh \qquad (3)$$

where,

$COEF_{BL}$: the fuel emission coefficient (tCO_2e/tCe), based on national average fuel data, if available, otherwise IPCC defaults can be used

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

Option 1. The build margin, calculated according to ACM0002

31 Use 10 as exchange rate for EURO/RMB.

Calculate the Build Margin Emission Factor ($EF_{BM,y}$) according to the consolidated baseline methodology ACM0002 using equation (4):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (4)$$

where:

$F_{i,m,y}$ is the amount of fuel i (tCe) consumed by relevant power source m in year(s) y,

$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/tCe), taking into account the carbon content of the fuels used by relevant power source m and the percent oxidation of the fuel in year(s) y, and

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

Option 1, calculate the Build Margin emission factor ($EF_{BM,y}$) ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission was selected for the Project.

According to the consolidated baseline methodology ACM0002, the sample group m consists of either (1) the five power plants that have been built most recently, or (2) the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. It is suggested that the sample group that comprises the larger annual generation should be used.

Consider of data availability, EB accepts the following deviation in application of methodology[32]:
1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor use the efficiency level of the best technology commercially available in China.

Since data of installed capacities can not be separated to coal based, oil based and gas based at present, BM is calculated with following steps and formula:

Step a. Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (5)$$

32 Http://cdm.unfccc.int/Projects/Deviations.

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \tag{6}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \tag{7}$$

where:

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

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/tCe), taking into account the carbon content of the fuels used by power plant j and the percent oxidation of the fuel in year(s) y, and

COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

Step b. Calculate emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \tag{8}$$

Where $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are emission factor proxies of efficiency level of the best coal-fired, oil-based and gas-based power generation technology commercially available in China.

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \tag{9}$$

Where CAP_{Total} is total capacity additions while $CAP_{Thermal}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2000 to 2005 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*[33].

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the weighted average fuel consumption for power generation of 11 sets of 600 MW sub-critical coal-fired power generators built in 2004 (336.66 gCe/kWh) and the 200 MW oil/gas based combined cycle power generators (268.13 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid* issued by Chinese DNA on December 15th, 2006 on http://cdm.ccchina.gov.cn, the build margin emission factor

33 To be conservative, emission factor is calculated separately with Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories and IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Since the result from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories is lower thus conservative, it is used for the Project. Detail of comparison of the results is provided in Annex 3.

($EF_{BM,y}$) of the North China Grid is calculated as 0.9066 tCO_2e/MWh (see Annex 3 for details).

Option 2. The combined margin, calculated according to ACM0002, using a 50/50 OM/BM weight

The baseline emission factor (EF_y) is calculated as a combined margin (CM) of $EF_{OM,y}$ and $EF_{BM,y}$.

According to the consolidated methodology ACM0002, calculate the Operating Margin Emission Factor(s) ($EF_{OM,y}$) based on one of the four following methods:

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

Each method is analyzed as below.

Method (a) Simple OM

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount of grid generating output 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. Among the total electricity generations of the North China Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 1.13% in 2000, 0.85% in 2001, 0.89% in 2002, 0.86% in 2003 and 0.76% in 2004, all less than 50%. Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin ($EF_{OM,y}$) for the Project.

Method (b) Simple adjusted OM

The application of simple adjusted OM method requires annual load duration curve of the grid. The power sector in China is in a transitional period of "separating the plant operation from the grid operation", resulting in the detailed data of dispatch and fuel consumption are often taken as confidential business information by the grid company and the power plants. Therefore those data are not publicly available. In most cases, it is difficult for the CDM projects in China to adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$). Similarly, the Project can not adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$) due to unavailability of the dispatch data of the North China Grid.

Method (c) Dispatch data analysis OM

Dispatch data analysis OM method should be the first choice if the dispatch data are available, because the method can truly reflect the substitutable relationship between the amount of electricity output from power plants of the baseline grid and that from the Project activity and the emission reductions generated. However, Method (c) cannot be adopted for the Project because of unavailability of the dispatch data of the North China Grid, similar reason as method (b).

Method (d) Average OM

Method (d) can only be used when 1) low-cost/must run resources constitute more than 50% of total amount of grid electricity output and 2) detailed data required by applying method (b) and method (c) is unavailable. Among the total electricity generations of the North China Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 1.13% in 2000, 0.85% in 2001, 0.89% in 2002, 0.86% in 2003 and 0.76% in 2004, all less than 50%, all less than 50%. Therefore method (d) cannot be applied to the Project.

In conclusion, Method (a) Simple OM is the only reasonable and feasible method among the four methods for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the Project. With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, Method (a) Simple OM is adopted for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the Project.

In accordance with the consolidated baseline methodology ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated with formula (10)

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (10)$$

where:

$F_{i,j,y}$ is the total amount of fuel i (in a mass or volume unit) consumed by province j in year(s) y,

$COEF_{i,j,y}$ is the total amount the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by province j and the oxidation rate of the fuel in year(s) y, and

$GEN_{j,y}$ is the electricity output (MWh) supplied to the grid by province j.

The CO_2 emission coefficient $COEF_i$ is then obtained from equation (11) as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad (11)$$

where:

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

$OXID_i$ is the oxidation factor of the fuel i, and

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The data on electricity generation and auxiliary electricity consumption are obtained from the *China Electric Power Yearbook* from 1998 to 2005 (published annually). The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2000 to 2005 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*[34].

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34 To be conservative, emission factor is calculated separately with Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories and IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Since the result from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories is lower thus conservative, it is used for the Project. Detail of comparison of the results is provided in Annex 3.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid* issued by Chinese DNA on December 15th, 2006 on http://cdm.ccchina.gov.cn, the Simple OM emission factor ($EF_{OM,y}$) of the North China Grid is calculated as 1.0585 tCO_2e/MWh (see Annex 3 for details).

As described above, the build margin emission factor ($EF_{BM,y}$) of the North China Grid is calculated as 0.9066 tCO_2e/MWh. Based on the consolidated baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated as the weighted average of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$), as

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \qquad (12)$$

According to the consolidated baseline methodology ACM0002, both the weight w_{OM} and the weight w_{BM} take 0.50 as default. Therefore the combined baseline emission factor EF_y=0.5×1.0585+0.5×0.9066=0.98255 (tCO_2e/MWh).

Option 3. The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above

As described in Section B5, the 600 MW sub critical coal-fired plant has been identified as the most likely baseline, then emission coefficients of coal can be calculated with formula (3) provided above. Based on the reality of the Project, formula (13) can be translated into the following one:

$$EF_{BL,CO2} = COEF_{BL} \times \frac{PGCC_{BL}}{1-e} \times \frac{44}{12} \qquad (13)$$

where:

$COEF_{BL}$: is the emission coefficient of coal in tCO_2e/tCe, calculated with formula (11).

$PGCC_{BL}$: is the power generation standard coal equivalent consumption of the most likely baseline technology identified in previous step, 600 MW sub critical coal-fired plant in the PDD, in tCe/MWh.

e : is the auxiliary electricity consumption of the 600 MW sub critical coal-fired plant.

The average auxiliary electricity consumption of the coal-fired power plant in Inner Mongolia Power Grid from 2002 to 2004 is calculated as the value of e. The emission factor of the 600 MW sub critical coal-fired plant is calculated ex ante as 0.9397 tCO_2e/MWh.

$$EF_{BL,CO2} = NCV_{coal} \cdot EF_{CO2,coal} \cdot OXID_{coal} \times \frac{PGCC_{BL}}{1-e} \times \frac{44}{12} = 0.029271 \times 25.8 \times 0.98 \times \frac{0.32}{1\text{-}7.59\%} \times \frac{44}{12}$$

$$= 0.9397 \ (tCO_2e/MWh)$$

The value of the build margin emission factor ($EF_{BM,y}$) of the North China Grid is the lowest of the three options, therefore the baseline emission factor ($EF_{BL,CO2,y}$) for the Project is 0.9066 tCO_2e/MWh.

II. Calculate the project GHG emissions

According to methodology AM0029, the project activity is on-site combustion of natural gas to generate electricity. Since there is no auxiliary fuel used in the Project besides natural gas, the project GHG emissions are those emissions from on-site combustion of natural gas. The CO_2 emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = FC_{NG,y} * COEF_{NG,y} \quad (14)$$

where:

$FC_{NG,y}$: is the total volume of natural gas combusted in the project plant (m^3) in year(s) 'y';

$COEF_{NG,y}$: is the CO_2 emission coefficient (tCO_2/m^3) in year(s) for natural gas and is obtained as:

$$COEF_{NG,y} = NCV_{NG,y} * EF_{CO2,NG,y} * OXID_{NG} \quad (14a)$$

where:

$NCV_{NG,y}$: is the net calorific value (energy content) per volume unit of natural gas in year 'y' (GJ/m^3) as determined from the fuel supplier, wherever possible;

$EF_{CO2,NG,y}$: is the CO_2 emission factor per unit of energy of natural gas in year 'y' (tCO_2/GJ);

$OXID_{NG}$: is the oxidation factor of natural gas.

