Sulige Natural Gas Based Power Generation Project

Monitoring period (Ref. No. 1243)

(21/07/2008~31/12/2008)

(Version 01 finalized on 10/04/2009)

Sulige Fuel Gas Power Generation Co., Ltd.

of Inner Mongolia

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SECTION A. General description of the project activity

A.1. Title of the project activity:

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Sulige Natural Gas Based Power Generation Project

A.2. Short 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 load balancing power plant including installation of two sets of air-cooling gas-steam combined cycle power generation equipments which use natural gas to generate electricity and then, deliver the electricity to North China Grid via two 220 kV outlet circuits. Key technical parameters of the key equipments used in the Project are listed in Table 1.

Table 1. Key technical parameters 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	

In the absence of the Project, equivalent amount of annual power output to the Project will be generated and supplied by North China Grid which the Project is connected to. North China Grid is dominated by coal fired power plants. It is expected that the Project as a clean energy source with less carbon content will generate emission reductions of about 277,817 tCO_2e from 21/07/2008 to 31/12/2008 by avoiding CO_2 emissions from the same amount of power generation from coal fired power plants which would have been built otherwise within North China Grid.

A.3. Status of the project activity:

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This Monitoring Report refers to the Project which has been registered as a CDM project on 21/07/2008 (Ref. No. 1243). Timeline of the Project prior to CDM registration is summarized in Table 2.

1 The Dabuchake Town has been incorporated with the Galutu Town in 2006. (http://www.ordosagri.gov.cn/news/ about.asp?id=4731).

Table 2. Timeline of the Project

Date	Progress
18/11/2004	Approval of Environmental Impact Assessment Report
10/12/2004	Approval of Feasibility Study Report
18/04/2005	Construction Started
08/11/2006	CDM GSP
01/01/2007	Put into operation
22/03/2007	LOA issued by China's Designated National Authority
18/06/2007	LOA issued by Japan's Designated National Authority
31/07/2007	CDM request for registration
21/07/2008	CDM registration

A.4. Monitoring period:

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This Monitoring Report focuses on the emission reductions generated by the Project from 21/07/2008 to 31/12/2008.

A.5. Methodology applied to the project activity:

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AM0029.ver 01 – "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and "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".

A.6. Person(s)/entity(ies) responsible for preparation and submission of the monitoring report:

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SECTION B. General description of monitoring activities

B.1. Monitoring equipment:

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Information on the equipments used in the Project is summarized in Table 3 and Table 4.

Table 3. Equipments for monitoring the electricity delivered to the grid

Parameter	Location	No.	Type	S/N	Precision	Manufacturer
Supplied electricity	The point connecting the Project to the grid system through 220 kV transmission line (I)	84532928 (Main)	ZMU202c.4c-1r441r41z	433918870	0.2s	Landis & Gyr Metering (Zhuhai) Co., Ltd.
Supplied electricity	The point connecting the Project to the grid system through 220 kV transmission line (I)	84532929 (Backup)	Ditto	Ditto	0.2s	Ditto
Supplied electricity	The point connecting the Project to the grid system through 220 kV transmission line (II)	84532927 (Main)	Ditto	Ditto	0.2s	Ditto
Supplied electricity	The point connecting the Project to the grid system through 220 kV transmission line (II)	84532930 (Backup)	Ditto	Ditto	0.2s	Ditto
Power generation	Outlet of No.1 gas turbine	84532931	ZMU205c.4c-1r441r41z	Ditto	0.5s	Ditto
Power generation	Outlet of No.2 gas turbine	84532934	Ditto	Ditto	0.5s	Ditto
Power generation	Outlet of No.1 steam turbine	84532932	Ditto	Ditto	0.5s	Ditto
Power generation	Outlet of No.2 steam turbine	84532935	Ditto	Ditto	0.5s	Ditto

Table 4. Equipments for monitoring the natural gas consumed

Parameter	Location	No.	Type	S/N	Precision	Manufacturer
Natural gas consumption	The point connecting the Project to the natural gas transmission line (Main)	1	3400-DN250	06-490268	1.0	DANIEL
Natural gas consumption	The point connecting the Project to the natural gas transmission line (Backup)	2	3400-DN250	06-490271	1.0	DANIEL
Natural gas consumption	Gas Pressure Regulating Station within the project site (Main)	-	FLOWSIC-600	287	Repeatability: <0.2% of reading	SICK MAIHAK

The metering points are given in Figure 1.

