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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Shanxi Fenxi Coal Mine Methane Utilization Project
Version: 03
Date: 31/10/2012

The version history of the PDD is summarized as below:

Version No.	Date	Main revision and purpose
Version 01	26/09/2011	GSP edition
Version 02	12/01/2012	Revised according to the CARs and CLs after the on-site validation
Version 02.1	05/06/2012	Update the version of *"Tool to calculate the emission factor for an electricity system"*
Version 03	31/10/2012	Revised according to the requirements of information and reporting check

A.2. Description of the project activity:

The proposed project is composed of 4 coal mine methane (CMM) power stations located in Hexi, Shuangliu and Zhongxing coalmines, which have production capacities of 1.5 Mt/y, 2.0 Mt/y and 0.3 Mt/y respectively. In Hexi coalmine, two drainage pump stations named Xuejialing and Duhumao stations with capacities of 24m^3/min and 39.55m^3/min (methane) are in operation. In Shuangliu and Zhongxing coalmines, two drainage pump stations with capacities of 66.93m^3/min and 55.3m^3/min (methane) respectively are in operation as well. The concentration of all the drained CMM is below 30%. Before implementation of the proposed project, all the extracted CMM was released into the atmosphere directly. Power and heat supply to the mine was from the North China Power Grid (NCPG) and coal fired boilers respectively. Baseline scenario of the proposed project is same as scenario prior to the project..

The total installation capacity of the proposed project is 19.9MW equipped with 6 sets of 650kW gas gensets in Xuejialing power station, and 32 sets of 500kW gas gensets in Duhumao, Guojiashang and Mazhang power stations. Waste heat recovery systems will be fixed as well. The construction contract of the main factory building of Xuejialing Station was singed at 15th July 2008 which is the starting date of the propose project. The detailed installation capacity and schedule of each station are listed in the Table A-1 below.

Table A-1 Detailed installation capacity and schedule of each station

	Xuejialing Station	Duhumao Station	Guojiashan Station	Mazhang Station
Location	Hexi mine		Shuangliu mine	Zhongxing mine
Installation capacity	6*650kW	8*500KW	16*500kW	8*500kW
Operation date	12/2011	01/2014	07/2012 (8 sets) 01/2015 (left 8 sets)	07/2012
Designed power generated	20,160MWh	20,640MWh	41,280MWh	20,640MWh

When the project is fully operated, the anticipated annual CMM consumption will be up to 35.87Mm^3. Most of CH_4 in CMM would be converted to low GWP CO_2 by combustion in gas engines except for a

small part of unburned methane. The annual electricity output will be up to 102,720MWh, 93,690MWh of which will be delivered to the North China Power Grid. The rest electricity will be consumed by the power station self use. Moreover, the proposed project could recover up to 55,898.4GJ of waste heat from waste recovery boilers annually. The heat supplied by the proposed project would replace the thermal energy supplied from coal-fired boilers. In 10 years of crediting period, the green house gas (GHG) emission reductions by the proposed project will be a total of 4,849,738tCO_2e.[1]

The contribution of the proposed project to local sustainable development includes:

- Taking full advantage of clean energy that would have been released into the atmosphere for power generation;
- Reduce environment pollution;
- Guarantee of coal mine production safety;
- Decrease of coal usage by substituting coal fired heat supply and power generation from North China Power Grid;

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Shanxi Fenxi Coal Mine Methane Development Ltd.	No
the Netherlands	Timing Carbon UK Ltd	No
France	EDF Trading Limited	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

The People's Republic of China

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

Shanxi Province

A.4.1.3. City/Town/Community etc.:

Lvliang City

[1] Emission reductions from heat replacement by the project are not claimed.

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

The 4 power stations are all located in Lvliang City, which is a western city of Shanxi Province.

Xuejialing Station is located in southeast of Xuejialing village, while Duhumao Station is located in northwest of Duhumao village. Both stations are in Liulin County. The geographical coordinates of Xuejialing Station is east longitude 110°58′ 06" (110.9683°), north latitude 37°20′ 43’’ (37.3453°). The geographical coordinates of Duhumao Station is east longitude 110°57′ 17" (110.9547°), north latitude 37°19′ 45’’ (37.3292°).Guojiashan Station is located in northwest of Guojiashan village, which is also in Liulin County. Its coordinate is 110°48′ 14"(110.8039°), north latitude 37°31′41" (37.5281°).Mazhuang Station is located in the northwest of Mazhuang village, which Is in Jiaocheng County. Its coordinate is 112°06′ 20’’ (112.1056°), north latitude 37°38′08" (37.6356°).

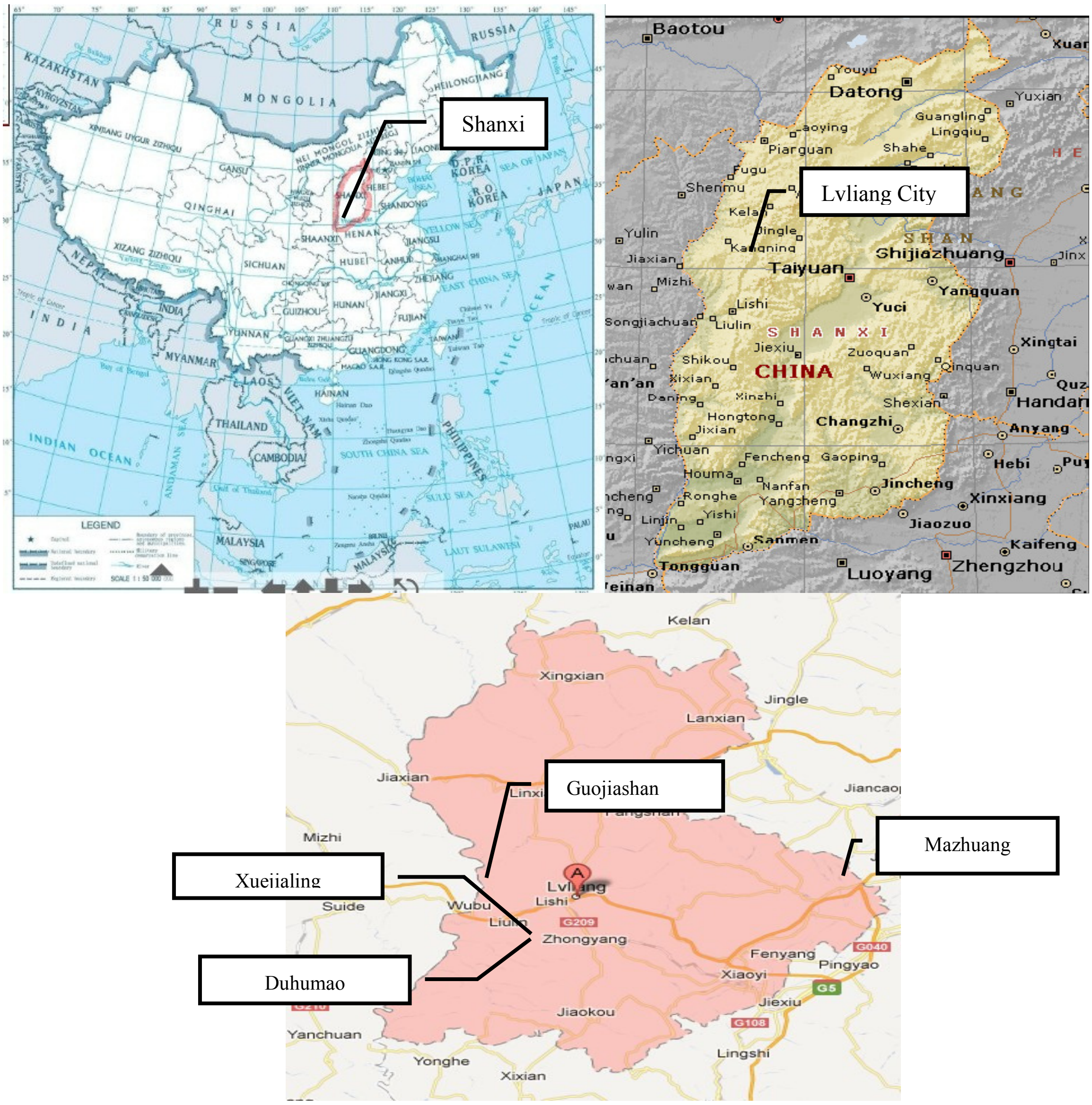


Figure A-1: Location of the proposed project (4 stations)

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

10: fugitive emissions from fuels
8: mining mineral production

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

The scenario existing prior to implementation of the project

Before the implementation of the proposed project activity, the equipment and system in operation at that time are listed as follows:

Table A-2 Equipment and System existing prior to the project activity

Service	Equipment (system)	Description
Coal mine methane extraction and emission	Coal mine methane extraction system	Before the project was implemented, the extracted coal mine methane would be released into the atmosphere.
Electricity	Electricity provided by North China Power Grid	The electricity imported from North China Power Grid is mainly generated by fossil fuels.
Heat	Coal fired boilers	The heat needed in the coal mine was provided by the coal fired boilers before the implementation of the project activity.

The baseline scenario

The baseline scenario is same as the scenario existed prior to the start of the implementation of the project activity. The green gas resources and energy & mass flow of baseline are indicated in Figure A-2

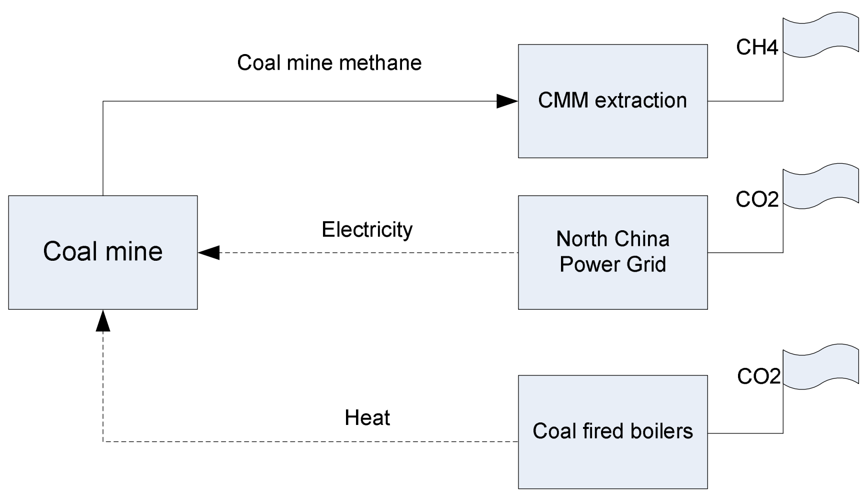


Figure A-2 Green gas resources and energy & mass flow of baseline scenario

The project activities:

The proposed project will employ the following technologies:

Table A-3 Equipment and system in the project activity

Service	Equipment (system)	Description
Electricity	CMM gensets	The gas engines adopted in the proposed project are all domestic The total installation capacity will reach 19.9MW.
Heat	Waste heat recovery boilers	Total of 26 waste heat recovery boilers will be installed to recover the heat in exhausted gas for heat supply.

The adopted CMM power gensets adopted in the proposed project will utilize CMM that would be released into atmosphere. Besides, heat recovery systems will recover the high temperature exhausted gas from power engines to generate heat. CMM power generation and heat recovery systems would both avoid the SO_2 and NO_x pollution emitted by coal fired power generation/ boilers, which could improve the local air quality.

1) Power Generation by Gas-Fired Reciprocating Engines

The project activity will adopt domestic 650kW and 500kW reciprocating engines. As methane concentration is lower than 30%, explosion prevention of employed generators is effectively achieved by adopting several advanced technologies such as auto control of fuel gas mixing, water pulverization protecting gas transmission, dry fire extinguishing, etc. [2] So far, 6* 650KW gensets have been installed in Xuejialing Station. Also, 8*500kW gensets have been installed in Mazhuang Station. The detailed parameters of installed gensets are listed as follow:

Table A-4 Technical parameters of 650GF6-W2

Model	650GF6-W2
Rated Power	650kW
Rated Frequency	50Hz
Rated Voltage	6300V
Rated Current	91.6A
Rated Speed	1000r/min
Power Factor(Lagging)	0.8
Exciting Method	Brushless

Table A-5 Technical parameters of 500GF1-3PwW

Model	500GF1-3PwW
Rated Power	500kW

[2] *'Certificate of Scientific and Technological Achievements'* awarded by Department of Science & Technology of Shandong Province 5th, November 2005.

Rated Frequency	50Hz
Rated Voltage	400V
Rated Current	902A
Rated Speed	1000r/min
Power Factor(Lagging)	0.8
Phase and Connecting	Y-O

2) Waste Heat Recovery

The waste heat generated by the gas engines in the proposed project will be recovered. The exhausted gas, generated by the gas engines, with the temperature of approximately 550℃ is sent to waste heat boilers. Waste heat boiler will produce hot water for heating in Xuejialing, Duhumao and Mazhuang Stations, while boilers will send steam to Guojiashan Station for heating.

The green gas resources and energy & mass flow of the proposed project activity are shown in Figure A-3.

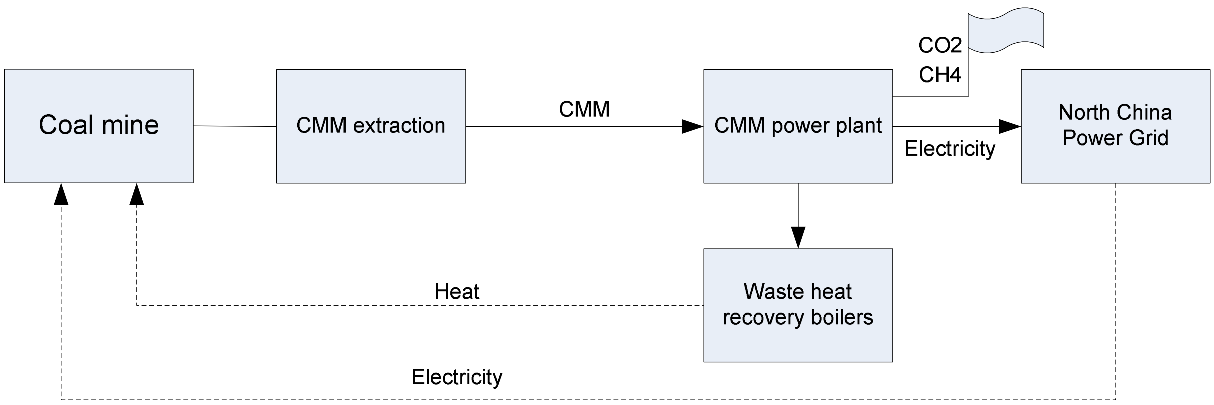


Figure A-3 Green gas resources and energy & mass flow of project activity

The information of the monitoring meters that will be used in the proposed project is listed below.

Table A-6 Monitoring equipment list

Instrument	Symbol	Location	Function
CH_4 concentration meter	C	CMM inlet of power generation.	Measure CH_4 concentration of the drained CMM sent to power generators
Gas flow meter	F_G	CMM inlet of power generation.	Measure the CMM volume sent to gas engines
Electricity meter	E	At the inlet of coalmine substations	Measure the electricity delivered to the grid and imported from the grid.

All the equipment and related accessories require the professional technicians to operate and maintain. On-the-job training should be held periodically. The service technicians of equipment manufacture will be in charge of the maintenance and training.

The Project only adopts domestic technology and equipment, thus there is no technology transfer.

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

It is expected that the project activity will reduce GHG emissions for 484,973 tCO_2e per year over the 10-year fixed crediting period from 1st December 2012 to 30th November 2022.

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
01/12/2012-31/12/2012	25,832
2013	309,987
2014	413,799
2015	517,910
2016	517,910
2017	517,910
2018	517,910
2019	517,910
2020	517,910
2021	517,910
01/01/2022-30/11/2022	474,752
Total estimated reductions (tonnes of CO_2e)	**4,849,738**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**484,973**

A.4.5. Public funding of the project activity:

No public funding from Annex I Parties has been provided for this CDM 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:

ACM0008 "Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation" (version 7.0) is applied for the proposed project.

"Tool to calculate the emission factor for an electricity system" (Version 02.2.1) is adopted for calculation of emission factor of North China Power Grid.

"Tool for the demonstration and assessment of additionality" (Version 6.1.0) is adopted to demonstrate the additionality of the proposed project.

All above methodologies and tools as well as their consideration by the executive board can be found at the UNFCCC website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

ACM0008 defines the applicability of this methodology. The following tables B-1, B-2 and B-3 explain the reasons why the methodology applies to this project:

Table B-1 Comparison of the proposed extraction activities with applicability of the methodology

ACM0008 Applicability	Proposed extraction activities
Underground boreholes in the mine to capture pre mining CMM	Pre mining CMM captured through underground boreholes is included.
Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	No post mining CMM is included.