For the Project, the net calorific value (energy content) per volume unit of natural gas in year 'y' (GJ/m^3) is obtained by the natural gas supplier and other parameters are obtained from the IPCC Guidelines for National Greenhouse Gas Inventories.

III. Calculate the project leakage

Natural gas used in the Project is not LNG. According to methodology AM0029, leakage emission (LE_y) sources considered in the Project) includes the fugitive CH4 emissions ($LE_{CH4,y}$) associated with fuel extraction, processing, transportation and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.

For the purpose of estimating fugitive CH4 emissions, project participants should multiply the quantity of natural gas consumed by the project in year y with an emission factor for fugitive CH4 emissions ($EF_{NG,upstream,CH4}$) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the project activity, as follows:

$$LE_{CH4,y} = \left\lfloor FC_y \cdot NCV_y \cdot EF_{NG,upstream,CH4} - EG_{PJ,y} \cdot EF_{BL,upstream,CH4} \right\rfloor \cdot GWP_{CH4} \quad (15)$$

where:

$LE_{CH4,y}$ is the leakage emissions due to fugitive upstream CH_4 emissions in the year y in t CO_2e;

FC_y is the quantity of natural gas combusted in the project plant during the year *y* in m^3;

$NCV_{NG,y}$ is the average net calorific value of the natural gas combusted during the year *y* in GJ/m^3;

$EF_{NG,upstream,CH4}$ is the emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, in t CH_4 per GJ fuel supplied to final consumers;

$EG_{PJ,y}$ is the electricity generation in the project plant during the year in MWh;

$EF_{BL,upstream,CH4}$ is the emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 per MWh electricity generation in the project plant;

GWP_{CH4} is the global warming potential of methane valid for the relevant commitment period.

The emission factor for fugitive upstream emissions for natural gas ($EF_{NG,upstream,CH4}$) include fugitive emissions from production, processing, transport and distribution of natural gas, is obtained from Table 2 "other oil exporting countries / rest of world" provided in methodology AM0029.

According to methodology AM0029, the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the project activity ($EF_{NG,upstream,CH4}$) should be calculated consistent with the baseline emission factor ($EF_{BL,CO2,y}$) used above.

Since Option 1 (the build margin, calculated according to ACM0002) is selected for the calculation of the baseline emission factor, relevant emission factor for upstream fugitive CH_4 emissions ($EF_{BL,upstream,CH4}$) is calculated as follows:

$$EF_{BL,upstream,CH4} = \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream,CH4}}{\sum_j EG_j} \qquad (16)$$

where:

$EF_{BL,upstream,CH4}$ is the emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 per MWh electricity generation in the project plant;
j is the plants included in the build margin;
$FF_{j,k}$ is the quantity of fuel type *k* (a coal or oil type) combusted in power plant j included in the build margin;
$EF_{k,upstream,CH4}$ is the emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or oil type) in t CH_4 per MJ fuel produced;
EG_j is the electricity generation in the plant j included in the build margin in MWh/yr;

The emission factor for fugitive upstream emissions for coal ($EF_{k,upstream,CH4}$) include fugitive emissions from underground coal production, is obtained from Table 2 provided in methodology AM0029.

In China, it is very difficult to obtain the data of the plant j. Therefore, according to the deviation in application of methodology AM0005[35] approved by CDM EB, recent 20% capacity additions of the North China Grid during 2001~2004[36] were used for estimating the Build Margin emission factor for grid electricity and the 600 MW sub-critical coal-fired power generator was used as the proxy of efficiency level of the best technology in China[37]. Based on these data, formula (16) can be conservatively converted into formula (17) [38]:

$$EF_{BL,upstream,CH4} = \varphi_{coal} \times PGCC_{coal,best} \times EF_{coal,upstream,CH4} \times \frac{NCV_{coal}}{NCV_{Rawcoal}} \qquad (17)$$

where,

35 Http://cdm.unfccc.int/Projects/Deviations.
36 Capacity additions during 2001~2004 are greater than and most close to 20% of the electricity system. See Annex 3 for details.
37 Http://www.ccchina.gov.cn/source/fa/fa2002082803.html.
38 The conservativeness of such switch has been demonstrated in Annex 3.

φ_{coal} is the share of coal-fired generation in BM generation (0.9888, see Annex 3 for details).
$PGCC_{coal,best}$ is the power generation standard coal equivalent consumption of the 600 MW sub critical coal-fired generation technology within the grid boundary.
$NCV_{Rawcoal}$ is the net caloric value of raw coal which is used for power generation in GJ/tCe[39].

Since all natural gas used in the Project are from local area and no natural gas imported from other countries is used in the Project, upstream emissions occurring in Annex I countries that have ratified the Kyoto Protocol are not necessary to be excluded.

Since the total net leakage effects are negative ($LE_y < 0$), project participants assume $LE_y = 0$ for the Project (see Section B.3 for details).

IV. Calculate the emission reductions

To calculate the emission reductions the project participant shall apply the following equation:

$$ER_y = BE_y - PE_y - L_y \quad (18)$$

where:

ER_y is the emissions reductions of the project activity during the year y (tCO_2e),

BE_y is the baseline emissions due to displacement of electricity during the year y (tCO_2e),

PE_y is the project emissions during the year y (tCO_2e),

L_y is the leakage in year y (tCO_2e).

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

Data / Parameter:	$F_{i,j,y}$
Data unit:	mass or volume unit
Description:	total amount of fuel i consumed by province j in year y
Source of data used:	*China Energy Statistical Yearbook* (see Annex 3 for details)
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Energy Statistical Yearbook* is reliable.
Any comment:	-

Data / Parameter:	-
Data unit:	MWh
Description:	electricity generated by province j in year y
Source of data used:	*China Power Electric Yearbook* (see Annex 3 for details)

39 As per the data on P365 of China Energy Statistics (2005 edition), caloric value of raw coal is 5000 kcal/kg and that of standard coal is 7000 kcal/kg.

Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Power Electric Yearbook* is reliable.
Any comment:	For calculation of electricity output to the grid by province j in year y.

Data / Parameter:	-
Data unit:	%
Description:	Auxiliary electricity consumption rate of province j in year y
Source of data used:	*China Power Electric Yearbook* (see Annex 3 for details)
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Power Electric Yearbook* is reliable.
Any comment:	For calculation of electricity output to the grid by province j in year y.

Data / Parameter:	NCV_i
Data unit:	MJ/t or 1000 m^3
Description:	net calorific value of fuel i
Source of data used:	*China Energy Statistical Yearbook* (see Annex 3 for details)
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Energy Statistical Yearbook* is reliable.
Any comment:	-

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	oxidation factor of the fuel i
Source of data used:	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: workbook*
Value applied:	99.5% for gas fuel, 99% for liquid fuel and 98% for solid fuel
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* is reliable.
Any comment:	-

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tC/TJ
Description:	CO_2 emission factor of the fuel i
Source of data used:	*Revised 1996 Guideline for National Greenhouse Gas Inventories* (see Annex 3 for details)
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *Revised 1996 IPCC Guideline for National Greenhouse Gas Inventories* is reliable.
Any comment:	-

Data / Parameter:	-
Data unit:	-
Description:	Fuel consumption per kWh electricity supplied to grid of best technology commercially available in China
Source of data used:	http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1051.pdf
Value applied:	See Annex 3 for detail
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the China's DNA is reliable.
Any comment:	-

Data / Parameter:	-
Data unit:	tCe/t
Description:	Conversion factor from physical unit to standard coal equivalent
Source of data used:	P365 of *China Energy Statistical Yearbook* (2005 edition)
Value applied:	0.7143
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Energy Statistical Yearbook* is reliable.
Any comment:	-

Data / Parameter:	$PGCC_{BL}$
Data unit:	gCe/kWh
Description:	the power generation standard coal equivalent consumption of the most likely baseline technology identified in previous step, 600 MW sub critical coal-fired plant in the PDD
Source of data used:	http://www.ccchina.gov.cn/source/fa/fa2002082803.html
Value applied:	320
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is obtained from official web site of China's DNA. The data source is reliable.
Any comment:	-

Data / Parameter:	e
Data unit:	%
Description:	Baseline scenario: the auxiliary electricity consumption of the 600 MW sub critical coal-fired plant.
Source of data used:	*China Electric Power Yearbook 2003, P591; China Electric Power Yearbook 2004, P670; China Electric Power Yearbook 2005, P472.*
Value applied:	7.59%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average auxiliary electricity consumption of the coal-fired power plant in Inner Mongolia Power Grid from 2002 to 2004 is calculated as the value of e
Any comment:	=(7.93%+ 7.66%+ 7.17%)/3

Data / Parameter:	$EF_{NG,upstream,CH4}$
Data unit:	tCH_4/PJ
Description:	the emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, in t CH_4 per GJ fuel supplied to final consumers
Source of data used:	"Other oil exporting countries / rest of world" provided in Table 2 of methodology AM0029.
Value applied:	296
Justification of the choice of data or description of measurement methods and procedures actually applied :	Consider of data availability, use defaults provided by methodology AM0029.
Any comment:	-

Data / Parameter:	$EF_{coal,upstream,CH4}$
Data unit:	tCH_4/kt
Description:	the emission factor for fugitive upstream emissions for coal
Source of data used:	"Underground coal production" provided in Table 2 of methodology AM0029
Value applied:	13.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Consider of data availability, use defaults provided by methodology AM0029.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

>>

I. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

According to formula (2), the annual baseline emission of the Project is 1,084,042 tCO_2e as calculated in table below.

