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:

Project title: Gansu Jingyuan Coal Mine Group Jieneng Thermoelectricity Company CMM Power Generation Project
PDD version: 4.0
Completion date PDD: 17/10/2012

Revision history:

Version	Date	Purpose
Version: 1.0	22/07/2010	The first edition for GSP
Version: 2.0	21/01/2011	Revised version according to CLs and CARs in validation
Version: 3.0	04/06/2012	Revised version according to TR comments in validation
Version: 4.0	17/10/2012	Revised version based on EB's incompleteness requests

A.2. Description of the project activity:

The Gansu Jingyuan Coal Mine Group Jieneng Thermoelectricity Company CMM Power Generation Project (hereafter referred to as "the project" or "the proposed project") , located at coal mining concession area of Jingyuan Coal Group in Gansu Province, China, is implemented by Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd., which is a wholly-owned subsidiary of Jingyuan Coal Group. The project will utilize the Coal Mine Methane (CMM), which has been vented into the atmosphere, to generate electricity at two separate mining areas that of Weijiadi and Dashuitou coal mines. The project will install 11 domestic generator units with single installed capacity of 500 kW to generate power and equip waste heat boilers to utilize waste heat from the generation process to supply heating for staff household use, the total capacity being 5.5 MW. The total estimated consumed CH_4 is 10,008,999 m^3, referring to 6,706 tonnes (metric, here and after) per year, and the expected power supply is 27,805 MWh annually. All of the electricity generated by the project will be supplied to the internal grid of Jingyuan Coal Group to displace the electricity that would have been supplied by Northwest China Power Grid (NWCPG) and heating generated by the project will be supplied for staff household use to displace heating that would have been supplied by coal-fired boilers, but only emission reductions associated with electricity displacement will be claimed. The power demand[1] of Jingyuan Coal Group in 2006-2008 was 204,711MWh, 209,780.6MWh and 215,604.8MWh respectively, which was all provided by NWCPG.

Waste heat produced from the generation process will be used to supply heating for staff household use, but the project will not claim the emission reductions associated with the displacement of heat in order to be conservative. The project falls within sectoral scope 8, Mining / mineral production, and sectoral scope 10: Fugitive emissions from fuels (solid, oil and gas). While obviously reducing the amount of CMM vented into the atmosphere, the proposed activity will displace the same amount of power supplied by NWCPG. Coal-fired power generation is currently the dominant power supply option within NWCPG. The expected annual emission reductions are estimated to be 144,961 tCO_2e[2].

---

[1] Evidence is provided to DOE.

[2] 144,961tCO_2e is the ERs estimation on one year basis other than an annual average ERs over the ten year crediting period. As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not

The scenario prior to the implementation of the project activity is the same as the baseline scenario that is power supplied by NWCPG, heating supplied by coal-fired boilers and low concentration CMM vented into the atmosphere.

The spatial boundary of the project includes all equipments installed and used as part of the project activity for the extraction, compression, transportation, and utilization of CMM (including waste heat recovery facilities) at the project site; the internal grid of Jingyuan Coal Group, and NWCPG to which the internal grid connects, including the grid-connected power generation facilities providing power to NWCPG.

This project fits with the objective of Chinese government to improve safety in China's coal mines through increasing CMM utilization, strengthening CMM treatment and eliminating CMM accidents. The destruction of methane contained in CMM will lead to a substantial reduction of Greenhouse Gas (GHG) emissions. The project activity's contributions to sustainable development are:

- Helping to improve coal mine safety through CMM drainage techniques;
- Reducing local air pollution and adverse impact to health by displacing coal-fired power plants with cleaner CMM-fired power generation equipments;
- Reducing the amount of CMM released to the atmosphere directly and saving energy;
- Contributing to local economic development through employment generation.

A.3. Project participants:

The parties involved in the project are shown in Table A.1:

Table A.1 Project participants

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	the Party involved wishes to be considered as project participant (Yes/No)
China (host)	Private: Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd. (project entity)	No
United Kingdom of Great Britain and Northern Ireland	Private: Gazprom Marketing & Trading Singapore Pte. Ltd. (buyer)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0 and the annual average ERs over the ten year crediting period is 101,472tCO_2e.

Gansu Province

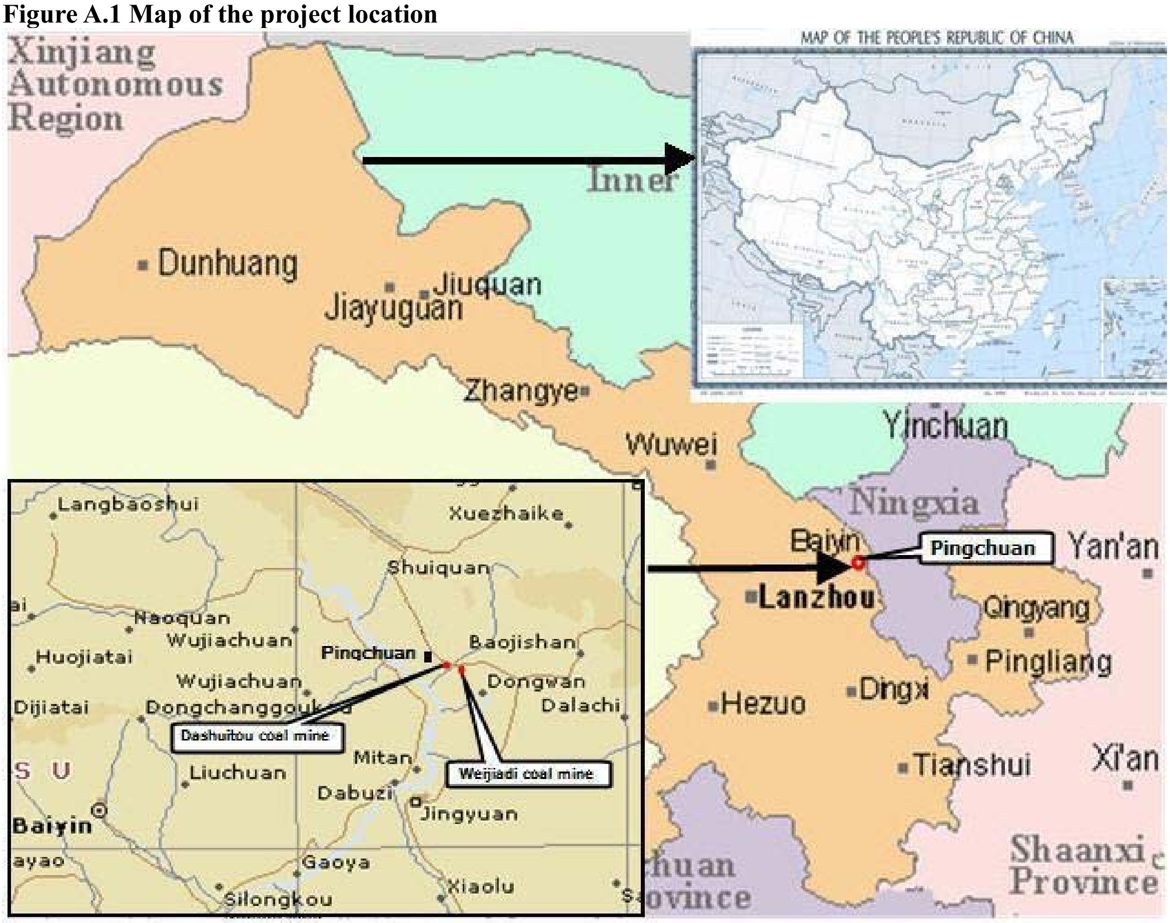
A.4.1.3. City/Town/Community etc:

Pingchuan District of Baiyin City

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

The project is implemented at Weijiadi and Dashuitou coal mines of Jingyuan Coal Group in Pingchuan District of Baiyin City in Gansu Province, China. The approximate coordinates of Dashuitou mine are east longitude of 104.86° and north latitude of 36.73°; that of Weijiadi mine are east longitude of 104.92° and north latitude of 36.76°. Figure A.1 shows the location of the project.

Figure A.1 Map of the project location



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

The project activity falls within the following sectoral scopes:

Sectoral Scope 8: Mining / mineral production

Sectoral Scope 10: Fugitive emissions from fuels (solid, oil and gas)

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

The coal mines for the implementation of the project activity

The Gansu Jingyuan Coal Group Dashuitou Coal Mine was established in 1958, then extended in 1988, and put into operation on 1 August 1997. The amount of its authorized annual production is 2,200,000 tonnes, and the remaining service life of Dashuitou coal mine is 43 years. The production is mainly "Crystal Rainbow No. 3 Coal", low-ash-sulfur-phosphorus high calorific value and environmentally friendly high-quality coals for chemical engineering, power and civil uses. In the aspect of mining, advanced technology of fully mechanized caving and coal rock bolt support are used. In the aspect of CMM control, the coal mine is a gassy mine and the main source of the methane is the CMM drainage from the underground tunnel. Till the end of 2006, the total VAM and CMM gas drainage is 160 million m^3 and the CMM gas reserve is 840 million m^3.

Weijiadi Coal Mine, which was put into operation in December 1989, is a gas outburst mine. Its annual production capacity is 1.5 million tonnes of coal, and the remaining service life of the coal mine is 105 years. Its production of "Crystal Rainbow No. 3 Coal" is high-quality coals for chemical engineering and civil uses. It uses central border exhaust ventilation and mechanized top coal mining technology. The main source of the methane is from draining CMM from the underground tunnel. Till the end of 2006, the total VAM gas drainage is 258.8 million m^3, the total CMM extraction volume is 77 million m^3 and the CMM gas reserve is 2,522 million m^3.

The scenario prior to the implementation of the project activity

The project owner had operated two sets of 2,000kW high concentration (above 30%)[3] gas engine generators to utilize the CMM with methane concentration above 30% from the only CMM drainage system at each of Dashuitou and Weijiadi coal mines for power generation since 2004. From the end of 2006, the two CMM drainage systems respectively at the two mines were retrofitted to improve the safety and the miners' working environment during underground mining activities. The retrofit included installation of moveable pumps underground and fixed pumps aboveground to extract coal mine methane at upper corners of mining panels and goafs, which were neglected before, to the same drainage systems connected to the existing pumps and supplying CMM for power generation at each mine. Details of the installed pumps[4] are as below:

---

[3] In the "Emission Standard of Coalbed Methane / Coal Mine Gas (on trial)", which has been published by the Ministry of Environmental Protection & General Administration of Quality Supervision, Inspection and Quarantine on 2nd April 2008, high concentration CMM is defined as "coal mine drainage methane that the volume concentration above 30%"; and low concentration CMM is defined as "coal mine drainage methane that the volume concentration below 30%".

[4] Evidence is available to DOE.

Mine	Type of pumps	Unit
Weijiadi Mine	2BEA-353-0 moveable	1
	BWY-85 moveable	3
Dashuitou	2BE1405 fixed	2

As the concentration of methane at upper corners of mining panels and goafs is much lower because of the huge amount of ventilation air that is circulated in sufficient quantity to dilute the methane to low concentrations for safety reasons during mining activities, the concentration of all extracted CMM was lowered gradually. As of the beginning of 2008, the extracted CMM cannot meet the concentration requirement (above 30%) of the high concentration CMM gas engine generators anymore, so the high concentration gas engines formally stopped from 1 February 2008[5] and the gas engines were abandoned since then and sold out as idle equipments later[6].

Since then all extracted coal mine methane is with CH_4 concentration below 30% in the two mines, so has to be vented into the atmosphere unused. The power consumed by Jingyuan Group is purchased from NWCPG, in which coal-fired power generation is the dominant power supply option. Heating for staff household use is provided by coal-fired boilers. This is scenario prior to the implementation of the project activity.

The technology employed by the project activity

The project will install 11 sets of 500 kW 500GF1-3RW low concentration methane-fuelled internal combustion engine/generator units, which are manufactured by Shengli Oilfield Shengli Power Machinery Co., Inc., (also short as Shengdong), one of the top engine manufacturers that occupies 80% of China's gas engine market, and experienced in producing the methane concentration between 8%-30% CMM power generation technology in China. The project involves the utilization of CMM which is currently drained from both mines and vented into the atmosphere. Usually when the CMM falls between the ranges of explosive concentration levels from 4.8% to 14.5%; it cannot be used for power generation in a normal gas engine. However, if the CMM of explosive methane concentration levels is sent to a cylinder in the gas engine for compression before fuelling, it will be able to efficiently power the gas engine, and thus be employed for power generation. In order to generate electricity with low-concentration methane, technologies to ensure the safe transport of CMM and gas engine technologies to accommodate low-concentration methane (methane concentrations over 8% and higher) are essential. Generators that can safely generate electricity under such conditions are limited to the 500GF1-3RW, Shengdong Company, which will be employed by the proposed project. This generator model is composed of an anti-explosion device against methane and technologies to combust low-concentration methane. The generator was approved by the State Administration of Work Safety in July 2005; and the low-concentration methane transport system was approved in December 2005[7]. It was the first officially approved low-concentration methane transport system in China. The project will collect Coal Mine Methane (CMM, methane concentration between 8%-30%) at the working mines and use the recovered

[5] *Notice on stopping power generation and arrangement of relevant work* issued on 21 January 2008

[6] *Application for selling the idle gas engines* dated on 30 June 2011; *Approval to the application for selling idle gas engines* issued by Jingyuan Coal Group on 18 August 2011; *Transfer agreement of idle gas engines* between the project owner and Zhuzhou Nanfang Gas Engine Manufacturing and Installation Co., Ltd. on 16 September 2011

[7] The evidences are provided to DOE.