The proposed project is CMM capture and utilization project at a working coal mine. No CBM/post mining CMM/ventilation air methane capture and utilization are involved.

Table B-2 Comparison of the proposed utilization activities with applicability of the methodology

ACM0008 Applicability	Proposed CMM utilization activities
The baseline is the partial or total atmospheric release of the methane	All the methane is vented without usage in baseline
The methane is captured and destroyed through utilization to produce electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources	The methane is captured and destroyed by power generators.
The remaining share of the methane to be diluted for safety reason may still be vented	Yes, the remaining share of the methane to be diluted for safety reason is still vented.

All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented	All CMM captured by the project will be utilized for power generation.
Project participants must be able to supply the necessary to data for ex ante projections of methane demand as described in sections Baseline Emissions and Leakage to use this methodology.	All the methane is vented to the atmosphere in the baseline without any use.
The methodology applies to both new and existing mining activities	Yes. Existing mining activities in Hexi, Shuangliu and Zhongxing coalmines.

Besides the applicability, ACM0008 baseline methodology and monitoring methodology also define the types of activities that could not be applied to this methodology. The proposed project does not involve any of those activities (Table B-3):

Table B-3 Comparison of the project with inapplicable activities stated in the methodology

ACM0008 Inapplicability	**Proposed project activities**
Capture methane from abandoned/decommissioned coalmines	Methane is captured from working mines.
Capture/use of virgin coal-bed methane, e.g. methane of high quality extracted from coal seams independently of any mining activities	Extraction activities are concomitance with coal production
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place	No CBM activities are involved in the project

It can be concluded from the tables above that the proposed project complies with both the baseline and monitoring methodologies of ACM0008.

According to the methodology ACM0008,the emission factor of the electricity system is determined by using *Tool to Calculate the Emission Factor for an Electricity System (version 02.2.1)*, which may be applied to estimate the OM, BM and/or CM when calculating baseline emission for a project activity that results in saving of electricity that would have been provided by the Grid.

Besides, ACM0008 refers using *Tool for the Demonstration and Assessment of Additionality (version 6.1.0)*, which provides a general framework for demonstrating and assessing additionality and is applicable to a wide range of project types.

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

Project boundary:

For the purpose of determining project emissions, the following emissions are included:

- CO_2 emissions from the combustion of methane in the power engines;
- CO_2 emissions from the combustion of non methane hydrocarbons (NMHCs), if they represent more than 1% by volume of the extracted coal mine gas;
- Fugitive emissions from unburned methane.

For the purpose of determining baseline emissions, the following emissions are included:

- CH_4 emissions as a result of venting gas that would be captured in the project scenario;

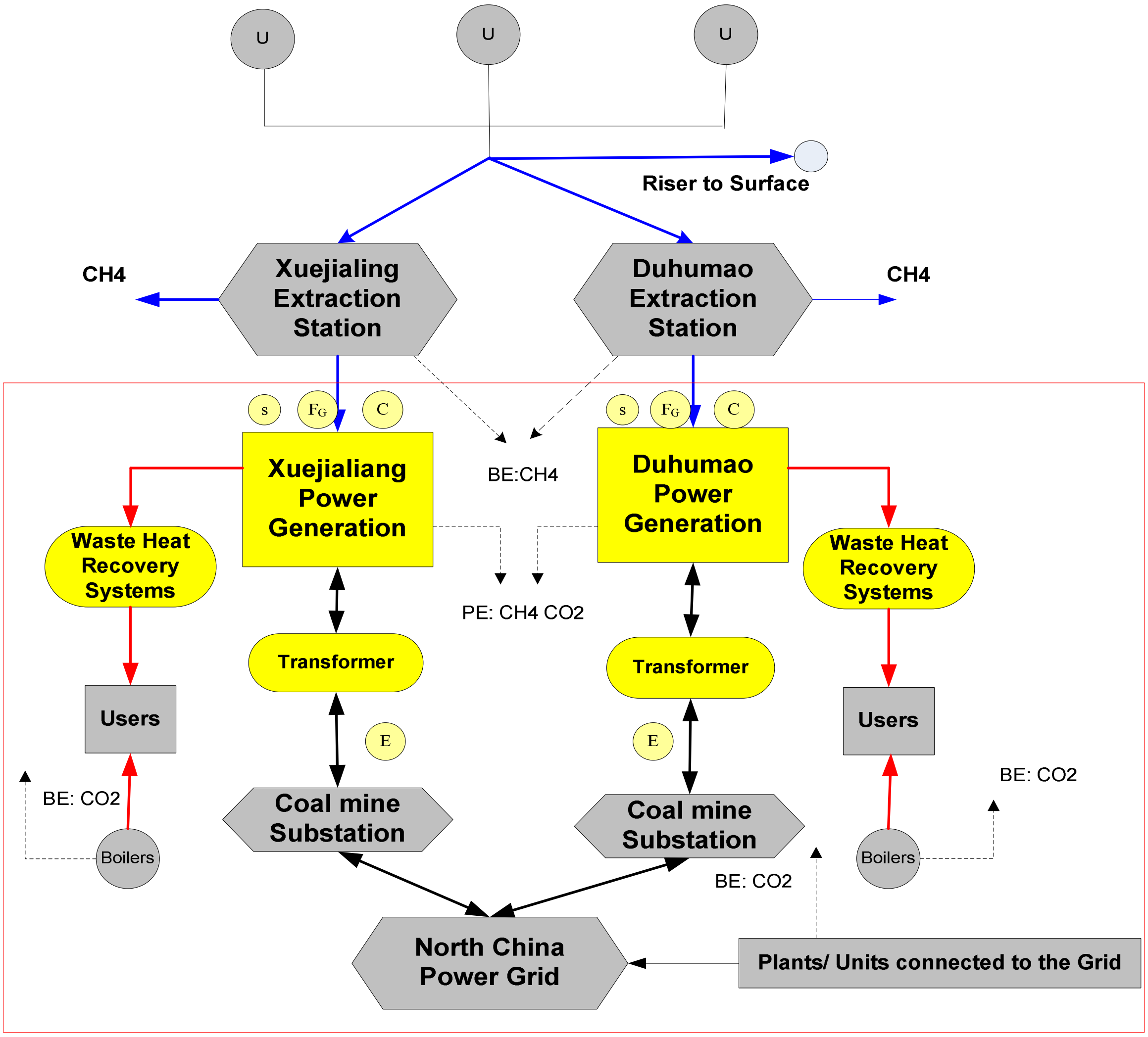
- CO_2 emissions from the production power that is replaced by the project activity;
- CO_2 emissions from the production heat using coal as fuel that is replaced by the project activity.

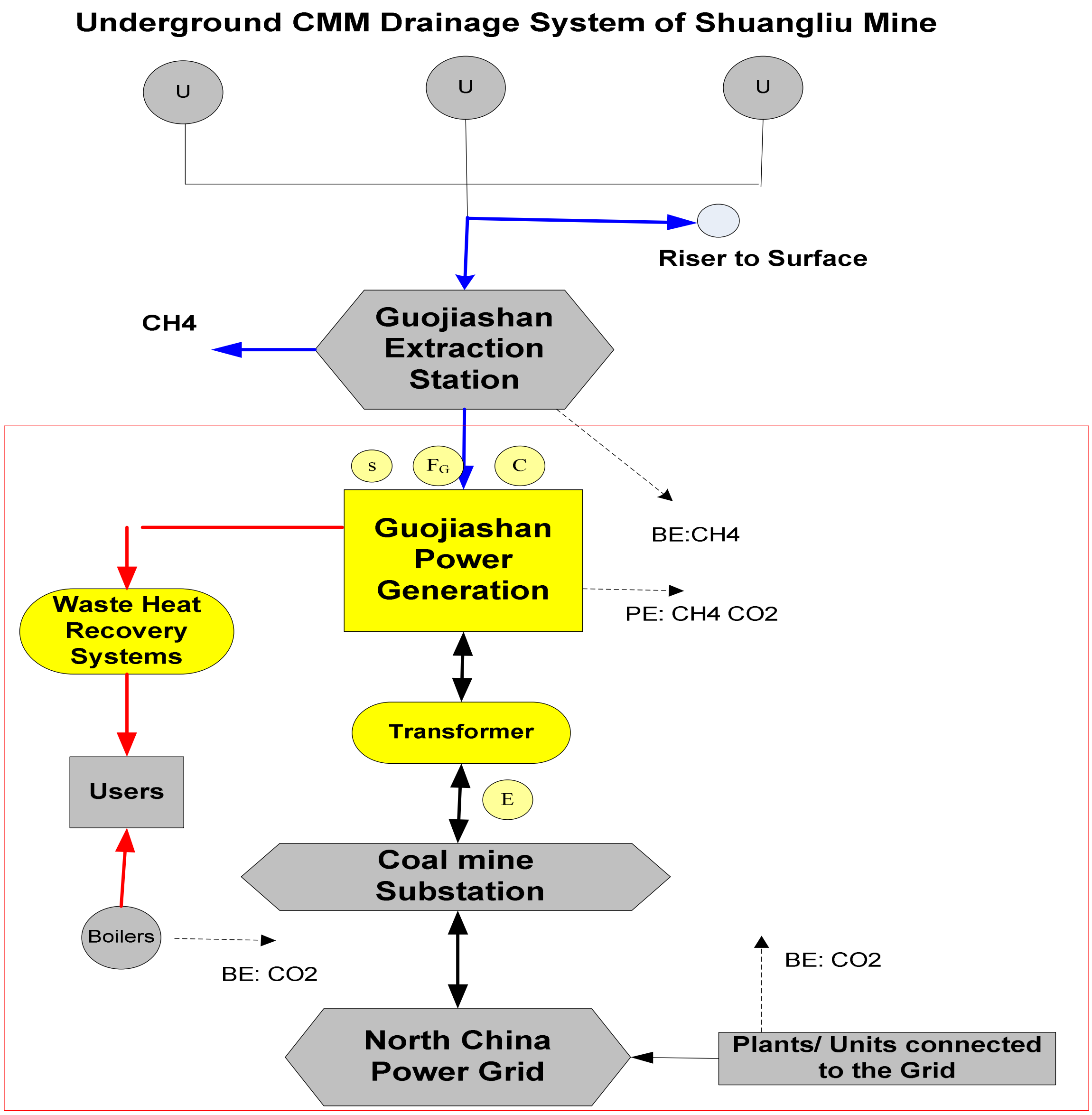
The *spatial extent* of the project boundary comprises:

- All equipment installed and used as part of the project activity for CMM transmission at the project site. There was extraction system in the coal mine before implementation of the project activity. The extraction system is not included in the project activity;
- Power generation facilities and waste heat recovery systems installed and used as part of the project activity;
- Power plants connected to North China Power Grid[3] that the power plant is connected to as per the definition of project electricity system and connected electricity system given in Tool to calculate the emission factor for an electricity system; coal fired boilers that would supply heat to users.

[3] As per the *Notification on Determining Baseline Emission Factor of China's Grid* published by NDRC (China's DNA) on 20/12/2010, issued by the DNA of China, the spatial extent of the project boundary is the North China Power Grid, which covers Beijing, Tianjin Shanxi, Hebei, Inner Mongolia, Shandong.

Underground CMM Drainage System of Hexi Mine




Underground CMM Drainage System of Shuangliu Mine
U
U
U
Riser to Surface
CH4
Guojiashan Extraction Station
S
FG
C
Guojiashan Power Generation
BE:CH4
PE: CH4 CO2
Waste Heat Recovery Systems
Transformer
Users
E
Coal mine Substation
Boilers
BE: CO2
BE: CO2
North China Power Grid
Plants/ Units connected to the Grid

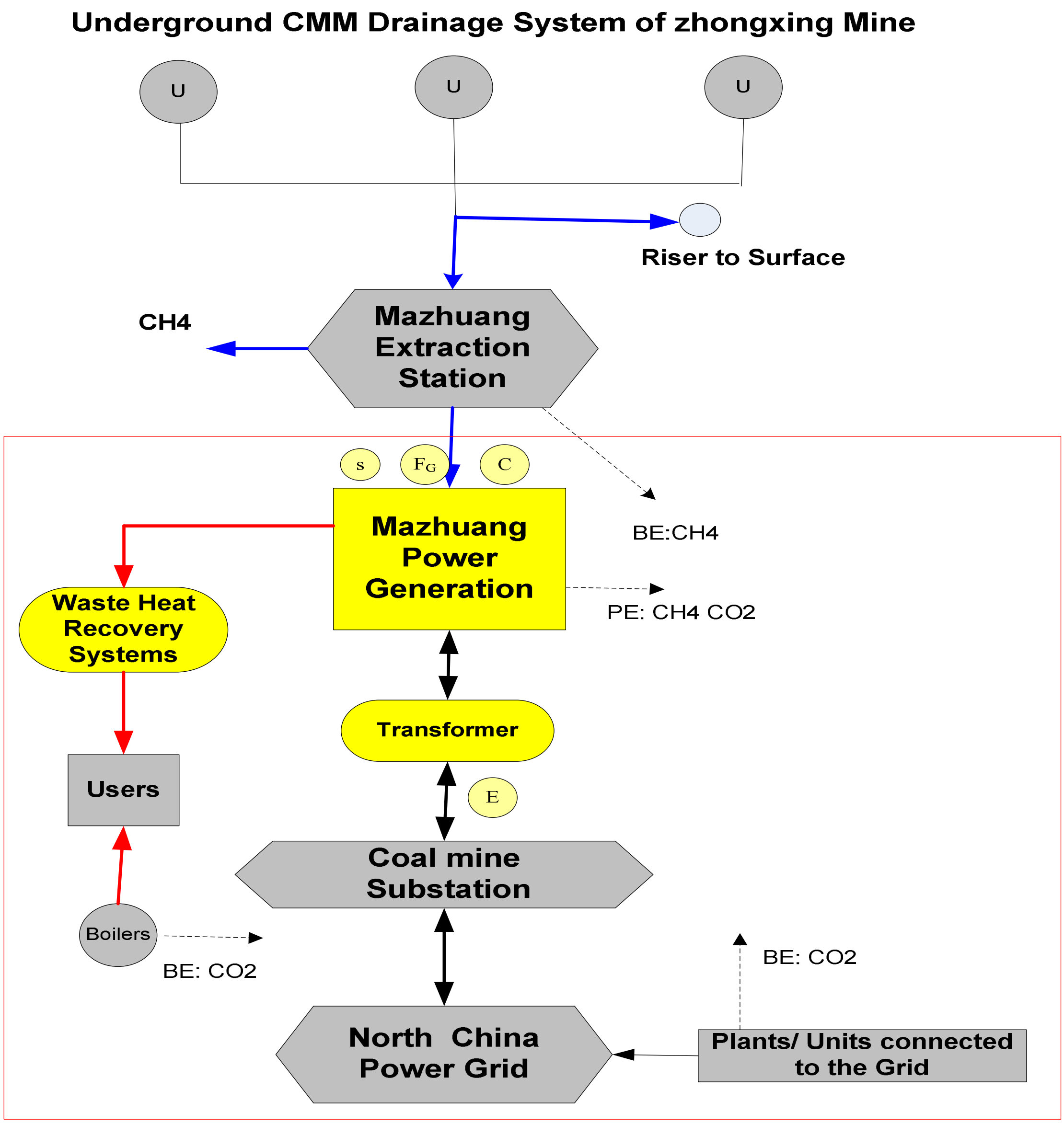


Figure B-1 Project Boundary (Hexi, Shuangliu and Zhongxing mine)

GHG emissions included in the project boundary:

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions of methane as a result of venting	CH_4	Included	Main emission source.
	Emissions from destruction of methane in the baseline	CO_2	Excluded	No CMM usage in the baseline scenario
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.

	Grid electricity generation (electricity provided to the grid)	CO_2	Included	Electricity generated from the project activity will substitute power generation in North China Power Grid.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Captive heat fuel use	CO_2	Included	Heat supplied by waste heat recovery system will replace the heat supplied by coal fired boilers.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	Emission of methane as a result of continued venting	CH_4	Excluded	No CMM/CBM/VAM emission release change in this proposed project.
	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	Additional electricity consumption in the proposed project leads to this part of emissions.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from methane destruction	CO_2	Included	Emissions from methane combustion in the power engines and hot stoves.
	Emissions from NMHC destruction	CO_2	Included	At present, NMHC accounts for less than 1% by volume of the drained CMM. If it accounts for more than 1% by volume of the drained CMM, the emissions will be considered.
	Fugitive emissions of unburned methane	CH_4	Included	Small amount of methane will remain unburned in power generation process, and hot stoves.
	Fugitive methane emissions from onsite equipment	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.

	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	Excluded for simplification.
	Accidental methane release	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.

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

ACM0008 baseline methodology is applied to identify baseline scenario.