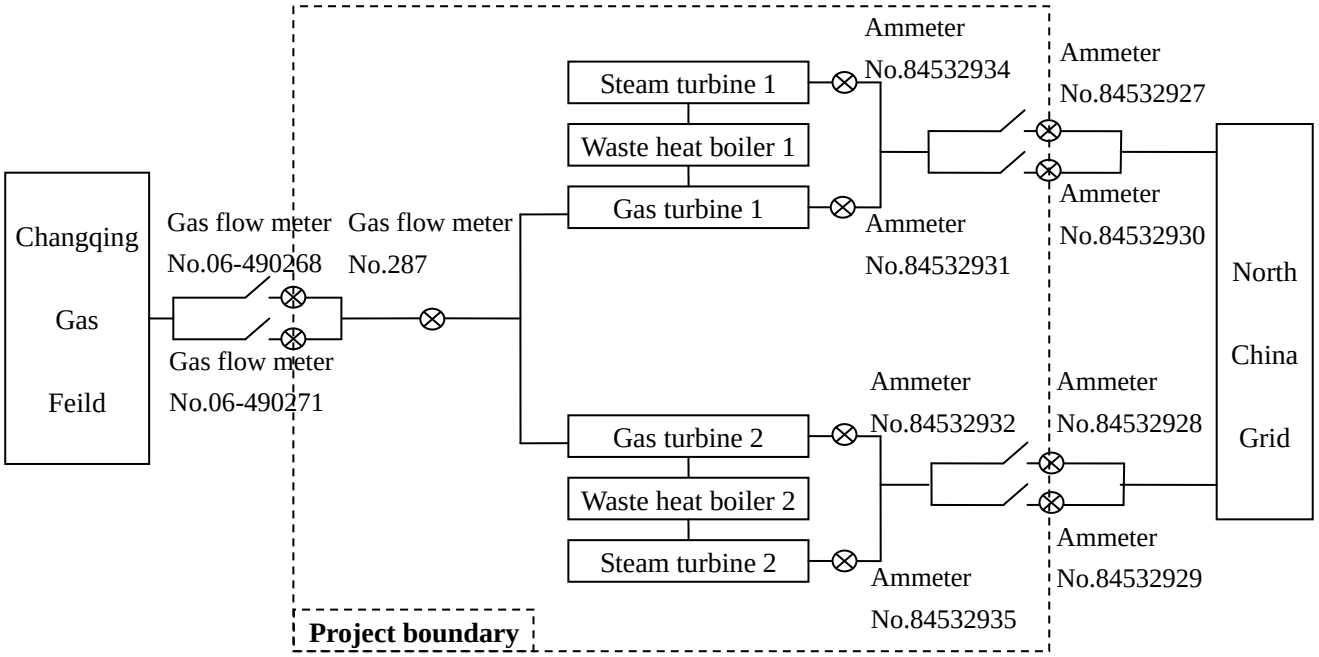

Figure 1. Metering points in the Project

B.2. Data collection:

B.2.1. Data and parameters that are fixed during the given monitoring period:

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The following data and parameters are fixed for the Project during the monitoring period as per the registered PDD of the Project.

Data/Parameter:	$EF_{NG,upstream,CH4}$
Data unit:	tCH_4/PJ
Description:	The emission factor for upstream fugitive CH_4 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 the methodology AM0029.
Value applied:	296
Justification of the choice of data or description of measurement methods and procedures actually applied :	Considering data availability, use defaults provided by the methodology AM0029.
Any comment:	-

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

Data/Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	The Global Warming Potential (GWP) of CH_4, valid for the relevant commitment period
Source of data used:	Kyoto Protocol
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Kyoto Protocol is a reliable data source.
Any comment:	-

B.2.2. Data and parameters that are monitored during the given monitoring period:

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The following data and parameters were monitored for the Project during the monitoring period as per the registered PDD.

Data/Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	The electricity delivered to the grid by the Project from 21/07/2008 to 31/12/2008
Source of data to be used:	Measurement record and electricity sales receipts/records to the grid.
Value of data applied for the purpose of calculating emission reductions:	636,666
Description of measurement methods and procedures applied:	Measured continuously by ammeters and monthly recorded by the Project Owner
QA/QC procedures:	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 the net electricity delivered to the grid, therefore it is unnecessary 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 to be used:	*China Energy Statistical Yearbook* from 2005 to 2007
Value of data applied for the purpose of calculating emission reductions:	see Annex 1 for details
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of *China Energy Statistical Yearbook.*
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$GEN_{m,y}$
Data unit:	MWh
Description:	Electricity generated by province m in year y
Source of data to be used:	*China Power Electric Yearbook* from 2006 to 2008
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of *China Power Electric Yearbook*.
QA/QC procedures:	-
Any comment:	For calculation of electricity output to the grid by province m in year y.

