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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Title: Shanxi Yangcheng Coal Mine Methane Utilization Project
Version: 03
Date: 07/11/2007

A.2. Description of the project activity:

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Yangcheng Coal Mine Methane Utilization Project is located in Yangcheng County, Jincheng City of Shanxi Province. The proposed project sites are located in Baigou, Shancheng, Huangcheng, Beizhuang, Tunchengcun, Zhulinshan, Xiyao, Huangcheng, Zhanggou, Mazai, Hougou and Fuyanshan mines. So far, 11 of those mines have been extracting underground CMM except for Fuyanshan mine which is under construction. Before the proposed project was carried out, all the extracted CMM by pumps were directly released into atmosphere, which causes not only the waste of resources but also air pollution.

The aim of the project is to compressively utilize the CMM extracted from those 12 proposed mines. The total installation capacity of the power generation is 33*500kW. In addition, gas boilers and gas pipelines for 1380 households are included in the project activity. The whole project will be carried out in the following three phases. The first phase includes a 4*500 kW power generation in Baigou mine, CMM pipelines for 380 households in Tunchengcun mine and 5 different gas boilers in Huangcheng mine. So far, the first phase has been in operation. The second phase of the project involves the gas boilers projects in Tunchengcun and Beizhuang mines, the gas pipeline projects in Huangcheng and Beizhuang mines. In addition, the second phase includes the different scale power generations in Tuncheng, Beizhuang and Zhulinshan mines. It is supposed to start in January of 2008. The last phase of the project will start in January of 2009, which includes power generations in Huangcheng, Hougou, Xirao, Zhanggou, Mazhai and Fuyanshan Mines. (See Table A-1, 2 and 3)

Table A-1 Time schedule and installation capacities of the proposed power generations

Site	Construction Starting time	Operation Starting time	Installation Capacity (Set*kW)	Annual power generation (MWh)
Baigou	2005	2006.2	4*500	9,600
Shancheng(CMM sent to Huangcheng)		-	-	-
Tunchengcun	2008.7	2009.1	2*500	4,800
Beizhuang	2007.8	2008.1	2*500	4,800
Tuncheng	2007.9	2008.1	4*500	9,600
Zhulinshan	2007.9	2008.1	4*500	9,600
Huangcheng	2008.6	2009.1	2*500	4,800
Hougou	2008.7	2009.1	5*500	12,000
Xiyao	2008.6	2009.1	2*500	4,800
Zhanggou	2008.6	2009.1	4*500	9,600
Mazhai	2008.7	2009.1	1*500	2,400
Fuyanshan	2008.7	2009.1	3*500	7,200
Total	-	-	16.5MW	79,200

Table A-2 Time schedule and scales of the proposed gas boilers

Location	Construction Starting Time	Operation Starting Time	Gas boiler
Huangcheng	2005.10	2006.4	4.2+2.8+4.0*2+4.2(MW)
Tunchengcun	2007.7	2008.1	Total 3(t)
Beizhuang	2007.8	2008.1	Total 3.5(t)

Table A-3 Time schedule and scales of the proposed municipal gas pipeline

Location	Construction Starting Time	Operation Starting Time	Number of Households
Huangcheng	2007.10	2008.1	400
Tunchengcun	2005.9	2006.7	380
Beizhuang	2007.7	2008.1	600

The total investment of the project is 8,853,750 USD which is all provided by Yangcheng Minsheng Gas Co., Ltd. The annual operational cost 1,965,513 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 and gas sales 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 CH_4 consumption volume by power generators could be up to 22.69Mm^3. It will annually generate 79,200MWh power, 3% of which will be consumed by the project activity. The rest will be delivered to North China Power Grid. In addition, gas boilers will combust 4.41Mm^3/y methane and supply approximately 157,885GJ/y thermal energy to coal mines, which will replace the thermal energy supplied from coal-fired boilers. The gas pipeline system for a total of 1380 households could consume 3.51Mm^3/y methane. In the first 7 years of crediting period, the proposed project could reduce 2,962,366tCO_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 cal 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	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (Host)	Yangcheng Minsheng Gas 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):

>>
The People's Republic of China

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

>>
Shanxi Province

A.4.1.3. City/Town/Community etc:

>>
Yangcheng County, Jincheng 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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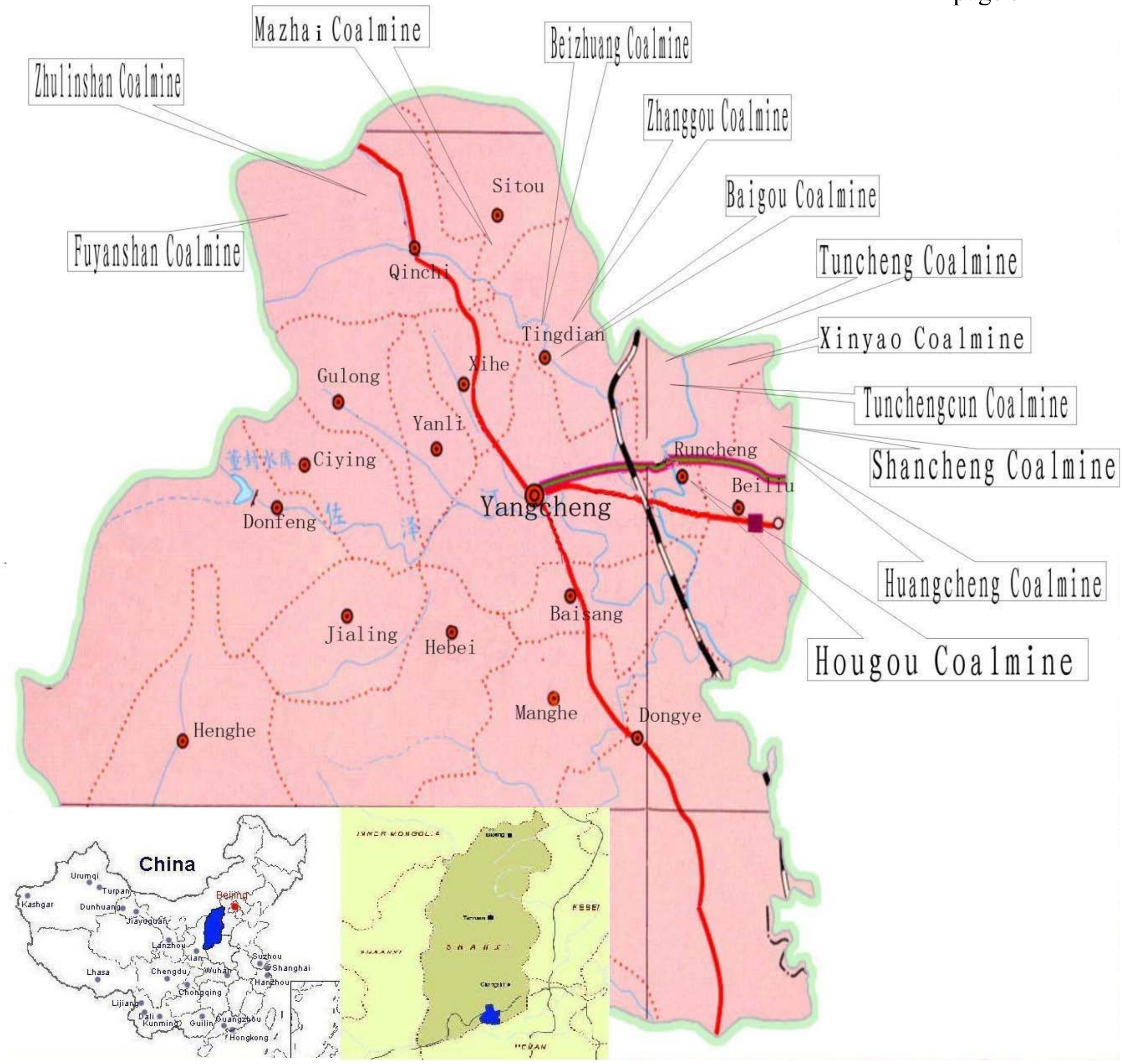
Yangcheng County is located at the southeast of Shanxi Province. It belongs to east part of Taiyue Mountain, which is located at the northeast side of Zhongtiao Mountain and west side of Taihang Mountain. The geographic coordinates of Yangcheng County are east longitude 112°00'— 112°37' and north latitude 35°12'—35°40'.