CMM in the low concentration generator units to produce electricity through pre-mining and post-mining CMM drainage techniques. The project has been filed at Baiyin Development and Reform Commission on May 26th 2008. The life time of the gas engine and the project is ten years.

The load factor of the project is 74.2% (6,500hrs[8] / 8,760hrs = 74.2%). The operation situation of CMM power plant depends on the coal production (CMM quantity) and methane concentration (CMM quality), which makes the output of CMM power plant variables and unstable, so the operation hours of CMM power plant could not be much higher than the regular thermal power plant. According to the China Electric Power Yearbook 2008, the average operation hours of thermal power plants in China is 5,344hrs/yr. Therefore, the annual operation hours for the proposed project of 6,500 hours is realistic and credible.

The project is connected to the internal transformer station of Jingyuan Coal Group at Dashuitou mine and Weijiadi mine. (Due to the difference of the project locations, the project is respectively connected to Dashuitou transformer station and Weijiadi transformer station). All generated electricity is sent and consumed by the coal mines internally. Because the generated power cannot meet all the power needs of the coal mines, the coal mines are still purchasing the rest part of electricity from NWCPG. When unstable operation happens in the proposed project, the coal mine and the project itself can obtain electricity from NWCPG via the internal power grid. This ensures the safety operation of the coal mines.

The total installed capacity of the project is 5.5MW, and the expected power supply is 27,805 MWh. The generated power is sent and consumed internally by the coal mines.

Technical flow diagram of the project is shown as below.

[8] Sourced from FSR

Figure A.2 (a) Flow diagram of the project – Weijiadi Coal Mine

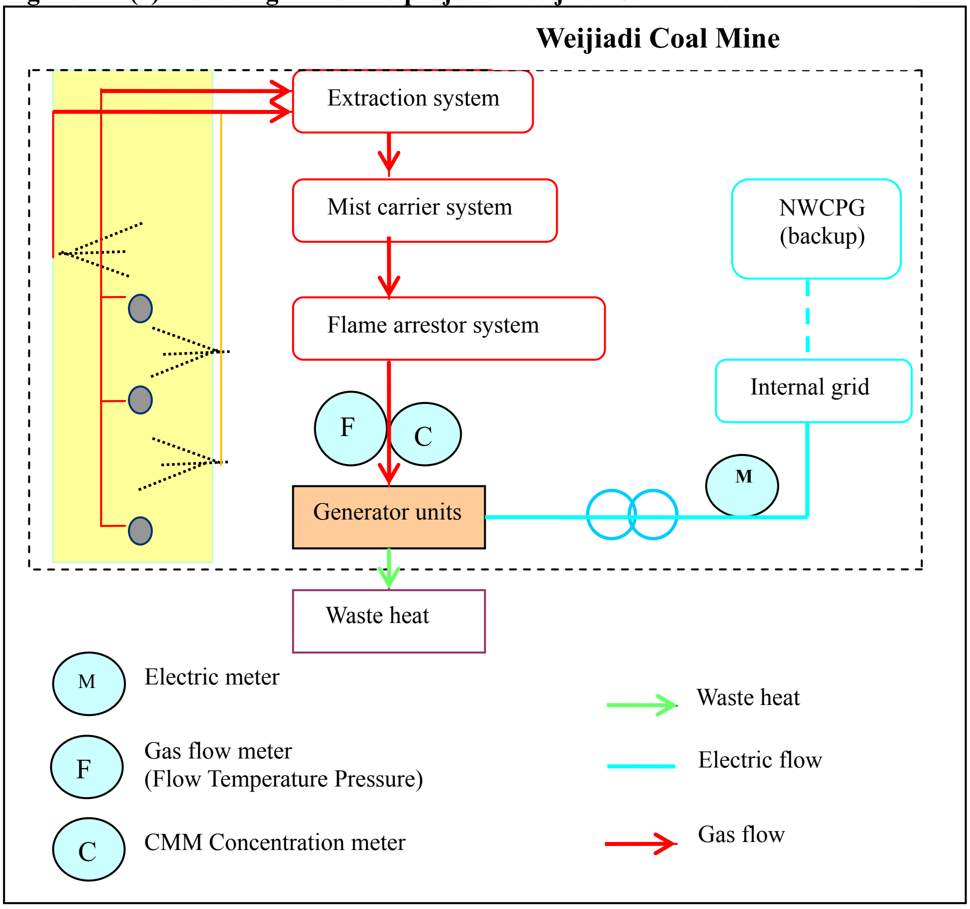
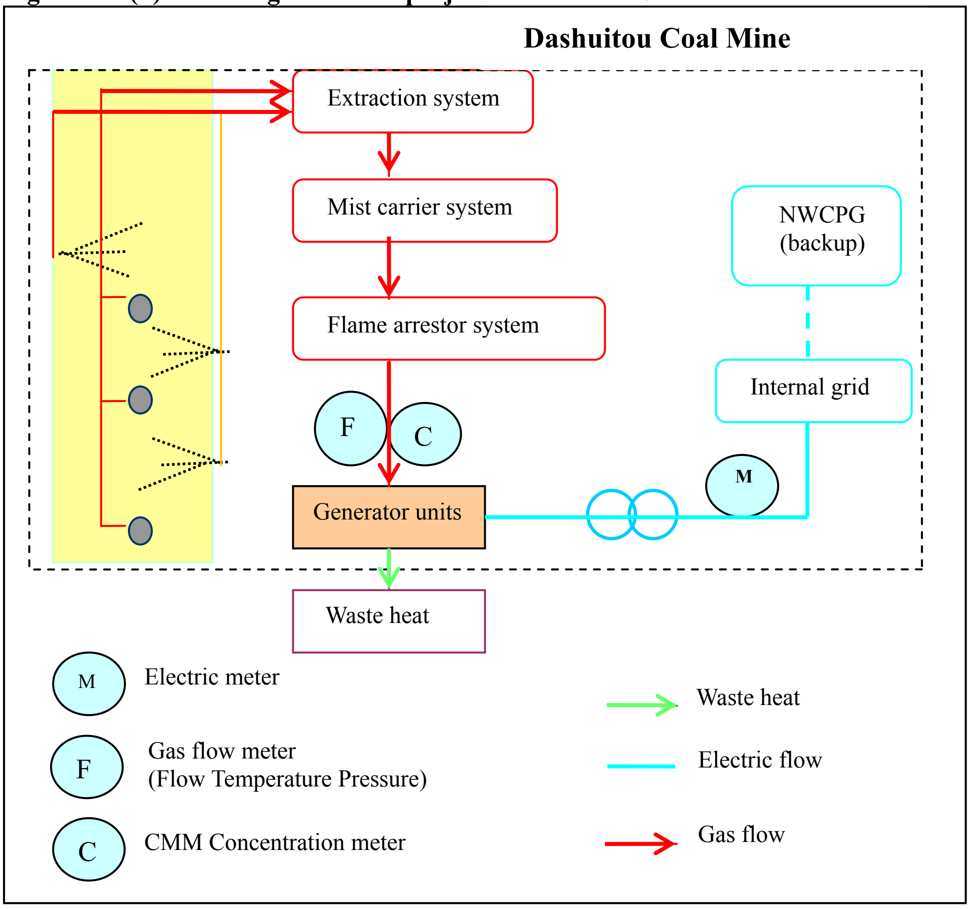


Figure A.2 (b) Flow diagram of the project – Dashuitou Coal Mine



The CMM flow will be continuously monitored on the basis of gas volume, pressure and temperature as well as methane concentration before it is delivered into the gas-fired engines in the power plant. The metering point to meter the power supply to the internal grid is set at the internal transformation side of Jingyuan Coal Group. All meters are satisfied with the national standards and calibrated periodically in accordance with the relevant regulations. For details, please refer to Section B.7.

Table A.2 Overview of 500 GF1-3RW generator unit technical specifications[9]

Gas engine / generator (per unit)	
Item	*Specification*
Type	*500GF1-3RW*
Engine type	*W12V190Z$_L$D$_X$-2C*
Generator type	*1FC6 454-6LA42*
Rated output	*500kW*
Power factor	*0.8*
Rated Voltage	*400V*
Rated current	*902A*
Rated frequency	*50Hz*
Engine dimension	*5506mm×1970mm×2698mm*

[9] Sourced from Equipment Purchase Contract

Weight	*12500kg*

The equipment manufacturer is domestic, so no technology transfer from Annex I countries is involved in the project.

Protective device installed to enhance the low concentration CMM transportation safety

Protective device installed at Extraction Station
This protective device is composed of Water Seal Type (Water-controlled) Flame Arresters, a Screen Filter, Dry-type Flame Arresters, a Low Temperature Wet Type Valve for Bleeding and an Explosion-Proof Electric-Motor-Driven Butterfly Valve.

i. Water Seal Type (Water-controlled) Flame Arresters
The CMM released from the bump is automatically transported into the water in the tank. Therefore, in the event the CMM is ignited, the energy is absorbed as water vapor, thus extinguishing the flame. Also, the water instantaneously evaporates, reducing the methane concentration of the CMM. Water is automatically supplied to maintain a constant water level.

ii. Screen Filter
Any dust is removed before the CMM is sent to the Dry-type Flame Arresters.

iii. Dry-type Flame Arresters
This equipment employs the principle that when a flame passes a narrow corridor at a certain speed, the energy of the flame is absorbed by the surrounding walls and the flame is extinguished after it has proceeded a certain distance. The device is lined with corrugated panels to put the flame out upon passage.

iv. Low Temperature Wet-Type Valve for Bleeding
When the quantity of the gas used by the system is suddenly reduced (e.g. CMM power generation is suddenly suspended) and the pressure within the pipe is temporarily increased, the CMM is released into the air from this device to reduce the pressure and thus mitigate the load on the pipe. This device is a wet-type valve where the water pressure is automatically adjusted; thus it automatically closes when the pressure within the pipeline has resumed its normal level.

v. Explosion-Proof Electric-Motor-Driven Butterfly Valve
This is a pressure-proof valve that will not be damaged in the event that an explosion occurs at either the inlet or outlet side of the valve during maintenance; thus the other side of the valve will not be affected.

Mist Transmission System

vi. The atomizers are installed in each CMM gas pipeline at 20 meter intervals. The ring-shaped atomizers are installed at each joint of the CMM gas pipeline and constantly spray mist from the mist generators. By constantly filling the pipes with mist, static-caused fires can be prevented.

Preventive devices installed at CMM Power Plant

vii. Water-Overflow-Seal-Type Dehydration Flame Arresters
These flame arresters operate under the same principle as the Water Seal Type (Water-controlled) Flame Arresters. Because the CMM has been exposed to mist in the CMM gas pipeline, a pipe is installed to drain water once the water volume has exceeded a certain level.

viii. Gravity-type Cyclones for Dehydration
Because the CMM is exposed to mist in the CMM gas pipeline, it is dehydrated using this device.

Training and maintenance requirements

The project entity has made the following arrangements for their staff to become familiar with the operation and maintenance of CMM to power projects.

Table A.3 Overview of training activities

Time	Attendants	Content
May 25th 2009	24	Knowledge on internal combustion generators
May 27th 2009	29	Knowledge on main parts and maintenance of internal combustion generators
May 28th 2009	29	Knowledge on internal systems
May 29th 2009	26	Generation set assembly
May 30th 2009	29	Questioning & closing

Regular maintenance and repairs of the project will be carried out by technical staffs of Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd. More substantial repairs will be carried by the equipment supplier or may require outside expertise for the equipment which is sent back.

Table A.4 shows the scenario existing prior to the start of the implementation of the project activity (which in this case is the same as the baseline scenario identified in Section B.4) and the project activity, including energy and mass flows and balances of the systems and equipments.