Data/Parameter:	$r_{m,y}$
Data unit:	%
Description:	Auxiliary electricity consumption rate of province m in year y
Source of data to be used:	*China Power Electric Yearbook* from 2006 to 2008
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of *China Power Electric Yearbook*.
QA/QC procedures:	-
Any comment:	For calculation of the 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 to be used:	*China Energy Statistical Yearbook* from 2006 to 2008
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of *China Energy Statistical Yearbook*.
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of the fuel i
Source of data to be used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value of data applied for the purpose of calculating emission reductions:	100
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of *IPCC Guideline for National Greenhouse Gas Inventories*.
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$EF_{CO2,i}$
Data unit:	tC/TJ
Description:	CO_2 emission factor of the fuel i
Source of data to be used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of *IPCC Guideline for National Greenhouse Gas Inventories*.
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$FC_{adv,coal}$
Data unit:	gCe/kWh
Description:	Weighted average fuel consumption of power generation of top 30 sets of 600 MW coal fired power generation units built in 2006 (taken as the efficiency level of the best technology commercially available in China)
Source of data to be used:	*China's Regional Grid Baseline Emission Factors* (renewed on 30/12/2008)
Value of data applied for the purpose of calculating emission reductions:	329.94
Description of measurement methods and procedures applied:	As per the registered PDD, the data obtained from China's DNA are reliable. Therefore, the data are obtained from the latest version of *China's Regional Grid Baseline Emission Factors* (renewed on 30/12/2008).
QA/QC procedures:	-
Any comment:	-

Data/ Parameter:	$FC_{adv,oil/gas}$
Data unit:	gCe/kWh
Description:	Weighted average fuel consumption of power generation of 200 MW oil/gas fired combined cycle power generation units (taken as the efficiency level of the best technology commercially available in China)
Source of data to be used:	*China's Regional Grid Baseline Emission Factors* (renewed on 30/12/2008)
Value of data applied for the purpose of calculating emission reductions:	252
Description of measurement methods and procedures applied:	As per the registered PDD, the data obtained from China's DNA are reliable. Therefore, the data are obtained from the latest version of *China's Regional Grid Baseline Emission Factors* (renewed on 30/12/2008).
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$FC_{NG,y}$
Data unit:	Nm^3
Description:	The total volume of natural gas combusted in the Project Plant from 21/07/2008 to 31/12/2008
Source of data to be used:	Daily measured continuously by natural gas flow meters and monthly recording by the project owner.
Value of data applied for the purpose of calculating emission reductions:	139,940,280
Description of measurement methods and procedures applied:	As per the registered PDD, the data measured continuously by natural gas flow meters and daily recorded by the Project Owner are used to determine $FC_{NG,y}$.
QA/QC procedures:	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 cross checked against the monitoring results of the natural gas flow meter installed at the Gas Pressure Regulating Station. Precision of the gas flow meter used in the Project shall not be lower than 1.0. The gas flow meter will be maintained and tested 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 for backup start off from 21/07/2008 to 31/12/2008.
Source of data used:	Measurement record and receipts
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the registered PDD, the data measured by the Project Owner is used to determine $FC_{diesel,y}$.
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. Only one flow meter is employed by the Project. The flow meter is a liquid level meter.
Any comment:	According to the Feasibility Study Report, diesel is only used for start off when HV accident was taken place. As per operation record of the Project, no HV accidentwas taken place from 21/07/2008 to 31/12/2008.

Data/Parameter:	$NCV_{NG,y}$
Data unit:	MJ/Nm^3
Description:	The net calorific value per volume unit of natural gas
Source of data to be used:	Gas component analysis reports provided by the natural gas supplier.
Value of data applied for the purpose of calculating emission reductions:	34.623 (weighted average from 21/07/2008 to 31/12/2008)
Description of measurement methods and procedures applied:	The net calorific value per volume unit of natural gas is measured by CGFPC periodically.
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$EG_{gen,y}$
Data unit:	MWh
Description:	The amount of electricity generated by the Project from 21/07/2008 to 31/12/2008.
Source of data to be used:	Measurement record.
Value of data applied for the purpose of calculating emission reductions:	653,621
Description of measurement methods and procedures applied:	Measured continuously by ammeters and monthly recorded by the Project Owner.
QA/QC procedures:	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 to be used:	*China Electric Power Yearbook*
Value of data applied for the purpose of calculating emission reductions:	0.9386
Description of measurement methods and procedures applied:	As per the registered PDD, the data are obtained from the latest publicly available edition of *China Power Electric Yearbook*.
QA/QC procedures:	-
Any comment:	-

B.2.3. Monitored data and parameters:

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The total volume of the natural gas combusted in the Project is monitored by the natural gas flow meter in Changqing Gas Field of PetroChina Co., Ltd. (hereafter referred to as CGFPC). The readings will be crosschecked against the monitoring results of the natural gas flow meter installed at the Gas Pressure Regulating Station. The natural gas flow meter in CGFPC measured the volume of the natural gas combusted in the Project Plant from 8:00 am of the day to 8:00 am of the next day, and clear reading to zero at each 8:00 am. Reading of the natural gas flow meter at CGFPC were read and recorded every two hours by the staff of CGFPC and confirmed by the staff of the Project Owner at each 8:00 am. The natural gas flow meter installed at the Gas Pressure Regulating Station measured the volume of natural gas combusted in the Project Plant in accumulation. Reading of the natural gas flow meter at the Gas Pressure Regulating Station were read and recorded every two hours by the staff of the Project Owner. The readings of the natural gas flow meter at the Gas Pressure Regulating Station (Series 2 of Table 5) were used to crosscheck the readings of the natural gas flow meter at CGFPC (Series 1 of Table 5).