Step 1. Identify technically feasible options for capturing and/or using CMM

Step 1a. Options for CMM extraction

A. Ventilation air methane;
B. Pre mining CMM extraction;
C. Post mining CMM extraction;
D. Combinations of ventilation air methane and pre mining extraction. Ventilation accounts for approximately 43% of total methane volume, and pre mining extraction accounts for approximately 57% of total methane volume in Xuejialing Station. In Duhumao station, ventilation and pre mining account for approximately 40% and 60% of total methane volume respectively. In guojiashan station, ventilation and pre mining account for approximately 40% and 60% of total methane volume. In Mazhuang station, ventilation and pre mining account for approximately 19% and 81% of total methane volume respectively. This is the continuation of current CMM extraction practice in each CMM extraction station.

Step 1b. Options for extracted CMM treatment

The CMM treatment options in the proposed coalmine include:

i. Venting. This is the continuation of existing CMM treatment practice;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation, this is the proposed project activity not implemented as a CDM project.
v. Use for additional captive power generation;
vi. Use for additional heat generation;
vii. Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation);
viii. Possible combination of options i to vii with the relative shares of gas treated under each option specified.

Step 1c. Options for energy production

The alternatives for power generation include:

1. Electricity supply by North China Power Grid. This is the continuation of existing power supply practice;
2. Electricity supply from captive coal-fired power generation of same scale;
3. CMM power generation. This is the project activity not undertaken as a CDM project;
4. Electricity supply from a renewable power plant of same scale;

The alternatives for heat production include:

5. Continuation of current heat supply by coal-fired boilers. This is the continuation of existing heat supply practice;
6. Heat supply by the heating Grid;
7. Heat supply by the CMM gas boilers;
8. Waste heat recovery from CMM-fuelled engines. This is the proposed project activity not undertaken as a CDM project.

Step 2. Eliminate baseline options that do not comply with legal or regulatory requirements

Currently, methane control measures only come under the requirements of health and safety regulations governing the maximum methane concentration at various locations within an underground coal mine. It is only required that methane concentrations in the air to be below 1% to avoid the risk of explosion. (*National Coalmine Safety Regulation 2010 version, Section Two item 100 –150* [4]). Under the requirements of the *National Coalmine Safety Regulation 2010 version*, in CMM drainage process, solely adopting pre mining or post mining or solely adopting ventilation in proposed mines could not meet the underground safety requirements. Thus, alternative A, B and C in step 1 do not comply with the regulatory requirements solely.

For CMM utilization, it is regulated in *National Coalmine Safety Regulation 2010 version, item 148* that CMM with methane concentration lower than 30% would not be combusted directly. According to the gas test report of the three mines, the methane concentration in CMM extracted in Zhongxing Mine is 14.15%, in Shuangliu Mine is 18.34%, in Hexi Mine is 18.95%. The methane concentration in the three mines is all below 30%.[5] Thus option *iii* (flaring of CMM) can be eliminated. While it is also regulated that CMM transfer and utilization of CMM with methane concentration lower than 30% should apply safety technology and measures when it is sent for power generation or other utilizations. Option i, ii, iv, v, vi, vii and viii could be feasible options for CMM utilization.

The technology developed by Shengli Oilfield Shengli Power Machinery Co., Inc. could make it possible to utilize CMM ranging from 8% to 30% methane concentration for power generation. The technology including special gas engine and safety transport system of low methane concentration CMM has been successfully tested. The results were verified and the system was approved by Planning, Science and Technology Department of the National Safety Production and Supervision Management Bureau.[6]

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[4] http://www.chinasafety.gov.cn/newpage/Contents/Channel_5330/2010/0126/83595/content_83595.htm;
http://www.chinasafety.gov.cn/files/2005-03/17/F_a40852441d814e24b7e26265bd0053a6_mkaqgc-all(wszt).doc

[5] Gas Test Report issued by the *Shanxi Test Center for Gas Appliances (CMA Code: 2010040366C)* issued on 31/10/2011

[6] *"Certificate of Scientific Results"* awarded by Planning, Science and Technology Department of the National Safety Production and Supervision Management Bureau

Introduction of this system for power generation as CDM project is becoming increased in China, such as the projects of Yima Coal Industry Co., Ltd. and Jiaozuo Coal Industrial Group Co., in Henan province. Actually, most of low concentration CMM projects (all applied for CDM) have been officially approved by China National Development and Reform Commission (NDRC).

According to the Chinese power regulation, the construction of fuel-fired power plant with a capacity of 135MW or below is prohibited in the national grid coverage area.[7] Thus, alternative 2 in energy generation stage does not comply with the local and regulatory requirements.

Step 3. Formulate baseline scenario alternatives

Baseline scenarios meeting the regulatory requirements include:

Step 3a. Alternatives for CMM extraction

The scenario left in step 1a is:

Alternative Scenario D
Combinations of ventilation air methane and pre mining extraction. Ventilation accounts for approximately 43% of total methane volume, and pre mining extraction accounts for approximately 57% of total methane volume in Xuejialing Station. In Duhumao station, ventilation and pre mining account for approximately 40% and 60% of total methane volume respectively. In Guojiashan station, ventilation and pre mining account for approximately 40% and 60% of total methane volume. In Mazhuang station, ventilation and pre mining account for approximately 19% and 81% of total methane volume respectively. This is the continuation of current CMM extraction practice in each CMM extraction station.

Step 3b. Alternatives for CMM treatment

The scenarios left in step 1b are:

Alternative Scenario i
CMM ventilation.

Alternative Scenario ii
VAM Utilization .

Alternative Scenario iv
Recovered CMM could be utilised for power generation delivered to North China Power Grid. This is the project activity not implemented as a CDM project.

Alternative Scenario v
Recovered CMM power generation for use directly at the coalmine

Alternative Scenario vi
Recovered CMM could be combusted in gas boilers to produce thermal energy or heat at the coal mine. This thermal energy could be in the form of hot water, hot air or steam.

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[7] "*Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with Capacity of 135 MW or below issued by the General Office of the State Council*", decree no. 2002-6.

<u>*Alternative Scenario vii*</u>
Extracted CMM could be delivered to the local pipeline for residential or commercial use. The low pressure-type system usually requires the delivered gas to be >30% CH_4.

<u>*Alternative Scenario viii*</u>
Combination of options *above.*

Step 3c. Alternatives for energy production

The alternatives for power generation include:

1. Electricity supply by North China Power Grid. This is the continuation of existing power supply practice;
3. CMM power generation. This is the project activity not undertaken as a CDM project;
4. Construction of a renewable power plant with equivalent amount of electricity;

The alternatives for heat production include:

5. Continuation of current heat supply by coal-fired boilers;
6. Heat supply by the heating Grid;
7. Heat supply by the CMM gas boilers;
8. Waste heat recovery from CMM-fuelled engines. This is the proposed project activity not undertaken as a CDM project.

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers

Step4a. Barrier analysis of the alternatives for CMM extraction:

<u>*Alternative scenario D*</u>
This is the continuation of CMM extraction practice at the project site without the proposed project. Thus it has no barriers.

Step4b. Barrier analysis of the alternatives for CMM treatment:

The barriers analyses of CMM treatment alternatives listed in Step 3b are as follows:

<u>*Alternative Scenario i*</u>
Business As Usual (BAU), no barriers exist.

<u>*Alternative Scenario ii*</u>
VAM Utilization.

The Project does not involve VAM utilization. Therefore this option is not feasible, and then can be eliminated.

<u>*Alternative Scenario iv*</u>
Recovered CMM could be utilised for power generation delivered to North China Power Grid.

This scenario will be discussed in step 5.

<u>*Alternative Scenario v*</u>
Recovered CMM power generation for use directly at the coalmine

This scenario will be discussed in step 5.

<u>*Alternative Scenario vi*</u>
Recovered CMM could be combusted in gas boilers to produce thermal energy or heat at the coal mine. This thermal energy could be in the form of hot water, hot air or steam.

This scenario will be discussed in step 5.

<u>*Alternative Scenario vii*</u>
Extracted CMM could be delivered to the local pipeline for residential or commercial use.

According to the latest "*Classification and essential property of city gas*" (GB/T 13611-2006),[8] if the gas contains methane and air only, the methane concentration must be at least 30.1% for feeding into the gas pipeline; in addition, it can be referred to literature "*Comments on China coal mine methane utilization"* that the concentration of coal mine methane feed into the pipe line must be higher than 30%.[9] Methane concentration in CMM extracted in Hexi, Shuangliu and Zhongxing mines are all below 30%, which makes it technically impossible that the extracted CMM is directly delivered to the gas pipeline. Furthermore, as the coal mines are all located in the mountain area, neither any gas pipeline connection nor methane concentrating facility of the proposed three mines exists. Finally, the coalmines are lack of infrastructure to fulfill management and gas fee charging work, since it is the governmental behavior. Therefore, this alternative faces the technology barriers of lack of infrastructure and is eliminated.

<u>*Alternative Scenario viii*</u>
Possible combination of *i* & *iv*, *i& v*, *i& vi* .

Step 4c. Barrier analysis of the alternatives for energy production:

The barriers analyses of CMM treatment alternatives listed in Step 3c are as follows:

<u>*Alternative Scenario 1*</u>
Electricity supply by North China Power Grid. No barrier exits.

<u>*Alternative Scenario 3*</u>
CMM power generation delivered to North China Power Grid. This is the same activity as alternative scenario *iv*. Detailed analysis will be discussed in Step 5.

<u>*Alternative Scenario 4*</u>

In China, hydro resources are unevenly distributed. It is very limited in Shanxi Province, which accounts for 0.7% of total hydro resources in China. Especially in Lvliang mountain area, the hydro resources are of seriously scarcity, which make construction of hydro power plant infeasible.

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[8] http://www.docin.com/p-226879240.html

[9]Lijingyu. *Comments on China coal mine methane utilization*. Coal Mine World.

For wind farm, it can not be considered as a feasible alternative due to scarcity of surface area on which the wind farm constructed. The owned area of coal mine is, or is go to be mined. Heavy wind mills can not be constructed on goaf.

For solar power generation, due to high investment per unit and low return rate, there is no large-scale solar project which can supply the equivalent electricity. Also it is stated that solar resources of the project site is not of good quality, which would increase the cost of solar power generation. Thus, it is not feasible to develop solar power generation. [10]

For the biomass generation, most of the biomass generations are suffering from severs loss due to continuously rising price of biomass.[11] In addition, the project is located in mountain area which makes it difficult for biomass transport. All these determine that it is not feasible to develop biomass generation.

<u>*Alternative Scenario 5*</u>
Continuation of existing practice - coal-fired boilers for heat supply. No barrier exits.

<u>*Alternative Scenario 6*</u>
Heat supply by the heating Grid.

As the coal mines are all located in the mountain area, neither heating grid nor the pipeline connection was existing in the local areas. Moreover, the coalmines are lack of infrastructure to fulfil management and heat supply charging work, since it is the governmental behavior. All these facts make this scenario be eliminated.

<u>*Alternative Scenario 7*</u>
Heat supply by the CMM gas boilers. This is the same activity as *alternative scenario vi*. Detailed analysis will be discussed in Step 5.

<u>*Alternative Scenario 8*</u>
Waste heat recovery from CMM-fuelled engines. Detailed analysis will be discussed in Step 5.

In conclusion, only alternative scenario D can be implemented in the CMM extraction process. The options *i* , *iv, v and vi* in the CMM treatment process and alternative scenarios 1, 3, 5,7 and 8 in energy production process are practical, the economical analysis will be carried out in Step 5.

Step 5. Identify most economically attractive baseline scenario alternative

According to ACM0008, investment comparison analysis will be used to identify most economically attractive baseline scenario.

In this step, economic evaluation is carried out to the alternative scenarios that are not analyzed in the steps above.

Table B-4: Economic evaluation of Scenario *i and iv*

Input Parameters of Scenario iv	Value	Data source

[10] http://www.newenergy.org.cn/Html/0087/790818772_1.html

[11] http://www.sdwj.gov.cn/ggfw/jgdy/dybg/05/4066.shtml

Installation Capacity(MW)	19.9	*Section 3.5 Major Technical Parameter of FSR*
Operation Hours(hr/y)	6,000	*Section 13.2.7 Basic Parameters of Financial Analysis of FSR*
Project life including construction period (years)	19	
Annual Power Generation (MWh/y)	102,720	
Annual Power supply (MWh/y)	93,960	
Power Tariff including VAT (RMB/kWh)	0.285	
Annual Heat Supply (GJ/y)	55,898.4	
Heat Price including VAT (RMB/GJ)	20	
Total Investment (10^4RMB)	16,763.35[12]	*Attached Table 1-3: Table of Investment Estimation of FSR*
Operation & Maintenance Cost(10^4RMB)	1,392.61	*Attached Table 1-9: Table of Total Expense Estimation of FSR*
Floating Capital (10^4RMB)	162.74	*Section 13.2.1 Financial Introduction of the Project of FSR*
VAT rate of power sale (%)	17	*Section 13.2.7 Basic Parameters of Financial Analysis of FSR*
VAT rate of heat (%)	13	
Income Tax (%)	25	
City maintenance construction tax rate (%)	5	
Additional tax rate of education (%)	3	
Residual value rate (%)	5	*Attached Table 1-13: Table of Depreciation of FSR*
Estimated CERs price (EUR)	9.0	*Estimated*
Crediting period (years)	10	PDD choice
Discount rate	**8%**	*Interim Rules on Economic Assessment of Electric Power Engineering Retrofit Projects*
NPV of scenario iv (10^4 RMB)	**-7,921**	-
IRR of Scenario iv (%)	**-0.45**	-
NPV of scenario i (10^4 RMB)	**0**	-

Table B-5: Economic evaluation of Scenario *i and v*

Input Parameters of Scenario iv	Value	Data source
Installation Capacity (MW)	19.9	*Section 3.5 Major Technical Parameter of FSR*

[12] No debt is raised by PO, thus all the investment is equity.

Operation Hours(hr/y)	6,000	*Section 13.2.7 Basic Parameters of Financial Analysis of FSR*
Project life including construction period (years)	19	
Annual Power Generation (MWh/y)	102,720	
Annual Power supply (MWh/y)	93,960	
Power Purchasing Tariff including VAT (RMB/kWh)	0.372	*Sales receipt of power purchased from the Grid in 2008*
Annual Heat Supply (GJ/y)	55,898.4	*Section13.2.7 Basic Parameters of Financial Analysis of FSR*
Heat Price including VAT (RMB/GJ)	20	
Total Investment (10^4RMB)	16,763.35	*Attached Table 1-3: Table of Investment Estimation of FSR*
Operation & Maintenance Cost(10^4RMB)	1,392.61	*Attached Table 1-9: Table of Total Expense Estimation of FSR*
Floating Capital (10^4RMB)	162.74	*Section 13.2.1 Financial Introduction of the Project of FSR*
VAT rate of power sale (%)	17	*Section 13.2.7 Basic Parameters of Financial Analysis of FSR*
VAT rate of heat (%)	13	
Income Tax (%)	25	
City maintenance construction tax rate (%)	5	
Additional tax rate of education (%)	3	
Residual value rate (%)	5	*Attached Table 1-13: Table of Depreciation of FSR*
Discount rate	**8%**	*Interim Rules on Economic Assessment of Electric Power Engineering Retrofit Projects*
NPV of scenario v (10^4 RMB)	**-2,185**	-
IRR of Scenario v (%)	5.93	-
NPV of scenario i (10^4 RMB)	**0**	-

Table B-6: Economic evaluation of Scenario *i and vi*[13]

Parameters	Value	Data source
Gas boiler investment (10^4 RMB)	3,581.16	*Calculated base on the sample of registered projects*
Gas purification investment (10^4 RMB)	2,413.8	*Investment and cost analysis Report of CMM Purification Project*
Gas boiler operating cost (10^4 RMB)	782.7	*Calculated base on the sample of registered projects*

[13] Data can be referred to the sampled registered PDDs and FSR of the proposed project. Detailed information can be referred to IRR spreadsheet.

Purification O&M cost (10^4 RMB)	612	*Investment and cost analysis Report of CMM Purification Project*
Installed capacity (kW_{th})	59,610	*Calculated base on the sample of registered projects and FSR of proposed project*
Potential thermal energy supply with CMM boilers (GJ/y)	1,158,827	*Calculated base on the sample of registered projects and FSR of proposed project*
Heat Price including VAT (RMB/GJ)	20	*Section 13.2.7 Basic Parameters of Financial Analysis of FSR*
Discount rate	**8%**	*Interim Rules on Economic Assessment of Electric Power Engineering Retrofit Projects*
NPV of scenario vi (10^4 RMB)	**-1,280**	-
IRR of Scenario vi (%)	**4.48**	-
NPV of scenario i (10^4 RMB)	**0**	-

The NPVs of the alternative scenario *iv ,v and vi* are negative and lower than the NPV of alternative scenario i, so alternative *iv,* v and *vi* are not baseline scenarios.