Table A.4 Energy and mass balances in the project activity and the baseline scenario[10]

		Unit	Project activity	Baseline
CMM extraction (CH_4 100%)		10^3m^3/yr	46,500	46,500
	CMM power plant	10^3m^3/yr	10,009	0
	CMM consumed in coal mines	10^3m^3/yr	0	0
	Emitted in the atmosphere	10^3m^3/yr	36,491	46,500
Electricity supplied		MWh/yr	27,805	0
Heat energy[11]		TJ/yr	85.78	0

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

A fixed crediting period of ten years has been selected for the project activity. The expected annual emission reductions is 144,961 tCO_2e[12] and the estimated total emission reductions is 1,014,727 tCO_2e.

Table A.5 provides an overview of emission reductions over the crediting period.

[10] Sourced from FSR

[11] The emission reduction of waste heat using is not claimed.

[12] 144,961tCO_2e is the ERs estimation on one year basis other than an annual average ERs over the ten year crediting period. As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0 and the annual average ERs over the ten year crediting period is 101,472tCO_2e.

Table A.5 The estimation of the emission reductions in crediting period[13]

Year	Annual estimation of emission reductions in tonnes of CO_2e
Year 1	144,961
Year 2	144,961
Year 3	144,961
Year 4	144,961
Year 5	144,961
Year 6	144,961
Year 7	144,961
Year 8	0
Year 9	0
Year 10	0
Total estimated reductions (tonnes of CO_2e)	1,014,727
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	101,472

A.4.5. Public funding of the project activity:

There is no public funding from Annex I countries available to the project.

[13] As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

Baseline and monitoring methodology:

Approved consolidated baseline methodology ACM0008 (Version 07): Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation.

The methodology draws upon:

- Tool to calculate the emission factor for an electricity system (Version 02.2.1);
- Tool for the demonstration and assessment of additionality (Version 06.1.0);
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2);[14]
- Tool to determine project emissions from flaring gases containing methane.[15]

Reference: UNFCCC website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

The methodology ACM0008 is applicable to this project activity as it meets all applicability criteria.

Comparison of the project with ACM0008 is presented in Table B.1, B.2 and B.3.

Table B.1 Comparison of the project with ACM0008 regarding CMM extraction applicable criteria

ACM0008 Applicability	Proposed project activity
Surface drainage boreholes to capture CBM associated with mining activities;	**No**, the project does not involve the utilization of CBM.
Underground boreholes in the mine to capture pre mining CMM;	**Yes**, underground boreholes are utilized to capture pre mining CMM.
Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM;	**Yes**, underground boreholes, gas drainage galleries to capture post mining CMM are utilized.
Ventilation Air Methane (VAM) that would normally be vented.	**Yes,** Ventilation Air Methane would be vented.

Table B.2 Comparison of the project activity with ACM0008 regarding CMM utilization activity

ACM0008 Applicability	Proposed project activity
The methane is captured and destroyed through flaring; and/or	**No,** no flaring of methane is involved.
The methane is captured and destroyed through flameless oxidation; and/or	**No,** no flameless oxidation of methane is involved.
The methane is captured and destroyed through utilization to produce	**Yes**, captured methane is utilized for

[14] This tool is not used in this PDD.

[15] This tool is not used in this PDD.

electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources;	electricity and heat generation, but only emission reductions associated with power generation are claimed.
The remaining share of the methane, to be diluted for safety reason, may still be vented;	**Yes,** for CMM that does not meet the technical requirements of the implemented technology (i.e. supplied CMM at concentrations lower than the minimum limit for power generation), the methane will not be sent to the power plant but ventilated to the atmosphere without utilization.
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented.	CMM is extracted and detected before it is sent to the proposed project. One CMM analysis report in 2010 indicates that the CMM concentration is 10.85% for Dashuitou and 7.54% for Weijiadi. Any CMM below the concentration of 8%, the lower limit of which can be utilized by the gas engine, will be vented in advance. By doing this, all the CMM captured by the project is used.

Table B.3 Comparison of the project with ACM0008 in applicability criteria

ACM0008 Inapplicability	Proposed project activity
Capture methane from abandoned/decommissioned coalmines;	**No**, CMM is extracted from a working coal mine.
Capture/use of virgin coal-bed methane, e.g. methane of high quality extracted from coal seams independently of any mining activities;	**No,** the project is in an active coal mine that no virgin coal-bed methane is involved.
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place.	**No,** the project does not involve CBM utilization.

- In the case of opencast mines, the methodology also limits the following:
  - The mines should have had a working mining concession for at least three years prior to the start of project;
  - Only pre-mining drainage from wells placed within the area to be mined are considered as eligible for crediting;
  - Such pre-mine drainage well life may be credited up to but no more than ten years prior to actual mining or the date of issuance of mining concession, whichever is later;
  - For open cast mines, avoided emissions from methane extracted should only be credited in the year in which the seam is mined through the well zone of influence or the de-stressing zone.

  The project is implemented at underground mines, so this is not applicable.

- The project participants must be able to supply the necessary data for *ex ante* projections of methane demand as described in sections Baseline Emissions and Leakage to use this methodology.
  All CMM to be utilized by the proposed project is vented into the atmosphere prior to the project implementation. No CMM is utilized prior to the project implementation.

- The methodology applies to both new and existing mining activities.
  The proposed project is implemented at existing mining activities, so the methodology is applicable.

As can be seen from TableB.1 to B.3, the proposed project activity meets all applicability conditions of the ACM0008 methodology.

The electricity from the proposed project activity will displace the same amount of electricity that would have been supplied by NWCPG. In accordance with ACM0008, the latest version of the "Tool to calculate the emission factor for an electricity system" is used to calculate the emission factor of NWCPG. And meanwhile, "Tool for the demonstration and assessment of additionality" is used to demonstrate the additionality of the project.

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

The baseline scenario of the proposed project activity is the continued venting of methane from both coal mines into the atmosphere and the continued supply of electric power by NWCPG.

Table B.4 provides an overview of emissions that potentially have to be taken into account when applying the ACM0008 methodology. The proposed project activity involves the utilization of CMM, which otherwise would be vented, for electric power generation and heat supply but will only claim emission reductions for the displacement of electric power and the destruction of methane. The emissions sources and gases that are considered relevant to the proposed project activity are highlighted in Table B.4 and discussed below.

For the purpose of determining project activity emissions, project participants shall include:

◆ CO_2 emissions from the combustion of methane in a flare, engine, power plant or heat generation plant;
· CO_2 is generated from methane combustion in the 5.5 MW CMM power plants.

◆ CO_2 emissions from the oxidation of methane in a flameless oxidation unit;
· Does not apply; the project will not employ flameless/ catalytic oxidation unit.

◆ CO_2 emissions from the combustion of non methane hydrocarbons (NMHCs), if they represent more than 1% by volume of the extracted coal mine gas;
· Included in the project, once NMHCs present more than 1% by volume of extracted CMM.

◆ CO_2 emissions from on-site fuel consumption due to the project activity, including transport of the fuel;
· The Extraction Station is operated under prior scenario to capture methane for the safe operation of the coal mine, so its electricity consumption is not included as the additional electricity consumption by the project. The CMM transportation from outlet of the extraction system to the CMM power plant is realized by the pressure produced by the extraction system without additional electricity usage. The captured CMM will be cleaned inside the CMM power plant and the electricity consumed will be provided by the proposed project as part of auxiliary consumption. Therefore, there is no additional electricity consumed by the project on gas transportation and cleaning.

◆ Fugitive emissions from unburned methane.
· The combustion rate for CH_4 is determined as 99.5 % according to the methodology ACM0008.

For the purpose of determining baseline emissions, project participants shall include the following

emission sources:

◆ CH_4 emissions as a result of venting gas that would be captured in the project scenario;
· In the baseline scenario, the CMM that would be captured in the project scenario is released into the atmosphere from the drainage station.

◆ CO_2 emissions from the destruction of methane in the baseline scenario;
· In the baseline scenario, all of CMM with CH_4 concentration below 30% (the so-called low concentration CMM) is released into the atmosphere, and thus, no methane is combusted or destructed.

◆ CO_2 emissions from the production of power (motive and electrical) that is replaced by the project activity.
· The power generation using CMM in the project activity replaces the electricity from public power grid.

The spatial extent of the project boundary comprises:

◆ All equipment installed and used as part of the project activity for the extraction, compression, and storage of CMM and CBM at the project site, and transport to an off-site user;
· According to the methodology, all equipments used as part of the project activity for the extraction of CMM at Extraction Station is included in the boundary, but the equipments prior to the existence of the proposed project is not included in the investment.
· The CMM transport system installed between the Extraction Station and the CMM Power Station is included in the project boundary.

◆ Flaring, flameless oxidation, captive power and heat generation facilities installed and used as part of the project activity;
· This project will not introduce flaring, flameless oxidation facilities, but captive power facility is included. Power generators will be equipped with waste heat boilers. Recovered heat energy will be utilized for supplying heating to the staff households in the mining area. In order to be conservative, the emission reductions from the use of recovered heat will **not** be claimed.

◆ Power plants connected to the electricity grid, where the project activity exports power to the grid, as per the definition of project electricity system and connected electricity system given in "Tool for calculation of the emission factor for an electricity system".
· The CMM power plant of the project is connected to the public electricity grid through internal grid and displaces the electricity that would have been provided by the public electricity grid, as per the definition of project electricity system and connected electricity system given in "Tool for calculation of the emission factor for an electricity system".

The spatial extent of this project boundary comprises all equipments installed and used as part of the project activity for the extraction, compression, transportation, and utilization of CMM (including waste heat recovery facilities) at the project site; the internal grid of Jingyuan Coal Group, and NWCPG to which the internal grid connects, including the grid-connected power generation facilities providing power to NWCPG.

All other emissions are in accordance with the ACM0008 methodology excluded from the baseline and

project scenario. Based on the conditions required in the methodology, the project boundary for this project activity is presented in Figures B.1.

In accordance with the document issued by Chinese Designated National Authority (DNA), the power grid of the project is NWCPG which includes power grids of Gansu, Ningxia, Shaanxi, Qinghai and Xinjiang.

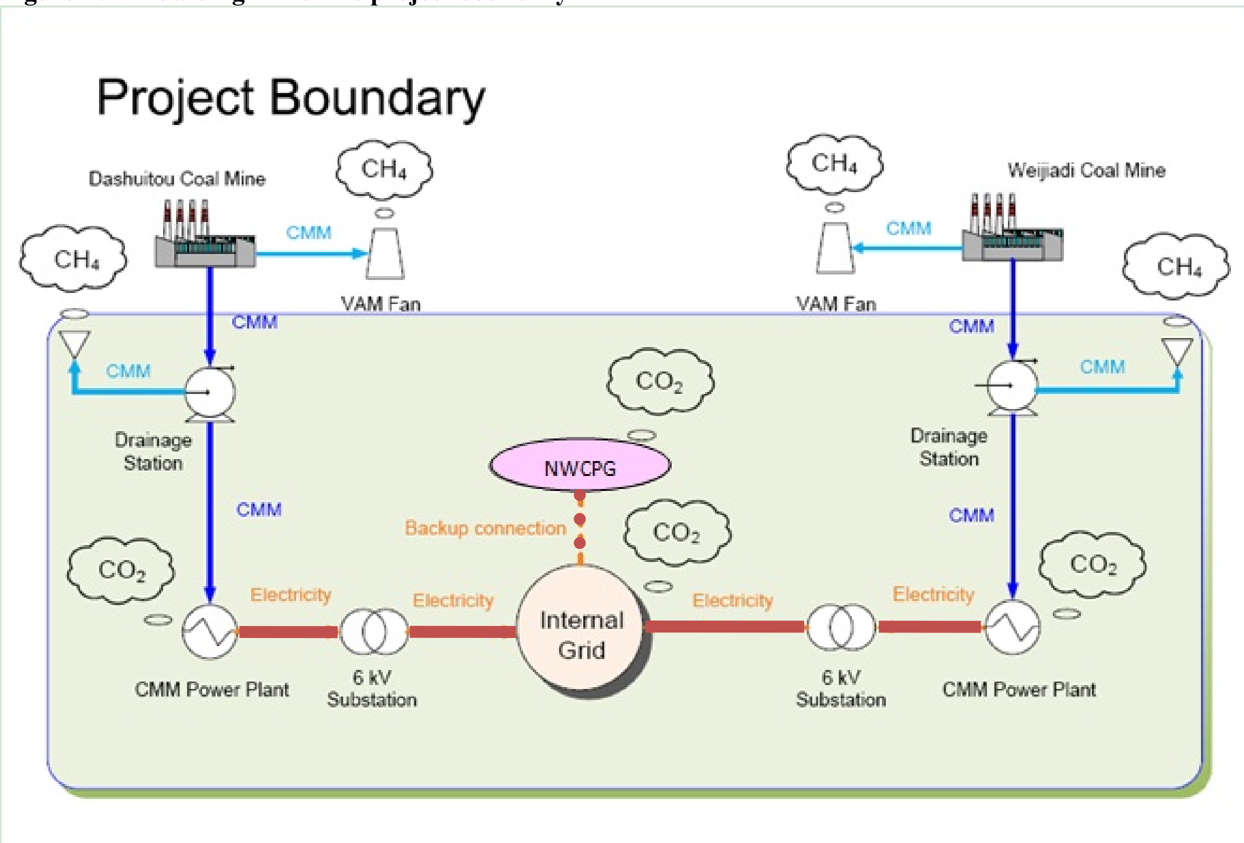
Sources and gases included in and excluded from the project boundary are described in Table B.4 as below.