The electricity delivered to the grid by the Project is measured continuously by the ammeters and recorded by the Project Owner every eight hours. Bi-direction ammeters with a precision of 0.2s are employed by the Project, whose readings are the net electricity delivered to the grid. Sales receipts to the grid were received from the local authorities of taxation each month and used for crosscheck.

The net calorific value per volume unit of the natural gas was a weighted average one calculated based on the net calorific value of the nature gas in the gas component analysis reports provided by the natural gas supplier within each two weeks and the volume of the natural gas combusted in the Project Plant.

Table 5 below summarizes the monitored data and invoiced data of the Project from 21/07/2008 to 31/12/2008.

Table 5. Monitored data and data for crosscheck from 21/07/2008 to 31/12/2008

Item	Recorded data (series 1)	Recorded data (series 2)	Invoiced data
Gas consumption (Nm^3)	139,940,280 (21/07/2008 to 31/12/2008 by flow meter installed at the point connecting the Project to the natural gas transmission line)	138,820,000 (21/07/2008 to 31/12/2008 by flow meter installed at the Gas Pressure Regulating Station within the project site)	
Supplied electricity (MWh)	636,666 (21/07/2008 to 31/12/2008 by ammeters installed at the point connecting the Project to the grid)	641,037 (01/07/2008 to 31/12/2008 by ammeters installed at the point connecting the Project to the grid)	641,037 (01/07/2008 to 31/12/2008)
Weighted net calorific value (MJ/Nm^3)	34.623	-	-

B.3. Data processing and archiving system:

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Generated electricity and supplied electricity:

The Project employs PDM2000 electricity metering and billing system and PSM-ID electricity remote terminal to process and archive the data relevant to the generated electricity and supplied electricity, and to communicate with the grid company regarding them. The system is developed by China Electric Power Research Institute. By using state-of-art IT, the system can ensure the integrity, accuracy, uniqueness, security and reliability of the data of electricity.

Natural gas consumption and net calorific value of natural gas:

The natural gas consumption and the net calorific value of natural gas are monitored, recorded and archived as per the clauses of *Natural Gas Purchase Agreement* signed between the Project Owner and CGFPC. Daily records of natural gas consumption of the Project are achieved by the Accounting Department of the Project Owner along with receipts relevant to the natural gas consumption. Reports of the net calorific value of natural gas provided by CGFPC are achieved by the Planning Department of the Project Owner.

B.4. Special event log:

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No special event log occurred during the given monitoring period of this Monitoring Report.

SECTION C. Quality assurance and quality control

C.1. Operation, maintenance and calibration:

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An Operation Manual has been developed by the Project Owner which guides the daily operation of the Project. The Operation Manual incorporates natural gas-turbine technical standard guidelines with data recording and managing process. The on-duty (in shift) staff in the Operation Department, are responsible for data monitoring and recording in *Daily Production Report* and *Record of Natural Gas Usage*, especially the generated electricity, the electricity delivered to North China Grid and the natural gas consumption.

The Project Owner has signed *Equipment Calibration and Maintenance Contract* with Inner Mongolia No.1 Electric Power Engineering Co., Ltd. According to the clauses of the contract, Inner Mongolia No.1 Electric Power Construction Engineering Co., Ltd. will take charge of daily calibration and maintenance of the equipments, including ammeters, of the Project. The objectives of the contract include well performance, stable operation and safety of the Project.

Additional to daily calibration and maintenance of the Project, an Emission Reduction Monitoring Team has been set up internally by Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia (hereafter referred to as the Project Owner). The Emission Reduction Monitoring Team is in charge, inter alia, of the implementation and management of the whole monitoring plan, including monitoring and management of the data relevant to the determination of GHG emission reductions.

The general manager of the Project Owner is the leader of the Emission Reduction Monitoring Team and is responsible for all the relevant activities during the operating and the maintaining period. Mr. Cui Jinbao, Director of the Planning Department of the Project Owner of Inner Mongolia is responsible for the supervision of the Emission Reduction Monitoring Team. The Director of the Production Department and the Director of the Maintenance Department are responsible for organizing and managing reading and recording of data. The Director of the Accounting Department is responsible for collecting and archiving the invoices.

As per the record of the Technological Department of the Project Owner, equipment calibration and maintenance activities from 01/01/2007 to 31/12/2008 have been summarized in Table 6.