In energy production process, since alternative scenario 1 and 5 are the BAU, their NPV is 0 RMB. As the activity of alternative scenario 3 and 7 are same as that of *iv* and *vi* respectively*,* thus the NPV of alternative scenario 3 and 7 are also negative and eliminated*.* For alternative scenario 8*,* it is can not be implemented because the alternative scenario *iv* is eliminated.

In conclusion, in CMM extraction step only alternative scenario D can be implemented in the CMM drainage process. In CMM treatment step, continuation of the current CMM extraction practice with all the extracted CMM released into atmosphere is the only baseline scenario. In energy production step, continuation of power supply by North China Power Grid and heat supply by coal fired boilers is the baseline scenario.

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

The Feasibility Study Report (FSR) of the proposed project was finalized in 04/2008 and approved on 09/05/2008, which shows that the IRR of the project is too low to reach the sector benchmark. On 02/06/2008, the project owner made the decision of CDM implementation. From then on, CDM is constantly considered in parallel with the development of the project. On 15/07/2008, the project owner signed construction agreement of Xuejialing Power station, which means that the project was started. During several months' negotiation, the project signed CDM consultation agreement with CAMCO on 17/07/2009. Unfortunately, this agreement was not implemented and terminated on 17/12/2010. Then the project owner kept seeking other CDM development opportunities and signed the term sheet with Timing Carbon Ltd. on 26/01/2011.

According to *"Guidelines on the demonstration and assessment of prior consideration of the CDM" (version 04) of* EB 62nd meeting, it can be concluded that continuing and real actions were taken to secure CDM status for the project activity. Detailed timeline is summarized in Table B-7.

Table B-7: Timeline of the project

04/2008	FSR completed
09/05/2008	FSR approval.
06/2008	Environment Impact Assessment (EIA)
02/06/2008	Board's decision to go through the CDM process for the Project
30/06/2008	EIA approval.
15/07/2008	Construction Agreement of Xuejialing Power Station (the starting date of the project activity)
22/10/2008	EPC Contract (except the construction part) of Xuejialing Power Station
17/07/2009	CDM Consultation Agreement with CAMCO
17/12/2010	Termination of Consultation Agreement with CAMCO
26/01/2011	CDM Term Sheet with Timing Carbon Ltd.
11/10/2011	PDD was published on UNFCCC for GSC

The additionality of the proposed project is demonstrated and assessed by using the *Tool for the Demonstration and Assessment of Additionality"* (version 6.1.0).

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

In section B.4 of this PDD, the alternatives analysis have been given, the baseline scenario of the proposed project activity is the continuation of the current CMM extraction practice with all of the extracted CMM to be released into the atmosphere and the continuation of power supply by North China Power Grid and heat supply by coal fired boilers . Based on ACM0008, Step 1 can be ignored.

Step 2. Investment Analysis

The purpose of investment analysis is to determine whether the proposed project is economically attractive. The following sub steps are adopted to assess the investment analysis:

Sub-step 2a Determine appropriate analysis method

The *Tool for Demonstration and Assessment of Additionality* provides three analysis methods: "Simple cost analysis" (option I), "Investment comparison analysis" (option II), and "Benchmark analysis" (option III). Considering that there are not only CDM revenues but also the power sale revenues, option I is not adopted here. Thus the method of "Benchmark analysis" is applied to assess the economic attractiveness of the proposed project.

Sub-step 2b Apply benchmark analysis

It is considered that only is the IRR of proposed project equal to or higher than the benchmark IRR, can the project be economically feasible. According to *Interim Rules on Economic Assessment of Electric Power Engineering Retrofit Projects,* the benchmark project IRR adopted by the Project is 8% (after tax).

Sub-step 2c Calculation and comparison of financial indicators

Calculation and comparison of financial indicators of the Project is implemented according to the *Guidance on Assessment of Investment Analysis*[14]. Based on the basic parameters of alternative *iv* listed in Step 5 of Section B.4, the IRR (after tax) for the proposed project without CDM assistance is -0.45%, which is much lower than the benchmark value of 8%. With CDM assistance, assuming the price of CERs is 9 EURO/tCO_2e[15], the project IRR will reach 14.57% that is much higher than benchmark. Therefore, a conclusion can be made that the proposed project is not economically attractive without revenues from CDM.

Table B-8 Project IRR with and without CDM

	IRR without CDM	**IRR with CDM**
Fenxi Project	-0.45%	14.57%

Sub-step 2d. Sensitivity analysis

According to *Guidance on the Assessment of Investment Analysis (ver 05)*, the "variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation". Furthermore, the O&M cost is a variable which constitutes less than 20% but has a material impact on the analysis. Therefore, the following financial indicators of the Project are taken as uncertain factors for sensitive analysis of financial attractiveness:

Table B-9: Sensitive analysis

	-10%	-5%	0%	5%	10%
Total investment	1.11%	0.30%	-0.45%	-1.16%	-1.83%
Annual O&M Cost	0.91%	2.40%	-0.45%	-1.16%	-1.88%
Annual Power Supply/Power Tariff	-2.67%	-1.50%	-0.45%	0.56%	1.54%

[15] Assuming the exchange rate is : 1EURO=10 RMB

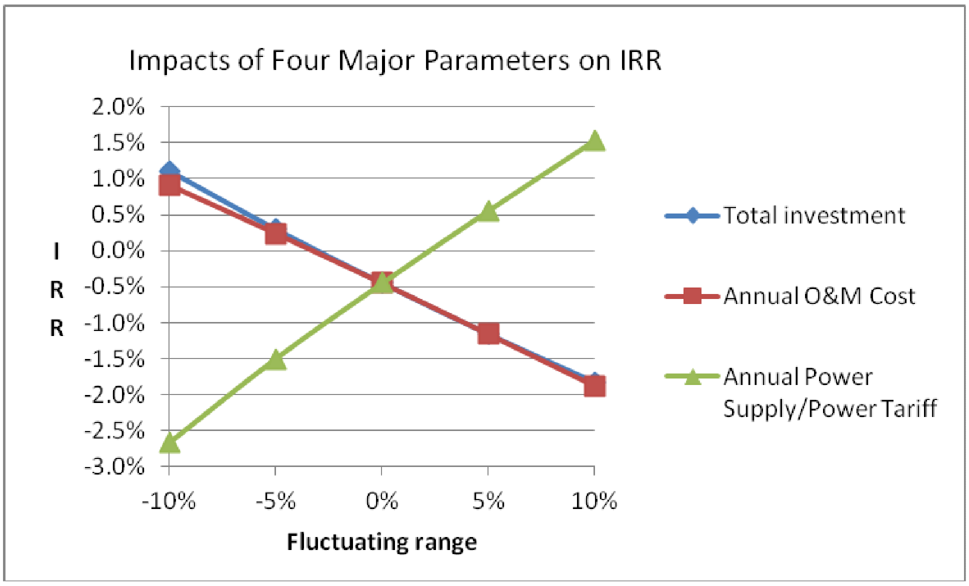

Figure B-2 Impacts of four major parameters on IRR

It can be seen from Figure B-2 that the project IRR, will vary to different degrees with these four sensitive parameters changing between -10% and +10%. It can be seen from Table B-9 that the project IRR does not exceed the benchmark value of 8% when the total investment and annual O&M cost decrease by 10%, and annual power supply and tariff increases by 10%.

For further consideration, the IRR of the Project could reach the benchmark 8% if one of the following conditions is achieved:

- The total investment is decreased by at least 41%;
- The annual O&M cost is decreased by at least75.2%;
- The power tariff (including VAT)/ annual power supply is increased by at least 49.4%.

However, none of these conditions can be achieved due to the following reasons:

- **Regarding the total investment**

According to *Price Index of Investment in Fixed Assets* (*Shanxi Statics Yearbook 2010*), labor cost, material cost (such as cements, construction, etc) machinery, and other costs kept increasing these years. It is impossible to decrease the total investment of the Project under such circumstances. Moreover, for the constructed Xuejialiang and Mazhuang Stations, the total value of signed contracts was beyond the designed value of investment estimation in the FSR[16]. It has slim possibility to decrease the total investment of the Project.

- **Regarding the annual O&M cost**

The O&M cost consists of material costs (e.g. water), fuel & power, and labour cost, etc.. Among these costs:

- Trends of materials (e.g. water) cost and power purchasing cost can be reflected in P*roducer Price Index of Material Products by Sectors (Shanxi Statics Yearbook 2010*). It is shown in the yearbook that *the water price and power purchasing price kept increasing these years (price index: water 102.5 in 2008, 103.4 in 2009; Power 105.2 in 2008, 106.7 in 2009);*

[16] Total signed value of two stations is 6,984.4753 10^4 RMB, while designed value in FSR is 6,463.29 10^4 RMB.

- Trends of fuel cost can be reflected in *Index of Raw Materials and Fuels Purchasing Price (Shanxi Statics Yearbook 2010*). It is shown in the yearbook that *the fuels price kept increasing these years (price index: 101.2in2000, 113.2 in 2005, 101.8 in 2009);*

- Trends of labor cost can be reflected in Average Wage of Staff and Workers and Related Index in Major years (*Shanxi Statics Yearbook 2010*). It is shown in the yearbook that *the average wage of staff kept increasing since 2000;*

Therefore, it is impossible to decrease the annual O&M cost of the Project.

- **Regarding the power tariff (including VAT)**

First of all, the tariff of the project is source from FSR, which is carried out by the third authorized party in April 2008. Thus the tariff in the FSR is credible at the time of decision making. In 2008, the bus-bar tariff of desulfurized coal-fired plant in Shanxi Province was 0.2754 RMB/kWh (VAT included). Several new grid connected CMM power generations adopted this tariff at that time. The proposed project adopted 0.285 RMB/kWh (VAT included) is conservative. Secondly, the electricity generated by this project is sold to the power grid and the electricity tariff is strictly controlled by the government. The adjustment of the electricity need to be achieved by negotiating among several government departments which could not be forecasted or controlled by one specific power company. Thus, project IRR has little possibility to reach 8%.

- **Regarding annual power supply**

The annual power supply would not increase since the calculation is based on the designed feasible load of the generators. Before the project started, Project Owner had studied carefully on the generators chosen. Annual operation hours of the generators would not exceed 6000 hours in the long run. As CMM power generation is a relatively new technology, no supplier could guarantee the engine's stable operation for a long time. Moreover, operation hour would exceed 8760 by increasing 49.4%.

In summary, the IRR (after tax) of the Project could not reach the benchmark according to the sensitivity analysis and critical point analysis. Therefore the conclusion that the Project is not financially attractive is robust to reasonable variations in the critical assumptions.

Step 4. Common Practice Analysis

According to the *Tool for the demonstration and assessment of additionality (Version 06.1.0)*, the common practice analysis is illustrated by following sub-steps.

Sub-step 4a. Analyze other activities similar to the proposed project activities
Sub-step 4a-1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity

The total installation capacity for power generation of the proposed project is 19.9MW. Range of +/-50% of the capacity is from 9.95MW to 29.85MW.

Sub-step 4a-2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculation in Step 4a-1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}.

Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

According to the *Tool for the demonstration and assessment of additionality*, the *applicable geographical area* covers the entire host country as a default. The start date of the Project was 15/07/2008. Therefore, $\mathbf{N_{all}}$ is the number of all the power plants within the applicable capacity range (9.95MW to 29.85MW) operated before 15/07/2008 in China, except for the registered CDM projects or under validation projects.

For the convenience of discussion in the following sub-steps, the $\mathbf{N_{all}}$ is divided into three parts:
1. The unknown value **X** is made to represent the number of all the non-coal mine gas utilization projects (including fossil fuel plants, nuclear plants, waste heat/gas plants, solid waste treatment plants, renewable energy power plants, etc.), and captive plants in $\mathbf{N_{all}}$;
2. The unknown value **Y** is made to represent the number of the coal mine gas utilization projects not located in Shanxi Province in $\mathbf{N_{all}}$;
3. The rest in $\mathbf{N_{all}}$ is the number of coal mine gas utilization projects located in Shanxi Province, thus the unknown value **R** is made to represent it.

Then the $\mathbf{N_{all}}$ is composed of: $\mathbf{N_{all} = X + Y + R}$.

Sub-step 4a-3. Within plants identified in sub-step 2, indentify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

Considering the facts that the non-coal mine gas utilization projects and captive plants enjoy different energy source/fuel, the plants in **X** are identified as applying different technology with the proposed project, thereby the number **X** is included in the $\mathbf{N_{diff}}$.

Moreover, in China, the provincial government is the highest level of local government. The local regulatory framework is often set by local government (e.g. price regulation, investment policy and so on). In addition, the natural conditions and investment conditions (e.g. electricity tariff, the commodity price and labour salary, etc.) are quite different among provinces. Then only the province could be regarded as applicable geographical area. And the FSRs and EIA statements of the proposed project were all approved by Provincial Government. Thereby the coal mine gas utilization projects in **Y** are identified as applying different technology with the proposed project, then the number **Y** is included in the $\mathbf{N_{diff}}$.

Therefore, $\mathbf{N_{diff} = X + Y}$

Searching from public & available sources, such as *Global Methane International Coal Mine Methane Projects Database*[17], China's DNA website and UNFCCC website, the mine gas utilization projects operated before 15/07/2008 in Shanxi Province were all registered as CDM project. Therefore, **R**=0.

Sub-step 4a-4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

The proposed project is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

[17] http://www2.ergweb.com/cmm/projects/ProjectFind.aspx

(a) the factor F is greater than 0.2, and
(b) N_{all}-N_{diff} is greater than 3.

Since $\mathbf{N_{all} = X + Y + R, N_{diff} = X + Y, R}=0$
$\mathbf{N_{diff}} = \mathbf{N_{all}}$
$\mathbf{N_{all}} - \mathbf{N_{diff}} = 0$, which is less than 3.

Therefore, the Project activity is not a "common practice".

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

As analyzed in *Sub-step 4a*, no similar project is found. Therefore, the project activity is not a common practice.

It can be concluded from the above discussions that the proposed project is additional, and estimated emission reduction will not be achieved without CDM assistance.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

The emission reduction ER_y by the project activity during a given year *y* is the difference between the baseline emissions (BE_y) and project emissions (PE_y), and also eliminates the leakage of CDM project activities (LE_y) as follows:

$ER_y = BE_y - PE_y - LE_y$

where:
ER_y: Emissions reductions of the project activity during the year y (tCO_2e)
BE_y: Baseline emissions during the year y (tCO_2e)
PEy: Project emissions during the year y (tCO_2e)
LE_y: Leakage emissions in year y (tCO_2e)

In order to determine this value, we should firstly to determine the baseline emissions, the project emissions and the leakage emissions.

1. Project Emissions

Project emissions are defined by the following equation:

$PE_y = PE_{ME} + PE_{MD} + PE_{UM}$

where:
PE_y: Project emissions in year y (tCO_2e)
PE_{ME}: Project emissions from energy use to capture and use methane (tCO_2e)
PE_{MD}: Project emissions from methane destroyed (tCO_2e)
PE_{UM}: Project emissions from un-combusted methane (tCO_2e)

1.1 Combustion emissions from additional energy required for CMM capture and use PE_{ME}

Additional power energy may be used to capture, transport, compress and use the CMM. Emissions from this electricity consumption should be treated as project emissions. No fossil fuels and heat are consumed in the project activity. Thus, the formula is as follows:

$PE_{ME} = CONS_{ELEC,\ PJ} \times CEF_{ELEC}$

where:
PE_{ME}: Project emissions from energy use to capture and use methane (tCO_2e)
$CONS_{ELEC,\ PJ}$: Additional electricity consumption for capture and use of methane (MWh)
CEF_{ELEC}: Carbon emissions factor of electricity used by coal mine, which is the emission factor of the North China Power Grid in this project (tCO_2e/MWh)

1.2 Combustion emissions from use of captured methane PE_{MD}

When the captured methane is burned, combustion emissions are released. In addition, if NMHC accounts for more than 1% by volume of the extracted CMM, combustion emissions from these gases should also be included. In each end-use, the amount of gas destroyed depends on the efficiency of combustion of each end use. The proposed project activity only involves methane destroyed after being supplied to power generators. The use of captured methane only includes electricity generation. Therefore, the formula will be as following:

$PE_{MD} = MD_{ELEC} \times (CEF_{CH4} + r \times CEF_{NMHC})$

with:
$r = PC_{NMHC} / PC_{CH4}$

where:
PE_{MD}: Project emissions from CMM destroyed (tCO_2e)
MD_{ELEC}: Methane destroyed through power generation (tCH_4)
CEF_{CH4}: Carbon emission factor for combusted methane ($2.75tCO_2e/tCH_4$)
CEF_{NMHC}: Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2e/tNMHC$)
r: Relative proportion of NMHC compared to methane
PC_{CH4}: Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}: NMHC concentration (in mass) in extracted gas (%)

$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$

where:
MD_{ELEC}: Methane destroyed through power generation (tCH_4)
MM_{ELEC}: Methane measured sent to power plant (tCH_4)
Eff_{ELEC}: Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC)

1.3 Un-combusted methane from end uses PE_{UM}

Not all of the methane used to generate power will be combusted, so a small amount will escape to the atmosphere. Use the following equation to calculate PE_{UM}:

$PE_{UM} = GWP_{CH4} \text{ x } [MM_{ELEC} \text{ x } (1 - Eff_{ELEC})]$

where:
PE_{UM}: Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}: Global warming potential of methane ($21tCO_2e/tCH_4$)
MM_{ELEC}: Methane measured sent to power generation (tCH_4)
Eff_{ELEC}: Efficiency of methane destruction/oxidation in power generation (taken as 99.5% from IPCC)

2. Baseline Emissions

Baseline emissions are given by the following equation:

$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y}$

where:
BE_y: Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$: Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$BE_{MR,y}$: Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
$BE_{Use,y}$: Baseline emissions from the production of power replaced by the project activity in year y (tCO_2e)

2.1 Methane destruction in the Baseline $BE_{MD,y}$

In baseline scenario, all the extracted gas is vented and not destroyed, thus $BE_{MD,y} = 0$.