The 12 coal mines of the proposed CMM utilization project are all located in the north of Yangcheng County. Baigou mine is in the Fengcheng Town. Beizhuang and Zhanggou are respectively located in Beizhuang and Dongzhanggou villages of Beidingdian Town. Huangcheng and Zhanggou mines are located at the north of Huangcheng village and northwest of the Goudi village of Beiliu Town. Tunchengcun and Tuncheng mines are both located in the Tuncheng village that connects Runcheng Town and Qinshui County. Funyanshan and Zhulinshan mines are respectively in Beiyi and Nanyi villages of Qinchi Town. Xiyao mine is located in Xiyao village of north part of Runcheng Town connecting Qinshui. Hougou mine is along the Qin River which is at the north of Runcheng. Mazai mine is located along the South Road of Luwei River, which is at the south of Mazai village, Sitou Town. Figure A-1 shows the location of the proposed project sites. The geographic coordinates of the mines are listed in Table A-4:



FigureA-1 Project Location Map

Table A-4 Geographic coordinates of the proposed coal mines

Coal site	East longitude	North latitude
Baigou	112°25'04"— 112°26'03"	35°32'03"—35°32'46"
Shancheng	112°34'53"— 112°36'12"	35°31'21"—35°32'16"
Tunchengcun	112°31'42"— 112°33'00"	35°32'54"—35°33'39"
Beizhuang	112°26'04"— 112°27'05"	35°32'29"—35°33'22"
Tuncheng (3#)	112°31'37"— 112°33'34"	35°32'02"—35°33'23"
Tuncheng (9#&15#)	112°31'37"— 112°33'00"	35°31'46"—35°31'37"
Zhulinshan	112°15'10"— 112°17'20"	35°36'25"—35°38'59"
Huangcheng(3#)	112°34'30"— 112°35'31"	35°31'21"—35°32'39"
Huangcheng(9#&15#)	112°34'26"— 112°35'31"	35°31'02"—35°32'07"

Hougou	112°32'37"— 112°33'45"	35°31'56"—35°33'21"
xiyao	112°33'27"— 112°34'11"	35°33'07"—35°33'46"
Zhanggou	112°26'35"— 112°28'05"	35°32'39"—35°33'33"
Mazhai	112°22'08"— 112°22'47"	35°34'36"—35°35'07"
Fuyanshan	112°17'30"— 112°19'00"	35°36'38"—35°38'09"

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

As a complementary technology to utilize the extracted gas for power production, the type"500-T" reciprocating engines are adopted in the project. This end-use technology can accommodate variations in gas quality (methane concentration). It can steadily operate when the gas concentration fluctuates in great ranges since it adopts closed loop control to automatically track the change of gas composition and pressure and sufficient methane combustion can be guaranteed. In addition, the engines adopt measures such as no contact firing system, breakaway explosion doors fixed at both air inlet pipe and crankcase to effectively prevent explosion from occurring. The detailed functions of power genset are listed in Table A-5:

Table A-5 Technical parameters of power genset

Genset Type	500-T
Rated Power	500kW
Rated Voltage	400V
Rated Speed	1000 r.p.m
Power Conversion Factor	0.8
Generator Type	1FC6456-6LA42

2) CMM Boilers

So far, 5 CMM boilers with different capacities have been installed in the heat supply station of Huangcheng mine. The adopted types of gas boilers in the east area of Huangcheng village are WNS4.2-1.0/115/70-Q and WNS2.8-1.0/115/70-Q. The rated water inlet and outlet temperatures are 70℃ and 115℃ respectively. The designed thermal efficiency is above 88%. The boiler adopts full automatic control system which has the function of continuous adjustment so that the highest efficiency can be achieved. In western area, the gas boilers with single capacities of 4.2MW and 4.0 MW have already been installed. The rated water inlet and outlet temperature are 70℃ and 95℃ respectively. The designed thermal efficiency is above 88%. CMM with methane concentration above 30% can be fed into the boilers as combustion fuel.

A-6 Technical parameters of CMM boilers

Type	WNS4.2-1.0/115/70-Q	WNS2.8-1.0/115/70-Q2	WNS4.2-1.0/95/70-YQ
Rated thermal power	4.2MW	2.8MW	4.2MW
Rated outlet pressure	1.0MPa	1.0MPa	1.0MPa

Rated outlet temperature	115℃	115℃	95℃
Rated inlet temperature	70℃	70℃	70℃
Designed thermal efficiency	88.5%	88.5%	89.1%

3) Gas pipelines for households

The project activities also include municipal CMM pipelines system for 1380 households. Extracted CMM is transmitted through trunk pipelines to low-pressure wet storage tank and pressed by the roots blower. The pressed gas then flows through medium-pressure pipelines. After the adjustment of gas pressure, de-pressed gas is finally transmitted to each household for daily use. Based on different gas flow rates, one 10,000m^3 low-pressure wet storage tank will be installed in Huangcheng mine, while one 3000m^3 helical guide wet storage tank will be installed in Beizhuang and Tunchengcun mine respectively.

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 (tons of CO_2 e)**
2007.10~12	34,653
2008	260,721
2009	463,825
2010	463,825
2011	463,825
2012	463,825
2013	463,825
2014.1~9	347,867
Total emission reductions (Tones of CO_2 e)	**2,962,366**
Total number of crediting years	7
Annual average over the crediting years of estimated reductions (tones of CO_2 e)	**423,195**

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 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 proposed extraction activities with applicability of the methodology

ACM0008 Applicability	Proposed extraction activities
Underground boreholes in the mine to capture pre mining CMM	Included
Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	Underground boreholes, gas drainage galleries and some other goaf gas capture techniques are adopted to capture the 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, CMM boilers and residential gas pipelines.
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, gas boilers and residential gas pipelines.

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

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

ACM0008 Inapplicability	Proposed project activities
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” 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 or not	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 supply of 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	Gas boilers will replace coal combustion to supply heat; and substitution of residential gas usage will not be concerned for the conservativeness.
		CH_4	Excluded	According to ACM0008
		N_2O	Excluded	According to ACM0008
Project Activity	Emissions of methane as a result of continued venting	CH_4	Excluded	According to ACM0008

	On-site fuel consumption due to the project activity, including transportation 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
	Emissions from methane destruction	CO_2	Included	Emissions from methane combustion for power generation, gas boiler and residential gas usage.
	Emissions 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, gas boilers and gas pipelines.
	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.

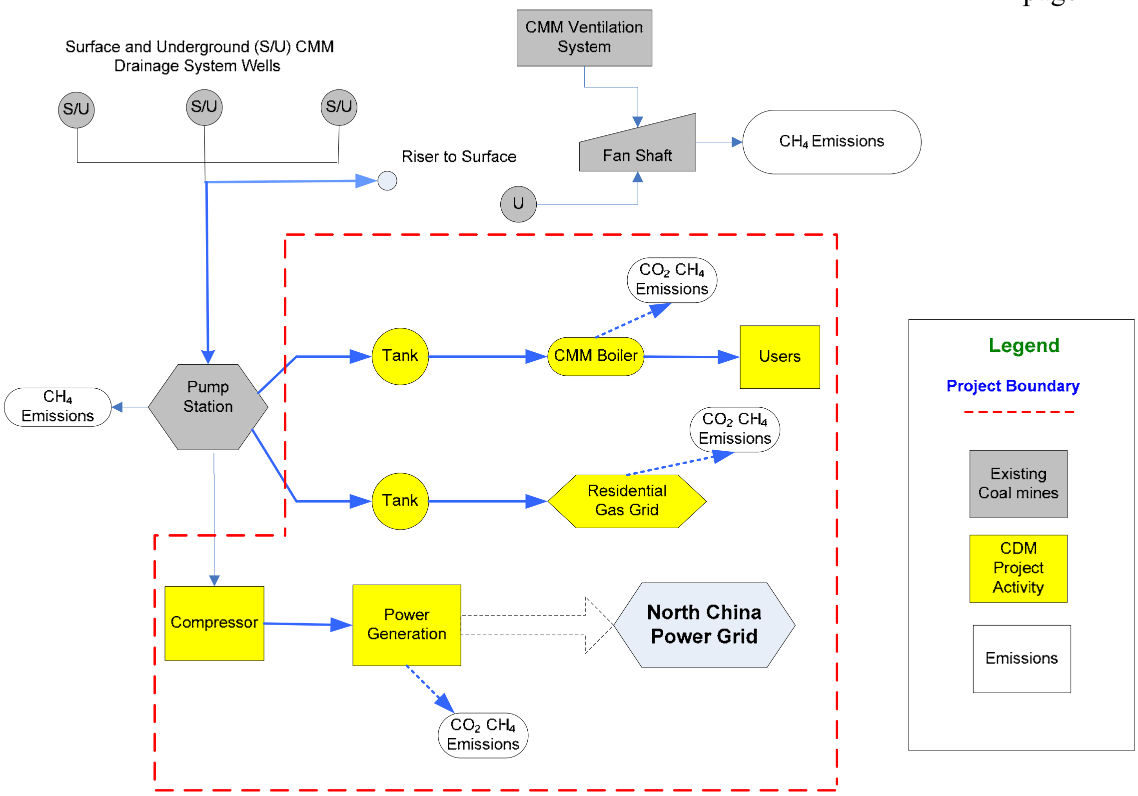

Figure B-1 The proposed project boundary

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, pre mining and post mining extraction, with ventilation accounting for approximately 55%, pre mining extraction accounting for approximately 9% and post mining extraction accounting for approximately 36%. 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 is the continuation of existing CMM treatment practice;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation;
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 *i, iv*, *vi* and *vii.* 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 undertaken 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 undertaken as a CDM project;
6. Transmit CMM to gas pipelines. This is project activity not undertaken as a CDM project.

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

Currently, methane control measures only come under the requirements of health and safety regulations governing the maximum methane concentration at various locations within an underground coal mine. It is only required that methane concentrations in the air to be below 1% to avoid the risk of explosion. (*National Coalmine Safety Regulation* 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 the proposed mines could not satisfy the 1% requirement. Therefore, option A does not comply with the regulatory requirement 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 coal mines 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 coal mines, thus all of the options in CMM treatment 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] And it 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, in step 1 alternative 2 in energy generation stage does not comply with the local and regulatory requirements.