Table B.4 Overview of emissions sources included in or excluded from the project boundary

	Source	Gas	Included or not	Justification / Explanation
Project activity	Emissions of methane as a result of continued venting	CH_4	Excluded	Volume of CH_4 in gas extracted from coal mines in project activity equals that of baseline; thus no monitoring is conducted.
	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	The Extraction Station is operated under prior scenario to capture methane for the safe operation of the coal mine, so its electricity consumption is not included as the additional electricity consumption by the project. The CMM transportation from outlet of the extraction system to the CMM power plant is realized by the pressure produced by the extraction system without additional electricity usage. The captured CMM will be cleaned inside the CMM power plant and the electricity consumed will be provided by the proposed project as part of auxiliary consumption. Therefore, there is no additional electricity consumed by the project on gas transportation and cleaning.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		NO_2	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from methane destruction	CO_2	Included	From the combustion of methane in power generation.
	Emissions from NMHC destruction	CO_2	Included	NMHC emission should be accounted if more than 1% by volume of extracted coal mine gas is detected.
	Fugitive emissions of unburned methane	CH_4	Included	Small amounts of methane will remain unburned in power generation.
	Fugitive methane emissions from on-site equipment	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	Excluded for simplification. However taken into account among other potential leakage effects.
	Accidental methane release	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
eim e	**Source**	**Gas**	**Included or not**	**Justification / Explanation**

	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	The baseline scenario is total atmospheric release of the methane, not involving destruction of methane.
		CH_4	Excluded	Excluded for simplification, this is conservative.
		NO_2	Excluded	Excluded for simplification, this is conservative.
	Grid electricity generation (electricity provided to the grid)	CO_2	Included	Electricity supplied in this project activity is supplied by NWCPG power plant in baseline scenario.
		CH_4	Excluded	Excluded for simplification, this is conservative.
		NO_2	Excluded	Excluded for simplification, this is conservative.
	Captive power and/or heat, and vehicle fuel use	CO_2	Excluded	Excluded for simplification, this is conservative.
		CH_4	Excluded	Excluded for simplification, this is conservative.
		NO_2	Excluded	Excluded for simplification, this is conservative.

Figure B.1. Flow diagram of the project boundary



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

The proposed project does not involve the utilization of CBM/VAM and therefore the discussion below only considers the baseline scenario for the utilization of CMM. We discuss the baseline options in accordance with the steps identified with the ACM0008 methodology.

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

Step 1a: Options for CMM extraction

The baseline scenario alternatives should include all possible options that are technically feasible to handle CMM to comply with safety regulations. These options could include:

A. Ventilation air methane (VAM)
B. Pre mining CMM extraction;
C. Post mining CMM extraction;
D. Combinations of options A, B and C with the relative shares of gas specified, i.e. continuation of the current practice in Weijiadi and Dashuitou Coal Mines.

Step 1b: Options for extracted CMM treatment

The baseline scenario alternatives should include all possible options that are technically feasible to use CMM. These options could include:

i Venting
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 Possible combinations of options i to vii with the relative shares of gas treated under each option specified.

Step 1c: Options for energy production

The proposed project activity utilizes CMM to produce electricity and waste heat will be used, but only the emission reductions from power generation will be claimed.

The ACM0008 methodology requires that all possible options for energy production are taken into consideration. There are several possible alternatives that are *prima facie* realistic and credible.

Option a: The proposed project activity not undertaken as a CDM project activity (electricity generated by CMM gas generators and heating generated by waste heat)
The ACM0008 methodology requires that the proposed project activity be included as an alternative, without the benefit from CDM. This option is a technically credible alternative.

Option b: Continuation of the current practice (import of electricity from NWCPG and heating supplied by existing coal-fired boilers)
The Jingyuan Coal Group currently obtains electric power from the local grid, which is part of NWCPG and heating is currently supplied by existing coal-fired boilers. The continuation of the current situation is a technically credible alternative.

Option c: Additional fossil fuel-fired cogeneration
The construction of a coal-fired power plant to provide same amount of power to the coal mine is a technically credible alternative. The installed capacity of the proposed project is around 5.5MW, so the installed capacity of the coal-fired thermal power plant same as 5.5MW is an option.

Option d: Additional other renewable power generation & heating supplied by existing coal-fired boilers
Since there is no available wind, solar, geothermal or biomass renewable resources resulting the same annual power generation at the project location, the construction of a renewable power generation plant is not a credible alternative to the project alternative. However, it is a technically feasible alternative.

Option e: Using CMM as vehicle fuel
Using CMM as vehicle fuel is a technically feasible alternative in theory.

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

Step 2 of the baseline identification guidance of the ACM0008 methodology involves a confrontation of the identified alternatives with the legal or regulatory requirements. In the governmental document "Guidance on Acceleration of CBM/CMM Development and Utilization"[16], which is issued by State Council in 2006, coal mines are encouraged to build captive CMM power generation plants, and these plants can be connected to the public power grid.

Options for CMM extraction:

- To ensure the health and safety of coal mine production and avoid the risk of explosion, it is stipulated in China that the maximum concentration of methane in a mine's air should be below 1% (National Coalmine Safety Regulation version 2010). Safety requirements cannot be met by using any of these gas extraction options A, B or C individually. Currently, to comply with the safety requirements, these extraction techniques need to be used jointly because none of the three options could achieve the safety requirement of methane concentration below 1% in the underground mine air individually. Therefore, option D is the only gas extraction complying with legal requirements, and **options A, B and C can be eliminated**. Moreover, as pre-mining and post-mining CMM are brought to the drainage station on the surface through the same drainage lines, it is impossible to specify the share of CMM captured by each method.

Options for extracted CMM treatment:

- According to the National Coalmine Safety Regulation, the low concentration methane, which is under 30% is not allowed to flare directly; however it can be transported and utilized by authorized technology (National Coalmine Safety Regulation (01/03/2010) Section two, Item 148).
  The methane concentration of the project activity is below 30%. The direct flaring of CMM is not compliance with the legal / regulatory requirement, eliminated. However, for the proposed project:
  (1) It has been filed at Baiyin DRC on May 26th 2008.
  (2) The equipment supplier Shengdong Group has already successfully developed CMM power generation technology, including special gas engine (500GF1-3RW) and safety transport system of low methane concentration CMM with concentration below 30% and passed Appraisal of the Scientific and Technological Achievements on December 25th, 2005, conducted by the China State Administrative Bureau of Safety Production Supervision[17].
  (3) Many CMM utilization projects, which recover and utilize low concentration CMM, have been successfully registered as CDM project[18], such as Jiaozuo, Zheng Zhou, and Dafosi projects, etc.

---

[16] http://www.gov.cn/zwgk/2006-06/19/content_314623.htm

[17] Sourced from FSR

[18] http://cdm.unfccc.int/

Therefore, **option iii: CMM flaring can be excluded**.

- According to Point 5 of Item 148 of the National Coalmine Safety Regulation (01/03/2010), when the concentration of the extracted coalmine gas is below 30%, the gas is not permitted to be combusted through open flame in gas-fired boilers (the same way as in coal-fired or oil-fired boilers) as fuel gas. Therefore, **option vi: Use for additional heat generation is eliminated**.

Options for energy production:

- According to relative national laws and regulations, construction of new thermal power units with a capacity under 135 MW is prohibited for provincial grid or regional grid such as NWCPG. (see General Office of the State Council (2002), *Notice of the General Office of the State Council concerning the Strict Prohibition of the Construction of Thermal Power Units with a Capacity of 135MW or Below*, Guo Ban Fa Ming Dian [2002] Document No.6.). Therefore, **option c: Additional fossil fuel-fired cogeneration is not legal, eliminated**.

- In China, there is a standard named "Compressed Natural Gas for Vehicle (GB18047-2000)[19]". In this standard, the gross calorific value of the gas must be higher than 31.4MJ/m^3 to be used as fuel for vehicles. The calorific value of the coal mine methane with a concentration around 40.8% is about 16.24MJ/m^3[20], which is much lower than 31.4MJ/m^3 of the standard requirement. The typical CMM concentration in Weijiadi and Dashuitou is below 30%, obviously lower than 40%, which leads to a much lower calorific value than the Standard required value. Besides, according to the *Progress of Recovery of Low Concentration Coal Mine Methane*[21], various methods of low concentration CMM purification are still under development and not mature for commercial operation. Thus, the coal mine methane extracted in this project cannot be used as the vehicle fuel. Therefore, **option e: Using CMM as vehicle fuel is eliminated.**

<u>Step 3: Formulate baseline scenario alternatives.</u>

Step 3 involves the formulation of baseline scenarios on the basis of the options that are technically feasible and in compliance with all legal and regulatory requirements. Following the Step 1 and Step 2 above, the available baseline scenario alternatives are listed as below and will be analyzed one by one in Step 4.

ID	CMM extraction	CMM treatment	Energy production
Alternative 1	Option D: Combinations of VAM, pre mining and post mining extraction	Option i: Venting	Option b: Continuation of the current practice (import of electricity from NWCPG and heating supplied by existing coal-fired boilers)
Alternative 2	Option D: Combinations of VAM, pre mining	Option i: Venting	Option d: Additional other renewable power generation & heating supplied by existing coal-fired boilers

[19] http://www.xt12365.cn/E_ReadNews.asp?NewsID=1169

[20] http://news.stcn.com/content/2011-10/11/content_3642077.htm

[21] http://wenku.baidu.com/view/da33c365f5335a8102d2201a.html

	and post mining extraction		
Alternative 3	Option D: Combinations of VAM, pre mining and post mining extraction	Option ii: Using/destroying ventilation air methane rather than venting it	Option b: Continuation of the current practice (import of electricity from NWCPG and heating supplied by existing coal-fired boilers) or Option d: Additional other renewable power generation & heating supplied by existing coal-fired boilers
Alternative 4	Option D: Combinations of VAM, pre mining and post mining extraction	Option iv: Use for additional grid power generation	Option b: Continuation of the current practice (import of electricity from NWCPG and heating supplied by existing coal-fired boilers) or Option d: Additional other renewable power generation & heating supplied by existing coal-fired boilers
Alternative 5	Option D: Combinations of VAM, pre mining and post mining extraction	Option v: Use for additional captive power generation	Option a: The proposed project activity not undertaken as a CDM project activity (electricity generated by CMM gas generators and heating generated by waste heat)
Alternative 6	Option D: Combinations of VAM, pre mining and post mining extraction	Option vii: Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation)	Option b: Continuation of the current practice (import of electricity from NWCPG and heating supplied by existing coal-fired boilers) or Option d: Additional other renewable power generation & heating supplied by existing coal-fired boilers
Alternative 7	Option D: Combinations of VAM, pre mining and post mining extraction	Option viii: Possible combinations of options i to vii with the relative shares of gas treated under each option specified	Option a: The proposed project activity not undertaken as a CDM project activity (electricity generated by CMM gas generators and heating generated by waste heat) or Option b: Continuation of the current practice (import of electricity from NWCPG and heating supplied by existing coal-fired boilers) or Option d: Additional other renewable power generation & heating supplied by existing coal-fired boilers

Step 4: Eliminate baseline scenario alternatives that face prohibitive barriers

Step 4 involves the formulation of barriers that would prevent identified baseline scenarios to occur in the

absence of CDM. We discuss the identified barriers below:

Alternative 1: This alternative doesn't face any prohibitive barriers and it will be further analyzed in Step 5 with investment analysis.

Alternative 2: The average annual wind power density of the project location[22] is between 50 and 100 W/m^2, which is relatively low degree in China. Furthermore, the project site is not located in the wet zone of China[23], which means hydropower is not a feasible option. The solar power generation technology is immature in China at present, especially for the grid-connected solar generation technology. The cost of solar power generation is much higher than the coal-fired power plant[24].In conclusion, the construction of a hydropower plant, a wind farm, or a solar power plant at the project site is not a credible alternative to the project activity as the site of the coal mine has little of these resources. Since there are no available geothermal or biomass renewable resources resulting the same annual power generation at the project location, a*dditional other renewable power generation* is eliminated. So Alternative 2 is excluded.

Alternative 3: According to the National Coalmine Safety Regulation (01/03/2010), the concentration of methane in the VAM in coal mine must be below 1%. Destroying VAM needs large amount of investment while generates no economic benefits, and thus faces investment barrier. Moreover, technologies that oxidize VAM for electricity or heat generation are at present immature and still at the demonstration stage in China[25]. Therefore *using/destroying ventilation air methane rather than venting it* is not feasible, and Alternative 3 can be eliminated.

