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

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

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Shanxi Coal Transport Market Co., Ltd. Yangquan Branch CMM Utilization Project
Version: 05
Date: 26/12/2007

Version No.	Date	Reasons
Version 01	09-10-2006	The first edition
Version 02	20-12-2006	Revised according to expert's good advice.
Version 03	01-06-2007	New version of additionality Tool
Version 04	09-08-2007	Revised according to DOE's good advice.
Version 05	26-12-2007	Revised according to review requests

A.2. Description of the project activity:

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The proposed project is located in the six mines belonging to Shanxi Coal Transport Market Co., Ltd. Yangquan Branch Co., Ltd. (hereinafter referred to as the "Yangquan Branch"). They are Chengzhuang, Jiujie, Shangshe, Shangsheerjing, Hongtai and Baoan coalmines. At present, five of the proposed mines are extracting underground CMM except for Bao'an mine which is under construction. All the extracted CMM is released into atmosphere which leads to not only great waste of resources but also air pollution.

The whole project will be implemented in the following three phases. The first phase includes 16*500kW power generation in Chengzhuang mine and a total of 2.92MW CMM gas boilers in Jiujie mine. So far, the first phase has been in operation. The second phase of the project include a total of 31*500kW power generations in Shangshe, Shangsheerjing, Jiujie and Hongtai mines. It is supposed to be in operation at the beginning of 2009. At last, 13*500kW power generation in Bao'an mine will start in January of 2010. All the generators will be fixed with waste heat recovery equipment when they are operated. The detailed installation and time schedule of the proposed project in listed in Table A-1.

Table A-1 Detailed installation and time schedule of the proposed project

Location	Chengzhuang	Jiujie	Shangshe	Shangshe erjing	Hongtai	Baoan	Total
Installation Capacity (kW)	8,000	2,500	7,500	3,000	2,500	6,500	30,000
Power Generated (MWh/y)	38,400	12,000	36,000	14,400	12,000	31,200	144,000
Construction Time	2006	2008.6	2008.1	2008.6	2008.9	2009.6	-
Operation Time	2007.5	2009.1	2009.1	2009.1	2009.1	2010.1	-

*Note: 1.4*2+0.12 MW CMM gas boiler in Jiujie mine has already been in operation.*

The total investment of the project is 14,312,500 USD which is all provided by Yangquan Branch. The annual operational cost 3,275,625 USD is also totally provided by the project owner. Detailed financial information can be referred to Table B-4 in the following section. During the project activities, no other investors are involved. Although the first phase of the proposed project has been in operation, the incomes from power could not cover the great investment of the project. Without the potential financial help from CDM, the current operating equipment would shut down. The rest of the project would face the risk of being postponed.

When the project is fully operated, the annual electricity generated is 144,000MWh, 96.5% of which will be delivered to North China Power Grid. The rest will be self-consumed by the project activity. The anticipated annual methane consumed by both generators and CMM boilers will be up to 43.21Mm^3/y. Moreover, the waste heat recovery equipment will recover approximately 296,247GJ waste heat annually by collecting the high temperature gases from the generators, which will replace the thermal energy supplied from coal-fired boilers. In the first 7 years of crediting period, the proposed project could reduce a total of 4,132,973tCO_2e (See the table of A4.4) of green house gas (GHG) emissions.

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;
- Guarantee of coal mine production safety;
- Decrease of the coal consumption by substituting coal fired heat supply and power generation from North China Power Grid;
- Increase of job opportunities in the coalmine area.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (Host)	Shanxi Coal Transport Market Head Quarter Co., Ltd. Yangquan Branch Co., Ltd.	No
The Netherlands	Energy Systems International B.V.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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The People's Republic of China

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

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Shanxi Province

A.4.1.3. City/Town/Community etc:

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Yangquan City

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

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The proposed 6 coal mines are all located in Yangquan area which is in the east of Shanxi Province. Shanxi Province is in the North of China. Yangquan area consists of three parts from north to south named Yu County, Yangquan City and Pingding County respectively. The geographic coordinate of Yangquan area is east longitude 112°54'一 114°04', north latitude 37°40—38°31'.

Chengzhuang mine is in Chengzhuang village belonging to the countryside of Yangquan city. It is 25km away from the city centre. The proposed station is northeast 100m away from the pump station. Jiujie mine is located 300m east to Tianjia village, which belongs to Jiujie town of Yangquan city. It is 18km east away from city centre. The proposed station is 50m away in the west of the pump station. Shangshe mine is located close to Shangshe village of Nanlou Town, Yu County. It is 12km south to the town centre. The mine belongs to northern part of Qinshui Coalfield. The proposed station is located northeast 80m away from the pump station. Close to Shangshe mine, Shangsheerjing mine is at the west side of Shangshe village. The proposed station is 100m south to the pump station. Hongtai mine is located in the south of Zhongzhuang village belonging to Pingtan Town. It is 10km away from the city centre and also part of Qinshui Coalfield. The proposed station is 150m south to the pump station. Baoan mine is at the west side of Yangquan city, administratively belonging to Yangquan City and Yangshou County. The proposed station is 80m south to the pump station. The geographic coordinates of six coal mines are listed in Table A-2

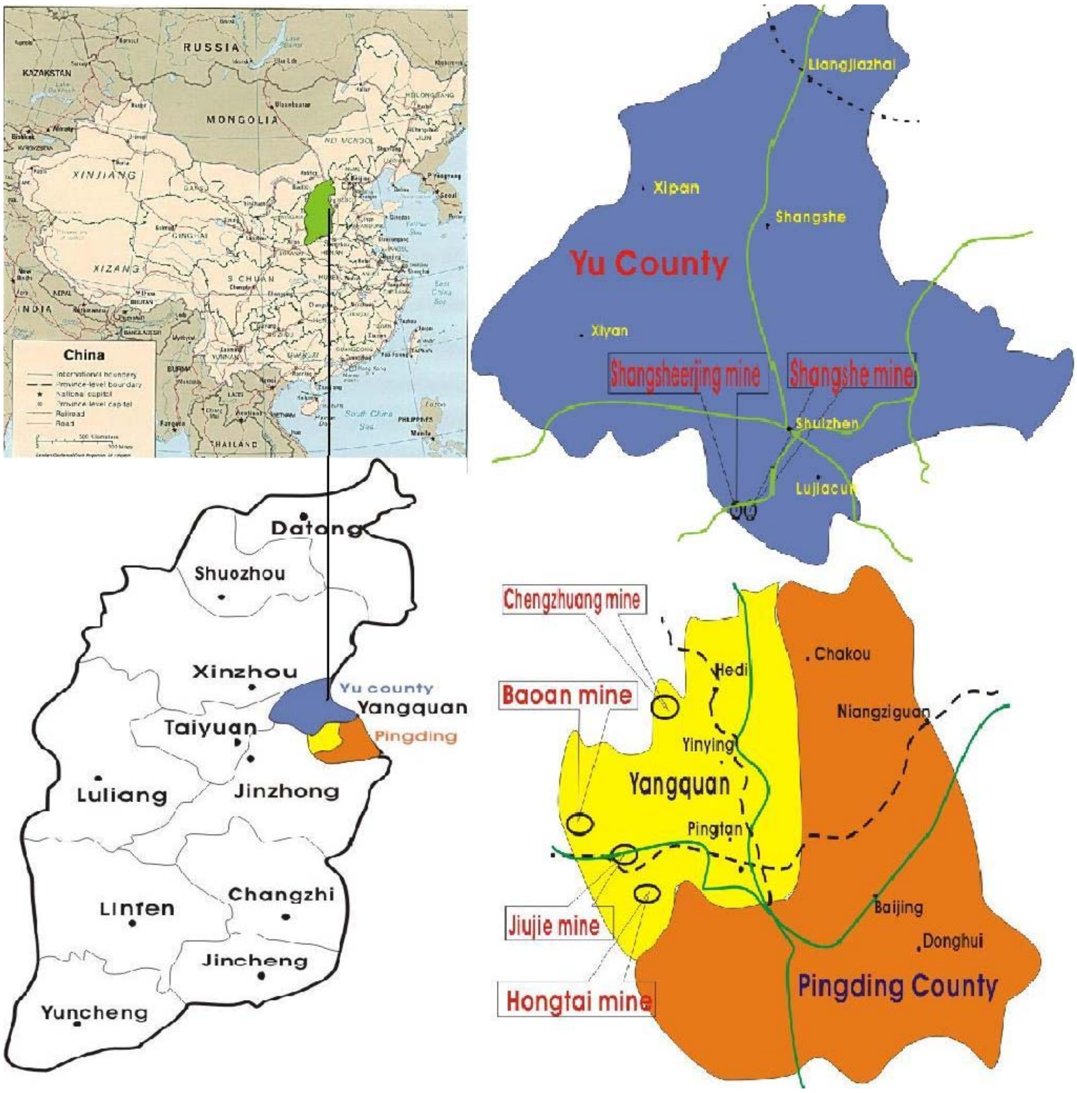

Figure A-1 Geographic position of the proposed project.

Table A-2 Geographic coordinates of the proposed coal mines

Coal site	East longitude	North latitude
Chengzhuang	113°26'25"—113°28'09"	37°59'53"—38°00'23"
Jiujie	113°47'58"—113°51'12"	37°51'12"—38°53'27"
Shangshe	113°16'57"—113°21'09"	37°58'44"—38°00'45"
Shangsheerjing	113°16'14"—113°17'45"	37°59'53"—38°00'23"
Hongtai	113°25'59"—113°27'18"	37°48'57"—38°51'07"
Baoan	113°17'13"—113°22'32"	37°51'47"—37°53'24"

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

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10: fugitive emissions from fuels

8: mining mineral production

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

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The proposed project will employ the following technologies:

1） Gas-fired Reciprocating Engines to Generate Electricity

The gensets with single capacity of 500kW have already been installed in Chengzhuang mine. The power engines require the minimum methane concentration to be over 30%. Automatic temperature alarm could guarantee the engine in safe situation when the temperature of motor oil and cooling water exceed the rated value. In addition, the pressure alarm and stop device could automatically control the engine operating at rated parameters. Moreover, overflow and short circuit protection function of the engine could make sure that the current is cut off and the alarm is turned on. Finally, the gensets are fixed with reverse-power relay which could automatically turn off the switch when power consumption from the grid occurs. Then the alarm signals will be turned on. The technical parameter of the power gensets is listed in Table A-3.

Table A-3 Technical parameters of power genset

Gensets Type	**500GF-WK**
Rated Power	500kW
Rated Voltage	400V
Rated Current	902A
Rated Frequency	50 HZ
Voltage Regulation Mode	Automated
Engine Type	**G12V190/LDW-2**
Power	550kW
Rated Speed	1000 r.p.m

2) CMM-Fuelled Boilers for Hot Water Supply

Three CMM boilers with capacity of 2*1.4MW and 0.12MW are installed in Jiujie mine. The boilers are able to use CMM with methane concentration above 30%. The thermal efficiency of the boilers is 90%. In addition to destroying CMM that would have been otherwise vented to the atmosphere, the project will offset existing CO_2 emissions resulting from the combustion of coal. Detailed information is shown in Table A-4.

Table A-4 Technical parameters of gas boilers

Type	**CWNS1.4-Q**	**CLHS0.12-Q**
Pressure	Normal	Normal
Rated Power	1.4MW	0.12MW
Rated outlet temperature	90℃	85℃
Rated inlet temperature	70℃	60℃
Thermal efficiency	90%	85%
Smoke Level	<50mg/m^3	-

3) Recovery of Power Engines Waste Heat

The exhaust gas from power generators will be sent to the waste heat utilization equipment. The needle-heat type of equipment will be adopted. Thermal energy of the exhaust gas will be utilized for hot water supply for miners' showers, which will replace the coal combustion of traditional boilers.

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 produce should be in charge of the maintenance and training.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
2007.11~12	33,723
2008	202,228
2009	547,946
2010	692,916
2011	692,916
2012	692,916
2013	692,916
2014.1~10	577,410
Total estimated reductions (tonnes of CO_2e)	**4,132,973**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**590,425**

A.4.5. Public funding of the project activity:

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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:

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ACM0008 "Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical and motive) and heat and/or destruction by flaring" (Version 03).
(http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html)

ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 06) is adopted for calculation of emission factor of North China Power Grid.

"Tool for the demonstration and assessment of additionality" (Version 03) is adopted to demonstrate the additionality of the proposed project.

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

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

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

ACM0008 Applicability	Proposed extraction activities
Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	Underground boreholes, gas drainage galleries and roof galleries are adopted to capture post mining CMM
Ventilation CMM that would normally be vented	Included

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

ACM0008 Applicability	Proposed CMM utilization activities
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 and CMM boilers. Emission reductions are claimed for displacing power and heat generated by coal combustion.
The remaining share of the methane to be diluted for safety reason may still be vented	Part of CMM is still vented in the proposed project
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented	CMM captured in the project will be utilized for power generation and transmitted into CMM boilers.