Step 3. Formulate 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, pre mining and post mining extraction, with ventilation accounting for approximately 55%, pre mining extraction accounting for approximately 9% and post mining extraction accounting for approximately 36%.

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 existing 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 Scenario i, iv, vi and vii. This is the project activity not implemented as a CDM project.

[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 activities not undertaken as a CDM project.

Scenarios for heat production include:

Alternative Scenario 4
Continuation of existing situation - coal fired boiler for heat supply.

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

Alternative Scenario 6
Transmitting CMM to residential gas pipeline; this is the project activity not undertaken as a CDM project.

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers

Step 4a. 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. The technology is immature.

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 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.[4] Moreover, power output is neither stable nor continuous due to unstable gas sources. All these factors prohibited the internal usage of generated power at coal mines.

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*, *vii* and *viii* 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 residential CMM pipeline system 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 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[5].

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:

Table B-4 IRR comparison of scenarios

	alternative iv	alternative vi	alternative vii	Alternative viii
Total Investment	6,712,500$	1,071,250$	1,070,000$	8,853,750$
Annual Operation,	1,490,388$/y	237,625$/y	237,500$/y	1,965,513$/y

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

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

maintenance cost				
Life of project	15 years	15 years	15 years	15 years
Electricity/Gas price	30$/MWh	525$/10^{4}m^3	562.5$/10^{4}m^3	Refers to alternatives iv, vi and vii
Electricity/Gas supply	76,824MWh	4.41Mm^3	3.51Mm^3	Refers to alternatives iv, vi and vii
IRR	8.0%	7.0%	7.4%	7.8%
Benchmark IRR	**13.5%**			

Note: Because the alternative scenario viii is the combination of three scenarios, the related parameters can be referred to alternatives iv, vi and vii.

The IRRs of alternatives iv, vi, vii and viii are much lower than their BAU benchmark IRR, so they can not be the baseline alternatives.

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 barrier of this option is similar to the scenario *vii*, so it can not be the baseline scenario.

Sub-step 5c. Sensitive Analysis

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 generation/gas supply
iv. Electricity/Gas price

The effect of electricity/gas price on IRR is same as that of Annual power generation/gas supply and electricity/gas price in Chinese market will not be changed largely in the foreseen future. Moreover, Minsheng Gas Co., Ltd has signed the agreement on gas supply and generating power to the grid, the price has been fixed. So the parameter of annual power generation/gas supply is selected for sensitivity analysis. The effect of changes in Total investment, Operation cost and annual power generation/gas supply will be examined on the internal return rate (IRR). Assuming these three parameters to change within the range between (-10%~+10%), the outcomes of IRR sensitivity are presented in the following table.

Table B-5: Sensitive analysis of alternative iv

Parameter \ Range	-10%	-5%	0%	5%	10%
Investment	9.7%	8.2%	8.0%	7.2%	6.5%
Operation Cost	10.6%	9.3%	8.0%	6.6%	5.2%
Annual Power Supply	2.70%	5.40%	8.0%	10.50%	12.90%

Table B-6: Sensitive analysis of alternative vi

Parameter \ Range	-10%	-5%	0%	5%	10%
Investment	8.5%	7.7%	7.0%	6.3%	5.7%
Operation Cost	9.4%	8.2%	7.0%	5.7%	4.4%
Annual Gas supply	2.3%	4.7%	7.0%	9.2%	11.2%

Table B-7: Sensitive analysis of alternative vii

Parameter \ Range	-10%	-5%	0%	5%	10%
Investment	8.8%	8.1%	7.4%	6.8%	6.1%
Operation Cost	9.6%	8.5%	7.4%	6.3%	5.1%
Annual Gas supply	3.1%	5.3%	7.4%	9.4%	11.3%

Table B-8: Sensitive analysis of alternative viii

Parameter \ Range	-10%	-5%	0%	5%	10%
Investment	9.4%	8.6%	7.8%	7.0%	6.3%
Operation Cost	10.3%	9.0%	7.8%	6.4%	5.1%
Annual Gas Supply	6.5%	7.1%	7.8%	8.4%	9.0%
Annual Power Supply	4.0%	5.9%	7.8%	8.4%	9.0%

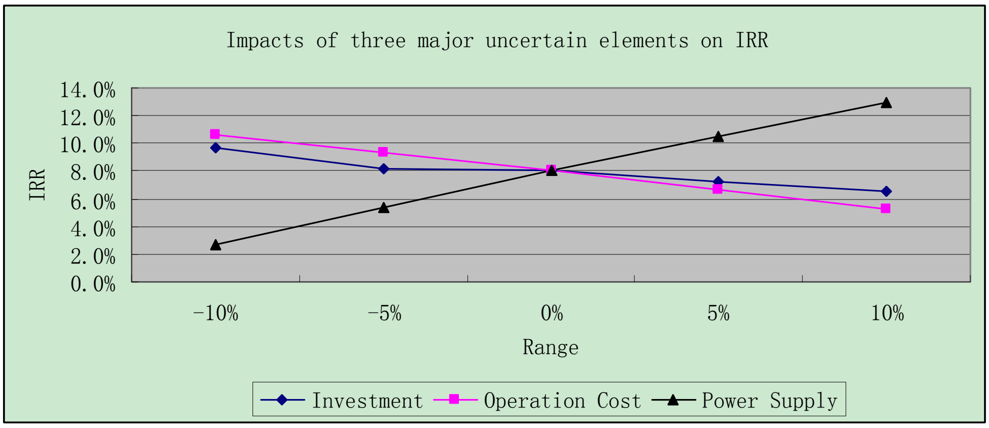

Figure B-2 Impacts of three major uncertain elements on IRR (alternative *iv*)

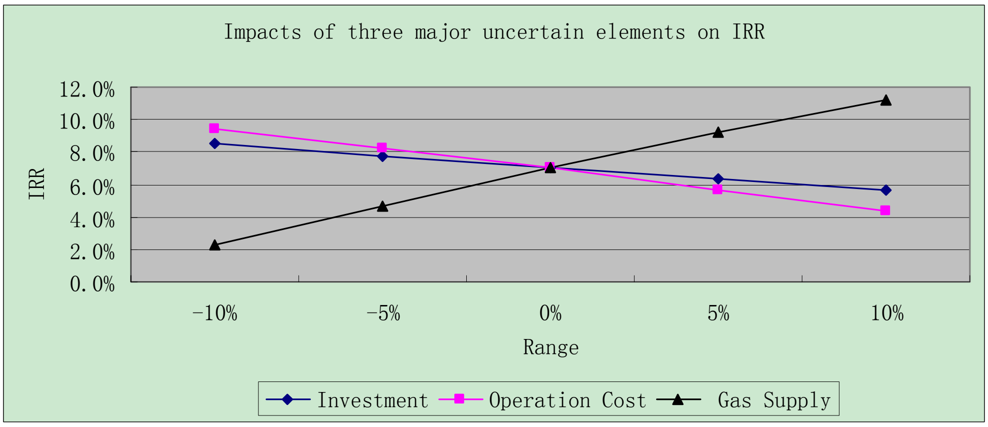

Figure B-3 Impacts of three major uncertain elements on IRR (alternative *vi*)

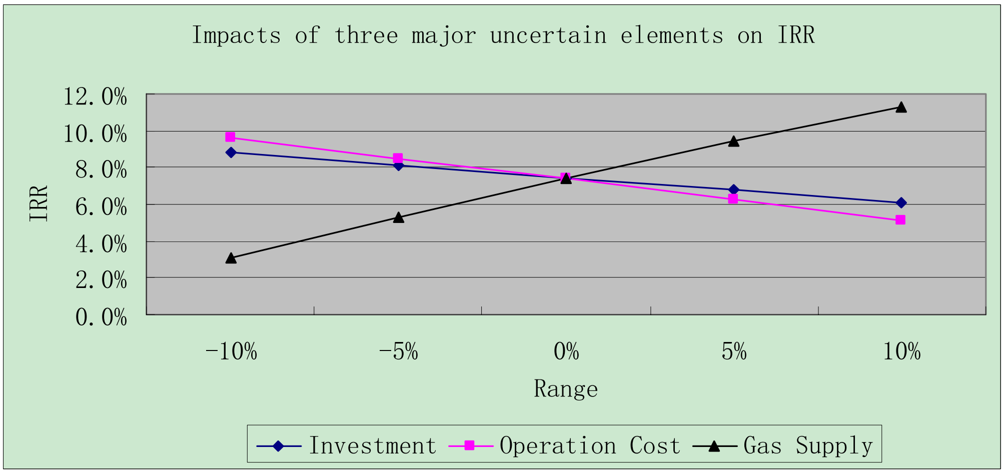

Figure B-4 Impacts of three major uncertain elements on IRR (alternative *vii*)