2.2 Methane released into the atmosphere $BE_{MR,y}$

None of the pre-mining CMM extraction and VAM in baseline was captured before the proposed project is implemented. All the extracted gas which is utilized by the project activity was released into the atmosphere in the baseline scenario.

Using the following equation to calculate $BE_{MR,y}$.

$BE_{MR,y} = GWP_{CH4} \text{ x } CMM_{PJ,ELEC,y} = GWP_{CH4} \text{ x } MM_{ELEC}$

where:
$BE_{MR,y}$: Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
GWP_{CH4}: Global warming potential of methane ($21tCO_2e/tCH_4$)
$CMM_{PJ,ELEC,y}$: Pre-mining CMM captured, sent to and destroyed by power generation in the project activity in year y(tCH_4)
MM_{ELEC}: Methane measured sent to power plant (tCH_4)

2.3 Emissions from power and heat generation replaced by project $BE_{Use,y}$

The power generation in the proposed project will replace electricity consumption from the North China Power Grid. ERs from heat replacement are not claimed. Thus, the following equation used to estimate $BE_{Use,y}$.

$BE_{Use,y} = GEN_y \times EF_{ELEC}$

where:
$BE_{Use,y}$: Baseline emissions from the production of power replaced by the project activity in year y (tCO_2e)
GEN_y: Electricity generated by project activity in year y (MWh)
EF_{ELEC}: Emissions factor of electricity (Northt China Power Grid) replaced by project (tCO_2/MWh)

2.3.1 Grid power emissions factor EF_{ELEC}

The electricity generated in the proposed project will exported to the North China Power Grid whose emission factor is ex-ante calculated by using "*Tool to calculate of the emission factor for an electricity system*". The proposed project will apply the following six steps:

Step 1. Identify the relevant electric power systems

In accordance with *Tool to Calculate the Emission Factor for an Electricity System*, the relevant electricity system of the Project is identified according to the delineation of the relevant electricity system and connected electricity systems published by China's DNA.

Electricity generated by the Project will be delivered to Shanxi Power Grid. According to *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China* issued by China's DNA which provides the delineation of relevant electricity systems, Shanxi Power Grid is an integral part of North China Power Grid. Thus North China Power Grid is the relevant electricity system of the Project.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Option I (only grid power plants are included in the calculation) provided in *Tool to Calculate the Emission Factor for an Electricity System* is chosen to calculate the operating margin and build margin emission factor.

Step 3. Select a method to determine the operating margin (OM)

Four methods are provided in *Tool to Calculate the Emission Factor for an Electricity System* for the calculation of operating margin emission factor ($EF_{grid,OM,y}$), they are

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

As per *Tool to Calculate the Emission Factor for an Electricity System*, referring to *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China*, the method (a) simple OM is employed for calculation of the operating margin emission factor(s) ($EF_{grid,OM,y}$) of the Project.

As per *Tool to Calculate the Emission Factor for an Electricity System*, the method (a) simple OM only

can be used when low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Among the total electricity generation of North China Power Grid which the Project is connected to, the amount of low-cost/must run resources accounts for about 0.8% in 2004, 0.7% in 2005, 0.8% in 2006, 0.9% in 2007 and 1.3% in 2008, [18]all less than 50%. Thus, the method (a) simple OM can be used to calculate the baseline emission factor of operating margin ($EF_{grid,OM,y}$) of the Project.

For the simple OM, the emission factor can be calculated using either of the two following data vintages:
• *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation weighted average, based on the most recent data available at the time of submission of the PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the PDD for validation.
• *Ex post* option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

For the Project, only grid power plants are included in the calculation. And the *Ex ante* option is adopted by the Project to determine the emission factor. Therefore, the emission factor is determined once at the validation stage and no monitoring and recalculation of the emission factor during the crediting period is required.

Step 4. Calculate the operating margin emission factor ($EF_{grid,OMsimple,y}$) according to the selected method

Two options are provided in *Tool to Calculate the Emission Factor for an Electricity System* for the determination of the simple operating margin emission factor ($EF_{grid,OMsimple,y}$).
Option A: Based on the net electricity generation and a CO_2 emission factor of each unit, or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and the total fuel consumption of the relevant electricity system.

Since the data on the net electricity generation and CO_2 emission factor of each power unit in North China Power Grid are not available, Option A is not applicable to the Project. As summarized in Annex 3, only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known. Moreover, off-grid power plants are not included in the calculation (Option I has been chosen in Step 2). Therefore, Option B (based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the electricity system) is adopted to calculate the simple operating margin emission factor ($EF_{grid,OMsimple,y}$). The formula of $EF_{grid,OMsimple,y}$ calculation is

[18] *China Electric Power Yearbook 2005-2009*

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

Where:
$EF_{grid,OMsimple,y}$ is the simple operating margin emission factor in year y (tCO_2/MWh);
$FC_{i,y}$ is the amount of fuel i consumed in North China Power Grid in year y (mass or volume unit);
$NCV_{i,y}$ is the net calorific value (energy content) of fuel i in year y (GJ/mass or volume unit);
$EF_{CO2,i,y}$ is the emission factor of fuel i in year y (tCO_2/GJ);
EG_y is the net electricity generated and delivered to the grid by all power sources serving North China Power Grid, not including low-cost/must-run power plants/units, in year y (MWh);
i are all fossil fuel types combusted in power sources in North China Power Grid in year y;
y is the relevant year as per the data vintage chosen in Step 3;

The data on electricity generation and auxiliary electricity consumption rate for calculating the operating margin emission factor ($EF_{grid,OM,y}$) are obtained from *China Electric Power Yearbook* from 2007 to 2009. The data on different fuel consumptions for power generation and the net calorific values of the fuels are obtained from *China Energy Statistical Yearbook* from 2007 to 2009. The data on electricity exchange capacity between the power grids are obtained from *Electric Industry Statistics Summary* of 2006 and *Electric Industry Statistics Collection 2007 to 2008*. The emission factors of the fuels employed and carbon oxidation rate are obtained from Table 1.3 and Table 1.4 on page 1.21-1.24 of volume 2 of *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. The lower values of the 95% confidence intervals in Table 1.4 are used for the emission factors of the fuels employed. For the regional power grids that import net electricity, the simple operating margin emission factor of the power grid that supply the electricity will be used as the emission factor of the net electricity import.

There exists no net electricity import to North China Power Grid. Referring to *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China*, the simple operating margin emission factor ($EF_{grid,OM,y}$) of North China Power Grid is 0.9914 tCO_2e/MWh (see Annex 3 for details).

Step 5. Calculate the build margin (BM) emission factor

According to *Tool to Calculate the Emission Factor for an Electricity System*, one of the following two options to calculate the build margin emission factor ($EF_{grid,BM,y}$) shall be chosen.

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

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the Project or, if information up to the

year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is adopted by the Project.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);
(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);
(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

It is very difficult to obtain the data of the five power units started to supply electricity to the grid most recently bechase these data are considered as confidential business matter in China. So, $SET_{\geq 20\%}$ is selected as SET_{sample}. Based on relevant data released by China's DNA, none of the power units in the selected SET_{sample} started to supply electricity to the gird more than 10 year ago. Hence the selected SET_{sample} is used to calculate the build margin.

According to the methodology ACM0002, calculate the build margin emission factor ($EF_{grid,BM,y}$) according to *Tool to Calculate the Emission Factor for an Electricity System* using equation (5):

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (5)$$

where:

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

$EF_{EL,m,y}$ is the emission factor of power unit m in year y (tCO_2/MWh);

$EG_{m,y}$ is the net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh).

m is the power units included in the build margin;

y is the most recent historical year for which electricity generation data is available.

The emission factor of unit m is calculated according to option A2 in Step 4 (a) "Simple OM" in *Tool to Calculate the Emission Factor for an Electricity System.*

As the data of installed capacity can not be separated into coal fired, oil fired and gas fired currently, the build margin emission factor is calculated by the following steps and formulas:

Currently, it is very difficult to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity generated and delivered to the grid and fuel consumption data in power unit *m* are regarded as commercial secrets or only for internal usage. Then the following deviation[19] approved by the EB was adopted to calculate the Build Margin emission factor.

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

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (6)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (7)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (8)$$

where:

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

$NCV_{i,y}$ is the net calorific value (energy content) of fuel i in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$ is the emission factor of fossil fuel i in year y (tCO_2e/GJ);

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

Step b. Calculate the 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.

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (9)$$

Where $EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$ and $EF_{Gas,Adv,y}$ are emission factor proxies of efficiency level of the best coal fired, oil fired and gas fired 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.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total.y}} \times EF_{Thermal,y} \quad (10)$$

Where $CAP_{Total,y}$ is total capacity additions that exceed 20% of existing capacity, while $CAP_{Thermal,y}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net calorific values of the fuels are obtained from *China Energy Statistical Yearbook* from 2007 to 2009. The emission factors of the fuels

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

employed are obtained from Table 1.3 and Table 1.4 on page 1.21-1.24 of volume 2 of *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

With reference to *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China*, the build margin emission factor ($EF_{grid,BM,y}$) of North China Power Grid is 0.7495 tCO_2e/MWh.

Step 6. Calculate the combined margin emissions factor

Based on *Tool to Calculate the Emission Factor for an Electricity System*, the combined emission factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$), as

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM} \quad (11)$$

According to *Tool to Calculate the Emission Factor for an Electricity System*, the weight w_{OM} is 0.5 and the weight w_{BM} is 0.5 for CMM power projects. Therefore the combined margin emission factor, i.e. the baseline emission factor of the Project,
$EF_{grid,CM,y}$ = 0.5 × 0.9914 + 0. 5 × 0.7495 = 0.87045 (tCO_2e/MWh).

3. Leakage

Leakage is given by the following equation:

$LE_y = LE_{d,y} + LE_{o,y}$

where:
LE_y: Leakage emissions in year y (tCO_2e)
$LE_{d,y}$: Leakage emissions due to displacement of other baseline thermal energy use of methane in year y (tCO_2e)
$LE_{o,y}$: Leakage emissions due to other uncertainties in year y (tCO_2e)

Displacement of baseline thermal energy use
There is no CMM utilisation in the baseline scenario, so no displacement of baseline thermal energy uses would occur.

CBM drainage from outside the de-stressed zone
The Project does not involve CBM, thus the leakage emissions in this part are 0.

Impact of CDM project activity on coal production
There is no noticeable impact of CDM project activity on coal production since the baseline scenario is not ventilation only. CMM extraction is part of baseline scenario. Thus, there would not be any impact on the coal production. The leakage emissions of this part are 0.

Impact of CDM project activity on coal prices and market dynamics
According to ACM0008, it is not necessary to consider this possibility at this stage.

Therefore, no leakage effects need to be accounted for under this proposed project. $LE_y = 0$.

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

Data / Parameter:	$FC_{i,y}$
Data unit:	tce
Description:	Amount of fossil fuel *i* consumed in the North China Power Grid in year y
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	MJ/t,km^3
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*.
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/GJ
Description:	CO2 emission factor per unit of energy of fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC 2006 Guidelines is reliable data source.
Any comment:	-

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y*

Source of data used:	*"China Electric Power Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data
Any comment:	-

Data / Parameter:	$F_{i,j,y}$
Data unit:	tce
Description:	Amount of fuel *i* consumed by relevant province *j* in year y
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$CAP_{Total,NCPG}$
Data unit:	MW
Description:	Capacity additions of the North China Power Grid
Source of data used:	*"China Electric Power Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data
Any comment:	-

Data / Parameter:	$CAP_{Thermal,NCPG}$
Data unit:	MW
Description:	Thermal power capacity additions of the North China Power Grid
Source of data used:	*"China Electric Power Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data
Any comment:	-

Data / Parameter:	Eff_{ELEC}
Data unit:	%
Description:	Efficiency of methane destruction/oxidation in power plant
Source of data used:	ACM0008 refer this value to IPCC as 99.5%
Value applied:	99.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008
Any comment:	-

Data/Parameter:	$FC_{adv,coal}$
Data unit:	gCe/kWh
Description:	Weighted average fuel consumption for power generation of top 30 sets of 600 MW coal fired power generation units built in 2008 (taken as efficiency level of the best technology commercially available in China)
Source of data used:	*Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China*
Value applied:	314.35
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China* made publicly available by China's DNA are reliable.
Any comment:	-

Data/Parameter:	$FC_{adv,oil/gas}$
Data unit:	gCe/kWh
Description:	Weighted average fuel consumption for power generation of 200 MW oil/gas fired combined cycle power generation units (taken as efficiency level of the best technology commercially available in China)
Source of data used:	*Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China*
Value applied:	238.74
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China* are reliable.
Any comment:	-

Data / Parameter:	GWP_{CH4}

Data unit:	tCO_2e/ tCH_4
Description:	Global warming potential of methane
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC 2006 Guidelines is reliable data source.
Any comment:	-

Data / Parameter:	CEF_{CH4}
Data unit:	tCO_2e/ tCH_4
Description:	Carbon emission factor for combusted methane
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	2.75
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC 2006 Guidelines is reliable data source.
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

1. Project Emissions

1.1 Emissions from additional energy required for CMM capture and use PE_{ME}

1.1.1. Emission Factor $EF_{ELEC,y}$ of the North China Power Grid

The proposed project will adopt *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China* to determine the emission factor of North China Power Grid. According to this notification, the EF_{OM} and EF_{BM} of North China Power Grid are 0.9914 tCO_2 /MWh and 0.7495tCO_2 /MWh respectively, hence $EF_{ELEC,y}$=0.87045tCO_2 /MWh.

1.1.2 Calculation of PE_{ME}

According to the feasibility study report, annual power consumption is 9,030MWh, which is deducted before the power is delivered to the Grid. Moreover, power engines would directly combust the supplied CMM by adjusting air/fuel ratio, which means that no other fuels are required for CMM combustion. Hence PE_{ME} = 0 here.

1.2 Combustion emissions from use of captured methane PE_{MD}

According to gas sample analysis in the proposed coalmine, the NMHC concentration is lower than 1%, thus the combustion emissions from non-methane hydrocarbons will be ignored. The NMHC

concentration will be monitored annually in Hexi, Shuangliu and Zhongxing coalmines to check whether its concentration is below or above 1% to determine whether NMHC combustion to be included in the project emissions.

Ex-ante estimated PE_{MD} is given as follows:

$PE_{MD} = MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH4}$

When the project is fully operated in 2015, annually methane volume (V_{CH4}) sent to power plant is 35.8659Mm^3/y, which is given by the feasibility study report of the proposed project. The density of methane at normal temperature and at normal pressure is 0.00067 t/m^3 (IPCC Default Value) according to ACM0008. Therefore:

When the project is fully operated from year 2015:

$PE_{MD} = MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH4} = (35.8659\times0.00067\times10^6)\times99.5\%\times2.75 = 65{,}753 tCO_2e/y$

For the period 01/12/2012 to 31/12/2013, only 6*650kW gensets in Xuejialing station, 8*500kW in Guojiashan station and 8*500kW gensts in Mazhuang station are operated, Annual methane volume (V_{CH4}) sent to the three power plants is 21.4525Mm^3/y. Thus:

01/12/2012 ~ 31/12/2012:
$PE_{MD} = MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH4} = (21.4525/12\times0.00067\times10^6)\times99.5\%\times2.75 = 3{,}277 tCO_2e/y$

In the year 2013:
$PE_{MD} = MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH4} = (21.4525\times0.00067\times10^6)\times99.5\%\times2.75 = 39{,}329 tCO_2e/y$

From the year 2014, 8*500kW gensets in Duhumao station is put into operation. Then the annual methane volume (V_{CH4}) sent to the four power plants increases to 28.6592Mm^3/y. Thus:

In the year 2014:
$PE_{MD} = MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH4} = (28.6592\times0.00067\times10^6)\times99.5\%\times2.75 = 52{,}541 tCO_2e/y$

1.3 Un-combusted methane from end uses PE_{UM}

As presented above, the calculation of PE_{UM} based on the implementation schedule is as follows:

When the project is fully operated from year 2015:
$PE_{UM} = GWP_{CH4}\times MM_{ELEC}\times(1-Eff_{ELEC}) = 21\times(35.8659\times0.00067\times10^6)\times(1-99.5\%) = 2{,}523 tCO_2e/y$

01/12/2012 ~ 31/12/2012:
$PE_{UM} = GWP_{CH4}\times MM_{ELEC}\times(1-Eff_{ELEC}) = 21\times(21.4525/12\times0.00067\times10^6)\times(1-99.5\%) = 126\ tCO_2e/y$

In the year 2013:
$PE_{UM} = GWP_{CH4}\times MM_{ELEC}\times(1-Eff_{ELEC}) = 21\times(21.4525\times0.00067\times10^6)\times(1-99.5\%) = 1{,}509\ tCO_2e/y$

In the year 2014:
$PE_{UM} = GWP_{CH4}\times MM_{ELEC}\times(1-Eff_{ELEC}) = 21\times(28.6592\times0.00067\times10^6)\times(1-99.5\%) = 2{,}016\ tCO_2e/y$

1.4 The calculation results of project emissions

According to the above calculation, the project emissions are shown as the following table.