Besides the applicability, ACM0008 also defines 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**
Operate in opencast mines	Underground operating coal mines
Capture methane from abandoned/decommissioned coalmines	Both coal production and CMM extraction are under way in the coal 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 concomitant with coal production
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place	No CBM extraction activities are involved in the project
Are not able to monitor the necessary parameters, as indicated in the relevant monitoring methodology, to provide a conservative and transparent estimate of emissions reductions achieved;	All necessary parameters can be monitored

It can be concluded from the above analysis that the proposed project complies with both the baseline and the monitoring methodologies of ACM0008. Besides, ACM0008 refers to ACM0002 for Emission Factor calculation of North China Power Grid and the "Tool for the demonstration and assessment of additionality" (version 03) for demonstration of project additionality.

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

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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 utilization in the baseline scenario of this project
		CH_4	Excluded	According to ACM0008
		N_2O	Excluded	According to ACM0008
	Grid electricity generation (electricity provided to the grid)	CO_2	Included	Electricity generated from the project activity will substitute electricity purchasing from North China Power Grid
		CH_4	Excluded	According to ACM0008
		N_2O	Excluded	According to ACM0008
	Captive power and/or heat, and vehicle fuel use	CO_2	Included	Waste heat recovered from power generators will replace heat supply from coal combustion. The coal substitution by gas boilers are omitted for conservativeness.
		CH_4	Excluded	According to ACM0008
		N_2O	Excluded	According to ACM0008
	Emissions of methane as a result of continued venting	CH_4	Excluded	According to ACM0008

Project activities	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	Additional equipment used in the project such as compressors will lead to this part of emissions.
		CH_4	Excluded	According to ACM0008
		N_2O	Excluded	According to ACM0008
	Emission from methane destruction	CO_2	Included	Emissions of methane combustion in power generators and gas boilers.
	Emission from NMHC destruction	CO_2	Excluded	In this project, NMHC accounts for less than 1% by volume of extracted coal mine gas.
	Fugitive emissions of unburned methane	CH_4	Included	Small amount of methane will remain unburned in power generation and gas boilers.
	Fugitive methane emissions from on-site equipment	CH_4	Excluded	According to ACM0008
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	According to ACM0008
	Accidental methane release	CH_4	Excluded	According to ACM0008

For the purpose of determining project emissions, the project boundary includes all the GHG emission sources. To determine baseline emissions, the project boundary includes all methane released into the atmosphere that is avoided by the project activity and CO_2 emissions from the production of heat and power that is replaced by the project activity. The electricity grid is defined as North China Power Grid. The spatial extent of the project comprises all equipment installed and used as part of the project activity.

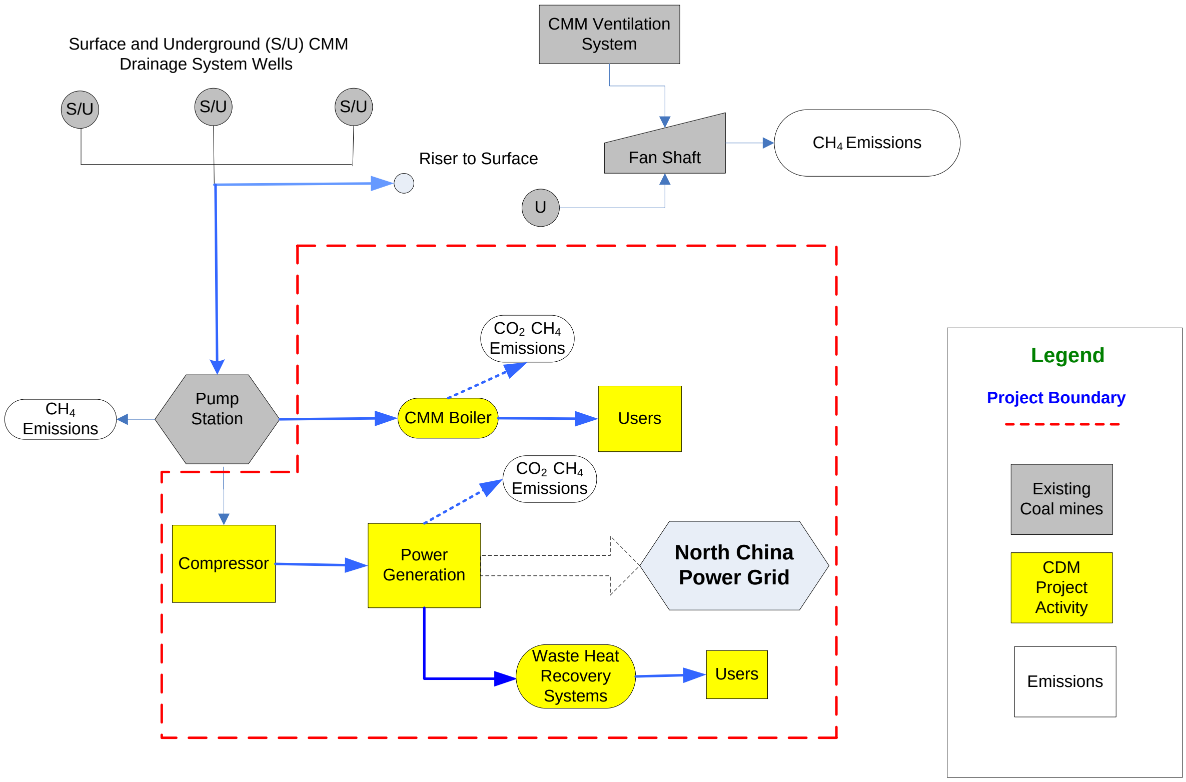

Figure B-1 The proposed project boundary

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

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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. Combination of ventilation and post mining extraction. Shares are 69% and 31% respectively. This is the continuation of current CMM extraction practice in the proposed coal mines.

Step 1b. Options for extracted CMM treatment

The CMM treatment options in the proposed coal mines include:

i. Venting. This it 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;
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. Combination of Scenario *i*, *iv* and *vi*. This is the proposed project activity not implemented as a CDM project.

Step 1c. Options for energy production

The alternatives for power generation include:

1. Electricity supply from North China Power Grid;
2. Electricity supply from captive coal-fired power generation of same scale;
3. CMM power generation. This is the project activity not implemented as a CDM project.

The alternatives for heat production include:
4. Continuation of existing heat supply by coal-fired boilers;
5. Heat supply by gas boilers; this is project activities not implemented as a CDM project;
6. Waste heat recovery from CMM-fueled engine. This is project activity not implemented 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* 2001 version and 2005 version, Section Two item 100 –150[1]). In CMM drainage process, solely adopting pre mining or post mining could not meet the underground safety requirements. Usually they are combined adopted with ventilation. Thus, alternative B and C in step 1 do not comply with the legal requirements. At present, solely adopting ventilation in six mines could not satisfy the 1% requirement, thus option A does not comply with the legal requirements either.

For CMM utilization, it is regulated that methane concentration can't be lower than 30% (*National Coalmine Safety Regulation* (11/2005) item 148.1). This was also emphasized in the *Coalmine Methane Treatment and Utilization Macro Plan* published by National Development and Reform Committee (NDRC) in June 2005.

Total volumes of methane released by the coalmines are not regulated in China. While the Chinese government promotes the utilization of CMM, especially in June 2005, NDRC announced the *Coalmine Methane Treatment and Utilization Macro Plan* to encourage the CMM drainage and utilization; it specifically called on the incentives from CDM to overcome barriers in the country to take such action. Therefore, we can deem it as an E- national policy according to EB 22 Annex 3. In China no legislation is known or is being considered to make CMM usage mandatory at coalmines, thus all of the options meet local and regulatory requirements.

According to the Chinese power regulation, the construction of coal-fired power plant with a capacity of 135MW or below is prohibited in the national grid coverage area. [2] It also strictly controls the

[1] http://www.chinasafety.gov.cn/files/2004-12/09/F_42cd456f6a924f7f8d36815edaa3e531.pdf

[2] "*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.。

construction of coal fired power plant with unit capacity less than 100MW. [3] Thus, alternative 2 in energy generation stage does not comply with the local and regulatory requirements.

Step 3. Formulate optional baseline scenario alternatives

Baseline scenarios meet the regulatory requirements include:

Step 3a. Alternatives for CMM extraction

The scenario left in step 1a is:

Alternative Scenario D
Combination of ventilation and post mining extraction, with ventilation accounting for 69% and post mining extraction accounting for 31%.

Step 3b. Alternatives for CMM treatment

The scenarios left in step 1b are:

Alternative Scenario i
CMM ventilation.

Alternative Scenario ii
VAM Utilization (methane concentration at < 0.75%).

Alternative Scenario iii
Recovered CMM could simply be destroyed through flaring, while this option has not gained widespread acceptance in the coal mining community in China.

Alternative Scenario iv
Recovered CMM could be combusted in reciprocating engines or gas turbines that generates electricity for the regional grid.

Alternative Scenario v
Recovered CMM could be combusted in reciprocating engines or gas turbines that generates electricity 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.

Alternative Scenario vii
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.

Alternative Scenario viii
Combination of *i, iv* and *vi*. This is the project activity not implemented as a CDM project.

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[3] "*Temporary regulation of small scale coal fired units construction management*"(Aug, 1997)

Step 3c. Alternatives for energy production

Scenarios (left in step 1c) for power generation include:

Alternative Scenario 1
Electricity supply from North China Power Grid.

Alternative Scenario 3
CMM power generation. This is the project activity not carried out as a CDM project.

Scenarios for heat production include:
Alternative Scenario 4
Continuation of existing situation - coal fired boilers for heat supply.

Alternative Scenario 5
Heat supply by gas boilers. This is the project activity not carried out as a CDM project.

Alternative Scenario 6
Waste heat recovery from CMM-fueled engine. This is the project activity not carried out as a CDM project.

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers

Step4a. Barrier analysis of the alternatives for CMM extraction:

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

Alternative scenario D
This is the continuation of CMM extraction practice at the project site, 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:

Alternative Scenario i
BAU, no barriers exist.

Alternative Scenario ii
Utilization of VAM is just on pilot stage. According to the pre-feasibility study of Huainan Coal Mine Group- one of the biggest coal mine group in China, the technology and the economic benefit are not satisfying. [4]

Alternative Scenario iii
Flaring does not utilize the energy potential of CMM, but requires great investment without any revenues. Chinese government does not regulate the extracted CMM to be treated, which lead to the fact that most

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[4] BCS Incorporated, *Prefeasibility Analysis of a Ventilation Air methane Project Opportunity in Huainan*, page 336, Proceedings of the 5th International Symposium on CBM/CMM in China, November 2005.

of coal mines in China release the extracted CMM into the atmosphere directly. The investment and prevailing practice barriers above prevent flaring from being widely adopted in coal mine community.

Alternative Scenario v

If CMM power generation adopts a separated self-governed system for coal mine internal use, the quality of generated power would be adversely affected. For instance, power from CMM generation can not guarantee the great power consumption by underground mining equipment.[5] Moreover, the voltage of power output is neither stable nor continuous due to unstable gas sources. All these factors prohibit the internal usage of generated power at coal mines.

Alternative Scenario vii

It requires a huge investment to install gas purification plant and lay residential pipeline network. Additionally, in order to implement residential or commercial CMM usage, the project owner has to obtain permission from local authorities. It is quite a complicated procedure. Moreover, the coalmines are not capable to fulfil management and gas fee charging work, since it is the governmental behaviour. Finally, the large investment for the construction of pipelines would be a big financial burden for the coal mines. The local residents are nearly all peasants, who have no willing to buy the coal mine methane for fuel to substitute their current fuel — inexpensive coal or nearly cost-free biomass fuel.All these barriers make this option not a plausible one.

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

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

Alternative Scenario 1

Electricity supply by North China Power Grid. No barrier exits.

Alternative Scenario 4

Continuation of existing practice – coal fired boilers for heat supply. No barrier exits.

It is concluded from the discussion above that Alternative D in CMM extraction process complies with regulatory requirements and does not face any barriers. In CMM treatment step, Option *i*, *iv*, *vi* and *vii* meet the regulatory requirements. The economic analyses of those options will be discussed in step 5. In energy production process, energy supply by North China Power Grid and heat supply by coal-fired boilers are the existing power and heat production approaches without any barriers. In the following step, economic barriers of CMM power generation, heat supply by gas boilers and waste heat recovery will be discussed.

Step 5. Identify most economically attractive baseline scenario alternative

Sub-step 5b Investment comparison analysis

The benchmark or hurdle internal rate of return (IRR) is determined by individual project development or investment companies. This rate of return can be influenced by perceived technical and/or political risk and by the cost of money. International project developers or investors will not invest in projects that do not meet a minimum IRR, often referred to as hurdle rates. Internationally accepted hurdle rates in the energy industry vary but range from a low of 11% up to 24% and expected payout periods range from

[5] http://www.sx.chinanews.com.cn/2005-05-17/1/22643.html

two to five years. The Confederation of British Industry (CBI) conducted a poll of 337 industrial investors in year 2001 and found that the average large industry used 13.5% for its hurdle rate[6].