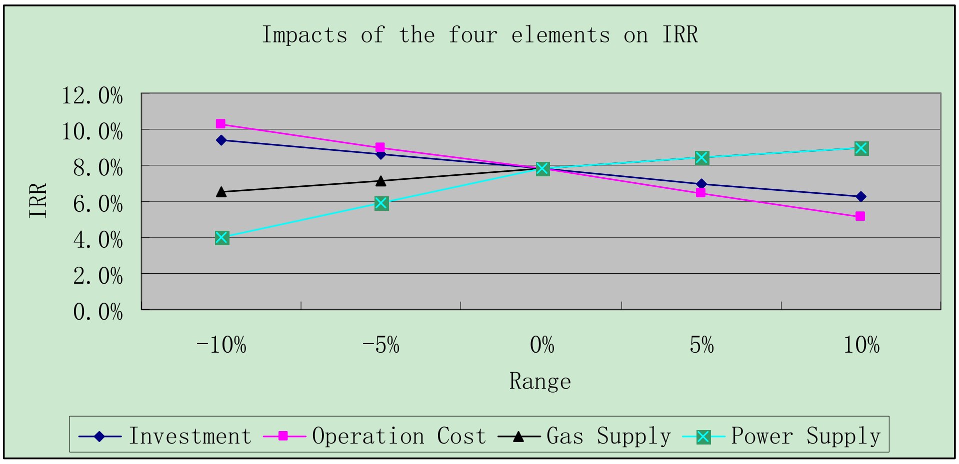

Figure B-5 Impacts of three major uncertain elements on IRR (alternative *viii*)

From the calculation outcomes as shown in the figures, the project IRR will vary to different degrees with these three uncertain parameters changing between -10% and +10%. It can be seen from the tables that the highest IRR of each alternative does not exceed benchmark value of 13.5% when the investment and operational cost decrease by 10% and annual power generation/gas supply increases by 10%. Therefore, a conclusion can be made that none of the alternatives above 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 to be released into the 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 01/11/2005. The validation will be carried out after the starting date. The project owner has provided 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 mining groups. Project Owner started to consider implementing its CMM utilization project with the assistance from CDM.

On 7th January 2005, Project Owner submitted an application letter to the Development and Reform Commission of Yangcheng County for CDM supporting. It indicated that the project was facing tremendous difficulties and would like to seek CDM assistance to overcome them.

On 26th January 2005, Development and Reform Commission of Yangcheng County transferred the application letter to the Administrative Office for Agenda 21 of Shanxi Province (Agenda 21 Office) – the public service facility under the Ministry of Science and Technology and the designated CDM authority in Shanxi Province. Agenda 21 Office accepted the application and started to help the Project Owner seek CERs buyers and CDM assistance.

On 20th March 2005, Agenda 21 Office sent an official notice to companies and organizations in Shanxi province to propagate and collect CDM projects, in which Yangcheng project was taken as an example. It was stated that CDM had been under implementation by the Project Owner. As CDM would significantly improve the project financial status, Agenda 21 Office would like to further promote the international cooperation for CDM implementation in Shanxi Province.

Knowing CDM would significantly improve the project internal return and with the belief that CDM assistance would soon be realized, the project started construction on 23rd October, 2005.

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

IRR for the proposed project without CDM assistance is 7.8%, which is lower than the benchmark value of 13.5%. With CDM assistance, assuming the price of CERs is 8Euro/tCO_2e, the project IRR will reach 36% that is much higher than benchmark. Therefore, a conclusion can be made that the proposed project is not economically attractive without revenues from CDM.

Table B-9 Project IRR with and without CDM

	IRR without CDM	IRR with CDM
Yangcheng Project	7.8%	36%

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 south of Qinshui Basin, which has more than 1 trillion cubic meters reserve.[6] 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.[7] 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%.[8] Moreover, less than 50% of China's drained CMM was

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

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

[8] 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

utilized,[9] 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. There are many unsolved problems both in theory and technique, the security research on some fundamentally key technology and equipment lacks the support in human resources, infrastructures and necessary funds. 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, Yangquan, 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-10 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 Coal Transport Market Ltd,. Co. Yangquan Branch CMM Utilization Project	30	32.00	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-10, 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.

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[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

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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

$$ER_y = BE_y - PE_y - LE_y$$

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

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

1. Project Emissions

Project emissions are defined by the following equation:

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

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

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

Additional power energy may be used to capture, transport, compress and use the CMM. Emissions from this 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 doesn't involve flaring. Therefore, the formula is as follows:

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

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)
MD_{GAS}: Methane destroyed after being supplied to gas grid or for vehicle use (tCH_4)
CEF_{CH4}: Carbon emission factor for combusted methane (tCO_2e/tCH_4)
CEF_{NMHC}: Carbon emission factor for combusted non methane hydrocarbons (tCO_2e/tNMHC)
r: Relative proportion of NMHC compared to methane
PC_{CH4}: Concentration (in mass) of methane in extracted gas (%), measured on wet basis[10]
PC_{NMHC}: NMHC concentration (in mass) in extracted gas (%)

$MD_{ELEC} = MM_{ELEC}$ x 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 (%)

$MD_{HEAT} = MM_{HEAT}$ x Eff_{HEAT}

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

$MD_{GAS} = MM_{GAS}$ x Eff_{GAS}

where:
MD_{GAS}: Methane destroyed after being supplied to gas grid (tCH_4)
MM_{GAS}: Methane measured supplied to gas grid for vehicle use or heat/power generation off-site (tCH_4)
Eff_{GAS}: Overall efficiency of methane destruction/oxidation through gas grid to various combustion end uses, combining fugitive emissions from the gas grid and combustion efficiency at end user (%)

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

Not all of the methane sent to power generators, gas boilers and CMM pipelines will be combusted, so a small amount will escape to the atmosphere. Using the following equation to calculate PE_{UM}:

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

where:
PE_{UM}: Project emissions from un-combusted methane (tCO_2e)

[10] The filters in the project only remove water that would have condensed out in the pipe.

GWP_{CH4}: Global warming potential of methane (tCO_2e/tCH_4)
MM_{ELEC}: Methane measured sent to power generation (tCH_4)
Eff_{ELEC}: Efficiency of methane destruction/oxidation in power generation (%)
MM_{HEAT}: Methane measured sent to gas boiler (tCH_4)
Eff_{HEAT}: Efficiency of methane destruction/oxidation in heat generation (%)
MM_{GAS}: Methane measured sent to gas grid (tCH_4)
Eff_{GAS}: Overall efficiency of methane destruction/oxidation through gas grid to various combustion end uses, combining fugitive emissions from the gas grid and combustion efficiency at end user (%)

2.Baseline Emissions

Baseline emissions are given by the following equation:

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

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. Therefore, $BE_{MD,y} = 0$.

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.

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

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 (tCO_2e/tCH_4)
$CMM_{PJ,ELEC,y}$: Pre-mining CMM captured, sent to and destroyed by power generation in the project activity in year y (tCH_4)
$CMM_{PJ,HEAT,y}$: Pre-mining CMM captured, sent to and destroyed by gas boiler in the project activity in year y (tCH_4)
$CMM_{PJ,GAS,y}$: Pre-mining CMM destruction/oxidation through gas grid to various combustion end uses in the project activity in year y (tCH_4)
$PMM_{PJ,ELEC,y}$: Post-mining CMM captured, sent to and destroyed by power generation in the project activity in year y (tCH_4)

$PMM_{PJ,HEAT,y}$: Post-mining CMM captured, sent to and destroyed by gas boiler in the project activity in year y (tCH_4)
$PMM_{PJ,GAS,y}$: Post-mining CMM destruction/oxidation through gas grid to various combustion end uses in the project activity in year y (tCH_4)

2.3 Emissions from power and heat generation 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. Fuel substitution from residential gas usage is omitted for conservativeness. This project's $BE_{Use,y}$ can be calculated by the following formula:

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

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 emissions 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.

Consider of data availability, CDM EB accepts the following deviation[11]:
1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
2) Use of weights estimated using installed capacity in place of annual electricity generation.

It is also suggested to use the efficiency level of the best technology commercially available in the

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

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}

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

where:
$EF_{heat,y}$: Emissions factor for heat generation (tCO_2/GJ)
$EF_{CO2,coai}$: CO2 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

The formula for leakage is given as follows:

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

where:
LE_y: Leakage emissions in year y (tCO_2e)
$LE_{d,\,y}$: Leakage emissions due to displacement of other baseline thermal energy uses 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 description of measurement methods and procedures actually applied :	China official data
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	IPCC 1996

choice of data or description of measurement methods and procedures actually applied :	
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 description of measurement methods and procedures actually applied :	ACM0008
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_{GAS}

Data unit:	%
Description:	Overall efficiency of methane destruction/oxidation through gas grid to various combustion end uses, combining fugitive emissions from the gas grid and combustion efficiency at end user
Source of data used:	ACM0008 refer this value to IPCC as 98.5%
Value applied:	98.5
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}

As stated in 2.3.1 below, EF_{ELEC} of North China Power Grid is 0.9826tCO_2e/MWh.

Self power consumption of the proposed project accounts for 3.0% of the total power generated, thus the value of $CONS_{ELEC,\ PJ}$ can be estimated by the total power generation. Total power generated is calculated based on the parameters shown in the feasibility study of the project. The actual power generation and consumption by the proposed project in the crediting period will be monitored by power meters.