Table 6. Equipment calibration and maintenance activities from 01/01/2007 to 31/12/2008

Date	Responsible party(ies)	Conclusion
07/04/2007~09/04/2007	Inner Mongolia No.1 Electric Power Engineering Co., Ltd.	Ok.
22/06/2007~24/06/2007	Inner Mongolia No.1 Electric Power Engineering Co., Ltd., supported by relevant equipments suppliers	Ok.
27/08/2007~07/09/2007	Inner Mongolia No.1 Electric Power Engineering Co., Ltd. and Daqing Feihong Gas Turbine Technology Development Co., Ltd.	Ok.

The Project Owner has signed an agreement with the gas supplier for the periodical calibration and testing of the precision of the gas metering devices, in order to ensure the monitoring accuracy of the natural gas consumption and its component analysis. The calibration and testing of the gas metering devices installed by the gas supplier have been outsourced by the gas supplier to be conducted by the National Metering Station for Crude Oil with High Flow Rate according to national measurement standards and regulations. Calibration Report No.GM20070291 and Calibration Report No.20070290 have been issued to confirm the precision of the gas metering devices from 09/06/2007 to 08/06/2009. Calibration report has been provided by SICK MAIHAK to confirm the precision of the gas flow meter installed by the project owner from 17/10/2005 to 17/10/2009. The calibration and testing of the gas component analysis devices have been accomplished by Shaanxi Institute of Metrology Science in line with national measurement standards and regulations. Calibration Report No.HX30061378J has been issued to confirm the precision of the gas component analysis devices from 01/11/2006 to 31/10/2008.

C. 2. Training:

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Relevant staff of the Project Owner, including the Emission Reduction Monitoring Team, had been trained on correct operation and maintenance by the equipment manufacturing company, according to the training contract included in the equipment procurement contract. In addition, the Monitoring Manual has been provided to the Project Owner with training on the emission reduction monitoring procedures.

As per the record of the Operation Department of the Project Owner, training activities from 01/01/2007 to 31/12/2008 have been summarized in Table 7.

Table 7. Training activities from 01/01/2007 to 31/12/2008

Date	Training content
15/01/2007~28/02/2007	Study of production and operation management
01/03/2007~31/07/2007	Training for operation staff on the basic theory
01/03/2007~30/09/2007	Training on on-site system and operation procedure
08/10/2007~30/12/2007	Post shifting training
01/01/2007~30/12/2007	Separate group training to improve the capability of dealing with emergency
01/01/2008~31/03/2008	All-duty training
01/04/2008~30/04/2008	Training for operation staff on the knowledge of the equipments, systems and monitoring points which are beyond their own responsibility for a sufficient understanding of the whole
20/04/2008~30/05/2008	Anti-accident exercises

C.3. Internal audits:

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The statistical staff in the Planning Department are in charge of verification and confirmation of the monitoring data records, which will be monthly aggregated and reported to the leader of the Emission Reduction Monitoring Team. After checking and ensuring no material mistakes, these data are archived and also sent to the Director of the Accounting Department which makes the financial clearance with the grid and the natural gas supplier on sale of electricity and purchase of gas respectively. The invoices are archived and managed by the Director of the Accounting Department.

C.4. Troubleshooting procedures:

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Possibly unexpected cases and relevant emergency responses are summarized in Table 8.

Table 8. Possibly unexpected cases and relevant emergency responses

No.	Unexpected case	Emergency response measure
1	Voltage loss of power supply at the data acquiring device	Measuring the power supply voltage, trying to find out the cause, removing the troubles, resuming power supply as soon as possible, reducing the loss of electricity.
2	Voltage loss of power supply at the ammeter	Measuring the power supply voltage at the ammeter and the electric circuit, trying to find out the cause, removing the troubles.
3	Strike of light at the electric current terminal	Shorting the current circuit, trying to find out the cause, removing the troubles.
4	Short circuit of the voltage loop	Turning off the small switch at the voltage transformer.
5	Malfunction of the communication system	Measuring the voltage at the communication terminals, trying to find out the cause, removing the troubles.

None of the unexpected cases listed above occurred during the given monitoring period.

SECTION D. Calculation of emission reductions

D.1. Emission reductions:

D.1.1. Baseline emissions:

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

$$BE_y = EG_{PJ,y} \cdot EF_{BL,CO2,y} \quad (1)$$

where:

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

$EG_{PJ,y}$: is the electricity generated in the Project Plant in year(s) y (MWh);

$EF_{BL,CO2,y}$: is the baseline emission factor in year(s) y (tCO_2/MWh).

As per the methodology AM0029, in order to address this uncertainty in a conservative manner, Project Participants use for $EF_{BL,CO2,y}$ the lowest emission factor among the following three options:

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

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

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

As analyzed in the registered PDD of the Project, Option 1 among the three options is adopted to determine the baseline emission factor ($EF_{BL,CO2,y}$).