Thus a hurdle rate that might be assumed for this project is 13.5%

In this step, economic evaluation will be carried out to the alternative scenarios that were not analyzed in the steps above:

According to the feasibility study of the proposed project, basic data required for financial indicators calculation are:

Installation capacity: 30MW
Operation hour: 6000
Annual power delivered to the grid: 138,960MWh
Electricity price: 32$/MWh (after tax)

Table B-4: IRR comparison of scenarios

	alternative iv	alternative vi	alternative viii
Total investment	14,255,000$	57,500$	14,312,500$
Annual operation, maintenance cost	2,636,600$/y	24,375$/y	2,661,000$/y
Annual methane Cost	41.26Mm^3/y	1.95Mm^3/y	43.21Mm^3/y
Life of project	15 years	15 years	15 years
Revenue	4,446,700$/y	-	4,446,700$/y
IRR	2.55%	negative	2.19%

Notes: Revenues of alternative vi is not accounted since unmarketable waste coals are provided to original coal fired boilers. Thus, the coal saving revenues of gas boilers can be considered as zero.

The IRRs of alternative iv and vi are much lower than their BAU benchmark IRRs, so they can not be the baseline alternatives. The IRR of alternative viii is 2.19%, which can lead to the conclusion that the project activity is not the baseline scenario.

Alternatives for heat production:

Alternative Scenario 3
This option faces the barriers of option *iv*, so it can not be the baseline scenario.

Alternative Scenario 5
The barrier of this option is similar to the scenario *vi*. So it can not be the baseline scenario.

Alternative Scenario 6
The barriers prevent the CMM power generation from being implemented, which leads to the fact that recovery of waste heat can not be realistic. This option could not be the baseline scenario.

Sub-step 5c. Sensitive Analysis

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[6] Department of Trade and Industry and HM Treasury. *2004. Productivity in the UK* 5: Benchmarking UK productivity performance. DTI Economics Papers Series: 27-28.

The sensitivity analysis shall show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions.

The following key parameters have been selected as sensitive elements to test the financial attractiveness for the proposed project.

i. Total investment
ii. Operation cost
iii. Annual power supply
iv. Electricity price

The effect of Electricity price on IRR is same as that of Annual power supply and Electricity price in Chinese market will not be changed largely in the foreseeable future. Moreover, Yangquan Branch has signed the agreement on selling electricity to the grid and the price has been fixed. No evidence indicates that the Electricity price will increase in the foreseeable future. Nevertheless, Annual power supply and Electricity price are both selected for sensitivity analysis. The influences from Total investment, Operation cost and Annual power supply/Electricity price on the internal return rate (IRR) are examined. To ensure the conservativeness, we conduct the sensitivity analysis with the four parameters fluctuating between -20% and +20%., The outcomes of IRR sensitivity are presented in the following table.

Table B-5: Sensitive analysis of alternative iv

	-20%	-10%	-5%	0%	5%	10%	20%
Total Investment	5.67%	4.00%	3.25%	2.55%	1.89%	1.27%	0.13%
Operation Cost	7.59%	5.15%	3.87%	2.55%	1.18%	-0.25%	-3.33%
Annual Power Supply/Electricity price	-9.55%	-2.18%	0.29%	2.55%	4.65%	6.63%	10.29%

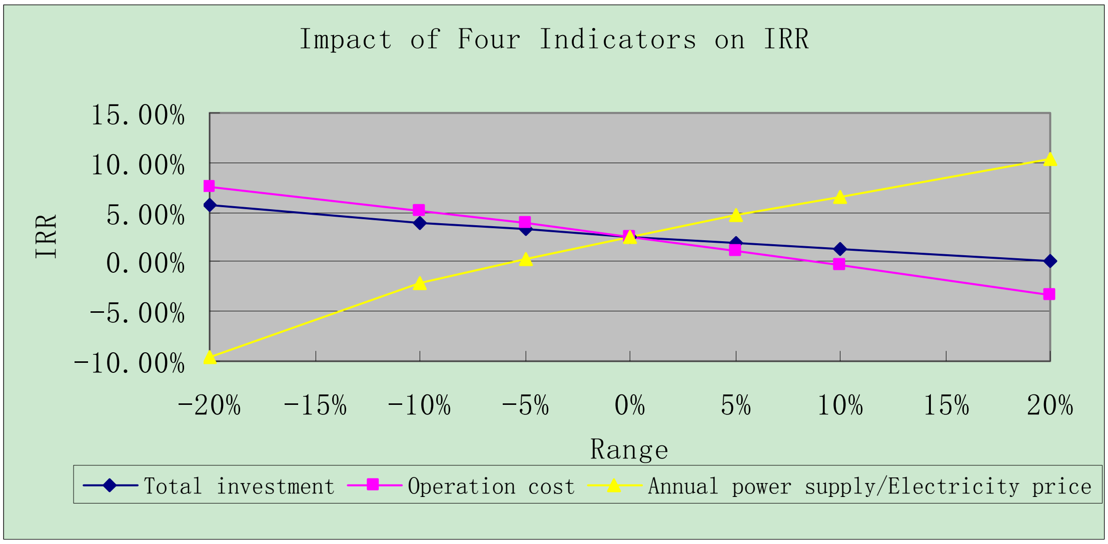

Figure B-2 Impacts of three major uncertain elements on IRR (alternative iv)

Table B-6: Sensitive analysis of alternative viii

	-20%	-10%	-5%	0%	5%	10%	20%
Total Investment	5.26%	3.62%	2.88%	2.19%	1.54%	0.93%	-0.20%
Operation Cost	7.29%	4.82%	3.53%	2.19%	0.80%	-0.65%	-3.79%
Annual Power supply/Electricity price	-8.46%	-2.56%	-0.08%	2.19%	4.30%	6.28%	9.94%

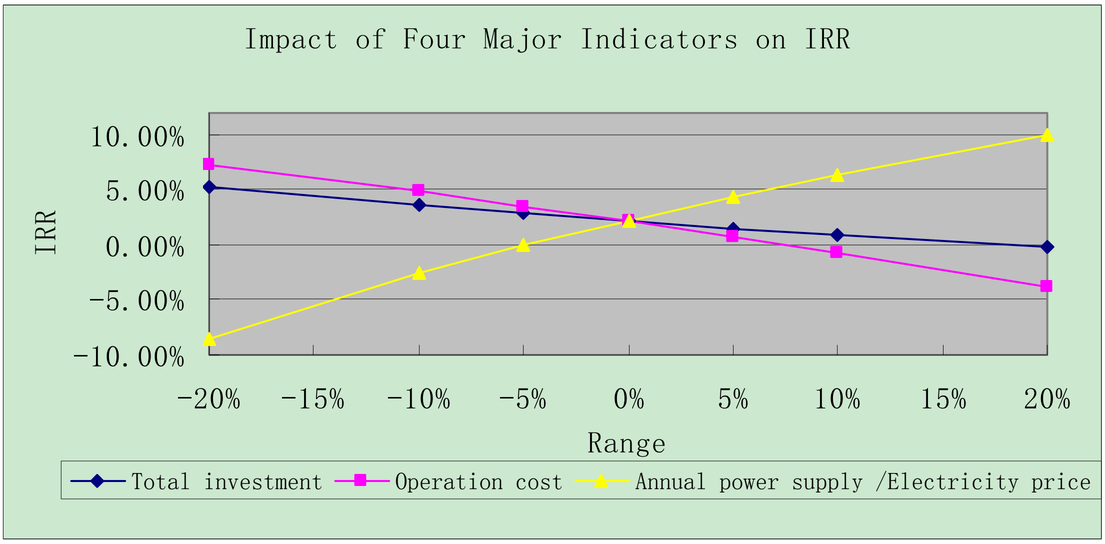

Figure B-3 Impacts of three major uncertain elements on IRR (alternative viii)

From the calculation outcomes as shown in the Tables, the IRRs of alternative iv and viii will vary to different degrees with these four uncertain parameters changing between -20% and +20%. It can be seen from Figure B-1 and B-2 that the highest IRRs of the two alternatives do not exceed the benchmark value of 13.5% when the Total investment and Operation cost decrease by 20% and Annual power supply/Electricity price increase by 20%. Therefore, a conclusion can be made that none of those alternatives can be the baseline scenario even considering the key parameters sensitivity.

In conclusion, only alternative scenario D can be implemented in the CMM drainage process. Except for BAU options, the rest alternatives in the CMM treatment process and energy production process all face great barriers. Therefore, only business as usual scenario – continuation of the current CMM extraction practice with all the extracted CMM is released into atmosphere, power purchase from North China Power Grid and heat supply by coal combustion 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):

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The proposed project activity will not occur without CDM assistance. *"Tools for the Demonstration and Assessment of Additionality" (version 03)* will be used to test the additionality of the proposed project.

The starting date of the project is 30/11/2005. The validation will be carried out after the starting date. The project owner has provided the evidence of considering CDM assistance as part of the project in decision-making process.

On 1st December 2004, as a major annual event in the coal mining industry in China, the 4th International Symposium on CBM/CMM was held in Beijing China. On the symposium, CDM was a major topic of a way to encourage coalmines to utilize CMM. After the symposium, the concept of CDM was spread around major Shanxi coal mining groups. Shanxi Coal Transport Market Head Quarter Co., Ltd. Yangquan Branch Co., Ltd. (Project Owner) started to consider implementing its CMM utilization project with the assistance from CDM.

Learned more on CDM, Project Owner held a board meeting on 16th August 2005 and decided to implement CMM utilization project with CDM assistance. Meanwhile, Project Owner started to look for qualified CDM consultant. Hence, on 12th September 2005, Project Owner signed "CDM Cooperation Protocol" with Yangquan Project Appraisal Consultant Corporation.

Then on 30th November 2005, Project Owner signed the CMM gas boiler contract with Yangquan Jiangong Normal Pressure Boilers Company (the boiler supplier) and started the project.

Based on ACM0008, Step 1 can be omitted.

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

Tools 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. "Investment comparison analysis" method is not applicable either because the baseline is not an investment project. Thus the method of "Benchmark analysis" is applied to assess the economic attractiveness of the proposed project.

Sub-step 2b Apply benchmark analysis

As discussed in step 5 of B.4, 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.

Sub-step 2c Calculation and comparison of financial indicators

According to the feasibility study of the proposed project, basic data required for financial indicators calculation are:

Installation capacity: 30MW
Operation hours: 6,000
Annual power delivered to the grid: 138,960MWh
Total investment: 14,312,500$
Operation cost: 2,661,000$/y
Electricity price: 32$/MWh (after tax)
Estimated CERs price: 10$/t$CO_2$e
Project Lifetime: 15years

Table B-7 Project IRR with and without CDM

	IRR without CDM	IRR with CDM
Yangquan Project	2.19%	32%
Benchmark IRR	13.5%	

It can be seen from the Table B-7 that IRR for the proposed project without CDM assistance is 2.19%, which is lower than the benchmark value of 13.5%. With CDM assistance, assuming the price of CERs is 10 $/tCO$_2$e, the project IRR will reach 32% that is much higher than benchmark. Therefore, a conclusion can be made that the proposed project is not economically attractive without revenues from CDM.

Sub-step 2d. Sensitivity analysis

Refer to step 5 of B.4.

Step 4 – Common Practice Analysis

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

Based on the statistics of methane resource evaluation, the total methane reserve of China is about 10 trillion cubic meters. 15 basins (group) have the reserve more than 100 billion cubic meters. The proposed project is located in Qinshui Basin, which has more than 1 trillion cubic meters reserve. [7] Meanwhile, China is the world's largest CMM emission country. China is the largest emitter of CMM in the world, releasing over 12 billion cubic meters in 2000.[8] This represents nearly 37% of the world's CMM emissions. In 2002 only 196 coal mines in China had undertaken methane drainage. The average drainage rate in the country is less than 10%.[9] Moreover, less than 50% of China's drained CMM was utilized,[10] which means that only less than 5% of the total CMM emitted by China is being used at coal mines.

In China, practical end-use options in coalmines are limited by existing market situations, infrastructure, and capital investment. Small-scale power generation projects have been attempted, but often fail due to unpredictable gas supply and lack of financial and technical support. The coal mining industry is encouraged to use CMM. Although there are certain investment incentives available to entities that wish to invest in CMM utilization projects, there are no national laws or regulations that mandate use nor are there comprehensive policies that forge and sustain the successful implementation of CMM utilization projects. The resulting course of action is the continued release of methane to the atmosphere by coal mines.

In addition, the complicated geological conditions in China coalmine areas make the CMM utilization and management difficult. The unstable gas sources due to the complicated geological condition both in flux and concentration would impose higher risks on the project return. Moreover, most of existing CMM power generations are small-scale, which means that CMM utilization rate is quite low and technology is immature. Thus, it can be concluded that development of CMM power generation requires supports in

[7] http://nyj.ndrc.gov.cn/zywx/t20060626_74590.htm

[8] United States Environmental Protection Agency, *Assessment of the Worldwide Market Potential for Oxidizing Coal Mine Ventilation Air Methane*, Washington DC, July 2003

[9] China Coal Information Institute (CCII), *Optimal Projects for China's Coal Mine Methane Mitigation*, 3rd International Methane & Nitrous Oxide Mitigation Conference, Beijing, China, November 2003

[10] China Coal Information Institute (CCII), *Optimal Projects for China's Coal Mine Methane Mitigation*, 3rd International Methane & Nitrous Oxide Mitigation Conference, Beijing, China, November 2003

better gas engine maintenance and professional services. [11] All the barriers mentioned above, to a certain extent, obstacle the research and innovation on the CMM utilization and management. At present, some large scale coal fields such as Huainan, Huaibei, Fuxin, Songzao, Jincheng are implementing CMM power generation only with CDM assistance.