Alternative 4: This alternative faces poor economic return and will be further analyzed in Step 5 with investment analysis. All input values of this alternative are the same as Alternative 5 except the feed-in tariff. In the *Notice on Implementing the Opinions of Power Generation by Coalmine Methane (FaGaiNengYuan No.[2007]721)*[26] issued by the National Development and Reform Commission on 2 April 2007, which was valid at the time of investment decision of the proposed project activity, the feed-in tariff of CMM grid power generation is stipulated: *"the feed-in tariff of electricity generated by CMM shall follow the feed-in tariff of electricity generated by biomass as described in the Trial Measures for Pricing and Cost Sharing Management for Renewable Energy Electricity Generation (FaGaiJiaGe No.[2006]7) that the feed-in tariff for biomass generated electricity is the local desulphurized coal fired electricity feed-in tariff in 2005 plus 0.25RMB/kWh."* The feed-in tariff of desulphurized coal fired electricity in Gansu Province in 2005 was 0.242RMB/kWh (incl.VAT)[27], so the feed-in tariff of CMM generated electricity in Gansu Province is 0.492RMB/kWh (incl.VAT) and this is a fixed tariff according to the above policy. This tariff will be used in investment analysis in Step 5.

Furthermore, according to the same Notice, *"electricity generated by coalmine methane (CMM) shall be used for captive purpose firstly, and then the grid company should permit the surplus electricity to supply*

---

22 http://cwera.cma.gov.cn/upload/b_2_left_02.jpg

23 Evidence is provided to DOE.

24 http://www.newenergy.org.cn/Html/0087/790818772_2.html

25 Cleaner Coal in China (by International Energy Agency) Page 98, (available at http://iea.org/textbase/nppdf/free/2009/coal_china_book_chinese.pdf).

26 http://www.sdpc.gov.cn/zcfb/zcfbtz/2007tongzhi/t20070413_129432.htm

27 http://www.gswj.gov.cn/detail.asp?LMID=2&ID=5788&Class=2261&FN=Jgzc

to the grid if any", so additional grid power generation should not be the first option for CMM power generation. For the proposed project activity, since all the generated electricity can be consumed in-house, no surplus electricity is available to be supplied to the grid.

As to the option of a*dditional other renewable power generation*, it is not a feasible option at the project site as analyzed in Alternative 2.

Alternative 5: This alternative doesn't face any prohibitive barriers except the poor economic returns, so it will be further analyzed in Step 5 with investment analysis.

Alternative 6: The extracted CMM of the proposed project activity cannot be directly fed into gas pipeline, because the calorific value of the extracted CMM is much lower than the standard requirement of gas pipeline. According to Natural Gas Standard (GB17820-1999)[28], in China, the gas pipeline requires that the calorific value of the gas fed into the pipeline must be higher than 31.4MJ/m^3 for both domestic and industrial users. The calorific value of the coalmine methane with a concentration around 40.8% is about 16.24MJ/m^3, which is much lower than 31.4MJ/m^3 of the standard requirement, and only the coalmine methane with a concentration around 97.8% would have a calorific value of 38.93MJ/m^3[29]. The methane concentration of the proposed project is below 30%, so its calorific value should be much lower than the standard requirement and thus, the CMM extracted in this project cannot be directly fed into gas pipeline.

Besides, according to the *Progress of Recovery of Low Concentration Coal Mine Methane*[30], various methods of low concentration CMM purification are still under development and not mature for commercial operation. Furthermore, there is no municipal pipeline connection in place which can be evidenced by the validator during on-site visit. Local residents living in the vicinity of the mines are nearly all farmers and they are located dispersedly. Thus, *feed into gas pipeline (to be used as fuel for vehicles or heat/power generation)* is not technically feasible and Alternative 6 is excluded.

Alternative 7: The technical feasible options for CMM treatment are venting, additional grid power generation and captive power generation, but they are mutually contradictory, so it is impossible to define combinations of different CMM treatments for consideration. Therefore, Alternative 7 is excluded.

On the basis of the above analysis, the possible baseline scenarios are **Alternative 1**, **Alternative 4** and **Alternative 5**.

Step 5: Identify most economically attractive baseline scenario alternative

According to the methodology ACM0008 (Version 07), if there are several baseline scenario candidates that do not face barriers, Step 5 shall be performed to choose the economically most viable scenario as the baseline scenario.

As described in Step 5, to determine which of the remaining baseline scenario alternatives not prevented by any barrier is the most economically or financially attractive, and therefore, is a possible baseline

---

[28] http://www.docin.com/p-35497812.html

[29] http://news.stcn.com/content/2011-10/11/content_3642077.htm

[30] http://wenku.baidu.com/view/da33c365f5335a8102d2201a.html

scenario, Step 2 (investment analysis) of the Tool for the demonstration and assessment of additionality shall be used to identify the most plausible baseline scenarios by eliminating options which are clearly economically unattractive.

Investment comparison analysis

Investment comparison analysis defined in Step 2 of the Tool for the demonstration and assessment of additionality is used to identify the most economically attractive baseline scenario. NPV is chosen to be an indicator of financial performances of each alternative scenario. All input values of Alternative 4 and Alternative 5 are the same as sourced from FSR except for the feed-in tariff as shown in Table B.5. Feed-in tariff of Alternative 4 is 0.492RMB/kWh as calculated in Step 4. Suitability of all these input values will be further presented in Section B.5. Besides, as additional grid power generation would need extra investment on transformers / transmission lines / etc., it is conservative to use the same static total investment (total equity) as additional captive power generation.

Table B.5 NPV calculations of each alternative scenario[31]

Parameter	Alterntaive 1	Alternative 4	Alternative 5
Static total investment (Total equity)	0	32,609,900 RMB	32,609,900 RMB
Investment horizon	11 years	11 years	11 years
Annual O&M cost	-	1,708,800 RMB	1,708,800 RMB
Power supply	-	27,805 MWh	27,805 MWh
Power sales price	-	0.492RMB/kWh (incl. VAT)	0.46RMB/kWh (incl. VAT)
Avoided cost by waste heat recovery (Heating revenues)	-	1,719,417.49 RMB	1,719,417.49 RMB
VAT rate	-	17%	17%
Urban construction & education tax	-	8%	8%
Income tax rate	-	25%	25%
Discount rate after tax	15%	15%	15%
NPV	**0RMB**	**-2,189,145.53RMB**	**-4,644,423.55RMB**

From Table B.5, we can see that NPV of **Alternative 1:** the combination of *Option D:* Continuation of current practice, combinations of VAM, pre-mining underground CMM drainage and post-mining underground CMM drainage for CMM extraction, *Option i:* Continuation of current practice, i.e. venting for CMM treatment, and *Option b:* Continuation of current practice, i.e. import of electricity from the public electricity grid and heating supplied by existing coal-fired boilers for energy production is the best, so it's the most economically attractive baseline scenario alternative.

Therefore, the baseline scenario of the proposed project is **Alternative 1**: *Option D* for CMM extraction, *Option i* for CMM treatment, and *Option b* for energy production.

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):

[31] Calculation spreadsheet is provided to DOE.

The influence of the CDM registration on the project

Registration of the project as a CDM project would result in additional revenues for the project. It will raise the IRR for the project from 10.74% to above the 15% benchmark, which will improve the financial and economic situation and improve the economic attractiveness of the project, significantly accelerating the development of the project.

The project entity was aware of the CDM incentive before the start of project activity. The key events of the implementation of the project activity are as below, which indicate that CDM is a key factor for investment decision.

Table B.6 Timeline of the key events of the project activity implementation and CDM consideration

Time	Project Event	CDM Action	Evidence
April 3rd 2008		Preliminary conclusion of financial analysis was provided to the project owner from Design Institute, which stated that the project IRR without CER revenues was below the benchmark while with CER revenues was well above it	IRR result report letter
April 8th 2008		Board decision of investment and CDM development for the project	Board meeting minutes
April 2008	Finalization of the FSR, in which additional revenues from the CDM were taken into consideration		FSR
May 15th 2008		Signed the CDM Development Contract	The contract
May 26th 2008	The project was filed at Baiyin DRC		Approval
June 2008	Finalization of the EIA		EIA report
June 2nd 2008	Signed the equipment purchase contract – **Start date**		The contract
June 20th 2008	Signed the equipment installation contract		The contract
June 23th 2008	Got approval of EIA		Approval of EIA
June 27th 2008	Signed the construction contract		The contract
July 1st 2008	The commencement of construction activity		The contract
November 26th 2008	The test operation of power units in the first coal mine		Agreement
December 17th 2008		The buyer showed its intention to buy the CER of the project	Email exchange record
January 6th 2009		A new ERPA was required by the CDM consultant for PO	Email exchange record
January 25th 2009	Project commissioning		The operation record
March 3rd 2009		Project questionnaire was sent to the PO for local residents’	Email exchange record

		comments collection	
March 23rd 2009		The development schedule agreement was requested by PO to the CDM consulting company	The project development schedule agreement
March 29th 2010		ERPA signed	ERPA
July 5th 2010		Submitted for host country DNA approval	NDRC notification
September 30th 2010		Obtained the host country DNA approval	NDRC LoA
November 3rd 2010		DOE on site CDM validation	

The additionality of the project activity is demonstrated using the steps described in the 'Tool for the demonstration and assessment of additionality'.

Reference: See UNFCCC Website:
http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

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

In accordance with ACM0008, this step is skipped.

Step 2. Investment analysis

Sub-step 2a: Determine appropriate analysis method

The analysis will be analyzed through Option III of the additionality tool, i.e. benchmark analysis. This method is applicable because:

- Option I: simple cost analysis, does not apply as the project generates economic returns through the displacement of electric power from the grid.
- Option II: investment comparison analysis is in the case of the proposed project activity not appropriate as the alternative is continuation of the current situation (venting and import of electricity from public grid) which is not an investment, so investment comparison approach cannot be used.
- Option III, benchmark analysis can be transparently demonstrated using financial/economic information for the proposed project activity and compare financial indicators against a relevant industry benchmark hurdle rate.

Conclusion: We conclude that option III is applicable to the project activity as transparent data on the project activity and relevant industry benchmark is available.

Sub-step 2b: Option III: Apply benchmark analysis

The equity IRR (EIRR) benchmark for coal sector given in the *Economic evaluation method and parameters for project construction* is used in the investment analysis.

The project participant Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd. is wholly owned by Jingyuan Coal Group which is a state-owned coal production group with coal mining as its core business. Meanwhile, the investment of the proposed project is totally funded by Jingyuan Coal Group

without any loan and the project is built for captive purpose only. Besides, considering Annex 59 of EB 51 Report, "For projects in which the electricity was being produced for captive consumption the benchmark of the core business was considered to be appropriate, as the project was considered to be an investment in the operation of the core business.", the equity IRR (EIRR) benchmark for coal sector is suitable for the proposed project.

Therefore, the equity IRR benchmark after tax of 15%, which is stipulated in the *Economic evaluation method and parameters for project construction (version 3)* issued by the National Development and Reform Commission and the Ministry of Construction, is applicable and appropriate.

Sub-step 2c: Calculation and comparison of financial indicators

According to the industry benchmark, calculation and comparison of financial indicators is as follows:

(1) Basic parameters for calculation of financial indicators

Basic parameters for calculation of the equity IRR (EIRR) are presented in Table B.7. All the data are from Feasibility Study Report of Gansu Jingyuan Coal Mine Group Jieneng Thermoelectricity Company CMM Power Generation Project.

Table B.7. Parameters used in the calculation of the EIRR

Parameter	Data	Source
Total installed capacity	5.5 MW	FSR
Continuous available capacity per gas engine	420 kW	FSR
Number of total gas engines	11	FSR
Investment horizon	11 years (1 year construction)	FSR
Static total investment (Total equity)	32,609,900 RMB	FSR
Working capital	1,708,800 RMB	FSR
Annual power supply	27,805 MWh	FSR
Annual heating supply[32]	85.78 TJ	FSR
Heat converted to raw coal[33]	5,330 tonnes	Calculated
Annual Operation and Maintenance costs[34] (include VAT on raw materials and water)	5,503,500 RMB	FSR
Twenty thousand hours overhaul cost	3,300,000 RMB	FSR
Power price (include VAT)	0.46 RMB/kWh	FSR
Raw coal price (include VAT)	322.59 RMB/tonne	Actual price at the time of investment decision
Raw coal price (exclude VAT)[35]	275.72 RMB/tonne	Actual price at the time of investment decision
VAT rate	17%	FSR
Urban construction and maintain fees	5%	FSR
Educational surtax	3%	FSR
Income tax rate	25%	FSR
Residual value rate	5%	FSR
Depreciation rate[36]	9.5%	FSR
Expected CER price[37]	9 EUR /tCO_2e	Market price

[32] Normally in every year heating season only covers five months (8,760 hours*5/12=3,650 hours), but in order to be conservative heating supply with the full project operational hours of 6,500 hours is applied in the IRR calculation.