Option 1. The build margin, calculated according to the methodology ACM0002

Calculate the build margin emission factor ($EF_{BM,y}$) according to the methodology ACM0002 using equation (2):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \quad (2)$$

where:

$EF_{BM,y}$ is the build margin emission factor in year y (tCO_2/MWh);

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

$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel i, 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 (tCO_2/tCe); and

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

According to the methodology ACM0002, Project Participants choose between one of the two options to calculate the build margin emission factor ($EF_{BM,y}$). Option 1 provided in the

methodology ACM0002 (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 in the registered PDD.

According to the 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.

Considering data availability, EB accepts the following deviation in application of methodology[2]:
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 using the efficiency level of the best technology commercially available in China.

Since the data of installed capacity can not be separated to coal based, oil based and gas based currently, the build margin emission factor is calculated with the 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 *Energy Balance Table* of the most recent year.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (3)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (4)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (5)$$

where:

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

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i, 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 (tCO_2/tCe); and

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

Step b. Calculate the emission factor of thermal power generation in the grid based on the

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

result of Step a and the efficiency level of the best technology commercially available in China.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (6)$$

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

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

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (7)$$

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 calorific values of the fuels are updated with the data obtained from *China Energy Statistical Yearbook* from 2005 to 2007. The emission factors and oxidation factors are updated with the data obtained from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Referring to *China's Regional Grid Baseline Emission Factors*, the weighted average fuel consumption for power generation of top 30 sets of 600 MW coal fired power generation units built in 2006 (329.94 gCe/kWh) and the 200 MW oil/gas fired combined cycle power generation units (252 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

Referring to *China's Regional Grid Baseline Emission Factors* (renewed on 30/12/2008) and *China Energy Statistical Yearbook 2008* and *China Electric Power Yearbook 2008*, the build margin emission factor ($EF_{BM,y}$) of the North China Grid is calculated as 0.8633 tCO_2e/MWh (see Annex 1 for details). Therefore the baseline emission factor ($EF_{BL,CO2,y}$) is 0.8633 tCO_2e/MWh.

Baseline emissions of the Project from 21/07/2008 to 31/12/2008 are summarized in Table 9.

Table 9. Baseline emissions of the Project from 21/07/2008 to 31/12/2008

Period	$EG_{PJ,y}$ **(MWh)**	$EF_{BL,CO2,y}$ **(tCO_2/MWh)**	BE_y **(tCO_2e)**
21/07/2008 ~ 31/12/2008	636,666	0.8633	549,633

D.1.2. Project emissions:

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According to the 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 emissions are those emissions from on-site combustion of natural gas. The

CO_2 emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = FC_{NG,y} * COEF_{NG,y} \quad (8)$$

where:

PE_y is the project emissions in year(s) y (tCO_2e);

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

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

$$COEF_{NG,y} = NCV_{NG,y} * EF_{CO2,NG,y} * OXID_{NG} \quad (8a)$$

where:

$NCV_{NG,y}$ is the net calorific value (energy content) per volume unit of natural gas in year y (GJ/Nm^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/Nm^3) is obtained by the natural gas supplier and other parameters are obtained from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

The project emissions of the Project from 21/07/2008 to 31/12/2008 are summarized in Table 10.

Table 10. Project emissions from 21/07/2008 to 31/12/2008

Period	$FC_{NG,y}$ **(Nm^3)**	$NCV_{NG,y}$ **(GJ/Nm^3)**	$EF_{CO2,NG,y}$ **(tCO_2/TJ)**	$OXID_{NG}$	PE_y **(tCO_2e)**
21/07/2008 ~ 31/12/2008	139,940,280	0.034623	0.0561	100%	271,816

D.1.3. Leakage:

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Natural gas used in the Project is not liquid natural gas. According to the methodology AM0029, leakage emission (LE_y) sources considered in the Project include the fugitive CH_4 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 CH_4 emissions, Project Participants multiply the quantity of natural gas consumed by the Project in year y with an emission factor for fugitive CH_4 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:

$$LE_{CH4,y} = \left[FC_y \cdot NCV_y \cdot EF_{NG,upstream,CH4} - EG_{PJ,y} \cdot EF_{BL,upstream,CH4}\right] \cdot GWP_{CH4} \quad (9)$$

where:

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

FC_y is the quantity of natural gas combusted in the Project Plant in year y (m^3);

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

$EF_{NG,upstream,CH4}$ is the emission factor for upstream fugitive CH_4 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 in year y (MWh);

$EF_{BL,upstream,CH4}$ is the emission factor for upstream fugitive CH_4 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 CH_4 valid for the relevant commitment period.

The emission factor for fugitive upstream emissions of natural gas ($EF_{NG,upstream,CH4}$) including 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 the methodology AM0029.

According to the 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 the methodology 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:

$$EF_{BL,upstream,CH4} = \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream,CH4}}{\sum_j EG_j} \quad (10)$$

where:

$EF_{BL,upstream,CH4}$ is the emission factor for upstream fugitive CH_4 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 CH_4 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 (MWh/yr).