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

In Shanxi province, there are several CMM power generation and utilization projects. All of them are implemented with CDM consideration.

Table B-8 Similar activities in Shanxi Province

Project name	Installation Capacity(MW)	Electricity Price($/MWh)	CDM (Y/N)
Yangquan Coal Mine Methane (CMM) Utilization for Power Generation Project, Shanxi Province, China	90	31.25	Y
Shanxi Yangcheng Coal Mine Methane Utilization Project	16.5	30.00	Y
Shanxi Liulin Coal Mine Methane Utilization Project	12	25.00	Y
China Jincheng Sihe 120 MW Coal Mine Methane Power Generation Project	120	29.25	Y

Data Source: UNFCCC website.

Moreover, because CMM power generation could result in unstable voltage, electricity generated from CMM power generation could not be directly supplied to the consumer due to its unstable voltage. It is required to be applied only when it is incorporated to the power grid for safety reason. However, currently, there is no clear regulation on the CMM power generation to the grid, making the power price in many projects very low. From Table B-8, it can be clearly seen that the price of Shanxi CMM power projects varies between 25~32$/MWh, which leads to many CMM generation projects in Shanxi can not be well carried out. Limited profits and restrained investment return speed, to some extent, affected the enterprises' enthusiasm of power generating and transmission. Actually, similar projects are being proposed at coalmines in Shanxi Province, through only with CDM incentives.

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)

[11] *Guojuanyan, Jiangdongxiang and zhaogang, CMM Power Generation Technology and Status quo in China,* page 153, Proceedings of the 4th International Symposium on CBM/CMM in China, November 2004

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 energy use should be treated as project emissions. The formula is as follows:

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

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 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 in a power plant, combustion emissions are released. In addition, if NMHC accounts for more than 1% of the coalmine gas, 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 involves none of gas for residential, vehicle utilization and flaring. Therefore, the formula will be as following:

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

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)
MD_{HEAT}: Methane destroyed through heat generation (tCH_4)
CEF_{CH4}: Carbon emission factor for combusted methane
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
$MD_{HEAT} = MM_{HEAT} \times Eff_{HEAT}$

where:
MD_{HEAT}: Methane destroyed throughheat generation (tCH_4)
MM_{HEAT}: Methane measured sent to heat plant (tCH_4)
Eff_{HEAT}: Efficiency of methane destruction/oxidation in heat plant

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

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

$PE_{UM} = GWP_{CH4} \times [MM_{ELEC} \times (1 - Eff_{ELEC}) + MM_{HEAT} \times (1 - Eff_{HEAT})]$

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)
MM_{HEAT}: Methane measured sent to gas boiler (tCH_4)
Eff_{HEAT}: Efficiency of methane destruction/oxidation in gas boiler (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 or heat 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 drained gas is vented without any utilization, thus $BE_{MD,y} = 0$.

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

All the extracted gas before implementing project activity was released into the atmosphere. However, only the portion of CMM sent to the project activity is accounted for in this calculation. The methane that still vented in the project scenario is not included in either the project emissions or the baseline emissions calculations, since it is vented in both scenarios.

Because there is no pre-mining drainage in the proposed project, only post-mining drainage gas is considered. Using the following equation to calculate $BE_{MR,y}$.

$$BE_{MR,y} = GWP_{CH4} \times (PMM_{PJ,ELEC,y} + PMM_{PJ,HEAT,y}) = GWP_{CH4} \times (MM_{ELEC} + MM_{HEAT})$$

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 ($21tCO_2e/tCH_4$)
$PMM_{PJ,ELEC,y}$: Post-mining CMM captured, sent to and destroyed by power generation in the project activity in year y, equals to MM_{ELEC} (tCH_4)
$PMM_{PJ,HEAT,y}$: Post-mining CMM captured, sent to and destroyed by boilers in the project activity in year y, equals to MM_{HEAT} (tCH_4)

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

The power generation in the proposed project will avoid the grid-connected electricity consumption. The utilization of thermal energy produced in the power generation process will replace the coal consumption in the baseline scenario. The boilers in Jiujie mine only has small rated-power, so we only calculate the CMM destroyed by the boilers but not the emission reduction of substitution of coal combustion. This is conservativeness.

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

where:
$BE_{Use,y}$: Baseline emissions from the production of power or heat 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 (grid) replaced by project (tCO_2/MWh)
$HEAT_y$: CMM boilers heat generation by project activity in year y (GJ)
EF_{HEAT}: Emissions factor for heat production replaced by project activity (tCO_2/GJ)

2.3.1 Grid power emissions factor EF_{ELEC}

The emission factor for displaced electricity is ex-ante calculated using methodology ACM0002. The equation is:

$$EF_{ELEC,y} = 0.5 \times EF_{OM,y} + 0.5 \times EF_{BM,y}$$

1) Operating Margin (OM)

ACM0002 provides the following 4 methods to calculate OM:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

According to the *Notification on Determining Baseline Emission Factor of China Grid*, Method (a) Simple OM is adopted for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the project. In accordance with the consolidated baseline methodology ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated ex ante. The formula of $EF_{OM,simple,y}$ calculation is:

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

where:
$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in years(s) *y*.
$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel.
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

Where CO_2 emission coefficient $COEF_{i,j,y}$ can be calculated by following equation:

$COEF_i = NCV_i * EF_{CO2,i} * OXID_i$

where:
NCV_i: The net calorific value of fuel i per unit mass or unit volume (energy content).
$OXID_i$: Oxidation factor of the fuel.
$EF_{CO2,I}$: CO_2 emission factor per unit of energy.

The Simple OM emission factor is calculated using the following data vintages for years(s) *y*: (*ex-ante*) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

2) Build Margin (BM)

According to ACM0002, BM is ex-ante calculated as the generation-weighted average emission factor of a sample of power plants *m*, as follows:

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

where:

$F_{i,m,y}$ is the amount of fuel *i* consumed by plant *m* in year y (tce);
$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2/tce), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in plant *m*;
$GEN_{m,y}$ is the electricity (MWh) delivered to the North China Power Grid by plant *m* in year *y*. It is the difference between power generation and self-consumption.

Based on ACM0002, in this project, the Build Margin emission factor $EF_{BM,y}$ is calculated ex-ante using Option 1 based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

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

Consider of data availability, CDM EB accepts the following deviation[12]:

- Use of capacity additions for estimating the build margin emission factor for grid electricity.
- Use of weights estimated using installed capacity in place of annual electricity generation.
- Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

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

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

2.3.2 Heat generation emissions factor EF_{HEAT}

$$EF_{heat,y} = \frac{EF_{CO2,i}}{Eff_{heat}} \times \frac{44}{12} \times \frac{1\,TJ}{1000\ GJ}$$

where:
$EF_{heat,y}$: Emissions factor for heat generation (tCO_2/GJ)
$EF_{CO2,i}$: CO_2 emissions factor of coal used in heat generation (tC/TJ)
Eff_{heat}: Boiler efficiency of the heat generation (%)
44/12: Carbon to Carbon Dioxide conversion factor
1/1000: TJ to GJ conversion factor

3. Leakage

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

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)

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

Data / Parameter:	$F_{i.j,y}$
Data unit:	tce
Description:	Amount of fuel *i* consumed by power sources *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:	$F_{i,m,y}$
Data unit:	tce
Description:	amount of fuel *i* consumed by plant *m* 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:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity delivered to the grid by source *j*
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:	$COEF_{i,j,y}$
Data unit:	tCO_2/kg(m^3)
Description:	CO_2 emission coefficient of fuel *i*
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
Data unit:	MJ/t,km^3
Description:	Net calorific value (energy content) per mass or volume
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:	$OXID_i$
Data unit:	-
Description:	Oxidation factor of the fuel
Source of data used:	IPCC default value
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 1996
Any comment:	-

Data / Parameter:	$CEF_{ELEC-PJ}$
Data unit:	tCO_2/MWh
Description:	Carbon emission factor of $CEF_{ELEC-PJ}$
Source of data used:	China DNA
Value applied:	0.9826
Justification of the choice of data or	China official data

description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	*EF_i*
Data unit:	tC/TJ
Description:	Oxidation factor of the fuel
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:	tC/TJ
Description:	CO_2 emission factor of coal used in heat generation
Source of data used:	IPCC default value
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC1996
Any comment:	-

Data / Parameter:	CEF_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data used:	ACM0008 default value
Value applied:	2.75
Justification of the choice of data or	ACM0008

description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	CEF_{NMHC}:
Data unit:	$tCO_2e/tNMHC$
Description:	Carbon emission factor for combusted non methane hydrocarbons
Source of data used:	According to the sampling report of the NMHC content analyse
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Concentration of NMHC is too low to be examined.
Any comment:	-

Data / Parameter:	GWP_{CH4}:
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane
Source of data used:	ACM0008 default value
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008
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:	Eff_{HEAT}
Data unit:	%
Description:	Efficiency of methane destruction/oxidation in heat 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:	Eff_{heat}
Data unit:	%
Description:	Boiler efficiency of coal heat plant
Source of data used:	ACM0008 Option B of Section 7.4.4
Value applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied:	Assume a boiler efficiency of 100% as a conservative approach
Any comment:	-

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

1. Project Emissions

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

Although self power consumption of the proposed project accounts for 3.5% of the total power generated, this part of power consumption will be deducted from the power generated. The net power connected to the grid will be monitored. Thus $PE_{ME} = 0$

However, the actual additional power sonsumption is monitoring onsite when the project is operated.

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

According to gas sample analysis in the proposed coalmines, the NMHC concentration is too low to be measured, thus the combustion emissions from non-methane hydrocarbons will be ignored. The NMHC concentration will be monitored annually in Yangquan coalmines to checkout 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:

$PE_{MD} = (MD_{ELEC} + MD_{HEAT}) \text{ x } CEF_{CH4}$

MM_{ELEC} and MM_{HEAT} are given by the feasibility study of the proposed project. The detailed parameters selection and calculation results are shown in Annex 3.

$MD_{ELEC} = 41.26Mm^3/y=27644.2\ tCH_4/y$

$MD_{HEAT} = 1.95Mm^3/y=1306.5\ tCH_4/y$

$PE_{MD} = (MD_{ELEC}+ MD_{HEAT}) \text{ x } (CEF_{CH4} + r \text{ x } CEF_{NMHC})$
$= (27644.2 + 1306.5) *2.75 = 79{,}614tCO_2e/y$

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

After the project is fully operated:
$MM_{ELEC}=MD_{ELEC}/Eff_{ELEC}=27644.2/99.5\%=27{,}783\ tCH_4/y$
$MM_{HEAT}=MD_{HEAT}/Eff_{HEAT}=1306.5/99.5\%=1{,}313\ tCH_4/y$

$PE_{UM} = GWP_{CH4} \text{ x } [MM_{ELEC} \text{ x } (1 - Eff_{ELEC}) + MM_{HEAT} \text{ x } (1 - Eff_{HEAT})]$
$= 21*[27{,}783*(1-0.995) + 1{,}313*(1- 0.995)] =3{,}055\ tCO_2e/$

1.4 The calculation results of project emissions

Table B-9 Project emissions at the proposed coalmines (tCO_2e)

Year	PE_{ME}	PE_{MD}	PE_{UM}	PE_y
2007.11~12	0	3,980	152	4,132
2008	0	23,861	916	24,777
2009	0	63,143	2,423	65,566
2010	0	79,614	3,055	82,670
2011	0	79,614	3,055	82,670
2012	0	79,614	3,055	82,670
2013	0	79,614	3,055	82,670
2014.1~10	0	66,367	2,545	68,912

Total	0	475,811	18,256	**494,067**

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 $BE_{MR,y}$

After the project is fully operated:

$BE_{MR,y} = GWP_{CH4}$ x $(PMM_{PJ,ELEC,y} + PMM_{PJ,HEAT,y}) = GWP_{CH4}$ x $(MM_{ELEC} + MM_{HEAT})$

$= 21*(27,783 + 1,313) = 611,020$ tCO_2e/y

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

GEN_y is calculated based on power installation capacity, annual generator's operation hours and conversion coefficient in the project

$HEAT_y$ 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.

2.3.1 Grid power emissions factor EF_{ELEC}

We refer to "*Notification on Determining Baseline Emission Factor of China's Grid*" published by China DNA to ex-ante determine the Emission Factor of North China Power Grid. The OM of North China Power Grid is 1.0585tCO_2/MWh. The BM of North China Power Grid is 0.9066tCO_2/MWh. Thus, the emission factor is 0.9826tCO_2/MWh.