After the project is fully operated:

GEN_y = 16.5*6000*0.8 = 79,200MWh/y

PE_{ME} = $CONS_{ELEC,PJ}$ x CEF_{ELEC} = 79,200*3.0%*0.9826 = 2,335tCO_2e/y

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

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

$PE_{MD} = (MM_{ELEC} + MM_{HEAT}) \times CEF_{CH4} \times 0.995 + MM_{GAS} \times CEF_{CH4} \times 0.985$

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

After the project is fully operated:

$MD_{ELEC} = 22.69 * 0.00067 * 10^6 = 15{,}203 tCH_4$
$MM_{ELEC} = 15{,}203/0.995 = 15{,}280 tCH_4$
$MM_{HEAT} = 2{,}955\ tCH_4$; $MM_{GAS} = 2{,}352 tCH_4$
$PE_{MD} = (MM_{ELEC} + MM_{HEAT}) \times CEF_{CH4} \times 0.995 + MM_{GAS} \times CEF_{CH4} \times 0.985 = (15{,}280 + 2{,}955) * 2.75 * 0.995 + 2{,}352 * 2.75 * 0.985 = 56{,}266 tCO_2e/y$

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

After the project is fully operated:

$PE_{UM} = GWP_{CH4} \times [MM_{ELEC} \times (1 - Eff_{ELEC}) + MM_{HEAT} \times (1 - Eff_{HEAT}) + MM_{GAS} \times (1 - Eff_{GAS})] =$
$21*[15{,}280*(1-0.995) + 2{,}955*(1-0.995) + 2{,}352*(1-0.985)]$
$= 2{,}655 tCO_2e/y$

Table B-10 Project Emissions of the proposed project (tCO_2e)

Year	PE_{ME}	PE_{MD}	PE_{UM}	PE_y
2007.10~12	71	4,885	332	5,288
2008	990	32,210	1,734	34,934
2009	2,335	56,266	2,655	61,256
2010	2,335	56,266	2,655	61256
2011	2,335	56,266	2,655	61,256
2012	2,335	56,266	2,655	61,256
2013	2,335	56,266	2,655	61,256
2014.1~9	1,751	42,200	1,992	45,943
Total	14,487	360,625	17,333	**392,445**

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 $(CMM_{PJ,ELEC,y} + CMM_{PJ,HEAT,y} + CMM_{PJ,GAS,y} + PMM_{PJ,ELEC,y} + PMM_{PJ,HEAT,y} + PMM_{PJ,GAS,y}) = GWP_{CH4}$ x $(MM_{ELEC} + MM_{HEAT} + MM_{GAS})$ = 21*(15,279.8+2,955+2,352) = 432,323tCO_2e

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

GEN_y is referred to 1.1 above.
$HEAT_y$ 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 = 0.0946tCO_2e/GJ

After the project is fully operated:

$HEAT_y$ = 4.41*35.9*99.5%*1000000/1000 = 157,885GJ/y

Therefore,
$BE_{Use,y} = GEN_y$ x $EF_{ELEC} + HEAT_y$ x EF_{HEAT} = 79,200*0.9826 + 157,885*0.0946 = 92,758tCO_2e/y

2.4 The calculation results of baseline emissions

Table B-11 Baseline Emissions at Yangcheng Coalmines (tCO_2e)

Year	BE_{MD}	BE_{MR}	BE_{Use}	BE_y
2007.10~12	0	35,823	4,118	39,941
2008	0	247,704	47,951	295,655
2009	0	432,323	92,758	525,081
2010	0	432,323	92,758	525,081
2011	0	432, 323	92,758	525,081
2012	0	432,323	92,758	525,081
2013	0	432,323	92,758	525,081
2014.1~9	0	324,242	69,568	393,810

Total	0	2,337,061	585,427	**3,354,811**

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:

$ER_y = BE_y - PE_y = 525{,}081 - 61{,}256 = 463{,}825 tCO_2e/y$

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)**
2007.10~12	5,288	39,941	0	34,653
2008	34,934	295,655	0	260,721
2009	61,256	525,081	0	463,825
2010	61,256	525,081	0	463,825
2011	61,256	525,081	0	463,825
2012	61,256	525,081	0	463,825
2013	61,256	525,081	0	463,825
2014.1~9	45,943	393,810	0	347,867
Total (tCO_2e)	**392,445**	**3,354,811**	**0**	**2,962,366**

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

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	$CONS_{ELEC, PJ}$
Data unit:	MWh/y
Description:	Additional electricity consumption by project
Source of data to be used:	Provided by Feasibility Study, self power consumption of the proposed project accounts for 3.0% of the total power generated
Value of data applied for the purpose of	2,376 (After the project is fully operated)

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:	MM_{ELEC}
Data unit:	tCH_4/y
Description:	Methane sent to power plant
Source of data to be used:	Provided by Feasibility Study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	15,280 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters adjusted by temperature and pressure.
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:	Provided by Feasibility Study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2,955 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters adjusted by temperature and pressure.
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance regime to ensure accuracy.
Any comment:	-

Data / Parameter:	MM_{GAS}
Data unit:	tCH_4/y

Description:	Methane sent to residential gas pipelines
Source of data to be used:	Provided by Feasibility Study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2,352 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters adjusted by temperature and pressure.
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, measured on wet basis
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 section B.5	In the emission reduction calculation, the amount of the pure methane will be used, not the concentration of the drained coal mine methane.
Description of measurement methods and procedures to be applied:	Continuously monitoring concentration using optical and calorific meters.
QA/QC procedures to	Concentration meters will be subject to a regular maintenance regime to ensure

be applied:	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:	Annual power generation
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	79,200 (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:	$HEAT_y$
Data unit:	GJ/y
Description:	Total heat generated by gas boilers
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	157,885 (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 Reductions 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, Yangcheng Minsheng Gas Co., Ltd. and supervised by the CDM project developer, Millennium Capital Services.

The monitoring plan is established on coal mine basis. Those mines where the same utilization approach (power generation, CMM boiler or CMM residential use) is implemented would adopt the same monitoring plan described here.

Table B-12 CMM Utilization Implemented in Each Mine

Coal mine site	Power generation	CMM boilers	CMM residential use
Baigou	×		
Shancheng(CMM send to Huangcheng			
Tunchengcun	×	×	×
Beizhuang	×	×	×
Tuncheng	×		
Zhulinshan	×		
Huangcheng	×	×	×
Hougou	×		
Xiyao	×		
Zhanggou	×		
Mazhai	×		
Fuyanshan	×		

1. What data will be monitored?

The data that need to be monitored are shown in Section B 7.1. The following figure indicates the detailed instruments installation:

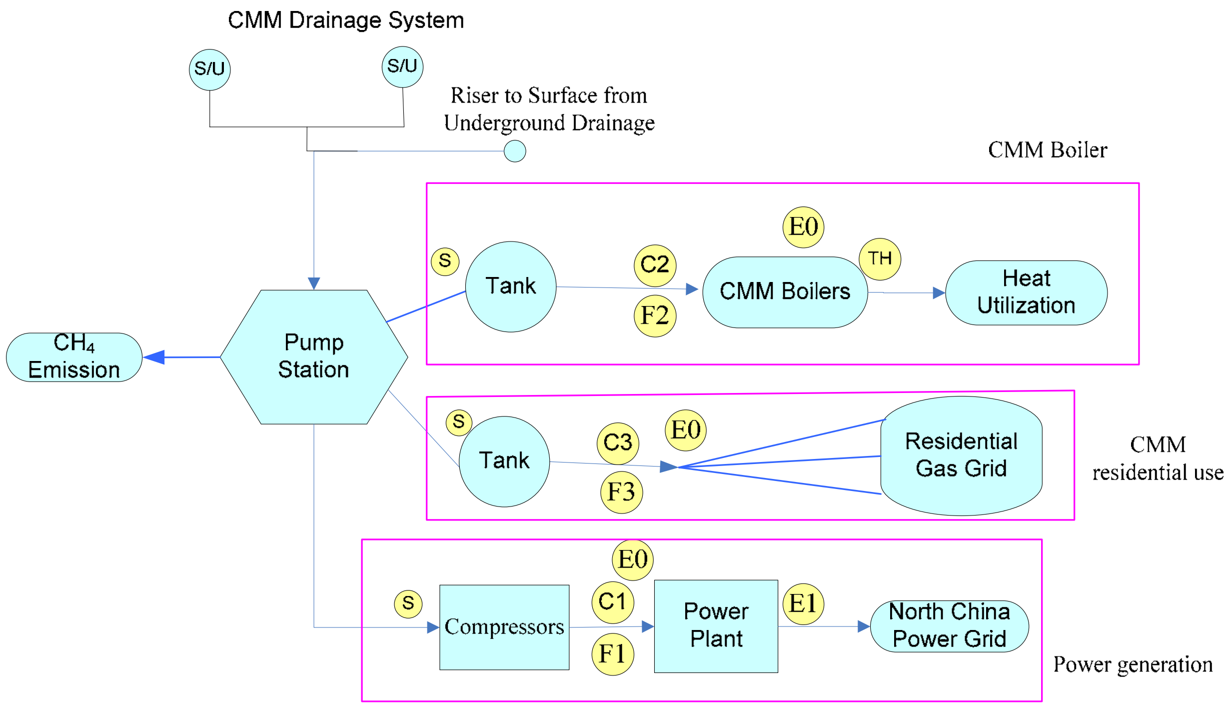

Figure B-6 Monitoring plan of the Proposed Project Activity

For power generation monitoring, the following instruments are required. The monitoring instruments shown in Table B-13 are applicable to all the coal mines where the power generation will be implemented.

Table B-13 Information of the Monitoring Instruments of Power Generation

Symbol	Instrument	Function	National Standard
C1	CH_4 concentration meter	Measure the CH_4 concentration of CMM transmitted to power generators	MT445-1995
F1	Gas flow meter	Measure CMM flow rate transmitted to power generators	GB/T-2624-93
E1	Ammeter	Measure the electricity generated	GB/T7676-98
E0	Ammeter	Measure the electricity consumed by the project	GB/T7676-98
s		Annual sampling of NMMC concentration	

For CMM gas boilers monitoring, the following instruments are required. The monitoring instruments shown in Table B-14 are applicable to Huangcheng, Tunchengcun and Beizhuang mines.