Item	$EG_{PJ,y}$ **(MWh/yr)**	$EF_{BL,CO2,y}$ **(tCO_2e/MWh)**	BE_y **(tCO_2e/yr)**
I.D.	A	B	C
Data	1,195,723	0.9066	1,084,042
Data source or calculation formula	FSR13-5	the *Notification on Determining Baseline Emission Factor of China's Grid*	C=A×B

II. Estimated project activity emissions:

According to formula (14) and formula (14a), the annual emission of the Project activities is 490,061 tCO_2e as calculated in table below.

Item	$FC_{f,y}$ **(Nm^3/yr)**	$NCV_{f,y}$ **(MJ/Nm^3)**	$COEF_{f,y}$ **(tC/TJ)**	$OXID_f$	PE_y **(tCO_2e/yr)**
I.D.	D	E	F	G	H
Data	247,805,250	35.42858	15.3	0.995	490,061
Data source or calculation formula	FSR13-5	Natural gas supplier	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*	H= D×E×F×G×44/12/10^6

III. Estimated project leakage:

According to formula (17), the emission factor for fugitive upstream emissions for the Project is estimated as 0.005936 tCH_4/MWh as shown in table below.

Item	φ_{coal}	$PGCC_{best}$ **(gCe/kWh)**	$EF_{coal,upstream,CH4}$ **(tCH4/kt)**	$\frac{NCV_{coal}}{NCV_{Rawcoal}}$	$EF_{BL,upstream,CH4}$ **(tCH4/MWh)**
I.D.	I	J	K	L	M
Data	0.9888	320	13.4	1.4	0.005936
Data source or calculation formula	See Annex 3 for details	China's DNA	AM0029	*China Energy Statistical Yearbook* 2005 edition, P365	M=I×J×K×L/10^6

According to formula (15), the annual total net leakage effects for the Project is estimated as -98,130 tCO_2e as shown in table below.

Item	$EF_{NG,upstream,CH4}$ **(tCH4/PJ)**	**Auxiliary electricity consumption of the Project (%)**	GWP_{CH4} **(tCO2e/tCH4)**	$LE_{CH4,y}$ **(tCO2e/yr)**
I.D.	N	O	P	Q
Data	296	2.39	21	-98,130
Data source or calculation formula	AM0029	*Feasibility Study Report* of the Project	IPCC default	Q=[D×E×N/10^9-A/(1-O)×M]×P

Since the total net leakage effects are negative ($LE_y < 0$), project participants assume $LE_y = 0$ for the Project.

IV. Estimated emission reductions

According to formula (18), the annual emission reductions of the Project are estimated as 593,981 tCO_2e as shown in table below.

Item	BE_y **(tCO2e/yr)**	PE_y **(tCO2e/yr)**	$LE_{CH4,y}$ **(tCO2e/yr)**	ER_y **(tCO2e/yr)**
I.D.	C	H	R	S
Data	1,084,042	490,061	0	593,981
Data source or calculation formula	C=A×B	H= D×E×F×G×44/12/10^6	AM0029	S=C-H-R

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

>>

Renewable crediting period (7yrs×3) is adopted by the Project. It is expected that the project activities will generate emission reductions for about 593,981 tCO_2e per year over the first 7-year crediting period from Sep., 15th 2007 to Sep., 14th 2014.

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Sep., to Dec., 2007	142,934	316,179	0	173,244
2008	490,061	1,084,042	0	593,981
2009	490,061	1,084,042	0	593,981
2010	490,061	1,084,042	0	593,981
2011	490,061	1,084,042	0	593,981
2012	490,061	1,084,042	0	593,981
2013	490,061	1,084,042	0	593,981
Jan., to Sep., 2014	347,127	767,863	0	420,737
Total (tCO_2e)	**3,430,427**	**7,588,294**	**0**	**4,157,867**

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	the electricity delivered to the grid by the Project
Source of data to be used:	Data in the PDD is obtained from FSR and real data will be obtained based on measurement.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,195,723
Description of measurement methods and procedures to be applied:	Measured continuously by ammeters and monthly recording by the project owner
QA/QC procedures to be applied:	Sales receipts/records to the grid are used to ensure the consistency.
Any comment:	Bi-direction ammeters with precision of 0.2s are employed by the Project, whose reading is net electricity delivered to grid, therefore, there is no need to monitor the auxiliary electricity consumption.

Data / Parameter:	$F_{i,m,y}$
Data unit:	mass or volume unit
Description:	total amount of fuel i consumed by province m in year y
Source of data used:	*China Energy Statistical Yearbook* (see Annex 3 for details)
Value applied:	(see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Energy Statistical Yearbook* is reliable. Update the data with the latest public available edition of the *China Energy Statistical Yearbook.*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	-
Data unit:	MWh
Description:	electricity generated by province m in year y
Source of data used:	*China Power Electric Yearbook* (see Annex 3 for details)
Value applied:	(see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Power Electric Yearbook* is reliable. Update the data with the latest public available edition of the *China Power Electric Yearbook.*
QA/QC procedures to be applied:	-
Any comment:	For calculation of electricity output to the grid by province m in year y.

Data / Parameter:	-
Data unit:	%
Description:	Auxiliary electricity consumption rate of province m in year y
Source of data used:	*China Power Electric Yearbook* (see Annex 3 for details)
Value applied:	(see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Power Electric Yearbook* is reliable. Update the data with the latest public available edition of the *China Power Electric Yearbook.*
QA/QC procedures to be applied:	-
Any comment:	For calculation of electricity output to the grid by province m in year y.

Data / Parameter:	NCV_i

Data unit:	MJ/t or 1000 m^3
Description:	net calorific value of fuel i
Source of data used:	*China Energy Statistical Yearbook* (see Annex 3 for details)
Value applied:	(see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *China Energy Statistical Yearbook* is reliable. Update the data with the latest public available edition of the *China Energy Statistical Yearbook.*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	oxidation factor of the fuel i
Source of data used:	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: workbook*
Value applied:	99.5% for gas fuel, 99% for liquid fuel and 98% for solid fuel
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* is reliable. Update the data with the latest public available edition of the *IPCC Guideline for National Greenhouse Gas Inventories.*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tC/TJ
Description:	CO_2 emission factor of the fuel i
Source of data used:	*IPCC Guideline for National Greenhouse Gas Inventories* (see Annex 3 for details)
Value applied:	(see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *Revised 1996 IPCC Guideline for National Greenhouse Gas Inventories* is reliable. Update the data with the latest public available edition of the *IPCC Guideline for National Greenhouse Gas Inventories.*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	-
Data unit:	-
Description:	Fuel consumption per kWh electricity supplied to grid of best technology commercially available in China
Source of data used:	Data used in the PDD is obtained from http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1051.pdf and the data will be updated with latest reliable data source.
Value applied:	(see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the China's DNA is reliable. Update the data with data obtained from the latest reliable data source.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$FC_{NG,y}$
Data unit:	Nm^3
Description:	the total volume of natural gas combusted in the project plant in year(s) 'y'
Source of data used:	Data in the PDD is obtained from FSR and real data will be obtained based on measurement.
Value applied:	247,805,250
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daily measured continuously by natural gas flow meters and monthly recording by the project owner.
QA/QC procedures to be applied:	The total volume of natural gas combusted in the project plant in year(s) 'y' will be monitored by the natural gas flow meter at the Changqing Gas Field, and double checked against the monitoring results of the natural gas flow meter installed by the supplier at the Gas Pressure Regulating Station. Precision of orifice meter used in the Project is 0.5s. The flow meter will be maintenance and testing in accordance with stipulation of the meter supplier to ensure accuracy. The readings will be double checked by the gas supply company.
Any comment:	-