[33] NCV of raw coal: 5000 kcal/kg or 20.90MJ/kg from China Energy Statistical Yearbook 2008; efficiency of coal-fired boilers 77% from General specification for industrial boilers (JB/T 10094-2002)

[34] The project owner, Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd. is a wholly-owned subsidiary of Jingyuan Coal Group. Therefore, the CMM is obtained for free.

[35] As the waste heat recovered is used to displace heating that would have been provided by coal-fired boilers also owned by the project owner, the actual revenue of heating supply is based on the avoided cost of raw coal consumption.

[36] The 5% residual value rate is legal according to "The Implementation of the Enterprise Income Tax Law of the People's Republic of China (1994)", refer to http://www.chinaacc.com/new/63/67/84/1993/12/ad22761730111722139917400.htm. The depreciation period for production equipments is 10 years, according to the latest Income Tax Law in 2008. Please refer to http://www.cpasz.com/qiyesuodeshui/xinqiyesuodeshuifa.htm. The operation period of the project is 10 years, therefore the depreciation rate of the project is (100%-5%)/10=9.5%.

[37] The exchange rate of Euro to CNY is 8.4.

Table B.8 Breakdown of static total investment (total equity) (unit: RMB)

Parameter	Data	Source
Civil construction	1,067,000	FSR
Equipment and auxiliaries purchase	20,445,000	FSR
Installation	7,840,000	FSR
Miscellaneous cost	1,705,000	FSR
Contingency cost	1,552,900	FSR
Total	**32,609,900**	**FSR**

Table B.9 Breakdown of annual operation maintenance costs[38] (unit: RMB)

Parameter	Data	Source
Expenditure on raw materials (include VAT)	938,100	FSR
Expenditure on water (include VAT)	402,200	FSR
Salary & Welfares	2,690,500	FSR
Repair costs	1,472,700	FSR
Total	**5,503,500**	**FSR**

(2) Comparison of the EIRR for the proposed project activity and the industry benchmark

According to benchmark analysis, the proposed project will not be considered as financially attractive if its EIRR is lower than the industry benchmark.

The main calculation results of the proposed project are summarized in Table B.10.

Table B.10 Main calculation results of the EIRR calculation

Scenario	EIRR
EIRR without revenues from the sale of CERs	10.74%
Benchmark	15%
EIRR with CER revenues[39] (at 9 EUR / tCO_2)	28.12%

From Table B.10, we can conclude that without the CDM revenues, the EIRR of the proposed project is 10.74%, below the benchmark of 15%, making the project economically and financially unattractive. While with CDM revenues, the EIRR of the proposed project is 28.12% higher than the benchmark of 15%, making the project economically and financially attractive. Therefore, CDM revenue is an essential condition to complete the project.

Sub-step 2d: Sensitivity analysis

The tool for the demonstration and assessment of additionality requires that a sensitivity analysis is conducted to check whether, under reasonable variations in the critical assumptions, the results of the analysis remain unaltered. We have used as critical assumptions:

- Static total investment (total equity)
- O&M costs
- Annual power supply

---

[38] The CMM gas is obtained from the coal mines for free.

[39] As the project started commissioning from 2009 and there is no CDM revenues for the first three years, only CDM revenues of seven years is taken into account for the equity IRR calculation with CDM revenues.

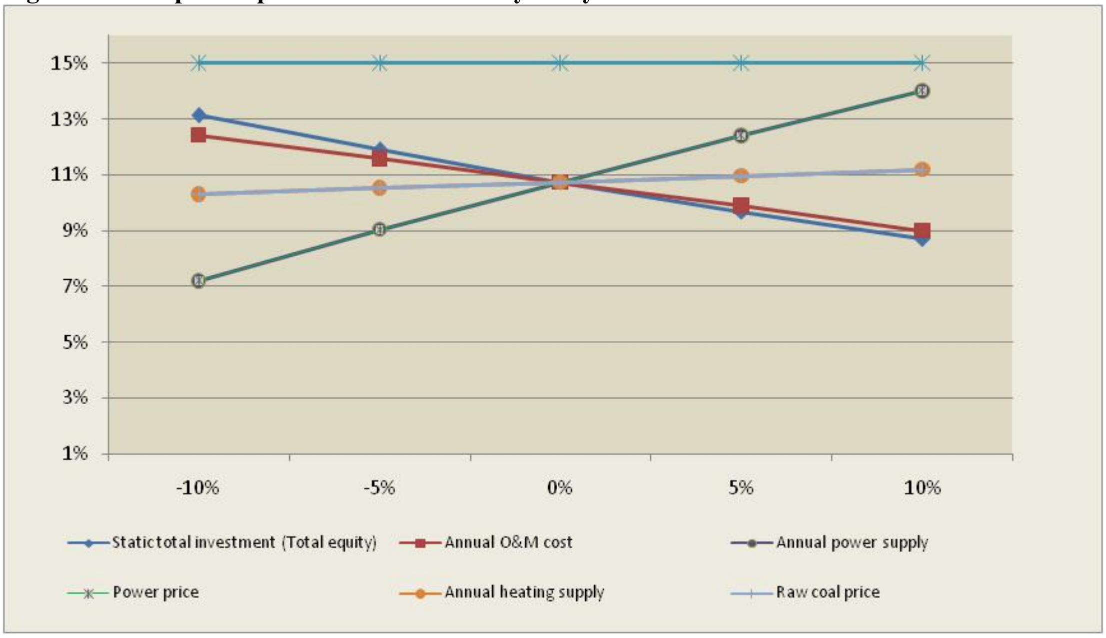
- Power price
- Annual heating supply
- Raw coal price

Variations of ±10% have been considered in the critical assumptions. Table B.11 summarizes the results of the sensitivity analysis, while Figure B.2 provides a graphic depiction.

Table B.11 Results of the sensitivity analysis – impact of variations in critical assumptions on EIRR

Percentage Variation / Critical assumption	-10%	-5%	0%	+5%	+10%
Static total investment (total equity)	13.13%	11.89%	10.74%	9.69%	8.71%
Annual O&M costs	12.43%	11.59%	10.74%	9.89%	9.01%
Annual power supply	7.20%	9.04%	10.74%	12.39%	14.00%
Power price	7.20%	9.04%	10.74%	12.39%	14.00%
Annual heating supply	10.29%	10.52%	10.74%	10.97%	11.19%
Raw coal price	10.29%	10.52%	10.74%	10.97%	11.19%

Figure B.2 Graphic depiction of the sensitivity analysis



From the Table B.11 and Figure B.2, we can see that without CDM revenues and when the six key parameters vary in certain ranges, the EIRR of the project will vary to some extent but still below the benchmark of 15% for projects in the coal mine industry.

<u>**Critical analysis of the four parameters**</u>

Critical point of each parameter is listed as below when the EIRR meets benchmark.

Parameter	Increase or decrease when the EIRR meets 15% (Critical point)
Static total investment (total equity)	-16.7%
Annual O&M cost	-25.8%
Annual power supply	13.2%
Power price	13.2%
Annual heating supply	98.0%
Raw coal price	98.0%

The suitability of input values

- *Static total investment (Total equity)*
  If parameters are adjusted to make the project reach the benchmark, the static total investment (total equity) should at least be reduced by 16.7%. The signed equipment contract, installation contract and construction contract has already cost 98% of the estimated static total investment in the FSR, 31,920,616RMB. Please refer to the below table.

Parameter	Data (Unit: RMB)	Source
Civil construction	1,630,000	Contract
Equipment and auxiliaries purchase	20,051,000	Contract
Installation	10,239,616	Contract
Total	**31,920,616**	

  So a decrease of 16.7% in static total investment (total equity) is unrealistic and that the equity IRR was not likely to reach the 15% benchmark by the static total investment (total equity) decrease.

- *Annual O&M costs*
  The results of the sensitivity analysis mean that only when the project incurs an O&M cost 25.8% less than the estimated O&M costs, the equity IRR of the project would reach 15%. The actual O&M cost in 2009 is 6,221,000RMB[40], which is 13% higher than the estimated value in the FSR. Considering the increasing prices of raw materials and the growing salaries of staff, the O&M costs would not decrease at all, not let alone drop by 25.8%.

- *Annual power supply*
  Annual power supply is relevant to operation hours. In case of the proposed project, the estimated operation hours is 6,500hrs/yr. The operation situation of CMM power plant depends on the coal production (CMM quantity) and methane concentration (CMM quality), which makes the output of CMM power plant variables and unstable, so the operation hours of CMM power plant could not be much higher than the regular thermal power plant. According to the *China Electric Power Yearbook 2008,* the average operation hours of thermal power plants in China is 5,344hrs/yr. On the other hand, according to the operational records of 2010[41], the actual operational hours of the project in 2010 is 6,307 hours and the actual power supply of the year is 25,169,712kWh, lower than the estimated value in the FSR 27,805,000kWh. In addition, the auxiliary consumption rates of power generation fuelled by CMM from Dashuitou mine and Weijiadi mine are 8.59% and 6.69% respectively in 2010. Both are higher than the estimated value in the FSR, 8.5% for Dashuitou and 6.5% for Weijiadi. Moreover, the annual power supply of the proposed project estimated in the FSR has to be increased

[40] Evidence is provided to DOE.

[41] Evidence is provided to DOE.

by 13.2%, which means the operation hours has to be increased to 7,358 hours/yr in order to make the equity IRR reach the benchmark. However this value is impossible because it is almost a whole year, which is not realistic to the CMM power plant. Therefore, it can be concluded that the estimated annual power supply in the FSR is reasonable and reliable.

- *Power price*
  The project owner of the proposed project activity Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd. is a wholly-owned company of Jingyuan Coal Group. Although the estimated power price 0.46RMB/kWh in the FSR is applied in the equity IRR calculation of the PDD, as all electricity generated by the proposed project is supplied to Jingyuan Coal Group to displace the electricity that would have been purchased from the Northwest China Power Grid in the baseline scenario, the actual returns on the investment should be based on the avoided power price of the displaced electricity, i.e. the power price at which Jingyuan Coal Group would purchase electricity from Gansu power grid, which is part of NWCPG. When the project investment was decided, the grid power purchase power price in Gansu was 0.4064 RMB/kWh (VAT incl.)[42]. With this avoided grid power price, the equity IRR of the proposed project is 6.57% without revenues from CDM, while with CDM revenues, the equity IRR would become 25.57%. The grid power purchase power price in Gansu province is 0.4706 RMB/kWh (VAT incl.)[43] from December 2011 onwards, even with which, the equity IRR will become 11.51%, still much lower than the benchmark.

  Besides, only with the FSR power price increasing by 13.2% to 0.52072 RMB/kWh (VAT incl.) throughout the whole project lifetime, the equity IRR would reach the benchmark. However, the grid power purchase power price is increased from 0.4064 RMB/kWh (VAT incl.) to 0.4706 RMB/kWh (VAT incl.) in 3.5 years (06/2008-12/2011). The yearly increasing tendency is 4.28%. With this yearly increase on the basis of 0.4064 RMB/kWh (VAT incl.) in 2008, the equity IRR is 13.18%, still lower than the benchmark. But in China, power price is relatively stable and regulated strictly by the government, so such year-by-year price increase is not possible to happen.

  Hence, it can be concluded that the FSR power price applied in the equity IRR calculation is conservative and credible.

- *Avoided cost by waste heat recovery*
  Waste heat boilers will be installed to capture the sensible heat contained in the exhaust gas released from gas engines to supply heating to staff households in the mining area. The heating generation is based on the sensible heat contained in the exhaust gas and the efficiency of the waste heat boilers. Based on the waste heat recoverable per unit in one hour given in the FSR, annual 6,500 operational hours (to be conservative, normally in every year heating season only covers five months) and 100% efficiency of waste heat boilers (to be conservative, the actual efficiency of the waste heat boilers is only 72.3%), the heating supply produced by waste heat recovered from the 11 gas engines is 85.78TJ. As the recovered heat is used to displace heating that would have been provided by coal-fired boilers also owned by the project owner, the actual revenue of heating supply is based on the avoided cost of raw coal consumption. Therefore, the avoided coal consumption is calculated based on heating supply, NCV of raw coal (5000kcal/kg or 20.90MJ/kg from China Energy Statistical Yearbook 2008) and efficiency of coal-fired boilers (77% from General specification for industrial

[42] http://jgs.ndrc.gov.cn/jggs/dljg/W020080703417914440162.PDF

[43] http://www.12398.gov.cn/login//uploadfile/71904521-8/2011/20111220174929680.doc

boilers (JB/T 10094-2002)) and the annual avoided raw coal consumption is 5,330 tonnes[44]. The heating revenues (avoided cost of coal consumption) exert very limited impact on equity IRR and only when the annual heating supply goes up by 98% throughout the whole project lifetime, the IRR could reach the 15% benchmark. This is obviously not possible at all.