2.3.2 Heat generation emissions factor EF_{HEAT}

Ex-ante identified $EF_{CO2,coal}$ and Eff_{heat} have been given in B.6.2.

$EF_{heat,y} = 25.8*44/12/1000 = 0.0946 tCO_2e/GJ$

After the project is fully operated:

$HEAT_y = 41.26*10^6*35.9*20\%/1000 = 296,247 GJ/y$

$BE_{Use,y} = GEN_y$ x EF_{ELEC} + $HEAT_y$ x EF_{HEAT} = 144,000*0.965*0.9826 + 296,247*0.0946 = 164,566tCO_2e/y

2.4 The calculation results of baseline emissions

Table B-10 Baseline emissions of proposed project（tCO_2e）

Year	BE_{MD}	BE_{MR}	BE_{Use}	BE_y
2007.11~12	0	30,543	7,312	37,855
2008	0	183,122	43,883	227,005
2009	0	484,602	128,910	613,512
2010	0	611,020	164,566	775,586

2011	0	611,020	164,566	775,586
2012	0	611,020	164,566	775,586
2013	0	611,020	164,566	775,586
2014.1~10	0	509,183	137,139	646,322
Total	0	3,651,530	975,510	**4,627,040**

3. Leakage

There is not any CMM utilisation in the baseline scenario, so no displacement of baseline thermal energy uses would occur; no CBM drainage involves; no noticeable impact of CDM project activity on coal production since the baseline scenario is not ventilation only; no reliable scientific information is currently available to assess the risk of impact of CDM project activity on coal prices and market dynamics. Therefore, no leakage effects need to be accounted for under this proposed project. $LE_y = 0$.

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).

After the project is fully operated:

$ER_y = BE_y - PE_y$ = 775,586- 82,670 = 692,916tCO_2e/y

The relevant parameters used for the calculation are shown in Annex 3.

>>

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

>>

Year	Estimation of Project activity Emission (tonnes of CO2e)	Estimation of baseline emission (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2e)	Estimation of Emission reductions (tonnes of CO2 e)
2007.11~12	4,132	37,855	0	33,723
2008	24,777	227,005	0	202,228
2009	65,566	613,512	0	547,946
2010	82,670	775,586	0	692,916
2011	82,670	775,586	0	692,916
2012	82,670	775,586	0	692,916
2013	82,670	775,586	0	692,916
2014.1~10	68,912	646,322	0	577,410
Total (tCO_2e)	**494,067**	**4,627,040**	**0**	**4,132,973**

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

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	MM_{ELEC}
Data unit:	tCH_4/y
Description:	Methane sent to power plant
Source of data to be	Volume is provided by feasibility study. Mass is calculated using the methane

used:	density 0.00067 tCH_4/m^3CH_4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	27,783 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters which will record gas volumes, pressure and temperature.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
Any comment:	-

Data / Parameter:	MM_{HEAT}
Data unit:	tCH_4/y
Description:	Methane sent to gas boilers
Source of data to be used:	Volume is provided by feasibility study. Mass is calculated using the methane density 0.00067 tCH_4/m^3CH_4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,313 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters which will record gas volumes, pressure and temperature.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance regime to ensure accuracy.
Any comment:	-

Data / Parameter:	$PMM_{PJ,ELEC,y}$
Data unit:	tCH_4/y
Description:	Post-mining CMM captured, sent to and destroyed by power generation in the project activity in year y
Source of data to be used:	Volume is provided by feasibility study. Mass is calculated using the methane density 0.00067 tCH_4/m^3CH_4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Equal to $MM_{ELEC:}$ 27,783 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters which will record gas volumes, pressure and temperature.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.

Any comment:	-

Data / Parameter:	$PMM_{PJ,HEAT,y}$
Data unit:	tCH_4/y
Description:	Post-mining CMM captured, sent to and destroyed by gas boiler in the project activity in year y
Source of data to be used:	Volume is provided by feasibility study. Mass is calculated using the methane density 0.00067 tCH_4/m^3CH_4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Equal to $MM_{HEAT:}$ 1,313
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters which will record gas volumes, pressure and temperature.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
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.5	-
Description of measurement methods and procedures to be applied:	Annually monitoring and analyzing NHMC 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. More procedures can be seen in CDM manual.
Any comment:	-

Data / Parameter:	PC_{CH4}
Data unit:	%
Description:	Concentration of methane in extracted gas
Source of data to be used:	The data comes from daily monitoring
Value of data applied for the purpose of calculating expected emission reductions in	The concentration of the coal mine methane is higher than 30%. In the emission reduction calculation, the amount of the pure methane will be used, not the concentration of the drained coal mine methane.

section B.5	
Description of measurement methods and procedures to be applied:	Continuously monitoring concentration using optical and calorific meters.
QA/QC procedures to be applied:	Concentration meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
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 NHMC concentration is less than 1%, it is not accounted.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not accounted
Description of measurement methods and procedures to be applied:	Annually monitoring NHMC concentration to determine whether its emissions to be included in the calculation.
QA/QC procedures to be applied:	Instruments will be subject to a regular maintenance regime before analysing gas components to ensure accuracy. More procedures can be seen in CDM manual.
Any comment:	-

Data / Parameter:	GEN_y
Data unit:	MWh/y
Description:	Net power annually supplied to the North China Power Grid
Source of data to be used:	Calculated based on power installation capacity, annual generator's operation hours and conversion coefficient in the project
Value of data applied for the purpose of calculating expected emission reductions in section B.5	138,960 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by power meters
QA/QC procedures to be applied:	Power meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
Any comment:	-

Data / Parameter:	$CONS_{ELEC, PJ}$
Data unit:	MWh/y
Description:	Additional electricity consumption by project

Source of data to be used:	Provided by Feasibility Study, self power consumption of the proposed project accounts for 3.5% of the total power generated. It is directly deducted in calculation from the total power generated.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Continuously monitored by electricity meter
QA/QC procedures to be applied:	Power meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
Any comment:	-

Data / Parameter:	$HEAT_y$
Data unit:	GJ/y
Description:	Total heat recovered by waste heat recovery systems
Source of data to be used:	Calculation based on the gas consumed, combustion efficiency and heat value of methane.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	296,247 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Thermometer and flow meter are adopted to continuously monitor the temperature difference of the heated medium and its flow rate to determine the amount of waste heat recovery.
QA/QC procedures to be applied:	Thermometers and flow meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
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, Yangquan Branch and supervised by the CDM project developer, Millennium Capital Services.

1. What data will be monitored?

As is shown in Section B7.1, the detailed meters installation is illustrated in the following figure:

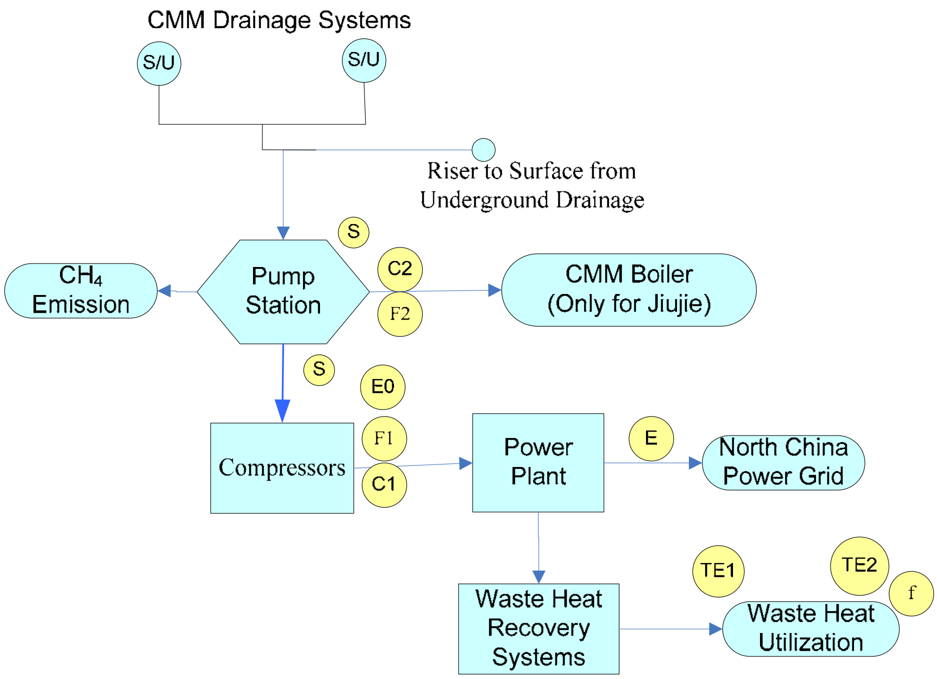

Figure B-4 Monitoring plan of the Proposed Project Activity

Table B-10 Information of the Monitoring Instruments

Symbol	Instrument	Function	National Standard
C	CH_4 concentration meter	Measure the concentration of the drained methane	MT445-1995
F	Gas flow meter	Measure CMM flow rate transmitted to utilization equipment	GB/T-2624-93
f	Fluid flow meter	Measure the flow rate of fluid from the outlet of the heat utilization equipment	JB/T9249-1999
TE	Thermometer	Measure the temperature of gas/fluid at the inlet and outlet of the heat utilization equipment	GB/T 1598-1998
E	Ammeter	Measure the electricity delivered	GB/T7676-98
s		Periodical sampling of NHMC concentration	

All the monitoring instruments are backed up with manual monitoring instruments. The procedure of manual monitoring is presented in CDM manual.

2. How will the data be monitored, recorded and managed?

All meters installed in the proposed project should be accorded with national standard. All the equipment used should be serviced, calibrated and maintained in accordance with the original manufacturers' instructions and complete records preservation. Data storage and filing system is to be established.

Record preservation is the most important process in the monitoring plan. Without accurate and efficient record keeping, project emission reductions can not be verified. The responsible personnel for monitoring

CDM related data and tracking CDM related information would be appointed by the proposed project owner and supervised by the CDM developer, Millennium Capital Services.

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. On a regular basis, all monitoring information is analyzed following the formulae in Section B.6. The management structure is as follows:

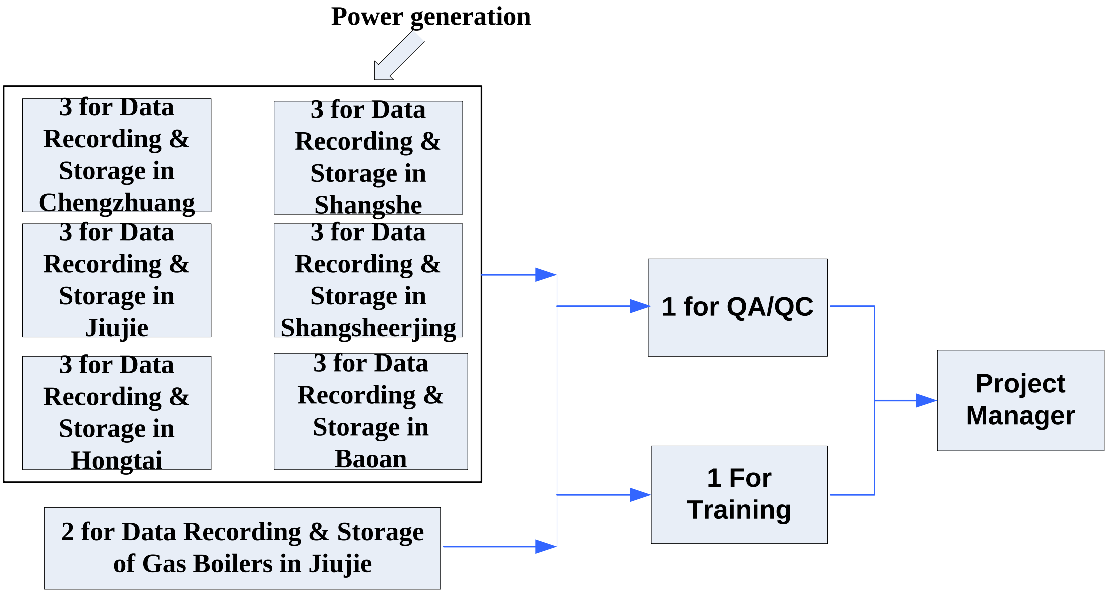

Figure B-5 Operational management structure chart of the project.

3. Calibration of Meters and Metering

The following procedures will be undertaken to calibrate the equipment used in the proposed project:
1) The metering equipment shall have sufficient accuracy so that error resulting from such equipment shall not exceed national standard requirements;
2) The metering equipment will be properly calibrated by the qualified Third Parties and checked annually for accuracy;
3) The electricity meters will be tested by the local grid company annually.

2.┌ Verification Procedure

The main objective of the verification is to independently verify whether the emission reductions reported in the PDD has been achieved by the proposed project. It is expected that the verification could be done annually.