Table B-10 Project emissions at the proposed coalmines (tCO_2e)

Year	PE_{ME}	PE_{MD}	PE_{UM}	PE_y
01/12/2012~ 31/12/2012	0	3,277	126	3,403
2013	0	39,329	1,509	40,838
2014	0	52,541	2,016	54,557
2015	0	65,753	2,523	68,276
2016	0	65,753	2,523	68,276
2017	0	65,753	2,523	68,276
2018	0	65,753	2,523	68,276
2019	0	65,753	2,523	68,276
2020	0	65,753	2,523	68,276
2021	0	65,753	2,523	68,276
01/01/2022~ 30/11/2022	0	60,273	2,313	62,586
Total	**0**	**615,687**	**23,626**	**639,313**

2. Baseline Emissions

2.1 Methane destruction in the Baseline $BE_{MD,y}$

In baseline scenario, all the drained gas is vented without any utilization, thus $BE_{MD,y} = 0$.

2.2 Methane released into the atmosphere $BE_{MR,y}$

As presented above, the calculation of $BE_{MR,y}$ based on the implementation schedule is as follows:

When the project is fully operated from year 2015:
$BE_{MR,y} = GWP_{CH4} \text{ x } MM_{ELEC} = 21\times35.8659\times0.00067\times10^6 = 504{,}633 \ tCO_2e/y$

01/12/2012 ~ 31/12/2012:
$BE_{MR,y} = GWP_{CH4} \text{ x } MM_{ELEC} = 21\times21.4525/12\times0.00067\times10^6 = 25{,}153 \ tCO_2e/y$

In the year 2013:
$BE_{MR,y} = GWP_{CH4} \text{ x } MM_{ELEC} = 21\times21.4525\times0.00067\times10^6 = 301{,}837 \ tCO_2e/y$

In the year 2014:
$BE_{MR,y} = GWP_{CH4} \text{ x } MM_{ELEC} = 21\times28.6592\times0.00067\times10^6 = 403{,}235 \ tCO_2e/y$

2.3 Emissions from power replaced by the project $BE_{Use,y}$

GEN_y in the formula of $BE_{Use,y}$ are calculated based on the parameters shown in the feasibility study of the project. The data during the crediting period will be acquired by monitoring.As presented above, the calculation of $BE_{Use,y}$ based on the implementation schedule is as follows:

When the project is fully operated from year 2015:
$BE_{Use,y} = GEN_y \times EF_{ELEC}$ = 93,690×0.87045 = 81,552 tCO_2e/y

01/12/2012 ~ 31/12/2012:
$BE_{Use,y} = GEN_y \times EF_{ELEC}$ = 56,279/12×0.87045 = 4,082 tCO_2e/y

In the year 2013:
$BE_{Use,y} = GEN_y \times EF_{ELEC}$ = 56,279×0.87045 = 48,988 tCO_2e/y

In the year 2014:
$BE_{Use,y} = GEN_y \times EF_{ELEC}$ = 74,813×0.87045 =65,121 tCO_2e/y

2.4 The calculation results of baseline emissions

According to the above calculation, the project emissions are shown in the following table.

Table B-11 Baseline emissions of proposed project（tCO_2e）

Year	BE_{MD}	BE_{MR}	BE_{Use}	BE_y
01/12/2012~ 31/12/2012	0	25,153	4,082	29,235
2013	0	301,837	48,988	350,825
2014	0	403,235	65,121	468,356
2015	0	504,633	81,552	586,186
2016	0	504,633	81,552	586,186
2017	0	504,633	81,552	586,186
2018	0	504,633	81,552	586,186
2019	0	504,633	81,552	586,186
2020	0	504,633	81,552	586,186
2021	0	504,633	81,552	586,186
01/01/2022~ 30/11/2022	0	462,580	74,757	537,338
Total	**0**	**4,725,238**	**763,814**	**5,489,052**

3. Leakage

Discussed as Section B.6.1, no obvious leakage occurs outside the proposed project boundary, therefore LE_y=0.

4. Emission Reductions

No leakage occurs outside the project boundary, so the emission reduction (ER_y) by the project activity during a given year y is the difference between the baseline emissions (BE_y) and project emissions (PE_y).

When the project is fully operated from year 2015:
$ER_y = BE_y - PE_y$ =586,186 – 68,276 = 517,910 tCO_2e/y

01/12/2012 ~ 31/12/2012:
$ER_y = BE_y - PE_y$ =29,235 – 3,403 = 25,832 tCO_2e/y

In the year 2013:
$ER_y = BE_y - PE_y$ =350,825 – 40,838 = 309,987 tCO_2e/y

In the year 2014:
$ER_y = BE_y - PE_y$ =468,356 – 54,557 = 413,799 tCO_2e/y

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

Year	Estimation of Project activity Emission (tonnes of CO_2e)	Estimation of baseline emission (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2e)	Estimation of Emission reductions (tonnes of CO_2 e)
01/12/2012~ 31/12/2012	3,403	29,235	0	25,832
2013	40,838	350,825	0	309,987
2014	54,557	468,356	0	413,799
2015	68,276	586,186	0	517,910
2016	68,276	586,186	0	517,910
2017	68,276	586,186	0	517,910
2018	68,276	586,186	0	517,910
2019	68,276	586,186	0	517,910
2020	68,276	586,186	0	517,910
2021	68,276	586,186	0	517,910
01/01/2022~ 30/11/2022	62,586	537,338	0	474,752
Total (tCO_2e)	**639,313**	**5,489,052**	**0**	**4,849,738**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$CONS_{ELEC, PJ}$
Data unit:	MWh/y
Description:	Additional electricity consumption by the project.
Source of data to be used:	Provided by Feasibility Study, approximately 8,760MWh power from the total power generated is directly deducted in BEuse calculation. In practice, the additional electricity is the electricity imported from the Grid, which is monitored through on-site measurement.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be	Continuously monitored by electricity meter

applied:	
QA/QC procedures to be applied:	Power meters will be subject to a regular maintenance regime to ensure accuracy. Standard DL/T448-2000 would be referred to annually calibrate the power meter.
Any comment:	-

Data / Parameter:	MM_{ELEC}
Data unit:	tCH_4/y
Description:	Methane sent to power plant
Source of data to be used:	Methane volume is provided by the FSR. The actual data will be obtained through on-site measurement during operations.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	24,030 (when the project is fully operated from 2015 onwards)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meter adjusted by temperature and pressure and methane concentration meter. The volume of pure CH_4 (V_{CH4}) is directly obtained from the monitoring system. MM_{ELEC} is equal to V_{CH4} multiply the density of methane ($0.67kg/m^3$).
QA/QC procedures to be applied:	Flow meter will be subject to a regular maintenance regime to ensure accuracy. Correlative calibration standard would be referred depending on the type of flow meter adopted, which will be annually calibrated.
Any comment:	-

Data / Parameter:	CEF_{NMHC}
Data unit:	$tCO_2e/tNMHC$
Description:	Carbon emission factor for combusted non methane hydrocarbons
Source of data to be used:	To be obtained through annual analysis of the fractional composition of captured gas. If the NHMC concentration is less than 1%, its emissions can be ignored.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	-
Description of measurement methods and procedures to be applied:	Annually monitoring and analyzing NMHC concentration. If it is above 1%, determining each carbon emission factor of different components.
QA/QC procedures to be applied:	Instruments will be subject to a regular maintenance regime before analysing gas components to ensure accuracy.
Any comment:	-

Data / Parameter:	PC_{CH4}
Data unit:	%
Description:	Concentration (in mass) of methane in extracted gas, measured on wet basis
Source of data to be used:	In PDD calculation, value of PC_{CH4} is not adopted since the mass of methane consumed (MM_{ELEC}) is directly presented in FSR. In operation, PC_{CH4} is hourly

	monitored by methane concentration meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Approximately 20
Description of measurement methods and procedures to be applied:	Hourly monitoring concentration using optical or calorific meter.
QA/QC procedures to be applied:	Concentration meter will be subject to a regular maintenance regime to ensure accuracy. Correlative calibration standard would be referred depending on the type of methane concentration meter adopted, which will be annually calibrated.
Any comment:	-

Data / Parameter:	PC_{NMHC}
Data unit:	%
Description:	NMHC concentration in coal mine gas
Source of data to be used:	To be obtained through annual analysis of the fractional composition of captured gas. If NMHC concentration is less than 1%, it is not accounted.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Not accounted
Description of measurement methods and procedures to be applied:	Annually monitoring NMHC concentration is implemented by sampling CMM at the inlet of the power generators. Gas sampling method is strictly met the requirement of 3^{rd} qualified entity who will examine the NMHC concentration.
QA/QC procedures to be applied:	The test report will be provided by the authorised third party.
Any comment:	-

Data / Parameter:	$CMM_{PJ,I,y}$
Data unit:	tCH_4
Description:	Pre-mining CMM capture, sent to and destroyed by use i in the project activity in year y.
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.6	$CMM_{PJ,i,y}$ is equal to MM_i
Description of measurement methods and procedures to be applied:	The extraction systems are located in the underground mine in this project activity. Monitoring of $CMM_{PJ,i,y}$ is same as that of MM_i.
QA/QC procedures to	-

be applied:	
Any comment:	

Data / Parameter:	GEN_y
Data unit:	MWh/y
Description:	Electricity supplied to North China Power Grid
Source of data to be used:	Data in calculation is from FSR. Actual data will be obtained through on-site measurement.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	93,960(when the project is fully operated from 2015 onwards)
Description of measurement methods and procedures to be applied:	Continuously monitored by electricity meter
QA/QC procedures to be applied:	Electricity meter will be subject to a regular maintenance regime to ensure accuracy. Standard DL/T448-2000 would be referred to annually calibrate the power meter.
Any comment:	-

B.7.2. Description of the monitoring plan:

The implementation of the monitoring plan is to ensure that real, measurable, long-term Greenhouse Gas Emissions Reduction can be monitored, recorded and reported. It is a crucial procedure to identify the final CERs of the proposed project. This monitoring plan for the proposed project activity will be implemented by the project owner and supervised by the CDM project consultant, Energy Systems International.

1. Parameters to be monitored

Section B.7.1 had given the data and parameters monitored by the project, shown as Table B-12.

Table B-12 Data monitored by the project

Parameters monitored	Unit	Description
MM_{ELEC}	tCH_4	In practice, standard volume of pure CH_4 (V_{CH4}) sent to the power engines is monitored, which multiple the density of methane at normal temperature and at normal pressure is 0.00067 t/m^3 (IPCC Default Value)
CEF_{NMHC}	$tCO_2e/tNMHC$	Carbon emission factor for combusted non methane hydrocarbons
PC_{CH4}	%	Concentration of methane sent to power engines
PC_{NMHC}	%	NMHC concentration of CMM
GEN_y	MWh	Electricity supplied to the Grid
$CONS_{ELEC, PJ}$	MWh	Electricity imported from the Grid

2. Management structure to implement monitoring

For ensuring implementation of monitoring, the project owner will appoint a project manager, who is fully responsible for the monitoring management of four power stations.

Roles and responsibilities:

- Project manager: responsible for implementing of the whole monitoring plan including internal staff management, operation process controlling, communication with external party (consulting party and DOE).
- QA/QC: responsible for data recording and periodic internal verification, including data keeping in the archives and documents numbering, checking data saved, inspecting behaviour criterion of operator on site and central controlling staff, participating in employee training.
- Training: periodic training operator, supervising and controlling (new) staff.
- Monitoring operation: Staff A is responsible for supervising, controlling all the instruments, and reading data timely. Staff B is responsible for supervising accuracy of data reading, data saving and reporting

Figure B-3 is monitoring management structure of the project.