Data / Parameter:	$FC_{diesel,y}$
Data unit:	t
Description:	the total volume of diesel combusted in the project plant in year(s) 'y' for backup start off
Source of data used:	Data in the PDD is assumed as zero and real data will be obtained based on measurement.
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since the diesel is used as backup fuel for star off, it will be measured continuously by flow meters and monthly recording by the project owner.
QA/QC procedures to be applied:	The total volume of diesel combusted in the project plant in year(s) 'y' will be monitored by flow meter and double checked against the diesel purchase receipts and storage record.
Any comment:	-

Data / Parameter:	$NCV_{NG,y}$
Data unit:	GJ/m^3
Description:	the net calorific value per volume unit of natural gas in year 'y'
Source of data used:	Data in the PDD is obtained from report provided by the natural gas supplier and real data will be obtained from report provided by the natural gas supplier once per two weeks.
Value applied:	0.03542858
Justification of the choice of data or description of measurement methods and procedures actually applied :	HP6890 Gas Chromatogram is adopted by the natural gas supplier to measure the net caloric value of natural gas.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$COEF_y$
Data unit:	tCO_2/m^3
Description:	CO_2 emission coefficient of the Project in year ‘y’
Source of data used:	Calculated under project activity
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	Annually calculated with $NCV_{f,y}$, $OXID_f$ and $EF_{CO2,f}$.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	PE_y
Data unit:	tCO_2
Description:	CO_2 emission of the Project in year ‘y’
Source of data used:	Calculated under project activity
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	Annually calculated with $FC_{f,y}$ and $COEF_y$.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$EG_{gen,y}$
Data unit:	MWh
Description:	The amount of electricity generated by the Project during year y
Source of data used:	Data in the PDD is obtained from FSR and real data will be obtained based on measurement.
Value applied:	1,225,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	Electricity generation will be measured by the ammeters at the outlet of generators and recorded per month.
QA/QC procedures to be applied:	Cross-checked with fuel consumption of the Project.
Any comment:	Used to calculate the auxiliary electricity consumption of the Project with the amount of electricity supplied to the grid.

Data / Parameter:	φ_{coal}
Data unit:	-
Description:	the share of coal-fired generation in BM generation
Source of data used:	*China Electric Power Yearbook*
Value applied:	0.9888
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimate based on data published by *China Electric Power Yearbook*, see Annex 3 for details. Update the data with the latest public available edition of the *China Electric Power Yearbook.*
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

Key content of the monitoring plan for the Project includes monitoring of electricity supplied to the grid, monitoring of baseline emission factor, monitoring of natural gas consumption of the Project, monitoring of net caloric value of natural gas and monitoring of leakage.

1. Management structure

Please refer to Figure 3 for details regarding the management structure of the monitoring plan.

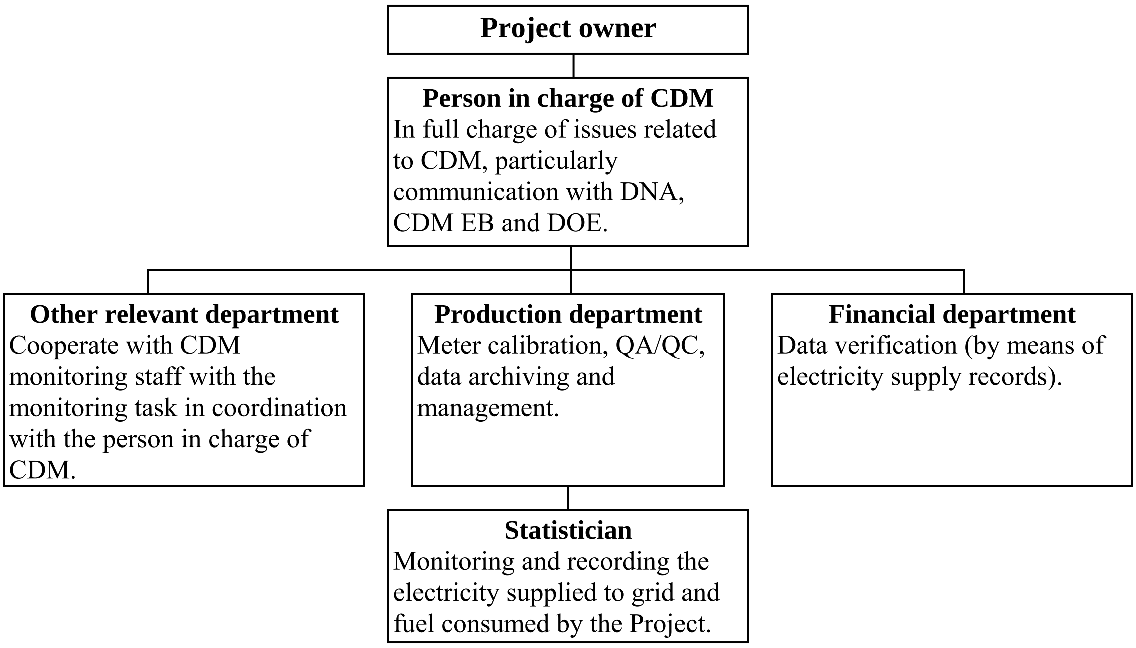

Figure 3. Management Structure of Monitoring Plan

2. Training Plan

The staffs of the Project have been trained in Shenzhen Nanshan Power Station Co., Ltd for 7 month regarding operation and maintenance. Prior to the submission of request for registration, the task of training staff in charge of executing the monitoring plan will be completed, with the training contents including basic concepts and operation modality of CDM, approaches of data monitoring and archiving for CDM projects, quality control and quality assurance of monitoring, and preparation and improvement of key documents of monitoring and verification. Contents and requirements of the training plan should be supplemented, modified and improved according to DOE's requirements.

3. Methods for monitoring

Electricity delivered to the grid by the Project: Electricity delivered to the grid by the Project will be measured by the ammeters installed at the point connecting the Project to the grid system, and cross-checked by the electricity sales receipts provided by the grid into which the Project is connected. The project owner will ensure that reading records of the ammeters are readily available for DOE's verification.

Baseline emission factors: The latest BM emission factor of the North China Grid, made public by China's DNA, is adopted as the baseline emission factors of the Project. If relevant is not available, project participates should calculate based on the latest public statistics.

Consumption of natural gas by the Project: consumption of natural gas will be daily monitored by natural gas flow meters at the inlet of gas turbine, monthly recorded and cross-checked by the monitoring results of the natural gas flow meter installed by the supplier at the endpoint of the gas transmission pipeline of the Project, natural gas metering handover receipt and natural gas purchase record.

NCV of natural gas: supplier of the natural gas for the Project should provide the project plant with the analysis report of caloric value of natural gas at least once per two weeks.

Leakage: as per China Electric Power Yearbook, the most recent 20% new additions to the North China Grid are calculated according to methodology ACM0002; writers of the monitoring report should be in charge of collecting data and determining the standard coal equivalent consumption for power generation using the most advanced commercialized technology and providing the authoritative and reliable sources for DOE's verification.

4. Error disposal procedure

Error disposal procedure for electricity delivered to the grid and natural gas supply will be executed as per stipulations in Power Purchase Agreement, Parallel Operation Agreement and Natural Gas Purchase Agreement.

5. Calibration of Meters & Metering

Calibration of Meters & Metering should be implemented according to relevant national and local standards and rules. And all the records should be documented and maintained by the project owner for DOE's verification.

6. Quality Assurance and Quality Control

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity according to CDM EB rules and real practice. This is an on-going process which will be ensured through the CDM mechanism in terms of the need for verification of the emission reductions on an annual basis according to this PDD.

7. Data Management System

• Specific staff will be appointed by the project owner to take the overall responsibility for monitoring greenhouse gas emission reductions and keeping all the data and information of emission reductions for verification.
• Electronic data and documents, including readings from electric meters connected into the computer central control system, will be regularly copied and archived via optical discs and storage tapes, and kept at least two years after the end of the crediting period.
• Written data and documents, including receipts for cross-checking of data, will be copied and archived with an explanation of the department or company where the original copy is kept, and kept at least two years after the end of the crediting period.

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 study and monitoring methodology of the Project was completed on 01/12/2007 by below parties:

Name/Origination	Project participate Yes/No
Dr. Zheng Zhaoning, Ms. Pan Tao	No
KOE Environmental Consulting, Inc. Ashisutotakebashi Bldg, 2-5, kanda nishikicho Chiyoda-ku, Tokyo, 101-0054, Japan Tel: +86 (10) 5830 1858 Fax: +86 (10) 5830 1856 http://www.koe.net.cn, http://www.cncdm.cn	No

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:

>>
01/01/2007

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

>>
20y-0m

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

C.2.1. Renewable crediting period

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

>>
15/09/2007 or the date after registration

C.2.1.2. Length of the first crediting period:

>>
7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

SECTION D. Environmental impacts

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

>>

The *EIA Report* of the Project was completed by the project owner, and approved by the Inner Mongolia Environmental Protection Agency in Nov., 2004 (Document No. Neihuanzi[2004]425).