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

In China, it is very difficult to obtain the data of the plant j. Therefore, according to the

deviation in application of the methodology AM0005[3] approved by CDM EB, recent 20% capacity additions of North China Grid during 2005~2006[4] were used for estimating the build margin emission factor for grid electricity and the 600 MW sub-critical coal fired power generation unit was used as the proxy of efficiency level of the best technology in China[5]. Based on these data, formula (10) can be conservatively converted into formula (11) [6]:

$$EF_{BL,upstream,CH4} = \varphi_{coal} \times PGCC_{coal,best} \times EF_{coal,upstream,CH4} \times \frac{NCV_{coal}}{NCV_{Rawcoal}} \quad (11)$$

where,

φ_{coal} is the share of coal fired generation in BM generation (0.9386, see Annex 1 for details).

$PGCC_{coal,best}$ is the power generation standard coal equivalent consumption of the 600 MW sub critical coal fired power generation technology within the grid boundary.

$NCV_{Rawcoal}$ is the net calorific value of raw coal which is used for power generation in GJ/tCe[7].

Since all the natural gas used in the Project is from the 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.

Leakage of the Project from 21/07/2008 to 31/12/2008 are summarized in Table 11.

Table 11. Leakage from 21/07/2008 to 31/12/2008

Period	$EG_{PJ,y}$ **(MWh)**	$FC_{NG,y}$ **(Nm^3)**	$NCV_{NG,y}$ **(GJ/Nm^3)**	φ_{coal}	$PGCC_{best}$ **(gCe/kWh)**
21/07/2008 ~ 31/12/2008	636,666	139,940,280	0.034623	0.9386	320

Table 11. Leakage from 21/07/2008 to 31/12/2008 (continued)

Period	$EF_{coal,upstream,CH4}$ **(tCH_4/kt)**	$\frac{NCV_{coal}}{NCV_{Rawcoal}}$	$EF_{NG,upstream,CH4}$ **(tCH_4/PJ)**	**Auxiliary electricity consumption rate (%)**	GWP_{CH4} **(tCO_2e/tCH_4)**	$LE_{CH4,y}$ **(tCO_2e)**
Data	13.4	1.4	296	2.59 (21/07/2008 to 31/12/2008)	21	-47,220

Since the total net leakage are negative ($LE_{CH4,y} < 0$), $LE_y = 0$ is assumed in the Project.

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

4 Capacity additions during 2005~2007 are greater than and most close to 20% of the electricity system. See Annex 3 for details.

5 Http://www.ccchina.gov.cn/source/fa/fa2002082803.html.

6 The conservativeness of such switch has been demonstrated in Annex 3.

7 As per the data on P365 of *China Energy Statistical Yearbook 2005*, the calorific value of raw coal is 5000 kcal/kg and that of standard coal is 7000 kcal/kg.

D.1.4. Summary of the emissions reductions during the given monitoring period:

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To calculate the emission reductions, the following equation is applied:

$$ER_y = BE_y - PE_y - LE_y \quad (12)$$

where:

ER_y is the emissions reductions of the Project Activity in year y (tCO_2e),

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

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

LE_y is the leakage in year y (tCO_2e).

Emission reductions of the Project from 21/07/2008 to 31/12/2008 are summarized in Table 12. An excel spreadsheet summarizing the calculation of emission reductions is prepared for verification.

Table 12. Emission reductions from 21/07/2008 to 31/12/2008

Period	BE_y **(tCO_2e)**	PE_y **(tCO_2e)**	LE_y **(tCO_2e)**	ER_y **(tCO_2e)**
21/07/2008 ~ 31/12/2008	549,633	271,816	0	**277,817**

D.2. Description and consideration of measurement uncertainties

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Recorded data and invoiced data have been cross-checked with each other. No significant differences in both gas consumption and power generation between the two sets of data (i.e. recorded and invoiced data) were observed.

Annex 1 - Calculation of the build margin emission factor

Table A1. Data and results of Step a.