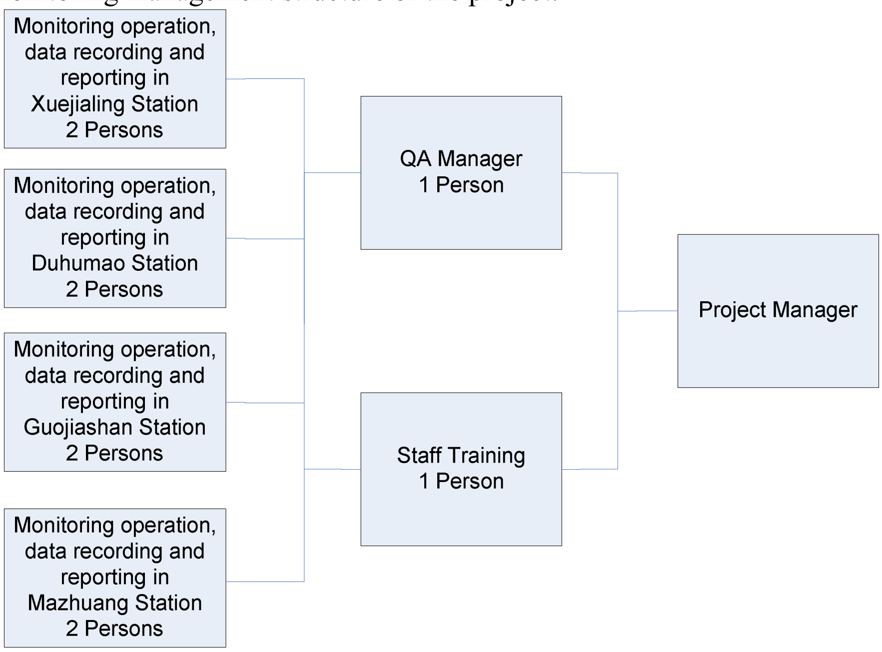
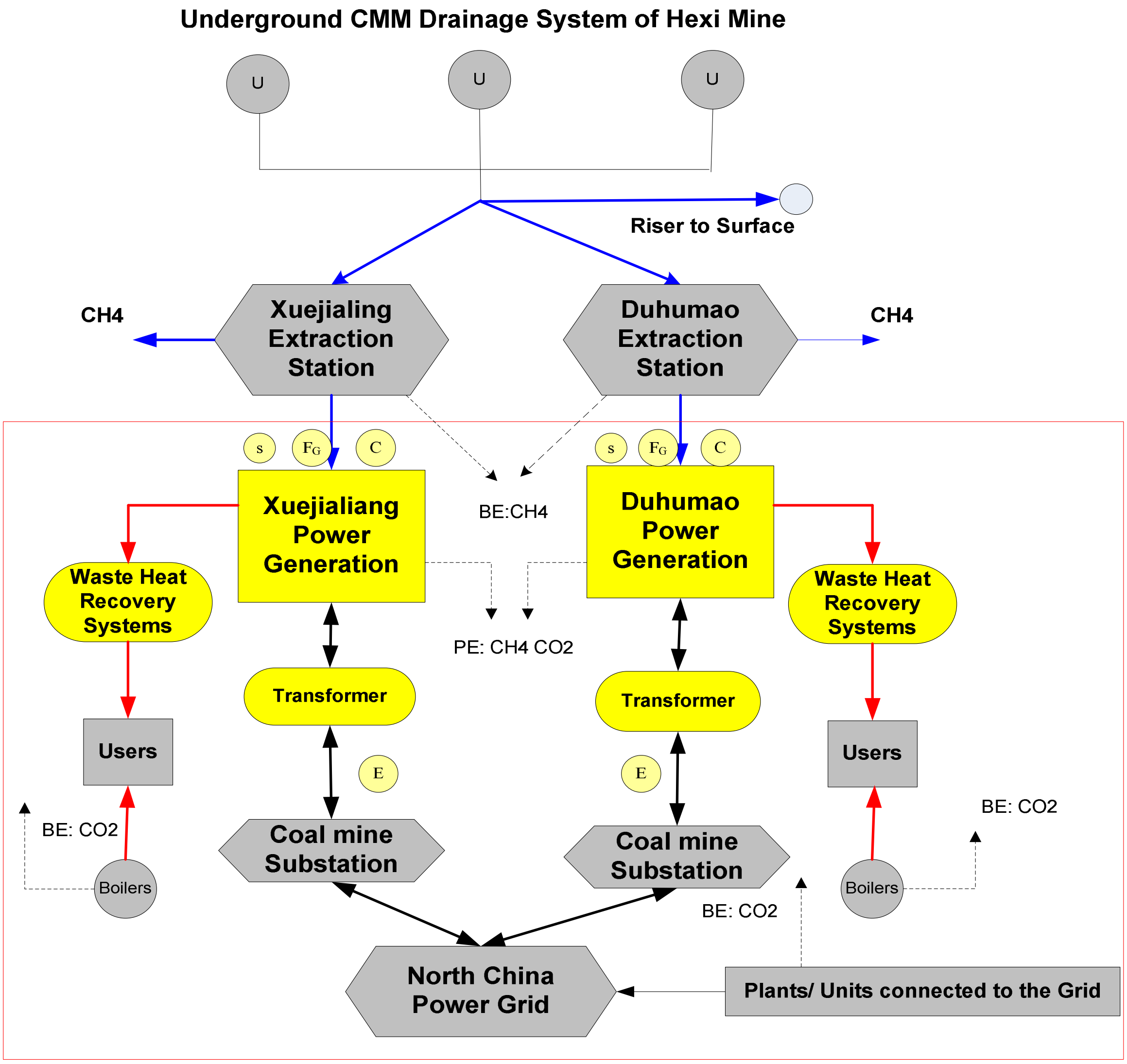
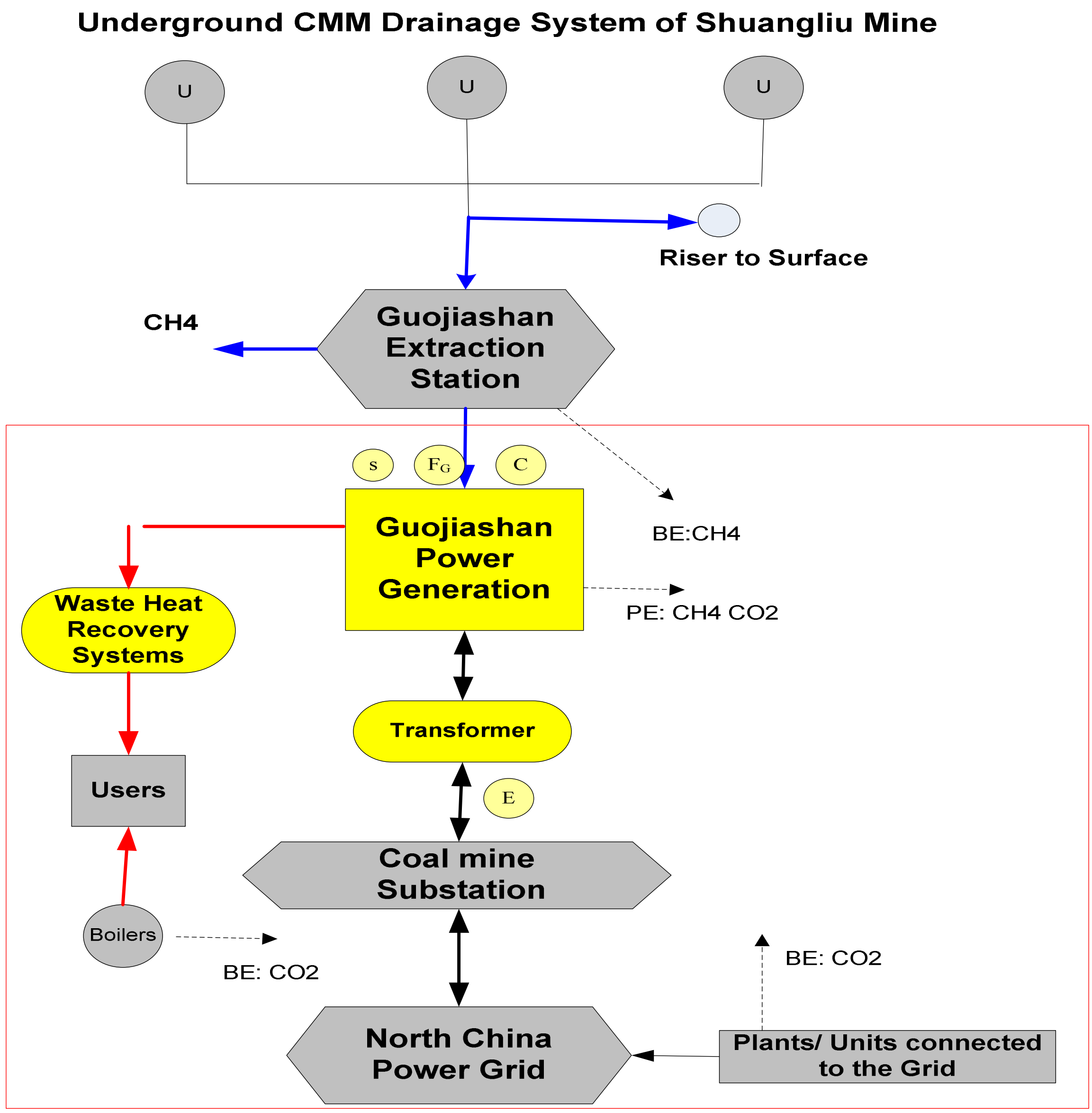


Figure B-3 Monitoring management structure

3. Installation of monitoring instruments

All the instruments installed in the project should be accorded with the relevant national standard, and Figure B-4 shows the detailed information of instrument installation.


Underground CMM Drainage System of Hexi Mine
U
U
U
Riser to Surface
CH4
Xuejialing Extraction Station
Duhumao Extraction Station
CH4
s
FG
C
s
FG
C
Xuejialiang Power Generation
BE:CH4
Duhumao Power Generation
Waste Heat Recovery Systems
PE: CH4 CO2
Waste Heat Recovery Systems
Transformer
Transformer
Users
E
E
Users
BE: CO2
BE: CO2
Coal mine Substation
Coal mine Substation
Boilers
Boilers
BE: CO2
North China Power Grid
Plants/ Units connected to the Grid


Underground CMM Drainage System of Shuangliu Mine
U
U
U
Riser to Surface
CH4
Guojiashan Extraction Station
S
FG
C
BE:CH4
Guojiashan Power Generation
PE: CH4 CO2
Waste Heat Recovery Systems
Transformer
Users
E
Coal mine Substation
Boilers
BE: CO2
BE: CO2
North China Power Grid
Plants/ Units connected to the Grid

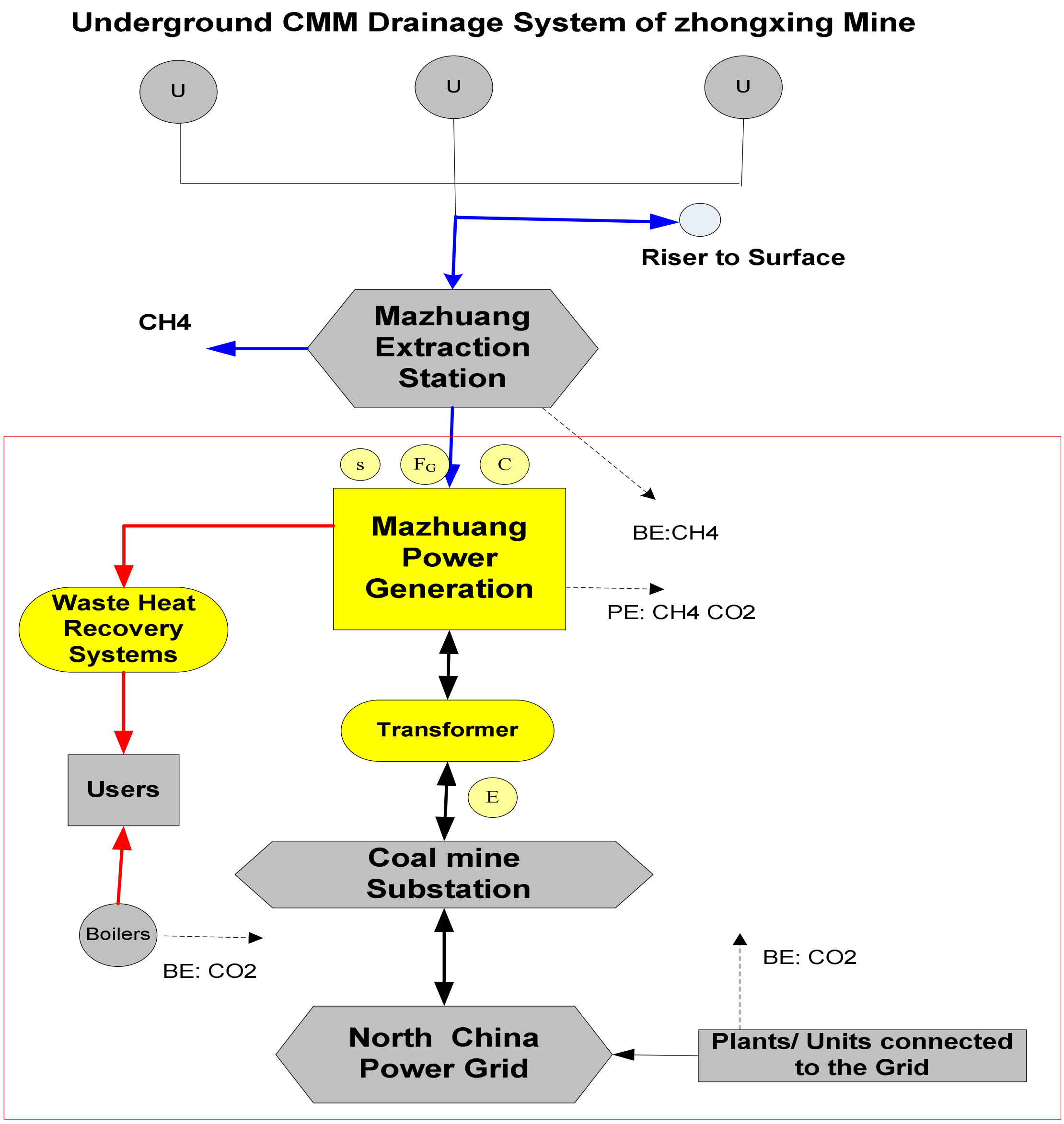


Figure B-4 Installation location of monitoring instruments

Information of the monitoring instruments adopted by the project as followed:

Table B-13 Information of the Monitoring Instruments

Symbol	Instrument	Function	Accuracy	Standard
C	CH_4 concentration meter	Measure the concentration of CMM	≤±3%	AQ1027-2007[20]
F_G	Gas flow meter (adjusted by pressure and temperature)	Measure standard volume of CMM transmitted to power engines	≤±2%	AQ1027-2007

20 *"Code for Coal Mine Gas Drainage"* (AQ1027-2007)

E	Electricity Meter	Measure the electricity supplied to/ imported from the Grid	0.5/0.5S at least	DL/T448-2000[21]
s	NMHC sampling	Periodical sampling of NMHC concentration		

4. Calibration of monitoring instruments

The following measures are used to calibrate instruments employed in the proposed project:
1) The instruments shall have sufficient accuracy so that measure errors do not exceed the national standard;
2) The instruments shall be properly calibrated and checked termly for accuracy.
3) Meters will be calibrated by the authorised third party annually.

5. Monitoring, recording and management of data

Data saving is the most important step in the monitoring plan. Without accurate and effective information recorded, emission reductions of the project can not be certified. The principal for monitoring CDM related data and tracking CDM related information would be appointed by the project owner.

The data are analyzed on a daily basis by the operator. In case of a drift of one parameter the operator can react quickly and fix any potential problems. All data required for the emission reduction calculations will be kept in the onsite-monitoring database.

6. Quality Assurance and Quality Control

The following requirement shall be met in the monitoring operation: strictly training the personnel on watch, strengthening the norms of manual data reading process, guaranteeing of two persons to complete the monitoring operation at the same time. Data monitoring and recording should be implemented by trained technical personnel and periodically reported to the QA/QC auditor with signed hard copies. All the original reports will be categorized and kept for 2 years after the end of the crediting period or the last issuance of CERs, whichever occurs later.

In case of CMM meters failure, gas consumed by power engines are not claimed for ERs. The operator records the time of failure and make sure that meters installed are in calibration valid period.

In case of power meters failure, no power will be imported when the power generators are in operation. When the power generators shut down, the imported power from the Grid is estimated base on the previous records. The maximum value will be adopted for ER calculation in this period.

7. Verification of emission reduction

The primary objective of verification is to independently verify whether emission reductions of the proposed project have been achieved. Main verification activities for the proposed project include:

1）The project owner will sign a verification service agreement with specific DOE in accordance with relevant EB regulations;

[21] *"Technical administrative code of electric energy metering"* (DL/T448-2000)

2）The project owner will provide the completed data records and other CDM related information to DOE during verification;
3）The project owner will cooperate with DOE to implement the verification process, i.e. the personnel in charge of monitoring and data processing should be available for interviews and answer questions honestly.

To be summarized, the relevant personnel of the project owner will implement perfectly the monitoring plan to make sure that the emission reductions for the proposed project would be measured accurately and actually.

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

The baseline and monitoring study was completed on 31/10/2012.

The baseline and monitoring methodology was determined by the entity:

Name/origination	**Project participate** **Yes/No**
Energy Systems International 1101 CYTS Plaza, No.5, Dongzhimen South Avenue, Dongcheng District, Beijing 100007 P.R.China Tel: +86(10)5815 6352 Fax: +86(10)5815 6003	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:

15/07/2008 (Construction Agreement of Xuejialing Power Station)

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

18years

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

Fixed crediting period

C.2.1. Renewable crediting period:

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/12/2012

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The EIA statements of the project were done in June, 2008, which was approved by Shanxi Environmental Protection Bureau on 30th June, 2008. The findings of this evaluation are summarised below.

Air Quality
During construction period, bug dust is the main emission by construction activities and transportation of materials. Although, construction dusts pollution is short-time lasting with low intensity and small impact area, vehicles are required to slow down to reduce the dusts. Meanwhile, periodical watering could reduce the dusts as well.

During operation period, main air pollution source is tail gas from engines, which contains mainly NO_x. According to design, the NO_x concentrations of four stations are less than that required in *Limited and measurement methods from exhaust pollutants from compression ignition and gas fuelled positive ignition engines of vehicles (III, IV, V)(GB 17691-2005)* of the People's Republic of China.

Water Quality
There are no negative impacts on surrounding water during both construction period and operation period. The project will produce sanitary sewage, discharged waste water by cooling systems, waste heat recovery systems and softened water treatment system. All the discharged water mainly contains saline, which can be discharged directly. The sanitary sewage will be pre treatment and then sent to sewage pipeline network of each station.

Noise
During construction period, mechanical noise in construction and installation activities will make some effects on surrounding environment. As construction time is strictly controlled, avoiding night working and reducing the noise impact on external environment. The proposed project is far away form residential area, thus no residents are disturbed.

During operation period, the main noise sources include gas-fired engines, generators and water pumps, etc. The project owner prefers to adopt low noise equipments with noise elimination, for decreasing the level of noise. High noise equipment such as CMM generator sets will be installed indoor and operators will wear earplug. Muffler should be equipped on aerodynamic noise source as fans. After the noise sources are treated properly, the project site boundary noise meets the requirement of the grade II of *Standard of noise at boundary of industrial enterprises (GB12348-90).*

Solid Waste
During construction period, no adverse impact on surrounding environment occurs by timely collecting and cleaning construction waste.

During operation period, CMM generator sets do not cause waste residue, and the main waste is MSW of employee. The amount of this part MSW is very small and treated together by local public sanitation department. Thus no negative effects on environment are expected to be resulted in.

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:

No significant negative environmental impacts are expected to result in during both construction period and operation period of the project, meeting environmental requirements of the host country. On the contrary, the project improves the local environmental quality, reduces air pollution and decreases of GHG emissions.

SECTION E. Stakeholders' comments

>>

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

During the environmental impact assessment process, public comments had been invited to evaluate the proposed project. Public participation process adopted the method of sending "Public Opinion Questionnaires". Requirements and suggestions associated with the project construction and environmental protection are collected. In the process, the project owner briefly introduced the CMM power generation project and the main environmental protection facilities so that the public could know the construction situation of power plants and supervise the whole process.