Table B-14 Information of the Monitoring Instruments of CMM Boilers

Symbol	Instrument	Function	National Standard
C2	CH_4 concentration meter	Measure the CH_4 concentration of CMM transmitted to CMM boilers	MT445-1995
F2	Gas flow meter	Measure CMM flow rate transmitted to CMM	GB/T-2624-93

		boiler	
E0	Ammeter	Measure the electricity consumed by the project	GB/T7676-98
TH	Calorimeter	Measure the heat generated by the boilers	GB/T 1598-1998 JB/T9249-1999
s		Annual sampling of NMHC concentration	

For CMM residential use monitoring, the following instruments are required. The monitoring instruments shown in Table B-15 are applicable to Huangcheng, Tunchengcun and Beizhuang mines.

Table B-15 Information of the Monitoring Instruments of CMM Residential Use

Symbol	Instrument	Function	National Standard
C3	CH_4 concentration meter	Measure the CH_4 concentration of CMM transmitted to residential gas grid	MT445-1995
F3	Gas flow meter	Measure CMM flow rate transmitted to residential gas grid	GB/T-2624-93
E0	Ammeter	Measure the electricity consumed by the project	GB/T7676-98
s		Annual sampling of NMHC concentration	

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

2. Management Structure

Individual monitoring will be implemented on mine bases, which means that the each mine has its own QA/QC procedure for CDM monitoring. The management structure chart is shown in Figure B-7:

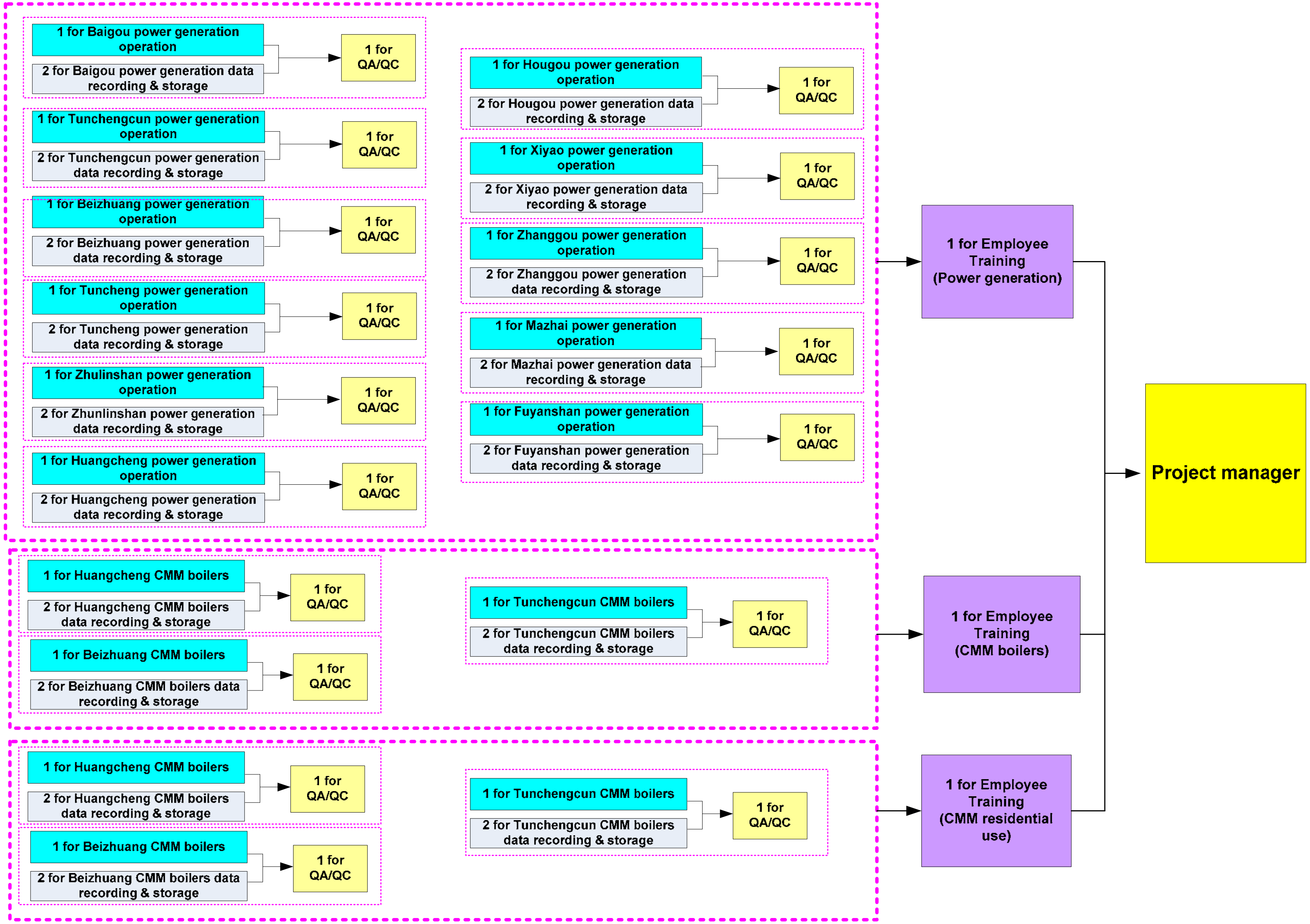

Figure B-7 Project management structure chart

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.

4. 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 - Yangcheng Minsheng Gas Co., Ltd. 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;

5. Quality Assurance:

- Yangcheng Minsheng Co., Ltd. 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, Yangcheng Minsheng Co., Ltd., 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: 01/03/2007
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:

>>
23/10/2005.

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

>>
At least 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:

>>
01/10/2007 (The date can be postponed to the date of registration)

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

Fixed crediting period is not chosen here.

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 effects assessment is to evaluate whether the proposed project could have potentially adverse impacts on the environment. The EIA statement for the proposed project conducted by Jincheng Environmental Protection Research Institute in August 2006 was approved by Jincheng Environmental Protection Bureau in September 2006. In the assessment, the proposed project has been considered with respect to potential impacts on air quality, water quality, noise, solid waste, zoology, etc. The findings of this evaluation are summarised below.

AIR QUALITY

Air pollution sources during construction period are mainly tail gases from construction and transportation trucks and dust from construction activities. Measures such as frequent watering, covering trucks, and centralized stacking the abandoned dust will be taken to mitigate the adverse effects on surrounding air environment.

In operation period, no waste and toxic gas will be discharged due to the closed gas collecting and transporting systems. Main emission source discharged gas form CMM boiler. As the combusted CMM contains 42.36% (mass) N_2 which will lead to the main pollutant NO_x emission of 70mg/m^3. This concentration could meet the national standard (400 mg/m^3) "Emission standard of air pollutants for coal-burning oil-burning gas-burning boiler" (GB13271-2001). [12]

WATER QUALITY

In construction period, waste water comes from engineering water of pipeline cleaning and residential wastewater of workers. Pollution indicators of residential wastewater are mainly COD, BOD, SS, etc. No pollution can be brought since it will be discharged to the public toilet for fertilizer. SS is mainly contained in pipeline cleaning wastewater which will be treated by a series of chemical measures in coagulation basin so that no adverse effects can be resulted on surface water.

In operation period, the wastewater is mainly from residents and industrial boilers. There is approximately 0.4m^3/d wastewater with abnormal pH discharged from boilers. It will be neutralized before discharging. Therefore, the proposed project will not result in any pollution on underground and surface water during the operation period.

NOISE

In construction period, noise from excavators and transport vehicles will lead to some effects on the residents' daily life. Low-noise equipment will be adopted in order to reduce these effects on surrounding sensitive points. Additionally, high-noise equipment is not supposed to be operated at the same time. Moreover, time of construction should strictly be controlled to guarantee that the high-noise equipment

[12] http://www.sepa.gov.cn/image20010518/5299.pdf

does not run in the night. In a word, the project will strictly control the construction time and noise according to GB12523-90 “Noise limits for construction site”. [13]

The noise sources in operation period mainly come from power engines, cooling towers and circulating water pumps. Without any noise mitigation measures, the longest distance which could be influenced by those equipment is 112.4 meters.[14] Considering that there is no resident around the power stations within 300 meters scope, noise will not adversely affect the normal life of the residents.

SOLID WASTE

In the construction period, solid waste was brought by construction activities. The proposed sites chosen for power plants and pump houses are flat terrain and farmland, which will not result in great amount of earth and stone, thus the digging and filling are able to be balanced.

ZOOLOGY

The project covers a total of 24,325m^2 permanent land, most of which are terrain. In order to avoid the negative impact on the crops by the dust of construction, some measures such as reducing the volume of temporary land use during the construction, digging and filling as soon as possible during excavation, cleaning the earth and stone in time, watering construction site frequently, expanding the planting areas will be adopted. No great impacts on the environment would be caused due to limited project capacity and the relatively flat terrain chose of the project sites.

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.