Fuel	Unit	Beijing A	Tianjin B	Hebei C	Shanxi D	Inner Mongolia E	Shandong F	Total G= A+B+…+F	Emission factor (tC/TJ) H	NCV (MJ/t or $1000m^3$) I	CO_2 emission (tCO_2e) J
Raw coal	10^4t	816.17	1753.99	7716.13	7510.06	10434.25	11884.83	**40115.43**	25.8	20908	793,441,806
Washed coal	10^4t	0.00	0.00	0.00	0.00	0.00	18.43	**18.43**	25.8	26344	459,302
Other washed coal	10^4t	5.76	0.00	156.89	478.81	48.57	756.84	**1446.87**	25.8	8363	11,446,764
Briquette	10^4t	7.93	0.00	0.00	0.00	0.00	42.86	**50.79**	26.6	20908	1,035,723
Coke	10^4t	0.00	0.00	0.02	0.00	0.00	4.09	**4.11**	29.2	28435	125,127
Sub-total of solid fuel											**806,508,722**
Crude oil	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	20	41816	0
Gasoline	10^4t	0.00	0.00	0.01	0.00	0.00	0.00	**0.01**	18.9	43070	298
Diesel	10^4t	0.33	0.00	2.35	0.00	0.62	5.08	**8.38**	20.2	42652	264,732
Fuel oil	10^4t	4.74	0.00	0.18	0.00	0.00	2.35	**7.27**	21.1	41816	235,196
Other oil products	10^4t	1.72	0.00	0.00	0.00	0.00	0.00	**1.72**	20	38369	48,396
Sub-total of liquid fuel											**676,127**
Coke oven gas	10^8m^3	5.03	0.73	0.00	0.54	4.22	0.01	**10.53**	15.3	38931	2,299,783
Other gas	10^8m^3	0.07	0.72	3.13	25.46	2.58	13.61	**45.57**	12.1	16726	3,381,644
LPG	10^4t	11.80	7.60	88.38	72.80	28.17	29.64	**238.39**	12.1	5227	5,528,373
Refinery gas	10^4t	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	17.2	50179	0
Natural gas	10^8m^3	0.06	0.00	2.85	0.00	0.00	1.65	**4.56**	15.7	46055	120,896
Sub-total of gas fuel											**11,330,696**
Total											**818,515,545**

Data source: China Energy Statistical Yearbook 2008.

Calculated with the data provided in Table A1 and formula (3)~(5), the value of λ_{Coal} is 98.53%, the value of λ_{Oil} is 0.08% and the value of λ_{Gas} is 1.38%.

Table A2. Emission factor of best technology

	Variable	Electricity supply efficiency	Emission factor of fuel (tC/TJ)	Oxidation Rate (%)	Emission factor Inner Mongolia (tCO2/MWh)
		A	B	C	D=3.6/A/10^3*B*C*44/12
Coal-based power plants	$EF_{Coal,Adv,y}$	37.28%	25.8	100	0.9135
Gas-based power plants	$EF_{Gas,Adv,y}$	48.81%	15.3	100	0.4138
Oil-based power plants	$EF_{Oil,Adv,y}$	48.81%	21.1	100	0.5706

Therefore, $EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$ =0.9063 tCO_2e/MWh.

Table A3. Installed capacity of North China Grid in 2007

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3900.0	6920.0	29020.0	30950.0	39870.0	54140.0	164800.0
Hydro power (MW)	1050.0	10.0	780.0	790.0	830.0	1050.0	4510.0
Wind power and Others (MW)	2.7	0.0	410.0	0.0	1096.5	210.0	1719.2
Total (MW)	4952.7	6930.0	30210.0	31740.0	41796.5	55400.0	171029.2

Data source: China Electric Power Yearbook 2008.

Table A4. Installed capacity of North China Grid in 2006

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3984.0	6512.0	26087.0	26661.0	28899.0	49395.0	141538.0
Hydro power (MW)	1053.0	5.0	785.0	790.0	818.0	553.0	4004.0
Wind power and Others (MW)	24.0	24.0	218.0	0.0	565.0	106.0	937.0
Total (MW)	5061.0	6541.0	27090.0	27451.0	30282.0	50054.0	146479.0

Data source: China Electric Power Yearbook 2007.

Table A5. Installed capacity of North China Grid in 2005

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3833.5	6149.9	22333.2	22246.8	19173.3	37332.0	111068.7
Hydro power (MW)	1025.0	5.0	784.5	783.0	567.9	50.8	3216.2
Wind power and Others (MW)	24.0	24.0	48.0	0.0	208.9	30.6	335.5
Total (MW)	4882.5	6178.9	23165.7	23029.8	19950.1	37413.4	114620.4

Data source: China Electric Power Yearbook 2006.

Table A6. Calculation of the build margin emission factor of North China Grid

	Installed capacity in 2005 (MW) A	Installed capacity in 2006 (MW) B	Installed capacity in 2007 (MW) C	Capacity additions from 2005 to 2007 (MW) D=C- A	Share in total capacity additions
Thermal power	111068.7	141538.0	164800.0	53731.3	95.25%
Hydro power	3216.2	4004.0	4510.0	1293.8	2.29%
Wind power and Others	335.5	937.0	1719.2	1383.7	2.45%
Total	114620.4	146479.0	171029.2	56408.8	100.00%
Share in the total installed capacity of 2006	67.02%	85.65%	100%		

Therefore, $EF_{grid,BM,y}$ =0.9063×95.25%=0.8633 tCO_2e/MWh.

As per Table A1, λ_{Coal} =98.53%. As per Table A6, $\frac{CAP_{Thermal}}{CAP_{Total}}$ =95.25%. Therefore, $\varphi_{coal} = \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal}$ =98.53%×95.25%=93.86%.