The environmental impacts arising from the Project are analyzed respectively for the construction phase and the operation phase.

Construction Phase

Ecological impact

Construction activities of the Project may disturb and impact the growth environment of the vegetation around the construction area, the project owner will make efforts to recover the ecology system within 2~3 years after the completion of the construction.

Noise

Noises generated during the construction stem mainly from the operation of construction machines and vehicles. As the noise sources during the construction are in the open air, calculated as per the sound source attenuation formula, noises located 60 m from the noise source will be at the level below the standard limit of 60 dB(A) for daytime, and noises located 180 m from the noise source will be at the level below the standard limit of 50 dB(A) for night. Noises generated during the construction satisfy the requirements of the *Noise limits for Construction Site* (GB12523-90).

Dust and waste gas

Excavation of foundation, piling up of discarded soil, loading and unloading of raw materials, mixing of concrete and running of vehicles will generate mill dust and off-gas during the construction of the Project. Due to the long distance between the construction site and the residential area, dust and waste gas generated by the Project will have limited impact only on the plant area and have no impact on residential area. The project owner will take some covering measures to prevent the dust in the process of transporting and piling of construction materials easily causing dust, such as sandstone. Dust and waste gas generated by the construction activities of the Project satisfy the requirements of the *Ambient Air Quality Standard* (GB3095-1996).

Waste water

Implementation of construction work such as cleaning the site, laying the pipeline, concocting concrete, installation and construction work will generate production waste water and a small amount of residential waste water. Since the major pollutants in the construction waste water are inorganic suspending particulates and the amount of waste water is small, the production waste water will be used for planting and irrigation together with the residential waste water.

Solid waste

Construction garbage mainly includes building garbage and residential garbage. The building garbage will be collectively piled at the regular places designated by the environment and city construction departments, and the residential garbage will be duly collected and delivered to the landfill site for treatment.

Operation Phase

Ecological impact
The Project will take active water-and-soil conservation measures, making the green area accounting for more than 90% of all the area suitable for planting trees within the responsibility area of the power plant, helping control the situation of water and soil loss and prominently improving the environmental and ecological quality of the power plant responsibility area and the surrounding area. Construction and operation of the Project will optimize the local industry structure, increase local profits and taxes, help the government at the project site reinforce the ecological protection and ecological construction, mitigate pressure of agricultural and livestock production on the environment and ecology, which will have active and profound impacts on improving environmental and ecological quality.

Noise
Particular requirements have been advanced in the process of equipment ordering to the equipment supplier regarding the noise control level of the equipment. In order to control the effect of equipment noises on the environment, the project owner has taken sound insulation and noise reduction measures such as installing all the gas turbines, steam turbines, generators, condensers and other key equipment in the factory house with good sound isolation capacities, installing 25 dB(A) exhaust muffler for boilers, reasonably laying out steam and water pipelines, and so on, according to the evaluation result of the environmental impact prediction. Operation noise of the Project satisfies the requirements of the *Standard of Noise at Boundary of Industrial Enterprises* (GB12348-90).

Waste gas and waste slag
The Project hardly generates SO_2 and particle emissions. Being the first natural gas power plant utilizing dry low-nitrogen burners in China, the Project will emit NO_X resulting in a concentration of 51.25 mg/Nm^3, far lower than the requirement of *Emission Standard of Air Pollutants for Thermal Power Plants* (GB13223-2003) which is 80 mg/Nm^3. Compared with coal-fired power plant which installs desulphurizing equipment and has a commensurate scale to the Project, the Project can reduce water consumption for about 67%, reduce emissions of 509 tons of SO_2, 3,876 tons of NO_X, 148 tons of CO, 221 tons of total suspending particle and 81.0 thousand tons of ash, having significant environmental benefits.

Waste water
Recycled waste water generated in the production process of the Project will be discharged to the chemical water treatment workshop for treatment after which will be reused for recycled water system and make-up water system of boilers. Surplus water will be discharged at a maximum quantity of 85 m^3/h. Major pollutants in the production waste water are total salt content, which will be discharged via drainage pipeline to the billabong of Chahanderisu livestock community which is 5 km away from the power plant for natural evaporation. Measures such as permeability-water-tigter by clay soil or by geotechnical membrane will be taken at the discharge point in order to prevent polluting the ground water. Residential waste water generated by the Project will be discharged at about 7 m^3/h. The residential waste water will be treated with bio-membrane and used for planting. Waste water emission of the Project satisfies the requirements of the *Integrated Wastewater Discharge Standard* (GB8978-1996).

Solid waste
Residential garbage generated during the operation of the Project is about 120 kg/day, which will be piled at regular places and will be delivered together with the small amount of sludge generated in the process of residential waste water treatment to the environmental sanitation department for treatment.

In conclusion, environmental impacts arising from the Project are considered insignificant.

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

>>

The Project use clean high efficiency combined cycle power generation technology to generate electricity whose environmental impact comply with relevant national laws and regulations. Environmental impacts arising from this project are considered insignificant.

SECTION E. Stakeholders' comments

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

>>

In October 2006, assisted by the local government, the project owner carried out a survey of the local residents who might be affected by the Project. The survey was conducted by distributing the questionnaires on a random basis.

Main concern of the questionnaires includes:

- What's the attitude of the stakeholders on the construction and operation of the Project?
- What positive impacts and negative impacts will be introduced by the implementation of the Project from the view of stakeholders?

Comments received through the survey are summarized as follows. The government of Wushen Banner issued a support letter for the Project which is available for DNA and DOE.

E.2. Summary of the comments received:

>>

The survey was conducted through distributing and collecting responses to a questionnaire. Totally 50 questionnaires returned out of 50 with 100% response rate. 47 of the respondents (accounting for 94%) are Mongolia minorities. The basic structure of the respondents is illustrated in Table 10.

Table 10. Structure of the respondents

Structure of gender		
Gender	**Number**	**Percentage (%)**
Male	28	56
Female	21	42
Left blank	1	2

Structure of educational level		
Educational level	**Number**	**Percentage (%)**
Junior college and higher	5	10
Senior high school and technical secondary school	12	24
Junior high school	12	24
Primary school	9	18
Left blank	12	24

Structure of age		
Age	**Number**	**Percentage (%)**
30 and younge r	9	18
31~40	21	42
41~50	7	14
51~60	5	10
Older than 60	8	16

It can be seen that respondents are adequately representative in terms of gender, nationality, age, educational level, etc., and their attitudes towards the impacts of the Project can be a comprehensive reflection of the attitudes of the residents possibly affected by the Project.

- 50 respondents (accounting for 100%) support the Project.
- Respondents consider that positive impacts possibly caused by the construction of the Project include increased employment opportunities (80%), increased income (50%) and improved living standards (46%).
- Respondents are concerned that construction of the Project might cause an increase in natural gas price (2%), a reduction of water supply (2%), and some respondents hope that attention is paid to reducing energy consumption (4%) and reducing pollution (4%) in the process of implementing the Project.

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

>>
Since local price of natural gas is under control of the government, implementation of the Project will not impact the price of natural gas and will not lead to an increase in the price. Air-cooling generators are adopted by the Project, which means that the Project will have little impacts on water supply, thus implementation of the Project will not impact the local water supply[40].

Financial indicators of the Project are extremely poor, so the project owner will strive to reduce energy consumption to reduce the cost of power generation. The Project is classified as a clean and environmental protection project, and the project owner will strictly comply with the national standards in the process of project operation and make great efforts to reduce pollutant emissions.

The residents and local government are all very supportive of the Project therefore there has been no need to modify the Project due to the comments received.

40 *Feasibility Study Report* of the Project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

Annex 3

BASELINE INFORMATION

Data recommended in the *Notification on Determining Baseline Emission Factor of China's Grid* for the North China Grid are adopted for the Project.

The following tables summarise the numerical results from the equations listed in the approved methodology ACM0002 (version 6). The information provided by the tables includes data, data sources and the underlying calculations.

Table A1. Basic statistics of fuel fired power plants of the North China Grid in 2002

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Beijing	17886000	7.95	16464063
Tianjin	27263000	7.08	25332779.6
Hebei	100970000	6.72	94184816
Shanxi	82256000	7.98	75691971.2
Inner Mongolia	51382000	7.93	47307407.4
Shandong	124162000	6.79	115731400.2
Total			374712437.4

Data source: China Electric Power Yearbook 2003.