People living and working near each station were invited. 90 questionnaires were sent out (30 for each mine) during the investigation with replied number of 90 (rate 100%). This public comment has good representativeness, with the detailed information of participants shown as Table E-1.

Table E-1 Detailed Information of Participants

Total participants		**90**
Gender	Male	77
	Female	13
Age	Under 40	42
	41-50	37
	51-60	11
	Above 60	0
Education	Above College	0
	High school and below	90
Occupation	Farmer	12
	Worker	77
	Student	0
	others	1

E.2. Summary of the comments received:

Public comments mainly focus on the following questions: What is your attitude of local economic development; what are the main effects on the local economy; what are the main effects on the local environment; what degree of the effects does the proposed project bring to local environment; what is your attitude on this project. The findings are summarized as follows:

For economic development, the results show that near 50% of the public think that the local economic situation is good. For economic problems, people agree that transport and human resource are the main problems prohibiting the local economy development. Dust is first local environmental problem.

For the proposed project, 93% of people agree that it will not or slightly affect the local environment, the rest 7% of people have no idea of that. Additionally, most of people think that the project will boost the economic development. No one opposes the construction of the project.

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

For dust pollution, the project owner should strictly obey the relevant requirement of construction management. Transport vehicles will slow down in construction site. Appropriate watering on the construction site will be done to reduce dust pollution.

To sum up, no negative comments have been received on the project. Moreover, the local community possesses strong positive comments on the effects that the proposed project will make on the local economy and infrastructure. In addition, to reduce the impacts on the local environment produced from the construction of the project, the project owner will take the environmental protection measures in accordance with the EIA.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	Francois Joubert
Title:	Executive Vice-President
Salutation:	Mr.
Last Name:	Joubert
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I countries has been provided for this CDM project.

Annex 3

BASELINE INFORMATION

To determine the simple operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$) of the Project, data recommended in *Announcement to Publish 2010 Baseline Emission Factors for Regional Power Grids in China* for North China Power Grid are adopted.

The following tables summarise the numerical results from the equations listed in *Tool to Calculate the Emission Factor for an Electricity System*. Information provided by the tables includes data, data sources and the underlying calculations.

Table A1. Thermal power generation of North China Power Grid in 2006

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Beijing	20,705,000	7.51	19,150,055
Tianjin	35,924,000	6.86	33,459,614
HeBei	143,888,000	6.63	134,348,226
Shanxi	150,250,000	7.45	139,056,375
Inner Mongolia	139,593,000	7.58	129,011,851
Shandong	230,922,000	7.12	214,480,354
Total	721,282,000		669,506,473

Data source: China Electric Power Yearbook 2007.

Table A2. Thermal power generation of North China Power Grid in 2007

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Beijing	22,300,000	7.51	20,625,270
Tianjin	39,900,000	6.53	37,294,530
HeBei	163,300,000	6.67	152,407,890
Shanxi	173,400,000	7.99	159,545,340
Inner Mongolia	180,100,000	7.77	166,106,230
Shandong	259,100,000	7.23	240,367,070
Total	838,100,000		776,346,330

Data source: China Electric Power Yearbook 2008.

Table A3. Thermal power generation of North China Power Grid in 2008

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Beijing	24,300,000	7.14	22,564,980
Tianjin	39,700,000	7.05	36,901,150
HeBei	158,000,000	6.9	147,098,000
Shanxi	176,200,000	8.22	161,716,360
Inner Mongolia	200,800,000	7.96	184,816,320
Shandong	268,900,000	7.14	249,700,540
Total	867,900,000		802,797,350

Data source: China Electric Power Yearbook 2009.

Table A4. Calculation of the simple operating margin emission factor of North China Power Grid in 2006

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission factor	Average Low Heat Value	CO_2Emissions （tCO_2e）
									($kgCO_2$/TJ) G	（MJ/t,km3）	L=G×J×K/100000 （Mass Unit）
		A	B	C	D	E	F	G=A+B+ C+D+E+F	J	K	L=G×J×K/10000 (Volume Unit)
Raw Coal	10^4tons	796.63	1639.2	6867.99	6968.88	8404.05	10930.66	**35607.41**	87,300	20,908	649,930,803
Cleaned coal	10^4tons						39.77	**39.77**	87,300	26,344	914,643
Other Washed Coal	10^4tons	6.36		214.13	371.14	61.77	544.6	**1198**	87,300	8,363	8,746,477
Moulded Coal	10^4tons	7.97					27.77	**35.74**	87,300	20,908	652,351
Coke	10^4tons						3.23	**3.23**	95,700	28,435	87,896
Coke Oven Gas	10^9m^3	0.38	0.63	5.8	22.32	0.64	5.79	**35.56**	37,300	16,726	2,218,517
Other Coke Gas	10^9m^3	20.66	6.58	69.72	13.79	22.76	7.22	**140.73**	37,300	5,227	2,743,772
Crude Oil	10^4tons					0.74		**0.74**	71,100	41,816	22,001
Petrol oil	10^4tons			0.01				**0.01**	67,500	43,070	291
Diesel Oil	10^4tons	0.21		3.01		0.07	6.32	**9.61**	72,600	42,652	297,577
Fuel Oil	10^4tons	6.38		0.08			4.1	**10.56**	75,500	41,816	333,391
Liquefied Petroleum Gas	10^4tons						0.01	**0.01**	61,600	50,179	309
Refinery Gas	10^4tons			2.43			2.32	**4.75**	48,200	46,055	105,443
Natural Gas	10^9m^3	3.41	0.73		0.53			**4.67**	54,300	38,931	987,216
Other Petroleum Products	10^4tons						0.28	**0.28**	72,200	41,816	8,454
Other Coke Products	10^4tons							**0**	95,700	28,435	0
Other Energy	10^4tons Standard Coal	6.83		47.11	230.76	12.51	132.29	**429.5**	0	0	0
Total emission of North China Power Grid (tCO_2e)									**667,049,139**		

Data source: China Energy Statistical Yearbook 2007

Table A5. Calculation of the simple operating margin emission factor of North China Power Grid in 2007

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission factor	Average Low Heat Value	CO_2Emissions (tCO_2e)
									($kgCO_2$/TJ) G	（MJ/t,km3）	L=G×J×K/100000 （Mass Unit）
		A	B	C	D	E	F	G=A+B+ C+D+E+F	J	K	L=G×J×K/10000 (Volume Unit)
Raw Coal	10^4tons	816.17	1753.99	7716.13	7510.06	10434.25	11884.83	**40115.43**	87,300	20,908	732,214,267
Cleaned coal	10^4tons						18.43	**18.43**	87,300	26,344	423,859
Other Washed Coal	10^4tons	5.76		156.89	478.81	48.57	756.84	**1446.87**	87,300	8,363	10,563,452
Moulded Coal	10^4tons	7.93					42.86	**50.79**	87,300	20,908	927,054
Coke	10^4tons			0.02			4.09	**4.11**	95,700	28,435	111,843
Coke Oven Gas	10^9m^3	0.07	0.72	3.13	25.46	2.58	13.61	**45.57**	37,300	16,726	2,843,020
Other Coke Gas	10^9m^3	11.8	7.6	88.38	72.8	28.17	29.64	**238.39**	37,300	5,227	4,647,821
Crude Oil	10^4tons							**0**	71,100	41,816	0
Petrol oil	10^4tons			0.01				**0.01**	67,500	43,070	291
Diesel Oil	10^4tons	0.33		2.35		0.62	5.08	**8.38**	72,600	42,652	259,490
Fuel Oil	10^4tons	4.74		0.18			2.35	**7.27**	75,500	41,816	229,522
Liquefied Petroleum Gas	10^4tons							**0**	61,600	50,179	0
Refinery Gas	10^4tons	0.06		2.85			1.65	**4.56**	48,200	46,055	101,225
Natural Gas	10^9m^3	5.03	0.73		0.54	4.22	0.01	**10.53**	54,300	38,931	2,225,993
Other Petroleum Products	10^4tons	1.72						**1.72**	72,200	41,816	51,929
Other Coke Products	10^4tons	4.74						**4.74**	95,700	28,435	128,986
Other Energy	10^4tons Standard Coal	11.94		77.25	360.26	30.75	163.48	**643.68**	0	0	0
Total emission of North China Power Grid (tCO_2e)									**754,728,750**		

Data source: China Energy Statistical Yearbook 2008

Table A6. Calculation of the simple operating margin emission factor of North China Power Grid in 2008

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission factor	Average Low Heat Value	CO_2Emissions （tCO_2e）
									($kgCO_2$/TJ) G	（MJ/t,km3）	L=G×J×K/100000 （Mass Unit）
		A	B	C	D	E	F	G=A+B+ C+D+E+F	J	K	L=G×J×K/10000 (Volume Unit)
Raw Coal	10^4tons	755.75	1800.12	7353.33	7854.39	12607.82	12360.75	**42732.16**	87,300	20,908	779,976,613
Cleaned coal	10^4tons						23.88	**23.88**	87,300	26,344	549,200
Other Washed Coal	10^4tons	5.05		134.52	582.39	66.2	691.21	**1479.37**	87,300	8,363	10,800,731
Moulded Coal	10^4tons	5.66			32.49		45.38	**83.53**	87,300	20,908	1,524,647
Coke	10^4tons			0.02			6.07	**6.09**	95,700	28,435	165,723
Coke Oven Gas	10^9m^3	0.11	0.86	8.37	24.55	3.55	16.2	**53.64**	37,300	16,726	3,346,491
Other Coke Gas	10^9m^3	10.4	9.08	187.54	36	34.32	29.76	**307.1**	37,300	5,227	5,987,440
Crude Oil	10^4tons					0.02		**0.02**	71,100	41,816	595
Petrol oil	10^4tons							**0**	67,500	43,070	0
Diesel Oil	10^4tons	0.15		3.08		0.35		**3.58**	72,600	42,652	110,856
Fuel Oil	10^4tons	2.56		0.25				**2.81**	75,500	41,816	88,715
Liquefied Petroleum Gas	10^4tons							**0**	61,600	50,179	0
Refinery Gas	10^4tons	0.44		2.93				**3.37**	48,200	46,055	74,809
Natural Gas	10^9m^3	11.09	0.7		0.97	2.12		**14.88**	54,300	38,931	3,145,563
Other Petroleum Products	10^4tons	1.45						**1.45**	72,200	41,816	43,777
Other Coke Products	10^4tons	7.97		7.61				**15.58**	95,700	28,435	423,968
Other Energy	10^4tons Standard Coal	4.9	2.34	61.02	466	63.72	141.71	**739.69**	0	0	0
Total emission of North China Power Grid (tCO_2e)									**806,239,126**		

Data source: China Energy Statistical Yearbook 2009

Table A7. Power import by North China Power Grid from 2006 to 2008

	2006	2007	2008
Net electricity import from Central China Power Grid (MWh)	497,060	803,000	
Emission factor of Central China Power Grid (tCO_2e/MWh)	1.12157	1.10197	
Net electricity import from Northeast China Grid (MWh)	2,618,060	1,789,750	5,286,140
Emission factor of Northeast China Power Grid (tCO_2e/MWh)	1.14972	1.08186	1.10489
Total emission of North China Power Grid (tCO_2e)	670,616,651	757,549,895	812,079,707
Total Power supply of North China Power Grid (MWh)	672,621,593	778,939,080	808,083,490
Emission Factor of North China Power Grid(tCO_2e/MWh)	**0.99702**	**0.97254**	**1.00495**

Based on the data provided in Table A1~A7, the operating margin emission factor of North China Power Grid is **0.9914** tCO_2e/MWh.

Table A8. Data and results of Step a.

		Beijing	**Tianjin**	**Hebei**	**Shanxi**	**Shandong**	**Inner Mongolia**	**Total**	**Average Low Caloric Value**	**Emission Factor**	**CO2 Emissions （tCO2e）**
Fuel Type	Unit	A	B	C	D	E	F	G=A+…+F	H	I	K=G*H*I/1000,000
Raw Coal	10^4tons	755.75	1,800.12	7,353.33	7,854.39	12,360.75	12,607.82	42,732.16	20,908	87,300	779,976,613
Cleaned Coal	10^4tons	0	0	0	0	23.88	0	23.88	26,344	87,300	549,200
Other Washed Coal	10^4tons	5.05	0	134.52	582.39	691.21	66.2	1,479.37	8,363	87,300	10,800,731
Moulded Coal	10^4tons	5.66	0	0	32.49	45.38	0	83.53	20,908	87,300	1,524,647
Coke	10^4tons	0	0	0.02	0	6.07	0	6.09	28,435	95,700	165,723
Other Coke Products	10^4tons	7.97	0	7.61	0	0	0	15.58	28,435	95,700	423,968
Sub-total								44,340.61			793,440,881
Crude Oil	10^4tons	0	0	0	0	0	0.02	0.02	41,816	71,100	595
Gasoline	10^4tons	0	0	0	0	0	0	0	43,070	67,500	0
Diesel oil	10^4tons	0.15	0	3.08	0	0	0.35	3.58	42,652	72,600	110,856
Fuel oil	10^4tons	2.56	0	0.25	0	0	0	2.81	41,816	75,500	88,715
Other Petroleum Products	10^4tons	1.45	0	0	0	0	0	1.45	41,816	72,200	43,777
Sub-total								7.86			243,942
Natural Gas	10^7m^3	110.9	7	0	9.7	0	21.2	148.8	38,931	54,300	3,145,563
Coke Oven Gas	10^7m^3	1.1	8.6	83.7	245.5	162	35.5	536.4	16,726	37,300	3,346,491
Other Coke Gas	10^7m^3	104	90.8	1875.4	360	297.6	343.2	3,071	5,227	37,300	5,987,440
Liquefied Petroleum Gas	10^4tons	0	0	0	0	0	0	0	50,179	61,600	0
Refinery Gas	10^4tons	0.44	0	2.93	0	0	0	3.37	46,055	48,200	74,809
Sub-total								3,759.57			12,554,302
Total											806,239,126

Data source: China Energy Statistical Yearbook 2009.

Calculated with the data provided in Table A8 and formula (4)~(6), the value of $\lambda_{Coa,yl}$ is 98.41%, the value of $\lambda_{Oil,y}$ is 0.03% and the value of $\lambda_{Gas,y}$ is 1.56%. Therefore,

$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$ =0.7975 tCO_2e/MWh.

Table A9. Installed capacity of the North China Power Grid in 2008

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Coal	MW	4,760	7,490	29,870	35,250	45,740	55,930	179,040
Hydro	MW	1,050	0	1,540	790	830	1,050	5,260
Nuclear	MW	0	0	0	0	0	0	0
Other(wind)	MW	0	0	700	0	2,300	370	3,370
Total	MW	5,810	7,490	32,110	36,040	48,860	57,350	187,660

Data source: China Electric Power Yearbook 2009.

Table A10. Installed capacity of the North China Power Grid in 2007

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Coal	MW	3,900	6,920	29,020	30,950	39,870	54,140	164,800
Hydro	MW	1050	10	780	790	830	1,050	4,510
Nuclear	MW	0	0	0	0	0	0	0
Oher(wind)	MW	2.7	0	410	0	1,096.5	210	1,719.2
Total	MW	4,952.7	6,930	30,210	31,740	41,796.5	55,400	171,029.2

Data source: China Electric Power Yearbook 2008.

Table A11. Installed capacity of the North China Power Grid in 2006

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Coal	MW	3,984	6,512	26,087	26,661	28,899	49,395	141,538
Hydro	MW	1,053	5	785	790	818	553	4,004
Nuclear	MW	0	0	0	0	0	0	0
Other(wind)	MW	24	24	218	0	565	106	937
Total	MW	5,061	6,541	27,090	27,451	30,282	50,054	146,479

Data source: China Electric Power Yearbook 2007.

Calculation of BM emission factor of North China Power Grid

	Installed Capacity in 2006	**Installed Capacity in 2007**	**Installed Capacity in 2008**	**New Capacity Additions 2006-2008**	**New Capacity Additions 2007-2008**	**The portion of Capacity Additions**
	A	B	C	D=C-A		
Coal(MW)	141,538	164,800	179,040	46,111	17,847	93.98%
Hydro(MW)	4,004	4,510	5,260	520	9	1.06%
Nuclear(MW)	0	0	0	0	0	0.00%
Wind(MW)	937	1,719.2	3,370	2,433	1,651	4.96%
Total (MW)	**146,479**	**171,029.2**	**187,660**	**49,064**	**19,508**	**100.00%**
The portion of installed capacity in 2008				26.15%	10.40%	

$EF_{BM,y}$=0.7975×93.98%=0.7495 tCO_2/MWh
Therefore, the EF_{ELEC} of North China Power Grid is:
EF_{ELEC} = 0.5*EF_{OM}+0.5*EF_{BM} = 0.5*0.9914+0.5*0.7495 = **0.87045tCO_2e/MWh**

Annex 4

MONITORING INFORMATION

No other relevant monitoring information.