Main verification activities for the proposed project include:
1) The project owner, Yangquan Branch will sign a verification service agreement with specific DOE in accordance with relevant EB regulations;
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 handling should be available for interviews and answer questions honestly;

2. **Quality Assurance:**

– Yangquan Branch will designate a system manager to be in charge of and accountable for the generation of ERs including monitoring, record keeping, computation and recording of ERs, audits and verification.
– The project manager will officially sign off on all worksheets used for the recording and calculation of ERs.
– Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting procedures will make it considerably easier for the auditor and verifier to do their work.
– Proper management processes and systems records will be kept by the project manager. The auditors can require copies of such records to judge compliance with the required management systems.

To be summarized, the project owner of Yangquan Branch, under supervision of Millennium Capital Services, will implement a proper monitoring plan to make sure that the emission reductions for the proposed project would be measured accurately.

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: 15/03/2007
The entity determining the methodology is:

Name/origination	**Project participate** **Yes/No**
Millennium Capital Services 1202 Jinbao Office Building, 89 Jinbao Street, Beijing 100005 P. R. China Tel: +86(10) 85221916 Fax: +86(10) 85221906	**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:

>>
30/11/2005

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

>>
15 years

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

>>
Renewable crediting period

C.2.1. Renewable crediting period

>>

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

>>
01/11/2007

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

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

>>

The purpose of the environmental impacts assessment is to evaluate whether the proposed project could have potentially adverse impacts on the environment. The EIA statement for the proposed project was approved by Shanxi Environmental Protection Bureau in August 2006. In the assessment, the proposed project has been considered with respect to potential impacts on air quality, water quality, solid waste, noise and traffic. The findings of this evaluation are summarised below.

AIR QUALITY

In construction period, construction equipment and transport activities as well as raw construction materials will bring dust emissions. However, the pollution is short-time lasting and in light intensity. The effects on surrounding environment can be greatly mitigated only if enhancing environmental management work and frequently watering. Dust emission can be eliminated when the construction activities are finished.

WATER QUALITY

It is anticipated that the proposed project will bring no adverse impacts on water quality in the surrounding area. Sludge wastewater from construction will be clarified before discharged. The residential wastewater of construction workers will be drained to treatment system and then used for watering. Oil wastewater from equipment installation will be drained to specific system for treatment.

In operation period, circulating water system will discharge 6 tonnes wastewater per hour. The wastewater contains mainly salt, which can be discharged directly. All the other residential water can be transmitted into wastewater treatment of coal mine site since all the wastewater pipelines of power station are connected to that system. The treated water will meet the primary standard of “Integrated wastewater discharge standard” (GB8978-1996). [13]

NOISE

Potential sources of noise during construction include construction equipment and materials. The exact measure to reduce the noise is firstly adopting low noise equipment. Then, construction time should be strictly controlled to avoid night working. No residents are disturbed, since no villages are close to the mine site.

There will be some increase in noise from the site associated with engines. However, the engines will be housed to reduce noise emissions. Also the CMM drainage system and reciprocating engines are located far away from residential development, schools, and sensitive receptors. It is anticipated that the project will have no obvious impacts on the existing acoustic amenity. Noise from the above mentioned facilities are minimal; they will be operated within the noise limitations that are applicable to the site.

SOLID WASTE

Proposed project will bring some solid waste during operation period. This waste will deteriorate the on-site construction environment if no strict management is applied. Thus, solid waste from construction activities should be cleared, transmitted and stacked in appointed place. Recycling is required if there are

15 http://211.100.19.230/image20010518/3435.pdf

valuable components in the waste. No obvious adverse effects will be brought during the construction period only if in time management and measure are adopted.

TRAFFIC

All the traffic and transport of activities associating with construction, operation, maintenance should occur through main road to mine site. Based on existing road grid and transport capacity, all these activities will not adversely affect the road and traffic capacity.

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 from the project activity. On the contrary, the project will lead to a significant reduction of local pollution along with a great decrease 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 have been invited to evaluate the proposed project. Public participation process adopted the method of sending "Public Opinion Questionnaires". Requirements and suggestions associated with 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.

Villagers around the project site were invited. The "Public Opinion Questionnaires" were filled for public comments on the proposed project. 180 questionnaires were sent out during the investigation with replied number of 178 (rate 98.9%). In the invited public, high school educated people account for 45.5% and the women representatives account for 14.1%. The different career and education degrees present the culture structure of local residents. Thus it has good representativeness.

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 environment? What are the main effects on the local environment? What is your attitude on this project?

The results show that most of people think that the local economy is good and agree that the proposed project could stimulate the economic development, while only a small part of villagers have no idea of that. No one denied the stimulation effects on economic development.

For environmental problems, most of people agree that the construction of the project would bring light effects to local environment. Villagers near Chengzhuang, Shangshe'erjing and Bao'an mines think that there will be some adverse effects on surrounding area. The problems focus on dust pollution in construction period and noise in both construction and operation periods.

Finally, for personal attitude on this project, most of villagers are supportive to this project. Some villagers have no idea of that. No one oppose it.

In addition, the staff also widely communicated with the residents about the project construction in the whole process. Most of people think that the project could bring benefits to local economic development. It will also bring more working opportunities, increase public incomes and effectively avoid the accidents of CMM explosion.

Table E-1 Results of the Stakeholder Questionnaire (%)

		Chengzhuang	Shangshe	Shangshe erjing	Jiujie	Hongtai	Baoan
What is your attitude towards local economic development?	Excellent	40	—	40	96.2	36.6	6.5
	Very good	60	29.0	56.7	3.8	53.4	58
	Good	—	37.5	3.3	—	6.7	35.5
	Bad	—	33.5	—	—	3.3	—
What do you think the main problems obstacle the economic development?	Power supply	3.3	6.3	13.4	65.4	3.3	50
	Traffic	6.7	6.3	3.3	3.8	6.7	46
	Natural resources	53.4	40.6	70	30.8	63.3	—
	Human Rources	23.3	6.3	10	—	23.3	—
	Others	—	6.3	—	—	3.4	2
	No ideas	13.3	34.2	3.3	—	—	2
What are the main effects of the proposed CMM power production project on the local environment?	SO_2	—	—	—	46.1	—	67.5
	Water	3.2	—	9.4	7.7	3.3	30
	Noise	38.7	21.9	28.1	19.2	43.3	2.5
	Dusts	58.1	46.9	62.5	27	50.1	—
	Others	—	31.2	—	—	3.3	—
What effects will the project make to local economic development?	Slight	66.7	53.1	76.7	92.3	93.3	—
	Weak	10	18.8	10	7.7	6.7	12.9
	Certain	23.3	—	13.3	—	—	83.9
	Deep	—	—	—	—	—	3.2
	No ideas	—	28.1	—	—	—	—
Does the proposed project promote t the local economic development?	Greatly	73.3	38.7	76.7	100	63.4	32.3
	Very	26.7	41.9	23.3	—	33.3	67.7
	Adversely	—	—	—	—	—	—
	Badly	—	—	—	—	—	—
	No ideas	—	19.4	—	—	3.3	—
What is your attitude to this project?	Support	100	74.2	90	100	90	80.6
	No idea	—	25.8	10	—	10	19.4
	Against	—	—	—	—	—	—

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

>>

From the survey it could be concluded that the majority of public in the mining area are supportive to the construction and operation of the project activity. They think that the proposed project will promote local economic development, improve the local residential daily life and environmental quality, etc. However, the local public also give some suggestions and hope for the proposed project.

For the problem of dust pollution, the project owner will adopt the following measures: 1) periodically watering the construction site and increasing the frequency in windy day; 2) flushing construction site and road in time to avoid the dust emission from trucks; 3) covering trucks carrying construction rubbish to avoid dropping off; 4) avoiding exposure of dusty materials; 5) covering all the dusty materials passing the project site.

For noise pollution both in construction and operation period, the project will adopt resolving measures. In construction period, properly arranging working time can avoid high noise equipment running at the same time. Night working time should be reduced. In addition, the construction site should be reasonable arranged to fix the high noise equipment in the centre and add sound panel around the fixed equipment. Moreover, adopting low noise equipment to reduce the sound level. Periodically maintain the equipment so that additional noise caused by broken accessories and mufflers can be mitigated. The noise in operation period mainly comes from power engines. The corresponding measures can be: 1) fixing mufflers at the entrance of air compressor can reduce about 15-20dB (A) noise level; 2) noise protection windows and doors are necessary in control house; 3) control the total area of window to avoid noise leak; 4) distinguish areas by function and selectively planting.

Project site belongs to industrial area which implements tertiary standard (daytime 65 dB, night 55dB) of "Standard of noise at boundary of industrial enterprises" (GB12348-90). [14] Noise for regional environment implements tertiary standard (daytime 65 dB, night 55dB) of "Standard of environmental noise of urban area" (GB3096-93). [15] When all the noise avoidance measures are strictly implemented, the noise emission would meet the standard.

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16 http://www.sepa.gov.cn/image20010518/4557.pdf

17 http://www.sepa.gov.cn/image20010518/4548.pdf

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Salutation:	General manager
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been provided for this CDM project.

Annex 3

BASELINE INFORMATION

Data recommended in the *Notification on Determining Baseline Emission Factor of China's Grid* for the North China Power Grid revised using values in IPCC1996 (for conservative) are adopted for the proposed project activity.

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

1. OM Calculation:

Calculation of simple OM emission factor of the North China Power Grid in 2002

Fuel type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	Oxidation Rate	Average Low Heat Value	CO_2 Emissions (tCO_2e)
									（tC/TJ）	（%）	（MJ/t,km3）	K=G*H*I*J*44/12/10000（Mass Unit）
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	Mtons	691.84	1052.74	4988.01	4037.39	3218	5162.86	**19150.84**	25.8	98	20908	371208174.5
Cleaned Coal	Mtons						80.71	**80.71**	25.8	98	26344	1971179.968
Other Washed Coal	Mtons	3.43		65.2	135.56		106.32	**310.51**	25.8	98	8363	2407436.829
Coke	Mtons							**0**	29.5	98	28435	0
Coke Oven Gas	10^9m^3	0.17	1.71		0.75	0.16	0.04	**2.83**	13	99.5	16726	224500.0238
Other Coke Gas	10^9m^3	15.82		7.34		10.35		**33.51**	13	99.5	5227	830739.3673
Crude Oil	Mtons						14.98	**14.98**	20	99	41816	454769.0717
Gasoline	Mtons						0.65	**0.65**	18.9	99	43070	19206.87269
Diesel Oil	Mtons	0.26	2.35	4.12		1.6	10.02	**18.35**	20.2	99	42652	573896.3513
Fuel Oil	Mtons	13.94	0.04	1.22		0.42	20.33	**35.95**	21.1	99	41816	1151411.233
Liquefied Petroleum Gas	Mtons							**0**	17.2	99.5	50179	0
Refinery Gas	Mtons			0.27				**0.27**	18.2	99.5	46055	8256.698951
Natural Gas	10^9m^3		0.55			0.02		**0.57**	15.3	99.5	38931	123867.2104
Other Petroleum Products	Mtons							**0**	20	99	38369	0
Other Coke Products	Mtons							**0**	25.8	98	28435	0
Other Energy	Mtons Standard Gas					1.1	15.92	**17.02**	0	0	0	0
										Total		**378973438.1**

Data source: China Energy Statistical Yearbook 2000-2002

Electricity generation of the North China Power Grid in 2002

Provinces	**Power Generation**	**Self Power Consumption Rate**	**Power Supply**
	（MWh)	**（%）**	**(MWh)**
Beijing	17886000	7.95	16464063
Tianjin	27263000	7.08	25332779.6
Hebei	100970000	6.72	94184816
Shanxi	82256000	7.98	75691971.2
Inner Mongolia	51382000	7.93	47307407.4
Shandong	124162000	6.79	115731400.2
Total			**374712437.4**

Data source: China Electric Power Yearbook 2003.

In 2002, a total of 2,905,200MWh power was connected to North China Power Grid supplied by Northeast China Power Grid. Since the Emission Factor of Northeast China Power Grid is 1.0302tCO_2e/MWh, the OM of North China Power Grid is 1.0115tCO_2e/MWh based on its total power supply of 377,617,637MWh and the total CO2 emission of 381,966,513tCO_2e.