Table A2. Basic statistics of fuel fired power plants of the North China Grid in 2003

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Beijing	18608000	7.52	17208678
Tianjin	32191000	6.79	30005231
Hebei	108261000	6.5	101224035
Shanxi	93962000	7.69	86736322
Inner Mongolia	65106000	7.66	60118880
Shandong	139547000	6.79	130071759
Total			425364906

Data source: China Electric Power Yearbook 2004.

Table A3. Basic statistics of fuel fired power plants of the North China Grid in 2004

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Beijing	18579000	7.94	17103827
Tianjin	33952000	6.35	31796048
Hebei	124970000	6.5	116846950
Shanxi	104926000	7.7	96846698
Inner Mongolia	80427000	7.17	74660384
Shandong	163918000	7.32	151919202
Total			489173110

Data source: China Electric Power Yearbook 2005.

Table A4-1. Calculation of simple OM emission factor of the North China Grid in 2002 based on IPCC 1996

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+…+F	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m^3) J	Emission[41] (tCO_2e) K
Coal	10^4t	691.84	1052.74	4988.01	4037.4	3218	5162.86	19150.84	25.8	98	20908	371208174.5
Cleaned coal	10^4t	0	0	0	0	0	80.71	80.71	25.8	98	26344	1971179.968
Other washed coal	10^4t	3.43	0	65.2	135.56	0	106.32	310.51	25.8	98	8363	2407436.829
Coke oven gas	10^8m^3	0.17	1.71	0	0.75	0.16	0.04	2.83	13	99.5	16726	224500.0238
Other gas	10^8m^3	15.82	0	7.34	0	10.35	0	33.51	13	99.5	5227	830739.3673
Crude oil	10^4t	0	0	0	0	0	14.98	14.98	20	99	41816	454769.0717
Gasoline	10^4t	0	0	0	0	0	0.65	0.65	18.9	99	43070	19206.87269
Diesel	10^4t	0.26	2.35	4.12	0	1.6	10.02	18.35	20.2	99	42652	573896.3513
Fuel oil	10^4t	13.94	0.04	1.22	0	0.42	20.33	35.95	21.1	99	41816	1151411.233
Refinery gas	10^4t	0	0	0.27	0	0	0	0.27	18.2	99.5	46055	8256.698951
Natural gas	10^8m^3	0	0.55	0	0	0.02	0	0.57	15.3	99.5	38931	123867.2104
Other energy	10^4tCe	0	0	0	0	1.1	15.92	17.02	0	0	0	0

Net electricity import from the Northeast China Grid to the North China Grid (MWh)	2905200
Average emission factor of the Northeast China Grid (tCO2e/MWh)	1.0302474
Total emission of the North China Grid (tCO_2e)	381966513
Fossil power supply of the North China Grid (MWh)	377617637
OM emission factor of the North China Grid (tCO_2e/MWh)	1.0115166

Data sources: China Energy Statistical Yearbook (2000-2002)

41 If the unit of the fuel is 10^4 t, then K=G×H×I×J×44/12/10^4; if the unit of the fuel is 10^8 m^3, then K=G×H×I×J×44/12/10^3. The same about the calculation of K in Table A5 -1 and Table A6-1.

Table A4-2. Calculation of simple OM emission factor of the North China Grid in 2002 based on IPCC 2006

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+…+F	Emission factor ($kgCO_2/TJ$) H	Oxidation rate (%) I	NCV (MJ/t or $1000m^3$) J	Emission[42] (tCO_2e) K
Coal	10^4t	691.84	1052.74	4988.01	4037.4	3218	5162.86	19150.84	94600	100	20908	378783852
Cleaned coal	10^4t	0	0	0	0	0	80.71	80.71	94600	100	26344	2011408
Other washed coal	10^4t	3.43	0	65.2	135.56	0	106.32	310.51	94600	100	8363	2456568
Coke oven gas	10^8m^3	0.17	1.71	0	0.75	0.16	0.04	2.83	44400	100	16726	210166
Other gas	10^8m^3	15.82	0	7.34	0	10.35	0	33.51	44400	100	5227	777696
Crude oil	10^4t	0	0	0	0	0	14.98	14.98	733000	100	41816	459154
Gasoline	10^4t	0	0	0	0	0	0.65	0.65	69300	100	43070	19401
Diesel	10^4t	0.26	2.35	4.12	0	1.6	10.02	18.35	74100	100	42652	579954
Fuel oil	10^4t	13.94	0.04	1.22	0	0.42	20.33	35.95	77400	100	41816	1163543
Refinery gas	10^4t	0	0	0.27	0	0	0	0.27	57600	100	46055	7162
Natural gas	10^8m^3	0	0.55	0	0	0.02	0	0.57	56100	100	38931	124490
Other energy	10^4tCe	0	0	0	0	1.1	15.92	17.02	0	100	0	0

Net electricity import from the Northeast China Grid to the North China Grid (MWh)	2905200
Average emission factor of the Northeast China Grid (tCO2e/MWh)	1.1385021
Total emission of the North China Grid (tCO_2e)	389900970
Fossil power supply of the North China Grid (MWh)	377617637
OM emission factor of the North China Grid (tCO_2e/MWh)	1.0325285

Data sources: China Energy Statistical Yearbook (2000-2002)

42 If the unit of the fuel is 10^4 t, then K=G×H×I×J/10^7; if the unit of the fuel is 10^8 m^3, then K=G×H×I×J/10^6. The same about the calculation of K in Table A5-2 and Table A6-2.

Table A5-1. Calculation of simple OM emission factor of the North China Grid in 2003 based on IPCC 1996

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+…+F	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or $1000m^3$) J	Emission (tCO_2e) K
Coal	10^4t	714.73	1052.74	5482.64	4528.5	3949.32	6808	22535.94	25.8	98	20908	436822883.4
Cleaned coal	10^4t	0	0	0	0	0	9.41	9.41	25.8	98	26344	229820.3878
Other washed coal	10^4t	6.31	0	67.28	208.21	0	450.9	732.7	25.8	98	8363	5680747.688
Coke	10^4t	0	0	0	0	2.8	0	2.8	29.5	98	28435	84397.73393
Coke oven gas	10^8m^3	0.24	1.71	0	0.9	0.21	0.02	3.08	13	99.5	16726	244332.1814
Other gas	10^8m^3	16.92	0	10.63	0	10.32	1.56	39.43	13	99.5	5227	977500.8431
Crude oil	10^4t	0	0	0	0	0	29.68	29.68	20	99	41816	901037.7869
Gasoline	10^4t	0	0	0	0	0	0.01	0.01	18.9	99	43070	295.490349
Diesel	10^4t	0.29	1.35	4	0	2.91	5.4	13.95	20.2	99	42652	436286.327
Fuel oil	10^4t	13.95	0.02	1.11	0	0.65	10.07	25.8	21.1	99	41816	826325.7251
Refinery gas	10^4t	0	0	0.27	0	0	0.83	1.1	18.2	99.5	46055	33638.40313
Natural gas	10^8m^3	0	0.5	0	0	0	1.08	1.58	15.3	99.5	38931	343351.2148
Other energy	10^4tCe	9.83	0	0	0	0	39.21	49.04	0	0	0	0

Net electricity import from the Northeast China Grid to the North China Grid (MWh)	4244380
Average emission factor of the Northeast China Grid (tCO2e/MWh)	1.09603
Total emission of the North China Grid (tCO_2e)	451232602
Fossil power supply of the North China Grid (MWh)	429609286
OM emission factor of the North China Grid (tCO_2e/MWh)	1.0503325

Data sources: China Energy Statistical Yearbook 2004

Table A5-2. Calculation of simple OM emission factor of the North China Grid in 2003 based on IPCC 2006

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+…+F	Emission factor ($kgCO_2$/TJ) H	Oxidation rate (%) I	NCV (MJ/t or $1000m^3$) J	Emission (tCO_2e) K
Coal	10^4t	714.73	1052.74	5482.64	4528.5	3949.32	6808	22535.94	94600	100	20908	445737636
Cleaned coal	10^4t	0	0	0	0	0	9.41	9.41	94600	100	26344	234511
Other washed coal	10^4t	6.31	0	67.28	208.21	0	450.9	732.7	94600	100	8363	5796681
Coke	10^4t	0	0	0	0	2.8	0	2.8	107000	100	28435	85191
Coke oven gas	10^8m^3	0.24	1.71	0	0.9	0.21	0.02	3.08	44400	100	16726	228731
Other gas	10^8m^3	16.92	0	10.63	0	10.32	1.56	39.43	44400	100	5227	915087
Crude oil	10^4t	0	0	0	0	0	29.68	29.68	73300	100	41816	909725
Gasoline	10^4t	0	0	0	0	0	0.01	0.01	69300	100	43070	298
Diesel	10^4t	0.29	1.35	4	0	2.91	5.4	13.95	74100	100	42652	440892
Fuel oil	10^4t	13.95	0.02	1.11	0	0.65	10.07	25.8	77400	100	41816	835032
Refinery gas	10^4t	0	0	0.27	0	0	0.83	1.1	57600	100	46055	29180
Natural gas	10^8m^3	0	0.5	0	0	0	1.08	1.58	56100	100	38931	345077
Other energy	10^4tCe	9.83	0	0	0	0	39.21	49.04	0	100	0	0