[13] http://ww2.sepa.gov.cn/image20010518/4556.pdf

[14] EIA statement of the proposed project

SECTION E. Stakeholders' comments

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

>>

Public comments were invited to evaluate the proposed project adopting the method of sending "Public Opinion Questionnaires". Requirements and suggestions associated with project construction and environmental protection were collected. In the process, the project owner briefly introduced the general situation of CMM power generation and the main environmental protection facilities so that the public could know the construction situation of power plants, gas boilers, and residential CMM pipelines and supervise the construction process.

In the middle of October 2006, the "Public Opinion Questionnaires" were filled for public comments on the proposed project. 300 questionnaires were sent out during the investigation with a reply number of 295 (rate 98.3%). The participants with different education backgrounds were involved and a number of women were interviewed, which means a good representation of this survey.

E.2. Summary of the comments received:

>>

The results show that most of people think that the local economy is good and agree that the proposed project could promote the economic development A small part of villagers have no idea about the effects of the project on economic promotion. No one thinks the project will cumber the economic development.

For environmental problems, most of people agree that the construction of the project would bring quite small effects on local environment. Villagers of Hougou, Xiyao, Fuyanshan and Zhulinshanm mines think that there will be some adverse effects on surrounding area during construction period. The problems focus on dust, solid waste pollution, solid waste and noise pollution.

Finally, for the attitude on this project, most of people are supportive to this project. 100% participants are supportive to the project in Beizhuang, Zhanggou, Huangcheng and Shancheng mines. 90% of the invited villagers near Tuncheng and Tunchengcun mines are optimistic to the project. This ratio in Zhunlinshan and Fuyanshan mine reaches 89%. In Baigou, Hougou and Xiyao mines, part of invited villagers has no idea on this project. No one opposes the construction of the project.

Moreover, the investigators also widely communicated with the residents about the project construction in the survey 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 enhance mining working safety.

Table E-1 Results of the Stakeholder Questionnaire %

		Baigou	Beizhuang Zhanggou	Huangcheng Shancheng	Tuncheng Tunchengcun	Hougou xiyao	Zhulinshan Fuyanshan	Mazhai
What is your attitude towards local economic development?	Excellent	35.5	9.3	100	52.3	30.8	11.4	15.8
	Very good	38.7	2.3	—	45.4	43.6	75.0	84.2
	Good	25.8	88.4	—	2.3	12.8	13.6	—
	Bad	—	—	—	—	12.8	—	—
What do you think the main problems obstacle the economic development?	Power supply	9.7	14.0	—	84.1	13.6	12.1	7.3
	Traffic	9.7	—	—	4.5	15.9	17.2	30.9
	Natural resources	19.4	4.0	35.6	9.1	31.8	39.6	29.1
	Human Rources	45.1	82.0	64.4	2.3	20.5	25.9	25.4
	Others	6.4	—	—	—	9.1	5.2	7.3
	No ideas	9.7	—	—	—	9.1	—	—
What are the main effects of the proposed CMM power production project on the local environment?	SO_2	9.4	—	—	40.9	2.3	—	3.8
	Water	3.1	3.3	2.2	11.4	18.2	32.2	38.5
	Noise	46.9	28.3	2.2	4.5	34.1	19.6	26.9
	Dusts	37.5	68.4	95.6	43.2	25.0	35.7	30.8
	Others	3.1	—	—	—	20.4	12.5	—
What effects will the project make to local economic development?	Slight	22.6	65.1	100	45.4	17.9	11.4	36.8
	Weak	41.9	32.6	—	36.4	35.9	25.0	23.7
	Certain	22.6	—	—	2.3	30.8	52.2	39.5
	Deep	3.2	—	—	2.3	—	11.4	—
	No ideas	9.7	2.3	—	13.6	15.4	—	—
Does the proposed project promote t the local economic development?	Greatly	25.8	100	100	59.1	46.2	45.5	68.4
	Very	51.6	—	—	38.6	48.7	54.5	31.6
	Adversely	—	—	—	—	—	—	—
	Badly	—	—	—	—	—	—	—
	No ideas	22.6	—	—	2.3	5.1	—	—
What is your attitude to this project?	Support	74.2	100	100	97.7	79.5	90.9	92.1
	No idea	25.8	—	—	2.3	20.5	9.1	7.9
	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 days; 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. Regarding to the management of solid waste produced during construction period, most of sites for methane storage station and power plants are relatively flat farmland, terrain or already deserted fruit forest, which will not produce great amount of earth and stone. Digging and filling are able to be balanced. The gas pipelines are short and on the surface of the ground resulting in small dust. Even if there are surplus earth and stone left in several sectors, they can be used to fill the ditches. The residential rubbish will be sent to the garbage dumps nearby.

For noise pollution in operation period, the project will adopt resolving measures. Some excavators are necessary in some sectors, which will bring some noise pollution to near villagers. Properly arranging working time can avoid high noise equipment running at the same time; working time is strictly controlled to be between 7:00 and 22:00. When noise level is above 72dB and there are people around the construction sites, it should strictly execute the national standard GB12523-90 “Noise limits for construction site”.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been provided for this CDM project.

Annex 3

BASELINE INFORMATION

EF_{ELEC} Calculation:

Data recommended in the *Notification on Determining Baseline Emission Factor of China's Grid* for the North China Power Grid revised using latest values in IPCC1996 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	CO_2 Emissions (tCO_2e)
									（tC/TJ）	（%）	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	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	371208174.5
Cleaned Coal	Mtons						80.71	**80.71**	25.8	98	1971179.968
Other Washed Coal	Mtons	3.43		65.2	135.56		106.32	**310.51**	25.8	98	2407436.829
Coke	Mtons							**0**	29.5	98	0
Coke Oven Gas	10^9m^3	0.17	1.71		0.75	0.16	0.04	**2.83**	13	99.5	224500.0238
Other Coke Gas	10^9m^3	15.82		7.34		10.35		**33.51**	13	99.5	830739.3673
Crude Oil	Mtons						14.98	**14.98**	20	99	454769.0717
Gasoline	Mtons						0.65	**0.65**	18.9	99	19206.87269
Diesel Oil	Mtons	0.26	2.35	4.12		1.6	10.02	**18.35**	20.2	99	573896.3513
Fuel Oil	Mtons	13.94	0.04	1.22		0.42	20.33	**35.95**	21.1	99	1151411.233
Liquefied Petroleum Gas	Mtons							**0**	17.2	99.5	0
Refinery Gas	Mtons			0.27				**0.27**	18.2	99.5	8256.698951
Natural Gas	10^9m^3		0.55			0.02		**0.57**	15.3	99.5	123867.2104
Other Petroleum Products	Mtons							**0**	20	99	0
Other Coke Products	Mtons							**0**	25.8	98	0
Other Energy	Mtons Standard Gas					1.1	15.92	**17.02**	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	CO_2Emissions （tCO_2e）
									（tc/TJ）	（%）	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	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	436822883.4
Cleaned Coal	Mtons						9.41	**9.41**	25.8	98	229820.3878
Other Washed Coal	Mtons	6.31		67.28	208.21		450.9	**732.7**	25.8	98	5680747.688
Coke	Mtons					2.8		**2.8**	29.5	98	84397.73393
Coke Oven Gas	10^9m^3	0.24	1.71		0.9	0.21	0.02	**3.08**	13	99.5	244332.1814
Other Coke Gas	10^9m^3	16.92		10.63		10.32	1.56	**39.43**	13	99.5	977500.8431
Crude Oil	Mtons						29.68	**29.68**	20	99	901037.7869
Gasoline	Mtons						0.01	**0.01**	18.9	99	295.490349
Diesel Oil	Mtons	0.29	1.35	4		2.91	5.4	**13.95**	20.2	99	436286.327
Fuel Oil	Mtons	13.95	0.02	1.11		0.65	10.07	**25.8**	21.1	99	826325.7251
Liquefied Petroleum Gas	Mtons							**0**	17.2	99.5	0
Refinery Gas	Mtons			0.27			0.83	**1.1**	18.2	99.5	33638.40313
Natural Gas	10^9m^3		0.5				1.08	**1.58**	15.3	99.5	343351.2148
Other Petroleum Production	Mtons							**0**	20	99	0
Other Coke Production	Mtons							**0**	25.8	98	0
Other Energy	Mtons Standard Coal	9.83					39.21	**49.04**	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	Shandon g	Subtotal	Emission Factor	Oxidation Rate	CO_2Emissions （tCO_2e）
									（tc/TJ）	（%）	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	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	527776527.1
Cleaned coal	Mtons						40	**40**	25.8	98	976919.8208
Other Washed Coal	Mtons	6.48		101.04	354.17		284.22	**745.91**	25.8	98	5783167.065
Coke	Mtons					0.22		**0.22**	29.5	98	6631.250523
Coke Oven Gas	10^9m^3	0.55		0.54	5.32	0.4	8.73	**15.54**	13	99.5	1232766.915
Other Coke Gas	10^9m^3	17.74		24.25	8.2	16.47	1.41	**68.07**	13	99.5	1687509.064
Crude Oil	Mtons							**0**	20	99	0
Diesel Oil	Mtons	0.39	0.84	4.66				**5.89**	20.2	99	184209.7825
Fuel Oil	Mtons	14.66		0.16				**14.82**	21.1	99	474656.87
Liquefied Petroleum Gas	Mtons							**0**	17.2	99.5	0
Refinery Gas	Mtons		0.55	1.42				**1.97**	18.2	99.5	60243.32197
Natural Gas	10^9m^3		0.37		0.19			**0.56**	15.3	99.5	121694.1015
Other Petroleum Products	Mtons							**0**	20	99	0
Other Coke Products	Mtons							**0**	25.8	98	0
Other Energy	Mtons Standard Coal	9.41		34.64	109.73	4.48		**158.26**	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 Usage 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				**489173109.9**