Prior to the project, the PO used coal residue without commercial value to fuel the coal-fired boilers. As the price and NCV of the coal residue is difficult to determine, the PDD chose raw coal, for which price can be found on publicly accessible information and NCV can be found on the official China Energy Statistical Yearbook in the IRR calculation. When the project investment decision was made, the actual raw coal sales price was 275.72RMB/tonne (VAT excl.)[45]or 322.59RMB/tonne (VAT incl.), which is applied in the equity IRR calculation. Moreover, the heating revenues (avoided cost of coal consumption) exert very limited impact on equity IRR and only when the annual heating supply goes up by 98% to 638.72RMB/tonne (VAT incl.) throughout the whole project lifetime, the IRR could reach the 15% benchmark. However, the raw coal price is increased from 275.72RMB/tonne (VAT excl.) to 431.01RMB/tonne (VAT excl.)[46] in 4 years (2008-2011). The yearly increasing tendency is 11.82%. Even with such year on year increase on the basis of 275.72RMB/tonne (VAT excl.) in 2008, the equity IRR is 13.93%, still lower than the benchmark. But coal is a very important energy resource in China which has close correlation with national economy, so the government will make the price of coal relatively stable and not fluctuate too much. Therefore, it can be concluded that the raw coal price used in IRR calculation is reliable and conservative.

The sensitive analysis results show that the project faces serious economic and financial barriers without CDM revenues.

Step 3. Barrier analysis

Barrier analysis is not chosen for this project.

Step 4. Common practice analysis

As per the Tool for the demonstration and assessment of additionality (Version 06.1.0), a stepwise approach for common practice analysis is conducted as below.

<u>Stepwise approach for Common Practice</u>

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The proposed project involves utilization of CMM for electricity generation with a design installed capacity of 5.5MW, so the applicable output range of +/-50% of the design capacity of the proposed project is 2.75MW to 8.25MW.

---

[44] Calculation spreadsheet is provided to DOE.

[45] Evidence is provided to DOE.

[46] Same document as in Footnote 50.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of project.[47] Note their number N_{all}. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

Identification of applicable geographical area

Gansu Province is identified as applicable geographical area, which is appropriate due to the following reasons:

- Gansu province is an administrative region clearly delineated in the Chinese laws. In China, the policy and regulation framework is based on provincial level, refer to the CONSTITUTION OF THE PEOPLE'S REPUBLIC OF CHINA, article 99, "*Within the limits of their authority as prescribed by law, they adopt and issue resolutions and examine and decide on plans for local economic and cultural development and for the development of public services. Local people's congresses at and above the county level shall examine and approve the plans for economic and social development and the budgets of their respective administration areas and examine and approve the reports on their implementation.*" So provincial government (above county level) develops its own local regulations according to local situations, therefore regulatory framework and investment climate (such as plans for economic and social development) are different by province.
- The investment environment for each province in China is different. This is due to a variation of available natural resources (CMM reserve), the economic development level, the industrial structure, the fundamental infrastructure, development strategy and the policy framework;
- A number of key economic factors vary from province to province. These include tariff rates of products, the cost of materials, the cost of other utilities such as water, the cost of labor and services and the types of loan that can be obtained. These all vary between provinces.

Therefore, all CMM power generation projects with design installed capacity between 2.75MW to 8.25MW for electricity generation as calculated in Step 1 and having started commercial operation before the start date of the proposed project in Gansu Province should be identified, but registered CDM project activities and projects activities undergoing validation should not be included in this step. Number of all projects is N_{all}.

As checked with the Methane to Markets CMM projects database[48] and the Internet, the proposed project activity is the only operating CMM power generation project and the first low concentration CMM power generation project in Gansu Province and aims to demonstrate advanced CMM capture and utilization technologies within the region. Therefore, $N_{all}=0$.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

As $N_{all}=0$, $N_{diff}=0$.

---

[47] While identifying similar projects, project participants may also use publically available information, for example from government departments, industry associations, international associations, on the market penetration of different technologies, etc.

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

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

$F = 1- N_{diff}/N_{all} = 1 - 0/0$=N/A

According to the Tool for the demonstration and assessment of additionality (Version 06.1.0), the proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

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

For the proposed project, F=N/A and $N_{all}-N_{diff}=0-0=0<3$, therefore, the proposed project is **<u>not</u>** a "common practice".

It can be concluded from the additionality analysis that the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

In accordance with the ACM0008 methodology emission reductions are calculated as the difference between <u>baseline emissions</u> and <u>project emissions</u>. Below we present the key methodological steps for the calculation of project emissions, baseline emissions and emission reductions. Since the proposed project activity does not involve CBM/VAM utilization, flameless oxidation, flaring, heating (waste heat is used without the claim for emission reductions), use for additional heat generation and feed into gas pipeline (to be used as fuel for vehicles or heat/power generation), etc. The low concentration CMM is not utilized before the project activity. Therefore, equations, which are not applicable to the project are simplified and eliminated in this section.

Project emissions

In accordance with ACM0008, the project emissions are calculated as:

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad \textbf{(1)}$$

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).

Combustion emissions from additional energy required for CMM capture and use

Project emissions as a result of additional energy consumption are calculated as:

$$PE_{ME} = CONS_{ELEC,PJ} \times CEF_{ELEC} + CONS_{HEAT,PJ} \times CEF_{HEAT} + CONS_{FossFuel,PJ} \times CEF_{FossFuel} + PE_{FC,j,y} \quad \textbf{(2)}$$

Where:

- PE_{ME}, Project emissions from energy use to capture and use methane (tCO_2e)
- $CONS_{ELEC,PJ}$, Additional electricity consumption for capture and use of methane, if any (MWh)
- CEF_{ELEC}, Carbon emissions factor of electricity used by coal mine (tCO_2e/MWh)
- $CONS_{HEAT,PJ}$, Additional heat consumption for capture and use of methane, if any (GJ)
- CEF_{HEAT}, Carbon emissions factor of heat used by coal mine (tCO_2e/GJ)
- $CONS_{FossFuel,PJ}$, Additional fossil fuel consumption for capture and use of methane, if any (GJ)
- $CEF_{FossFuel}$, Carbon emissions factor of fossil fuel used by coal mine (tCO_2e/GJ)
- $PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year y. Calculated using the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion

The Extraction Station is operated under prior scenario to capture methane for the safe operation of the coal mine. There are no additional installations or fuel consumption to supplement, heat or pump CMM for power generation using methane. The CMM transportation from outlet of the extraction system to the CMM power plant is realized by the pressure produced by the extraction system without additional electricity usage. The captured CMM will be cleaned within the CMM power plant and the electricity consumed will be provided by the proposed project as part of auxiliary consumption. Therefore, there is no additional electricity consumed by the project on gas transportation and cleaning, and $PE_{ME}=0$.

Combustion emissions from use of captured methane

When the captured methane is destroyed through the various project end-uses it will release combustion emissions:

$$PE_{MD} = \left(MD_{FL} + MD_{OX} + MD_{ELEC} + MD_{HEAT} + MD_{GAS}\right) \times (CEF_{CH4} + r \times CEF_{NMHC}) \qquad \textbf{(3)}$$

Where:

- PE_{MD}, Project emissions from CMM destroyed (tCO_2e)
- MD_{ELEC}, Methane destroyed through power generation (tCH_4)
- MD_{FL}, Methane destroyed through flaring (tCH_4)
- MD_{OX}, Methane destroyed through flameless oxidation (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 (2.75 tCO_2e/tCH_4)
- CEF_{NMHC}, Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2e/tNMHC$)
- r, Relative proportion of NMHC compared to methane

The project only involves power generation; therefore the equation is simplified as

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

Emissions from the combustion of NMHC should be taken into account when NMHC concentrations account for more than 1% by volume of extracted CMM. When the concentration of NMHC exceeds the

1% threshold, combustion emissions of these gasses are calculated as:

$$r = PC_{NMHC} / PC_{CH4} \quad \textbf{(4)}$$

Where:

- PC_{CH4}, Concentration (in mass) of methane in extracted gas (%), measured on wet basis
- PC_{NMHC}, NMHC concentration (in mass) in extracted gas (%)

According to the gas sample analysis in the two coal mines, the NMHC concentration in the proposed project is less than 1% of the coalmine gas, thus the combustion emissions from non-methane hydrocarbons will be ignored. The concentration of NMHC in the two coal mines will be monitored annually to check whether its concentration is below or above 1% to determine whether NMHC combustion will be included in the project emissions.

The proposed project activity involves only the destruction of methane through combustion for power generation. Therefore, only the methane destroyed through power generation (MD_{ELEC}) is considered relevant. The equations for the calculation of emissions from methane destroyed through flaring, flameless oxidation, heat generation and supply to gas grid or vehicle use (equations 5, 6, 8 and 9) will therefore be skipped.

Methane destroyed through power generation is calculated as

$$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC} \quad \textbf{(5)}$$ [49]

Where:

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

Un-combusted methane from flaring and end uses

Not all methane used to generate power will be combusted and the emissions of un-combusted methane are calculated according to the following equation:

$$PE_{UM} = \left[GWP_{CH4} \times \sum_i MM_i \times \left(1 - Eff_i\right) \right] + PE_{flare} + PE_{OX} \times GWP_{CH4} \quad \textbf{(6)}$$ [50]

Where:

- PE_{UM}, Project emissions from un-combusted methane (tCO_2e)
- GWP_{CH4}, Global warming potential of methane (21 tCO_2e/tCH_4)
- i, Use of methane (power generation, heat generation, supply to gas grid to various combustion end uses)
- MM_i, Methane measured sent to use i (tCH_4)

[49] Consider as equation 7 in the methodology.

[50] Consider as equation 10 in the methodology.

- Eff_i, Efficiency of methane destruction in use i (%); taken as 99.5% from ACM0008
- PE_{flare}, Project emissions of non-combusted CH_4 expressed in terms of CO_2 from flaring of the residual gas stream (tCO_2e)
- PE_{OX}, Project emissions of non oxidized CH_4 from flameless oxidation of the VAM stream (tCH_4)

There is no flaring or flameless oxidation involved in the project. The equation is simplified as below:

$$PE_{UM} = \left[GWP_{CH4} \times \sum_i MM_i \times \left(1 - Eff_i\right) \right]$$

Baseline Emissions

Baseline emissions are calculated according to the following equation:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \qquad \textbf{(7)}$$ [51]

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, heat or supply to gas grid replaced by the project activity in year y (tCO_2e)

Methane destruction in the baseline

In the baseline scenario, the CMM involved in the proposed project activity is totally atmospheric released.

Therefore, we conclude that baseline emissions due to the destruction of methane are zero, i.e. $BE_{MD,y} = 0$.

Methane released into the atmosphere

This methane would have been emitted to the atmosphere in the baseline scenario, unless some capture and use activities form part of the baseline:

$$BE_{MRy} = GWP_{CH4} \times [\sum_i (CBMe_{i,y} - CBM_{BLi,y}) + \sum_i (CMM_{PJi,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y}) + \sum_i (VAM_{PJi,y} - VAM_{BLi,y})] \qquad \textbf{(8)}$$ [52]

---

[51] Consider as equation 11 in the methodology.

[52] Consider as equation 16 in the methodology.