Net electricity import from the Northeast China Grid to the North China Grid (MWh)	4244380
Average emission factor of the Northeast China Grid (tCO2e/MWh)	1.13214
Total emission of the North China Grid (tCO_2e)	460363254.8
Fossil power supply of the North China Grid (MWh)	429609286
OM emission factor of the North China Grid (tCO_2e/MWh)	1.071585904

Data sources: China Energy Statistical Yearbook 2004

Table A6-1. Calculation of simple OM emission factor of the North China Grid in 2004 based on IPCC 1996

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+…+F	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m^3) J	Emission (tCO_2e) K
Coal	10^4t	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	25.8	98	20908	527776527.1
Cleaned coal	10^4t	0	0	0	0	0	40	40	25.8	98	26344	976919.8208
Other washed coal	10^4t	6.48	0	101.04	354.17	0	284.22	745.91	25.8	98	8363	5783167.065
Coke	10^4t	0	0	0	0	0.22	0	0.22	29.5	98	28435	6631.250523
Coke oven gas	10^8m^3	0.55	0	0.54	5.32	0.4	8.73	15.54	13	99.5	16726	1232766.915
Other gas	10^8m^3	17.74	0	24.25	8.2	16.47	1.41	68.07	13	99.5	5227	1687509.064
Diesel	10^4t	0.39	0.84	4.66	0	0	0	5.89	20.2	99	42652	184209.7825
Fuel oil	10^4t	14.66	0	0.16	0	0	0	14.82	21.1	99	41816	474656.87
Refinery gas	10^4t	0	0.55	1.42	0	0	0	1.97	18.2	99.5	46055	60243.32197
Natural gas	10^8m^3	0	0.37	0	0.19	0	0	0.56	15.3	99.5	38931	121694.1015
Other energy	10^4tCe	9.41	0	34.64	109.73	4.48	0	158.26	0	0	0	0

Net electricity import from the Northeast China Grid to the North China Grid (MWh)	4514550
Average emission factor of the Northeast China Grid (tCO2e/MWh)	1.22042
Total emission of the North China Grid (tCO_2e)	543813992
Fossil power supply of the North China Grid (MWh)	493687660
OM emission factor of the North China Grid (tCO_2e/MWh)	1.1015345

Data sources: China Energy Statistical Yearbook 2005

Table A6-2. Calculation of simple OM emission factor of the North China Grid in 2004 based on IPCC 2006

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total fuel G=A+B+…+F	Emission factor ($kgCO_2/TJ$) H	Oxidation rate (%) I	NCV (MJ/t or $1000m^3$) J	Emission (tCO_2e) K
Coal	10^4t	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	94600	100	20908	538547477
Cleaned coal	10^4t	0	0	0	0	0	40	40	94600	100	26344	996857
Other washed coal	10^4t	6.48	0	101.04	354.17	0	284.22	745.91	94600	100	8363	5901191
Coke	10^4t	0	0	0	0	0.22	0	0.22	107000	100	28435	6694
Coke oven gas	10^8m^3	0.55	0	0.54	5.32	0.4	8.73	15.54	44400	100	16726	1154054
Other gas	10^8m^3	17.74	0	24.25	8.2	16.47	1.41	68.07	44400	100	5227	1579760
Diesel	10^4t	0.39	0.84	4.66	0	0	0	5.89	69300	100	42652	174096
Fuel oil	10^4t	14.66	0	0.16	0	0	0	14.82	74100	100	41816	459207
Refinery gas	10^4t	0	0.55	1.42	0	0	0	1.97	63100	100	46055	57250
Natural gas	10^8m^3	0	0.37	0	0.19	0	0	0.56	57600	100	38931	125576
Other energy	10^4tCe	9.41	0	34.64	109.73	4.48	0	158.26	0	100	0	0
Net electricity import from the Northeast China Grid to the North China Grid (MWh)					4514550							
Average emission factor of the Northeast China Grid (tCO2e/MWh)					1.17385							
Total emission of the North China Grid (tCO_2e)					554301560							
Fossil power supply of the North China Grid (MWh)					493687660							
OM emission factor of the North China Grid (tCO_2e/MWh)					1.122777831							

Data sources: China Energy Statistical Yearbook 2005

Therefore the operating margin emission factor(s) ($EF_{OM,y}$) of the Project is calculated as 1.0585 tCO_2e/MWh based on IPCC 1996 and calculated as 1.0797 based on IPCC 2006. Of which the operating margin emission factor(s) ($EF_{OM,y}$) of 1.0585 tCO_2e/MWh based on IPCC 1996 is more conservative thus adopted for the Project.

Table A7-1. Data and result of Step a based on IPCC 1996.

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total G=A+B+…+F	Emission factor (tC/TJ) H	Oxidation Rate I	NCV (MJ/t or 1000m^3) J	Emission (tCO_2e) K
Raw coal	10^4t	823.09	1410.00	6299.80	5213.20	8550.00	4932.20	27228.29	25.80	0.98	20908	527,776,527
Cleaned coal	10^4t	0	0	0	0	40．00	0	40	25.80	0.98	26344	976,920
Other washed coal	10^4t	6.48	0	101.04	354.47	284.22	0	745.91	25.80	0.98	8363	5,783,167
Coke	10^4t	0	0	0	0	0	0.22	0.22	29.50	0.98	28435	6,631
Sub-total												**534,543,245**
Diesel	10^4t	0.39	0.84	4.66	0	0	0	5.89	20.20	0.99	42652	184,210
Fuel oil	10^4t	14.66	0	0.16	0	0	0	14.82	21.10	0.99	41816	474,657
Sub-total												**658,867**
Natural gas	10^7m^3	0	3.7	0	1.9	0	0	5.6	15.30	0.995	38931	121,694
Coke oven gas	10^7m^3	5.5	0	5.4	53.2	87.3	4.0	155.4	13.00	0.995	16726	1,232,767
Other gas	10^7m^3	177.4	0	242.5	82.0	14.1	164.7	680.7	13.00	0.995	5227	1,687,509
Refinery gas	10^4t	0	0.55	1.42	0	0	0	1.97	18.20	0.995	46055	60,244
Sub-total												**3,102,214**
Total												**538,304,326**

Data sources: China Energy Statistical Yearbook 2005.

Table A7-2. Data and result of Step a based on IPCC 2006.

Energy	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total G=A+B+…+F	Emission factor ($kgCO_2/TJ$) H	Oxidation Rate (%) I	NCV (MJ/t or $1000m^3$) J	Emission (tCO_2e) K
Raw coal	10^4t	823.09	1410.00	6299.80	5213.20	8550.00	4932.20	27228.29	94600	100	20908	538,547,477
Cleaned coal	10^4t	0	0	0	0	40．00	0	40	94600	100	26344	996,857
Other washed coal	10^4t	6.48	0	101.04	354.47	284.22	0	745.91	94600	100	8363	5,901,191
Coke	10^4t	0	0	0	0	0	0.22	0.22	107000	100	28435	6,694
Sub-total												**545,452,219**
Diesel	10^4t	0.39	0.84	4.66	0	0	0	5.89	69300	100	42652	174,096
Fuel oil	10^4t	14.66	0	0.16	0	0	0	14.82	74100	100	41816	459,207
Sub-total												**633,303**
Natural gas	10^7m^3	0	3.7	0	1.9	0	0	5.6	57600	100	38931	125,576
Coke oven gas	10^7m^3	5.5	0	5.4	53.2	87.3	4.0	155.4	44400	100	16726	1,154,054
Other gas	10^7m^3	177.4	0	242.5	82.0	14.1	164.7	680.7	44400	100	5227	1,579,760
Refinery gas	10^4t	0	0.55	1.42	0	0	0	1.97	63100	100	46055	57,250
Sub-total												**2,916,640**
Total												**549,002,162**

Data sources: China Energy Statistical Yearbook 2005.

Table A8. Emission factor of best technology

	Variable	**Electricity supply efficiency**	**Emission factor of fuel ($kgCO_2/TJ$)**	**Oxidation Rate (%)**	**Emission factor (tCO_2/MWh)**
		A	B	C	$D=3.6/A/10^6*B*C$
Coal-based power plants	$EF_{Coal,Adv}$	36.53%	94600	100	0.9323
Gas-based power plants	$EF_{Gas,Adv}$	45.87%	56100	100	0.4403
Oil-based power plants	$EF_{Oil,Adv}$	45.87%	74100	100	0.5816

Calculate with data provided in Table A7-1 and formula (5)~(7), the value for λ_{Coal} is 99.30%, the value for λ_{Oil} is 0.12% and the value for λ_{Gas} is 0.58%. Therefore $EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =0.9104 tCO_2e/MWh.