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:
:

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Power Supply (MWh)		9,312	9,312	32,592	76,824	76,824	76,824	76,824	76,824	76,824	76,824	76,824	76,824	76,824	76,824
Annual Thermal Supply (GJ)			52,747	157,885	157,885	157,885	157,885	157,885	157,885	157,885	157,885	157,885	157,885	157,885	157,885
Emission Reduction (tCO_2e)			51,266	260,721	463,825	463,825	463,825	463,825	463,825	309,289					
OUTFLOWS															
Capital Investment($)	2,713,750	677,500	2,000,000	3,462,500											
Current Cost ($)	0	70,750	54,500	102,000											
Operational Cost ($)		271,488	656,238	1,197,675	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513	1,965,513
Tax and Additives ($)		63,125	126,538	246,200	425,038	425,038	425,038	425,038	425,038	425,038	425,038	425,038	425,038	425,038	425,038
Income Tax ($)		36,325	86,450	149,813	255,413	255,413	255,413	255,413	255,413	255,413	255,413	255,413	255,413	255,413	255,413
INFLOWS															
Estimated price of CO_2e ($/t)				10	10	10	10	10	10	10	10				
Derived from sales of CERs ($)				346,530	2,607,210	4,638,250	4,638,250	4,638,250	4,638,250	4,638,250	3,478,670				
Derived from the power& heat ($)		513,324	1,249,074	2,217,264	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682	3,671,682
Reclaim the surplus current capital ($)															3,055,000
Reclaim the surplus capital assert ($)															200,375
Cash Flow with CDM	-2,713,750	-605,864	-1,674,651	-2,594,394	3,632,930	5,663,970	5,663,970	5,663,970	5,663,970	5,663,970	4,504,390	1,025,720	1,025,720	1,025,720	4,281,095
Cash flow without CDM	-2,713,750	-605,864	-1,674,651	-2,940,924	1,025,720	1,025,720	1,025,720	1,025,720	1,025,720	1,025,720	1,025,720	1,025,720	1,025,720	1,025,720	4,281,095
IRR without CDM	**7.8%**					IRR with CDM		**36%**							

Annex 4

MONITORING INFORMATION

CDM Monitoring & Quality Control Manual

1. Project Monitoring Systems

1.1 Monitoring Systems & Instruments

Figure B-6 in Section B7.2 shows the monitoring systems and the location of meters. The detailed information of instruments that will be used by the project is show in Table 1, Table 2 and Table 3:

Table 1: Information of the Monitoring Instruments of Power Generation

No.	Name	Precision	Purpose	Recording Frequency	Standard
E0	Ammeter	≤2% class2	Measure electricity consumption of power station	Continuous	GB/T7676-98
E1	Ammeter	≤2% class2	Measure electricity generated.	Continuous	GB/T7676-98
F1	Gas flow meter	≤1%	Measure CMM flow rate imported to generators	Continuous	GB/T-2624-93
C1	Methane concentration meter	≤5%	Measure methane concentration in the gas imported to generators	Hourly	MT445-1995
s	Regular sampling		Monitor NMHC concentration in CMM	Annually	

Table 2: Information of the Monitoring Instruments of CMM boiler

No.	Name	Precision	Purpose	Recording Frequency	Standard
F2	Gas flow meter	≤1%	Measure gas flow rate imported to CMM boiler	Continuous	GB/T-2624-93
C2	Methane concentration meter	≤5%	Measure methane concentration in the gas imported to CMM boiler	Hourly	MT445-1995
E0	Ammeter	≤2% class2	Measure electricity consumption of CMM boiler	Continuous	GB/T7676-98
TH	Calorimeter	≤2%	Measure input water temperature of CMM boiler	Continuous	GB/T1598-1998 JB/T9249-1999

s	Regular sampling		Monitor NMHC concentration in CMM	Annually	

Table 3: Information of the Monitoring Instruments of CMM Residential Use

No.	Name	Precision	Purpose	Recording Frequency	Standard
F3	Gas flow meter	≤1%	Measure gas flow rate imported to municipal pipeline	Continuous	GB/T-2624-93
C3	Methane concentration meter	≤5%	Measure methane concentration in the gas imported to municipal pipeline	Hourly	MT445-1995
E0	Ammeter	≤2% class2	Measure electricity consumption of residential	Continuous	GB/T7676-98
s	Regular sampling		Monitor NMHC concentration in CMM	Annually	

1.2 Data monitoring and recording

1）Electricity monitoring（E0, E1）

Ammeters are adopted to monitor electricity consumption by the project and power generated. Ammeter installation will be examined by the qualified third party. No one is authorized to disassemble ammeters. Electricity consumption and supply will be continuously monitored.

2）Coal mine gas concentration and flux monitoring（F1, F2, F3 & C1, C2, C3）

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 for exportation.

3）Heat generation monitoring（TH）

Heat generated by the gas boilers in the project is continuously measured by the calorimeter.

4）NMHC monitoring

The sampling of CMM for NMHC monitoring is carried out once a year. If the concentration of non-methane hydrocarbon is higher than 1%, carbon emission factor for combusted NMHC will be examined to calculate the emissions of NMHC. If not, the sampling report will be provided to DOE for verification.

1.3 Data keeping and reporting procedure

Each mine would install at least one control centre for data monitoring and recording. For Tunchengcun, Beizhuang and Huangcheng mines, data from different utilization approaches will be either gathered together in one control centre or separated managed in their own control centre. The electric data will be saved in the computer and printed out for filing. The assigned person will be responsible to make file list. All the electric files will be backed up, well kept and filed. All the files will be examined every month by the project owner and signed. All the data will be kept two years after the crediting period.

2. Project management

2.1 Project Management Structure

Each coal mine will be responsible for the CDM monitoring and QA/QC procedures. (See Figure B-7) Staff in those coal mines implementing the same utilization will periodically trained. Project manager is responsible for the whole monitoring.

2.2 Position Responsibilities

General Manager of Minsheng Gas is responsible for the project monitoring and three people will be appointed for staff training. Personnel in charge of QA&QC are appointed by each coal mine. Each position includes three teams rotating every 8 hours.

Except for Shancheng, there is power generation in the rest 11 coalmines. The responsibilities of personnel in these 11 coalmines are:

- Power station operator：Ensuring normal operation of compressors, generator sets and all the other monitoring instruments. When malfunction appears in monitoring instrument, the operator is supposed to contact the producers for maintenance and replace. At the same time, he is responsible for manual monitoring.
- Data reading, recording and saving staff on power station: Two people are responsible for data handling. 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. When malfunction occurs in monitoring instrument, Staff B should assist the power generation operator to complete tasks, such as monitoring and data reading.
- QA/QC auditor: 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.

For CMM boiler, Tunchengcun, Beizhuang and Huangcheng mines will assign people to be responsible for the monitoring. Their responsibilities are:

- Operator of CMM boiler：Ensuring normal operation of boilers and the online meters. When malfunction appears in monitoring instrument, the operator is supposed to contact the relevant staff to maintain or replace instrument. At the same time, he is responsible for manual monitoring.
- Data recording and saving staff on boiler: Two people are responsible for data handling Staff A is responsible for supervising and controlling of relevant boiler instrument, and reading data periodically. Staff B is responsible for supervising accuracy of data reading, data saving and reporting. When malfunction occurs in monitoring instrument, Staff B should assist the boiler operator to complete tasks, such as monitoring and data reading.
- QA/QC auditor: 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.

For CMM residential use, Tunchengcun, Beizhuang and Huangcheng mines will also assign people to be responsible for the monitoring.

- Operator of CMM residential use：Ensuring normal operation of residential system and the online meters. When malfunction appears in monitoring instrument, the operator will contact the relevant staff to maintain or replace instrument.

- Data recording and saving staff on CMM residential use: Two people are responsible for data handling. Staff A is responsible for supervising and controlling of relevant equipment, and reading data. Staff B is responsible for supervising accuracy of data reading, data saving and reporting. When malfunction occurs in monitoring instrument, Staff B should assist the operator to complete tasks, such as monitoring and data reading.
- QA/QC auditor: responsible for data recording and monthly 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.

Besides the employees in each mine, the project owner will also assign three people for employee training and a project manager for the whole project management. Their responsibilities are as follows:

- Employee training: periodic training operator, supervising and controlling (new) staff and assisting quality assurance staff and project manager to complete internal verification. The contents of training are described in Section 2.3.
- 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 position should be on duty on time and operate strictly according to operation specification and illustration of instrument. Additionally, they will 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.

2.3 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

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. In each coal mine, the operations and data will be examined by the QA/QC auditor monthly.

All the equipment adopted in the project will be calibrated and examined by qualified entities to make sure their accuracy. The calibration report will be provided to DOE for verification.

To insure accuracy, power generated by the project will be crosschecked by monthly settlement receipt; methane consumed for power generation and the CMM boilers can be crosschecked by calculation according to power and heat generated; methane consumed for residential use can be crosschecked by settlement receipt between the mine and village committee.

Internal audit will be carried out periodically in each mine, 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.