Calculation of simple OM emission factor of the North China Power Grid in 2003

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	Oxidation Rate	Average Low Heat Value	CO_2Emissions （tCO_2e）
									（tc/TJ）	（%）	（MJ/t,km3）	K=G*H*I*J*44/12/10000（Mass Unit）
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	Mtons	714.73	1052.74	5482.64	4528.51	3949.32	6808	**22535.94**	25.8	98	20908	436822883.4
Cleaned Coal	Mtons						9.41	**9.41**	25.8	98	26344	229820.3878
Other Washed Coal	Mtons	6.31		67.28	208.21		450.9	**732.7**	25.8	98	8363	5680747.688
Coke	Mtons					2.8		**2.8**	29.5	98	28435	84397.73393
Coke Oven Gas	10^9m^3	0.24	1.71		0.9	0.21	0.02	**3.08**	13	99.5	16726	244332.1814
Other Coke Gas	10^9m^3	16.92		10.63		10.32	1.56	**39.43**	13	99.5	5227	977500.8431
Crude Oil	Mtons						29.68	**29.68**	20	99	41816	901037.7869
Gasoline	Mtons						0.01	**0.01**	18.9	99	43070	295.490349
Diesel Oil	Mtons	0.29	1.35	4		2.91	5.4	**13.95**	20.2	99	42652	436286.327
Fuel Oil	Mtons	13.95	0.02	1.11		0.65	10.07	**25.8**	21.1	99	41816	826325.7251
Liquefied Petroleum Gas	Mtons							**0**	17.2	99.5	50179	0
Refinery Gas	Mtons			0.27			0.83	**1.1**	18.2	99.5	46055	33638.40313
Natural Gas	10^9m^3		0.5				1.08	**1.58**	15.3	99.5	38931	343351.2148
Other Petroleum Production	Mtons							**0**	20	99	38369	0
Other Coke Production	Mtons							**0**	25.8	98	28435	0
Other Energy	Mtons Standard Coal	9.83					39.21	**49.04**	0	0	0	0
										Total		**446580617.2**

Data source: China Energy Statistical Yearbook 2004

Electricity generation of the North China Power Grid in 2003

Province	Power Generation	Power Generation	Self Power Consumption Rate	Power Supply
	(10^8kWh)	**(MWh)**	**(%)**	**(MWh)**
Beijing	186.08	18608000	7.52	17208678.4
Tianjin	321.91	32191000	6.79	30005231.1
HeBei	1082.61	108261000	6.5	101224035
Shanxi	939.62	93962000	7.69	86736322.2
Inner Mongolia	651.06	65106000	7.66	60118880.4
Shandong	1395.47	139547000	6.79	130071758.7
Total				**425364905.8**

Data source: China Electric Power Yearbook 2004.

In 2003, a total of 4,244,380MWh power was connected to North China Power Grid supplied by Northeast China Power Grid. Since the Emission Factor of Northeast China Power Grid is 1.0961tCO_2e/MWh, the OM of North China Power Grid is 1.0503tCO_2e/MWh based on its total power supply of 429,609,286MWh and the total CO_2 emission of 451,232,602tCO_2e.

Calculation of simple OM emission factor of the North China Power Grid in 2004

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Emission Factor	Oxidation Rate	Average Low Heat Value	CO_2 Emissions (tCO_2e)
									（tc/TJ）	（%）	（MJ/t,km3）	K=G*H*I*J*44/12/10000（Mass Unit）
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (Volume Unit)
Raw Coal	Mtons	823.09	1410	6299.8	5213.2	4932.2	8550	**27228.29**	25.8	98	20908	527776527.1
Cleaned coal	Mtons						40	**40**	25.8	98	26344	976919.8208
Other Washed Coal	Mtons	6.48		101.04	354.17		284.22	**745.91**	25.8	98	8363	5783167.065
Coke	Mtons					0.22		**0.22**	29.5	98	28435	6631.250523
Coke Oven Gas	10^9m^3	0.55		0.54	5.32	0.4	8.73	**15.54**	13	99.5	16726	1232766.915
Other Coke Gas	10^9m^3	17.74		24.25	8.2	16.47	1.41	**68.07**	13	99.5	5227	1687509.064
Crude Oil	Mtons							**0**	20	99	41816	0
Diesel Oil	Mtons	0.39	0.84	4.66				**5.89**	20.2	99	42652	184209.7825
Fuel Oil	Mtons	14.66		0.16				**14.82**	21.1	99	41816	474656.87
Liquefied Petroleum Gas	Mtons							**0**	17.2	99.5	50179	0
Refinery Gas	Mtons		0.55	1.42				**1.97**	18.2	99.5	46055	60243.32197
Natural Gas	10^9m^3		0.37		0.19			**0.56**	15.3	99.5	38931	121694.1015
Other Petroleum Products	Mtons							**0**	20	99	38369	0
Other Coke Products	Mtons							**0**	25.8	98	28435	0
Other Energy	Mtons Standard Coal	9.41		34.64	109.73	4.48		**158.26**	0	0	0	0
										Total		**538304325.3**

Data source: *China Energy Statistical Yearbook 2005*

Electricity generation of the North China Power Grid in 2004

Province	Power Generation	Power Generation	Self Power Consumption Rate	Power Supply
	(10^8kWh)	**(MWh)**	**(%)**	**(MWh)**
Beijing	185.79	18579000	7.94	17103827.4
Tianjin	339.52	33952000	6.35	31796048
HeBei	1249.7	124970000	6.5	116846950
Shanxi	1049.26	104926000	7.7	96846698
Inner Mongolia	804.27	80427000	7.17	74660384.1
Shandong	1639.18	163918000	7.32	151919202.4
Total				**489173110**

Data source: China Electric Power Yearbook 2005.

In 2004, a total of 4,514,550MWh power was connected to North China Power Grid supplied by Northeast China Power Grid. Since the Emission Factor of Northeast China Power Grid is 1.2204tCO_2e/MWh, the OM of North China Power Grid is 1.1015tCO_2e/MWh based on its total power supply of 493,687,660MWh and the total CO2 emission of 543,813,992tCO_2e.

Therefore, the EF_{OM} of North China Power Grid is **1.0585tCO_2e/MWh**.

2．BM Calculation:

Step1 Ratio of CO_2 emissions among solid fuel, liquid fuel and gas fuel

		Beijing	**Tianjin**	**Hebei**	**Shanxi**	**Shandong**	**Inner Mongolia**	**Total**	**Average Low Caloric Value**	**Emission Factor**	**Oxidation Rate**	**CO_2 Emissions （tCO_2e）**
Fuel Type	Unit	A	B	C	D	E	F	G=A+…+F	H	I	J	K=G*H*I*J*44/12/100
Raw Coal	Mtons	823.09	1410.00	6299.80	5213.20	8550.00	4932.20	27228.29	20908 kJ/kg	25.80	0.98	527,776,527
Cleaned Coal	Mtons	0	0	0	0	40.00	0	40	26344 kJ/kg	25.80	0.98	976,920
Other Washed Coal	Mtons	6.48	0	101.04	354.17	284.22	0	745.91	8363 kJ/kg	25.80	0.98	5,783,167
Coke	Mtons	0	0	0	0	0	0.22	0.22	28435 kJ/kg	29.50	0.98	6,631
Sub-total												**534,543,245**
Crude Oil	Mtons	0	0	0	0	0	0	0	41816 kJ/kg	20.00	0.99	0
Gasoline	Mtons	0	0	0	0	0	0	0	43070 kJ/kg	18.90	0.99	0
Kerosene	Mtons	0	0	0	0	0	0	0	43070 kJ/kg	19.60	0.99	0
Diesel oil	Mtons	0.39	0.84	4.66	0	0	0	5.89	42652 kJ/kg	20.20	0.99	184,210
Fuel oil	Mtons	14.66	0	0.16	0	0	0	14.82	41816 kJ/kg	21.10	0.99	474,657
Other Petroleum Products	Mtons	0	0	0	0	0	0	0	38369 kJ/kg	20.00	0.99	0
Sub-total												**658,867**
Natural Gas	10^7m^3	0	3.7	0	1.9	0	0	5.6	38931 kJ/m^3	15.30	0.995	121,694
Coke Oven Gas	10^7m^3	5.5	0	5.4	53.2	87.3	4.0	155.4	16726 kJ/m^3	13.00	0.995	1,232,767
Other Coke Gas	10^7m^3	177.4	0	242.5	82.0	14.1	164.7	680.7	5227 kJ/m^3	13.00	0.995	1,687,509
Liquefied Petroleum Gas	Mtons	0	0	0	0	0	0	0	50179 kJ/kg	17.20	0.995	0
Refinery Gas	Mtons	0	0.55	1.42	0	0	0	1.97	46055 kJ/kg	18.20	0.995	60,244
Sub-total												**3,102,214**
Total												**538,304,326**

Data sources: China Energy Statistical Yearbook 2005.

Step2.EF$_{Thermal}$ calculation:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9104 tCO_2e/MWh$$

Step3. EF$_{BM}$ Calculation

Installed capacity of the North China Power Grid in 2004

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mingolia	Shandong	Total
Coal	MW	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro	MW	1055.9	5	783.8	787.3	567.9	50.8	3250.7
Nuclear	MW	0	0	0	0	0	0	0
Oher(wind)	MW	0	0	13.5	0	111.8	12.4	137.7
Total / % Changes	MW	4514.4	6013.5	20730	18480.5	14321.2	32923.6	96983.2

Data source: China Electric Power Yearbook 2005.

Installed capacity of the North China Power Grid in 2002

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Coal	MW	3407.5	6245.5	16745.7	14327.8	9778.7	25102.4	75607.6
Hydro	MW	1038.5	5	775.9	795.3	592.1	50.8	3257.6
Nuclear	MW	0	0	0	0	0	0	0
Other(wind)	MW	0	0	13.5	0	76.6	0	90.1
Total / % Changes	MW	4446	6250.5	17535.1	15123.1	10447.4	25153.1	78955.2

Data source: China Electric Power Yearbook 2003.

Installed capacity of the North China Power Grid in 2001

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Coal	MW	3412.5	5632	16474.9	13415.8	8898.3	20957.7	68791.3
Hydro	MW	1058.1	5	742.6	795.9	566.2	56.2	3224
Nuclear	MW	0	0	0	0	0	0	0
Other(wind)	MW	0	0	9.9	0	46.7	0	56.6
Total / % Changes	MW	4470.6	5637	17227.4	14211.8	9511.2	21013.9	72071.9

Data source: China Electric Power Yearbook 2002.

Calculation of BM emission factor of the North China Power Grid

	Installed Capacity in 2001	**Installed Capacity in 2002**	**Installed Capacity in 2004**	**New Capacity Additions 2001-2004**	**The portion of Capacity Additions**
	A	B	C	D = C-A	
Coal（MW）	68791.3	75607.6	93594.9	24803.6	**99.58%**
Hydro（MW）	3224	3257.6	3250.7	26.7	0.10%
Nuclear（MW）	0	0	0	0	0.00%
Wind（MW）	56.6	90.1	137.7	81.1	0.32%
Total （MW）	72071.9	78955.2	96983.2	24911.3	100.00%
The portion of installed capacity in 2004	74.31%	81.41%	100%		

$EF_{BM,y}$ = 0.9104×99.58% = 0.9066 tCO_2e/MWh

Therefore, the EFELEC of North China Power Grid is:
EF_{ELEC} = 0.5*EF_{OM}+0.5*EF_{BM} = 0.5*1.0585+0.5*0.9066 = **0.9826tCO_2e/MWh**

IRR calculation table:

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Annual Power Supply (MWh)		9,264	37,056	108,852	138,960	138,960	138,960	138,960	138,960	138,960	138,960	138,960	138,960	138,960	138,960
Waste heat recovery (GJ)		19,749	78,994	232,046	296,247	296,247	296,247	296,247	296,247	296,247	296,247	296,247	296,247	296,247	296,247
Emission Reduction (tCO_2e)		50,570	202,280	549,853	692,914	692,914	692,914	692,914	519,686						
OUTFLOWS															
Capital Investment（10^4＄）	385.88		736.51	308.86											
Current Cost（10^4＄）	17.88	23.88	-6.00												
Operational Cost（10^4＄）	2.03	102.20	102.20	211.02	266.10	266.10	266.10	266.10	266.10	266.10	266.10	266.10	266.10	266.10	266.10
Tax and Additives（10^4＄）		6.51	9.25	27.18	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70
INFLOWS															
Estimated price of CO_2e（＄/t）				10	10	10	10	10	10	10	10				
Derived from sales of CERs（10^4＄）				33.72	202.23	547.95	692.92	692.92	692.92	692.92	577.41				
Derived from the power（10^4＄）		29.64	118.58	348.33	444.67	444.67	444.67	444.67	444.67	444.67	444.67	444.67	444.67	444.67	444.67
Reclaim the surplus current capital（10^4＄）															17.88
Reclaim the surplus capital assert（10^4＄）															90.58
Cash Flow with CDM	-405.79	-102.94	-689.66	3.49	691.82	836.79	836.79	836.79	836.79	721.28	143.87	143.87	143.87	143.87	252.33
Cash flow without CDM	-405.79	-102.94	-723.38	-198.74	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	252.33
IRR without CDM	2.19%					IRR with CDM		32%							

Annex 4

MONITORING INFORMATION

CDM Monitoring & Quality Control Manual

2. Project Management

1.1 Monitoring Systems

Adopted monitoring equipment in the proposed project include CMM flow meter (with temperature and pressure adjustment) and methane concentration meter for methane consumption monitoring, liquid flow meter and thermometer for waste heat utilization monitoring,, and ammeter for power generated and self consumption monitoring. The installation point of each instrument is presented in Figure1.