Calculate with data provided in Table A7-2 and formula (5)~(7), the value for λ_{Coal} is 99.35%, the value for λ_{Oil} is 0.12% and the value for λ_{Gas} is 0.53%. Therefore $EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =0.9299 tCO_2e/MWh.

Table A9. Installed capacity of the North China Grid in 2004

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro power (MW)	1055.9	5	783.8	787.3	567.9	50.8	3250.7
Wind power and Other (MW)	0	0	13.5	0	111.8	12.4	137.7
Total (MW)	4514.4	6013.5	20730	18480.5	14321.2	32923.6	96983.2

Data source: China Electric Power Yearbook 2005.

Table A10. Installed capacity of the North China Grid in 2002

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3407.5	6245.5	16745.7	14327.8	9778.7	25102.4	75607.6
Hydro power (MW)	1038.5	5	775.9	795.3	592.1	50.8	3257.6
Wind power and Other (MW)	0	0	13.5	0	76.6	0	90.1
Total (MW)	4446	6250.5	17535.1	15123.1	10447.4	25153.1	78955.2

Data source: China Electric Power Yearbook 2003.

Table A11. Installed capacity of the North China Grid in 2001

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3412.5	5632	16474.9	13415.8	8898.3	20957.7	68791.3
Hydro power (MW)	1058.1	5	742.6	795.9	566.2	56.2	3224
Wind power and Other (MW)	0	0	9.9	0	46.7	0	56.6
Total (MW)	4470.6	5637	17227.4	14211.8	9511.2	21013.9	72071.9

Data source: China Electric Power Yearbook 2002.

Table A12. Calculation of BM emission factor of the North China Grid

	Installed capacity in 2001 (MW) A	Installed capacity in 2002 (MW) B	Installed capacity in 2004 (MW) C	Capacity additions from 2001 to 2004 (MW) D=C-A	Share in total capacity additions
Thermal power	68791.3	75607.6	93594.9	24803.6	99.58%
Hydro power	3224	3257.6	3250.7	26.7	0.10%
Wind power and Other	56.6	90.1	137.7	81.1	0.32%
Total	72071.9	78955.2	96983.2	24911.3	100.00%
Share in total installed capacity of 2004	74.31%	81.41%	100%		

Based on IPCC 1996, $EF_{BM,y}$ =0.9104×99.58%=0.9066 tCO_2e/MWh.

Based on IPCC 2006, $EF_{BM,y}$ =0.9299×99.58%=0.9260 tCO_2e/MWh.

Therefore the build margin emission factor(s) ($EF_{BM,y}$) of 0.9066 tCO_2e/MWh based on IPCC 1996 is more conservative thus adopted for the Project.

Table A13. Share of low-cost/must run resources in the North China Grid

	2000	2001	2002	2003	2004
Thermal power (GWh)	771035	289436	324204	382112	440292
Hydro power (GWh)	29294	34999	37835	31982	25556
Wind power and Other (GWh)	2118	2580	5775	15033	22138
Total (GWh)	802448	327015	367813	429127	487986
Share of low-cost/must run resources (%)	4	11	12	11	10

Data source: China Electric Power Yearbook 2001 (P667), 2002 (P617), 2003 (P585), 2004 (P709) and 2005 (P474).

Demonstration of the conservativeness of converting formula (16) into formula (17)

According to Methodology AM0029, in the absence of the project activity, emission factor for upstream fugitive CH_4 emissions ($EF_{NG,upstream,CH4}$) should be calculated consistent with the calculation of the baseline emission factor ($EF_{BL,CO2,y}$). Since Option 1 (calculation of the build margin emission factor according to ACM0002) is adopted to calculate the baseline emission factor, relevant calculation of emission factor for upstream fugitive CH_4 emissions ($EF_{BL,upstream,CH4}$) should be consistent with that used by ACM0002 to calculate the build margin emission factor ($EF_{BM,y}$).

According to ACM0002, the formula to calculate the build margin emission factor ($EF_{BM,y}$) is

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \qquad (A1)$$

Referring to the *Notification on Determining Baseline Emission Factor of China's Grid*, and as per the deviation approved by CDM EB, formula (A1) is converted to the following formula to calculate the Build Margin emission factor ($EF_{BM,y}$):

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \qquad (A2)$$

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \qquad (A3)$$

$$EF_{k,Adv} = PGCC_{k,best} \times EF_k \times \frac{NCV_{coal}}{NCV_k} \qquad (A4)$$

Where:

$PGCC_{k,best}$ is the power generation standard coal consumption of the best technology commercially available for power generation of fuel type k (raw coal, oil or natural gas) fired within the grid boundary(tCe/MWh);

EF_k is the CO2 emission factor of fuel type k (raw coal, oil or natural gas) (tCO_2/t);

NCV_{coal} is the net caloric value of standard coal equivalent (GJ/tce);

NCV_k is the net caloric value of fuel type k (raw coal, oil or natural gas) (GJ/t).

Since calculation of relevant emission factor for upstream fugitive CH4 emissions ($EF_{BL,upstream,CH4}$) is consistent with that of Build Margin emission factor ($EF_{BM,y}$) based on methodology ACM0002, as per the *Notification on Determining Baseline Emission Factor of China's Grid*, formula to calculate emission factor for upstream fugitive CH4 emissions ($EF_{BL,upstream,CH4}$) is converted from formula (16)

$$EF_{BL,upstream,CH4} = \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream,CH4}}{\sum_j EG_j} \qquad (16)$$

into

$$EF_{BL,upstream,CH4y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal,,upstream,CH4} \qquad (A5)$$

$$EF_{Thermal,upstream,CH4} = \lambda_{Coal} \times EF_{Coal,Adv,upstream,CH4} + \lambda_{Oil} \times EF_{Oil,Adv,upstream,CH4} + \lambda_{Gas} \times EF_{Gas,Adv,upstream,CH4} \qquad (A6)$$

$$EF_{k,Adv,upstream,CH4} = PGCC_{k,best} \times EF_{k,upstream,CH4} \times \frac{NCV_{coal}}{NCV_k} \qquad (A7)$$

Where:

$EF_{k,upstream,CH4}$ is the upstream fugitive CH_4 emissions ($EF_{BL,upstream,CH4}$) from power generation by the best technology commercially available for power generation of fuel type k (tCH4/MWh);while definition of other parameters is identical to the above.

Substituting formula (A6) into formula (A5)

$$EF_{BL,upstream,CH4y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times (\lambda_{Coal} \times EF_{Coal,Adv,upstream,CH4} + \lambda_{Oil} \times EF_{Oil,Adv,upstream,CH4} + \lambda_{Gas} \times EF_{Gas,Adv,upstream,CH4})$$

$$> \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal} \times EF_{Coal,Adv,upstream,CH4} \qquad (A8)$$

Substituting formula (A7) into formula (A8)

$$EF_{BL,upstream,CH4y} > \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal} \times PGCC_{coal,best} \times EF_{coal,upstream,CH4} \times \frac{NCV_{coal}}{NCV_{rawcoal}} \qquad (A9)$$

Since the share of coal-fired power generation (φ_{coal})in the recent 20% capacity additions of the grid into which the Project is connected is calculated by the following formula,

$$\varphi_{coal} = \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal} \quad \text{(A10)}$$

Substituting formula (A10) into formula (A9)

$$EF_{BL,upstream,CH4} > \varphi_{coal} \times PGCC_{coal,best} \times EF_{coal,upstream,CH4} \times \frac{NCV_{coal}}{NCV_{Rawcoal}} \quad \text{(A11)}$$

The following is formula (12)

$$EF_{BL,upstream,CH4} = \varphi_{coal} \times PGCC_{coal,best} \times EF_{coal,upstream,CH4} \times \frac{NCV_{coal}}{NCV_{Rawcoal}} \quad \text{(17)}$$

Based on the comparison of formula (A11) and formula (17), it can be seen that calculation by converting formula (16) into formula (17) underestimates the emission factor for upstream fugitive CH_4 emissions and thus the leakage emissions of the baseline scenario. It can be ensured that the result of the emission reduction calculation is conservative.

As per Table A7, λ_{Coal} =99.30%. As per Table A11, $\frac{CAP_{Thermal}}{CAP_{Total}}$ =99.58%. Therefore, $\varphi_{coal} = \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal}$ =99.58%×99.30%=98.88%.

Annex 4

MONITORING INFORMATION

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, Natural Gas Purchase Agreement, Report on the Analysis Data of Component of Natural gas and the checking and testing standard and the specification of the monitoring equipments and no other additional information.

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