1.2 Project Management Structure

See Figure 2

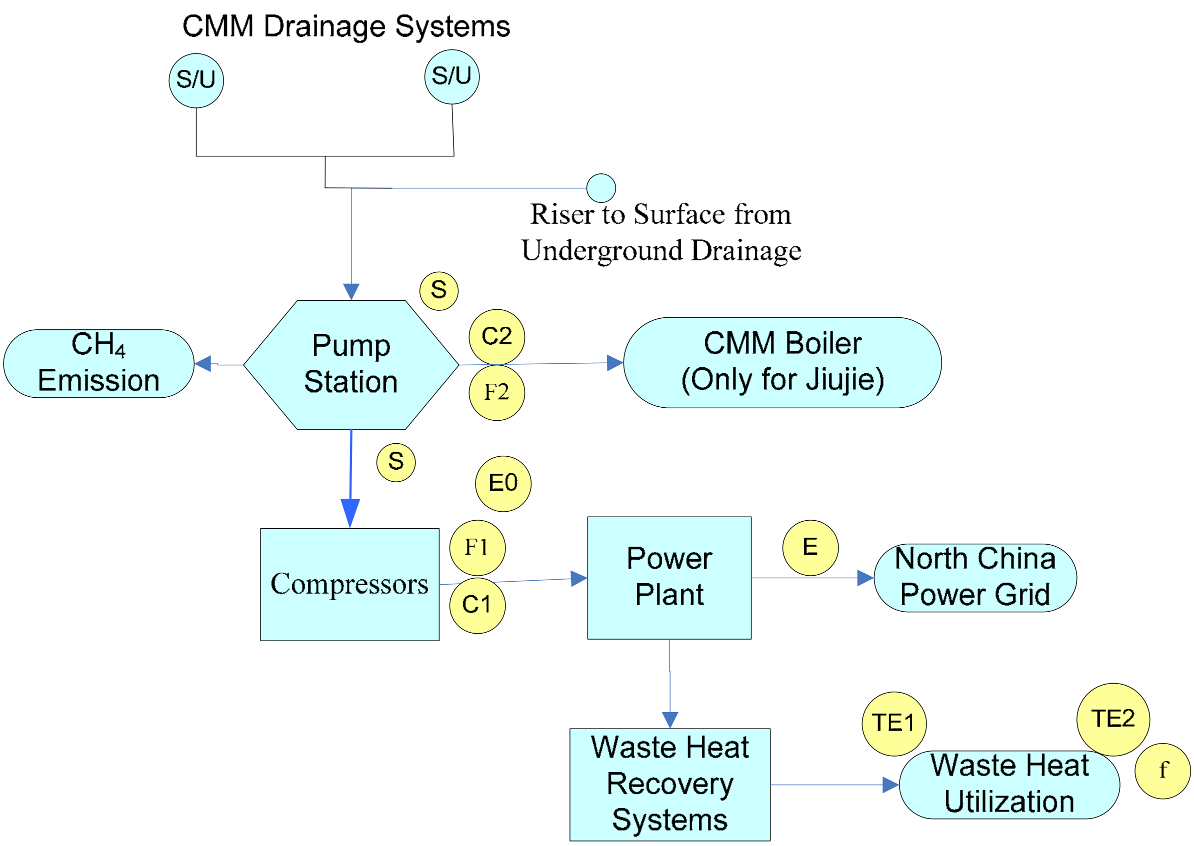

Figure 1 Installation Location of Monitoring Instruments

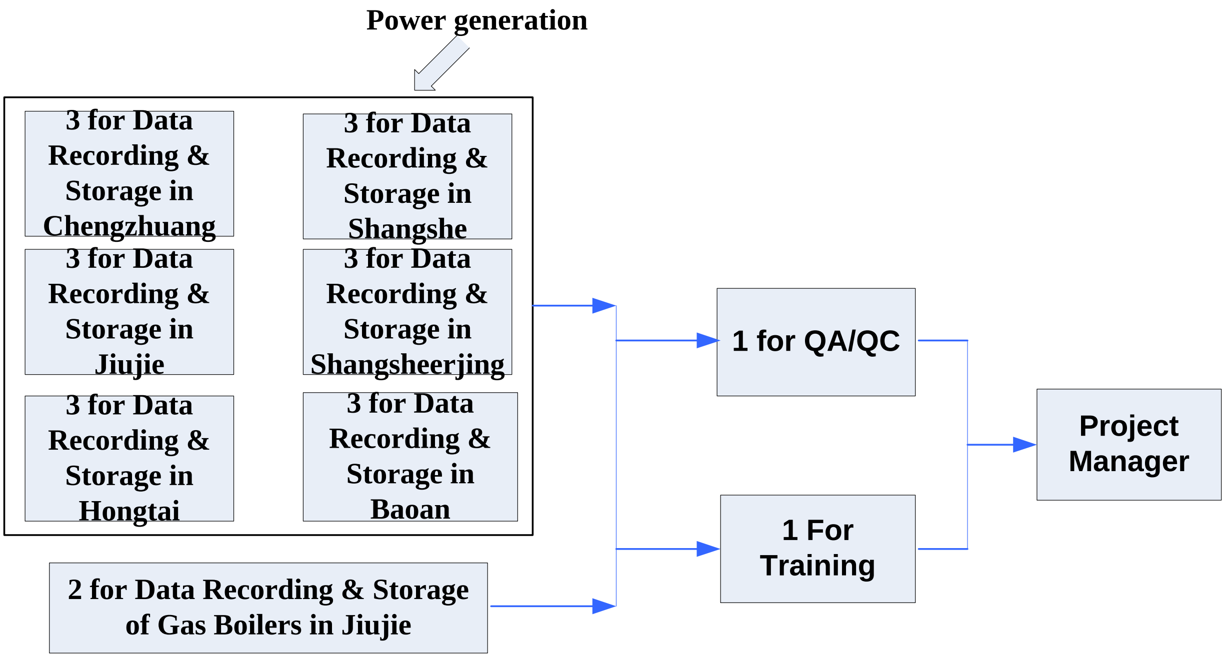

Figure 2 Project Management Structure

1.3 Position Responsibilities

General Manager of Yangquan Branch is responsible for the project monitoring. Two people in charge of training and QA&QC are directly appointed by the project manager. Each position includes 3 teams rotating every 8 hours.

- Data reading, recording and saving staff on power station: 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. Staff C is responsible for the operation of the generation and assistance of the manual monitoring when emergency occurs.
- Data recording and saving staff on boiler and resident using gas: Staff A is responsible for supervising, controlling all the boilers, and reading data timely. Staff B is responsible for supervising accuracy of data reading, data saving and reporting.
- Employee training: periodic training operator, supervising and controlling (new) staff and assisting quality assurance staff and project manager to complete internal verification.
- Quality assurance and audit: 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.
- 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).

The staff in each should be on duty on time and operate strictly according to operation specification and illustration of instrument. Additionally, they are supposed to actively attend employee training and assist verification staff to complete internal audit. All monitoring staff is under unified management of project manager, and they must obey project manager's working arrangement to complete tasks to make sure good quality and quantity.

1.4 Employee Training

Employee training is required in the process of project operation and monitoring. New staff has to be trained before they work. The training will be carried out before power station operation and new staff on position. Besides, periodic routine training is necessary according to actually project situation.

Employee training mainly includes:

A. CDM and Emission Reduction Generation Notion Introduction
   - Kyoto Protocol and CDM
   - Principal of How the GHG emission reduction are produced in the proposed project
   - Benefit provided by CDM
   - Essentiality of accurate data monitoring for emission reduction generation

B. Daily management system, operation specification and equipment maintenance
   - Position responsibilities and operation management system introduction
   - Operation rules and safety operation notes of generators
   - Daily maintenance and repair of generators and CMM boilers.

C. CDM monitoring instrument introduction
   - Requirement of monitoring
   - Selection and installation locations of monitoring instruments
   - Calibration and installation of instruments
   - Introduction of monitoring instruments
   - Operation note of monitoring instrument
   - Daily instrument maintenance
   - Periodic instrument calibration
   - Back-up instrument use

D. Monitoring data recording and storage
   - How to use monitoring system computer on line to deal daily monitor parameter
   - Requirement of data saving and regularly archiving
   - Auxiliary role of manual monitoring
   - Data recording and saving requirement of manual monitoring
   - Data reporting procedure

E. Emergency
   - Emergency treatment of gas power station and waste heat boiler operation
   - Emergency treatment of monitoring operation
   - Urgency treatment of data disorders

2. Monitoring operation

2.1 Monitoring equipment installation

The locations of monitoring instruments are referred in Figure 1. Instrument installation is carried out strictly based on the illustrations. The ambient conditions should meet the requirement of the equipment operation such as environment temperature, relative humidity and atmospheric pressure, etc. Flux and concentration sensors should be vertically or horizontally installed, with enough straight pipe left. For ensuring measure accuracy, the sensor should be avoided vibration pipeline in order to ensure its accuracy. The detailed information of monitoring equipment is listed in Table 1.

2.2 Instrument calibration

- Zero correction is required for each probe of the flow meter. Maker sure that the reading of the current flow is 4mA or 0mA when the flow rate of the gas is zero with no fluctuation. Sensor mainframe is required to have “zero” and “sensitivity” adjustment. Finally, they are set up according to their range.

- Methane concentration meter is required to have “thermal-conductivity zero-point” examination and “thermal conductivity accuracy” examination. Thermal-conductivity zero-point calibration is implemented on working status of instrument, with adjusting LED display to show zero. Thermal conductivity accuracy examination is implemented when standard mixed gas with given methane concentration importing gas chamber of sensor, with adjusting concentration value of display.

- Thermometer is required to have “zero point” and “accuracy” calibration. Zero point calibration means that LED display shows zero when instrument is in working situation with probe inserting ice-water mixture. Accuracy calibration means that digital display temperature is consistent with standard temperature on normal temperature.

- Ammeter installation and calibration are carried according to the industrial electricity ammeter requirement.

Table 1: Detailed Information Monitoring Instrument

No.	Name	Precision	Installation location	Purpose	Standard
E	Ammeter	≤2% class2	The booster station of the power station	Measure electricity supplied.	GB/T7676-98
E0	Ammeter	≤2% class2	Self electricity consumption of power station	Measure electricity consumption of power station	GB/T7676-98
F1	Gas flowmeter	≤1%	Gas pipeline to the power plant	Measure CMM flow rate imported to generators	GB/T-2624-93
C1	Methane concentration meter	≤5%	Gas pipeline to the power plant	Measure methane concentration in the gas imported to generators	MT445-1995
F2	Gas flowmeter	≤1%	Gas pipeline to the CMM boiler	Measure gas flow rate imported to CMM boiler	GB/T-2624-93
C2	Methane concentration meter	≤5%	Gas pipeline to the CMM boiler	Measure methane concentration in the gas imported to CMM boiler	MT445-1995
TE1	Thermometer	≤0.1℃	Inlet pipeline of waste heat utilization equipment	Measure input gas temperature	GB/T1598-1998
TE2	Thermometer	≤0.1℃	Outlet pipeline of waste heat utilization equipment	Measure output gas/water temperature	GB/T1598-1998
f	Liquid flowmeter	≤2%	outlet pipeline of waste heat recovery equipment	Measure heated water flow rate	JB/T9249-1999
s	Regular sampling		Pipeline of gas-using terminal	Monitor NHMC concentration in CMM	

2.3 Data monitoring and recording

1）Electricity monitoring（E）

Ammeters is adopted to monitor electricity consumption of new equipment bring by the project and power generated. Ammeter installation will be jointly examined by Yangquan Branch，consultant and third qualified party. No one is authorized to disassemble ammeters. Electricity consumption and supply will be continuously monitored and periodically recorded.

2）Coal mine gas concentration and flux monitoring（F C）

In this project, coal mine gas flux and concentration monitoring are achieved by collecting electric signal. The probe is installed in the gas pipeline. The collected signal is automatically converted the electric signal for exportation. The temperature and pressure sensors are fixed for calibration.

3）Heat supply monitoring（f TE）

The signal collection and transmission mode is same as flow meter and concentration meter.

4）NMHC monitoring

The sampling of CMM for NMHC monitoring is carried once a year. If the concentration of non-methane hydrocarbon is higher than 1％， the project owner is responsible to provide the value with consultant for calculation correction. If not, the sampling report can be directly supplied to DOE for verification.

2.4 Data keeping and reporting procedure

All the monitoring data is created and saved by computer automatically and periodically printed for hardcopy filing. The assigned person should be responsible to make file list. All the electric files should be backed up, well kept and filed as well. Any file transfer should be carefully checked up and signed by both sides. All the data should be kept 2 years after the crediting period.

3. QA & QC

The quality assurance and quality control procedure of data reading, recording and archiving is perfected based on the requirement of CDM. Most of the required data is monitored, recorded, and archived automatically by computer. Manual monitoring system is backed up for emergency. All the workers are trained in advance in order to make sure the exactitude of reading and appropriateness of monitoring operation. The operations and data will be examined by the team leader monthly.

All the equipment adopted in the project will be calibrated and examined by qualified entities to make sure their accuracy. The calculation is required to be recorded so that the recorded can be supplied to the consultant and DOE for verification.

Internal audit will be carried out periodically, which includes monitoring operation, instrument operation situation, data reading, recording and keeping, etc. Simulation test could also be a part if necessary. The aim of internal audit is to ensure the rationality of data collection, accuracy of the value recording, appropriateness of data reporting and recording and the conservative of ER calculation. All these procedures are essential to ensure that the ER can be honestly, transparently and effectively verified