Where:

BE_{MRy}	=	Baseline emissions from release of methane into the atmosphere in year *y* that is avoided by the project activity (tCO_2e)
i	=	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CBMe_{i,y}$	=	Eligible CBM captured, sent to and destroyed by use i in the project for year *y* (expressed in tCH_4)
$CBM_{BLi,y}$	=	CBM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in the year *y* (expressed in tCH_4)
$CMM_{PJi,y}$	=	Pre-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y* (expressed in tCH_4)
$CMM_{BLi,y}$	=	Pre-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year *y* (expressed in tCH_4)
$PMM_{PJi,y}$	=	Post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y* (tCH_4)
$PMM_{BLi,y}$	=	Post-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year *y* (tCH_4)
$VAM_{PJi,y}$	=	VAM sent to and destroyed by use i in the project activity in year *y* (tCH_4). In the case of flameless oxidation, $VAM_{PJ,i,y}$ is equivalent to MD_{OX} defined previously
$VAM_{BLi,y}$	=	VAM that would have been captured, sent to and destroyed by use i in the baseline scenario in year *y* (tCH_4)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)

CMM used in the project activity includes underground pre-mining CMM extraction, post-mining CMM extraction which would be released into the atmosphere in the baseline scenarios. The project does not utilize or destruct CBM and VAM. The equation is simplified as below:

$$BE_{MR,y} = GWP_{CH4} \times (CMM_{PJ,i,y} + PMM_{PJ,i,y})$$

In this project, pre-mining CMM and post-mining CMM will be sent to the same transportation system and finally to the proposed project for power generation and it is impossible to differ one from the other, so the total amount of the CMM sent to the proposed project for power generation ($MM_{ELEC,y}$) will be used in this calculation as below.

$$BE_{MR,y} = 21 \times MM_{ELEC,y} \quad \textbf{(9)}$$

Emissions from power generation

For emissions from displacing other energy forms, it is necessary to distinguish between emissions reductions derived from the use of CBM versus CMM, because CBM emissions reductions should only be credited once the mining area has intersected the zone of influence of the CBM well.

$$BE_{Use,y} = ED_{CBMw,y} + ED_{CBMz,y} + ED_{CPMM,y} \quad \textbf{(10)}^{53}$$

Where:

$BE_{Use,y}$ = Total baseline emissions from the production of power or heat replaced by the

[53] Consider as equation 24 in the methodology.

		project activity in year *y* (tCO_2)
$ED_{CBMw,y}$	=	Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence in year *y* (tCO_2)
$ED_{CBMz,y}$	=	Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence prior to year *y* (tCO_2)
$ED_{CPMM,y}$	=	Emissions from displacement of end uses by use of coal mine methane, VAM and post-mining methane (tCO_2)

As the proposed project will not involve the capture of either virgin or pre-mining CBM, all methane collected during the crediting period will be eligible to receive credits and $ED_{CBMw,y}$, and $ED_{CBMz,y}$, can be considered zero., so the equation is simplified as:

$$BE_{Use,y} = ED_{CPMM,y}$$

The total amount of methane captured, including pre and post mining CMM, in year *y* can in accordance with the ACM0008 methodology be calculated as:

$$CBMM_{tot,y} = CBM_{w,y} + CBM_{z,y} + CBM_{x,y} + CMM_{PJ,y} + VAM_{PJ,y} + PMM_{PJ,y} \qquad \textbf{(11)}$$[54]

Where:

- $CBMM_{tot,y}$, Total CBM and CMM captured and utilized by the project activity (tCH_4)
- $CBM_{w,y}$, CBM captured from wells where the mining area intersected the zone of influence in year y (tCH_4)
- $CBM_{z,y}$, CBM captured from wells where the mining area intersected the zone of influence prior to year y (tCH_4)
- $CBM_{x,y}$, CBM captured from wells where the mining area has not yet intersected the zone of influence in year y (tCH_4)
- $CMM_{PJ,i,y}$, Pre-mining CMM captured by the project activity in year y (tCH_4)
- $PMM_{PJ,i,y}$, Post-mining CMM captured by the project activity in year y (tCH_4)
- $VAM_{PJ,i,y}$, VAM captured by the project activity year *y* (tCH_4)

Again, as the project does not involve CBM or VAM, we determine that $CBM_{w,y}$, $CBM_{z,y,}$ $CBM_{x,y}$ and $VAM_{PJ,y}$ can be considered zero.

$$CBMM_{tot,y}=CMM_{PJ,y}+PMM_{PJ,y} \qquad \textbf{(12}^{\textbf{simplified from 11}}\textbf{)}$$

The total potential emissions reductions from displacement of power/heat generation and vehicle fuels are given by the following equation:

$$PBE_{Use,y} = GEN_{,y} \text{ x } EF_{ELEC} + HEAT_y \text{ x } EF_{HEAT} + VFUEL_y \text{ x } EF_V \qquad \textbf{(13)}$$[55]

Where:

$PBE_{Use,y}$	=	Potential total baseline emissions from the production of power or heat replaced by

[54] Consider as equation 25 in the methodology.

[55] Consider as equation 26 in the methodology.

		the project activity in year *y* (tCO_2e)
GEN_y	=	Electricity generated by project activity in year *y* (MWh), including through the use of CBM
EF_{ELEC}	=	Emissions factor of electricity (grid, captive or a combination) replaced by project (tCO_2/MWh)
$HEAT_y$	=	Heat generation by project activity in year *y* (GJ), including through the use of CBM
EF_{HEAT}	=	Emissions factor for heat production replaced by project activity (tCO_2/GJ)
$VFUEL_y$	=	Vehicle fuel provided by the project activity in year *y* (GJ), including through the use of CBM
EF_V	=	Emissions factor for vehicle operation replaced by project activity (tCO_2/GJ)

As the proposed project only utilizes CMM for electricity generation, baseline emissions from heat generation or vehicle fuel are considered as zero. The equation is simplified as below:

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

To identify the CBM/CMM that should receive credits in the year during which the gas is captured and used, the following formulae are used, assuming that CMM and CBM are used for various end uses in the same proportions as the overall supply for that year of different gas sources:

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y} + VAM_{PJ,y}}{CBMM_{tot,y}} \times PBE_{Use,y} \qquad \textbf{(14)}$$ [56]

Where:

$ED_{CPMM,y}$	=	Emissions from displacement of end uses by use of coal mine methane and post-mining methane (tCO_2e)
$CMM_{PJ,y}$	=	Pre-mining CMM captured by the project activity in year *y* (tCH_4)
$PMM_{PJ,y}$	=	Post-mining CMM captured by the project activity in year *y* (tCH_4)
$VAM_{PJ,y}$	=	VAM captured by the project activity in year *y* (tCH_4)
$CBMM_{tot,y}$	=	Total CBM CMM and VAM captured and utilised by the project activity in year *y* (tCH_4)
$PBE_{Use,y}$	=	Potential total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2e)

As the project does not involve the capture of CBM, these equations do not apply and all potential baseline emissions from the production of power replaced by the project activity are eligible to receive credits. Emissions from displacement of end use by use of coal mine methane and post-mining methane can be calculated as:

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y}}{CBMM_{tot,y}} \times PBE_{Use,y}$$

[56] Consider as equation 28 in the methodology.

As $CBMM_{tot,y}$ (total CBM and CMM captured and utilised by the project activity) is actually only composed of pre- and post-mining CMM, the equation can be simplified as:

$$ED_{CPMM,y} = PBE_{Use,y} \qquad \textbf{(15}^{\textbf{simplified from 14}}\textbf{)}$$

Calculation of the baseline Emission Factor ($EF_{CM,y}$)

For the calculation of Combined Margin CO_2 emission factor, $EF_{grid,CM,y}$ the methodology refers to the "Tool to calculate the emission factor for an electricity system". In accordance with this tool, the baseline emission factor is calculated as a combined margin: a weighted average of the operating margin (OM) emission factor and the build margin (BM) emission factor. Both the OM and BM emission factors are calculated *ex ante* and will not be updated during the crediting period.

The description below focuses on the key elements in the calculation of the published emission factors and the subsequent calculation of emission reductions. The full process of the calculation of the emission factors and all underlying data are presented in Annex 3 to this PDD.

This PDD refers to the Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor published by the Chinese DNA on July 2nd 2009. We will refer to these emission factors as the 'published emission factors'.

For more information on the published OM and BM emission factors, please refer to:
http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

- Calculation of OM: http://qhs.ndrc.gov.cn/qjfzjz/W020090703644238739485.xls
- Calculation of BM: http://qhs.ndrc.gov.cn/qjfzjz/W020090703644239079814.doc

Selection of values for net calorific values and CO_2 emission factors of various fuels.

As mentioned above, the Chinese DNA has entrusted key experts with the calculation of the grid emission factors. In these calculations choices have been made for the values of net calorific values and CO_2 emission factors. In the calculation files of the published emission factors, the net calorific values are based on the China Energy Statistical Yearbook, and the CO_2 emission factors are based on IPCC 2006 default values. The following table summarizes the values used. Note that the table lists the carbon emission factor of the fuels, while the CO_2 emission factor has been based on IPCC default values at the lower limit of the uncertainty at a 95% confidence interval. Rounded figures have been reported but exact figures have been used in the calculations in this PDD. The IPCC 2006 default carbon emission factors assume as a default value 100% oxidation in the combustion process. The calculation by the Chinese DNA and the calculations presented here follow the same approach by assuming complete combustion of the fuels. The 'Tool to calculate the emission factor for an electricity system' does not take into account oxidation rates, which is equivalent to assuming 100% oxidation.

Table B.12 Default values used for net calorific values and CO_2 emission factors of fuels

Fuel	Unit	NCV	CO_2 emission factor
		(TJ/unit)	(TCO_2e/TJ)
Raw coal	10^4 Tonnes	209.08	87,300
Clean coal	10^4 Tonnes	263.44	87,300
Other washed coal	10^4 Tonnes	83.63	87,300
Briquettes	10^4 Tonnes	209.08	87,300
Coke	10^4 Tonnes	284.35	95,700
Coke oven gas	10^8 m^3	1,672.60	37,300
Other gas	10^8 m^3	522.70	37,300
Crude oil	10^4 Tonnes	418.16	71,100
Gasoline	10^4 Tonnes	430.70	67,500
Diesel	10^4 Tonnes	426.52	72,600
Fuel oil	10^4 Tonnes	418.16	75,500
LPG	10^4 Tonnes	501.79	61,600
Refinery gas	10^4 Tonnes	460.55	48,200
Natural gas	10^8 m^3	3,893.10	54,300
Other petroleum products	10^4 Tonnes	418.16	75,500
Other coking products	10^4 Tonnes	284.35	95,700
Other E (standard coal)	10^4 Tonnes	0	0

Data source: All data are from the files mentioned above, and have been crosschecked against the original sources cited, as follows:

- Net calorific values: China Energy Statistical Yearbook, 2008 p. 284;
- CO_2 emission factors: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval; see 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 (energy).

Description of the calculation process

The key methodological steps according to the 'Tool to calculate the emission factor for an electricity system' are:

1. Identify the relevant electricity systems;
2. Choose whether to include off-grid power plants in the project electricity system (optional);
3. Select a method to determine operating margin (OM);
4. Calculate the operating margin emission factor according to the selected method;
5. Calculate the build margin (BM) emission factor, and;
6. Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electricity systems

The Chinese DNA has defined and published a delineation of the *project electricity system* and *connected electricity systems*. Therefore, in accordance with the above mentioned tool, this delineation is applied to the project activity. The project electricity system is defined as NWCPG.

Similarly, and following the delineation of the Chinese DNA, the connected electricity system is Central China Power Grid, as NWCPG exports electricity to the Central China Power Grid.

The project is connected to the Gansu Provincial Power Grid through local transformer station. The Gansu Provincial Power Grid is part of NWCPG, which includes Gansu, Shaanxi, Ningxia, Qinghai and Xinjiang power grids.

Electricity transfers from connected electricity systems to the project electricity system are defined as **electricity imports** and electricity transfers to connected electricity systems are defined as **electricity exports**.

For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system, as recent or likely future additions to transmission capacity would not enable significant increases in imported electricity.

For the purpose of determining the operating margin emission factor, we use "Option (b) The simple operating margin emission rate of the exporting grid, determined as described in Step 4 (a), if the conditions for this method, as described in Step 3 below, apply to the exporting grid" to determine the CO_2 emission factor for net electricity imports from a connected electricity system as the exporting grid meets the conditions for simple operating margin emission factor as described in Step 3 below.

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

Two options are provided in the "Tool to calculate the emission factor for an electricity system" to calculate the operating margin and build margin emission factor:

- **Option I:** Only grid power plants are included in the calculation.
- **Option II:** Both grid power plants and off-grid power plants are included in the calculation.

In China, off-grid plants are not significant as the power grids under government control are mainly responsible for supplying and dispatching electricity. According to the *China Electric Power Yearbook 2008*, the total power generation by off-grid power plants took up only 5.76% of the total power generation by grid power plants in NWCPG in 2007. Therefore, Option I is chosen for operating margin and build margin emission factor calculation.

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

Simple OM method (option a) is chosen as per the 'Tool to calculate the emission factor for an electricity system' since low-cost/must-run resources constitute less than 50% of total grid generation in average of the five most recent years. The proportion of low cost/must run in total electricity generation of NWCPG in 2003, 2004, 2005, 2006, and 2007 is 18.77%, 21.21%, 25.36%, 24.71%, and 21.95%[57] respectively.

Data vintage selection

In accordance with the 'Tool to calculate the emission factor for an electricity system', the OM is calculated according to the 'ex ante option' and the emission factor is determined once at validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, a three-year generation-weighted average is based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

Step 4. Calculate the operating margin emission factor according to the selected method

According to the Simple OM method, the OM emission factor is calculated as the generation-weighted average tCO_2 emissions per unit of net electricity generation (tCO_2/MWh) of all generating power plants

[57] China Electric Power Yearbook (editions 2004, 2005, 2006, 2007 and 2008)

serving the system, not including the low-cost/must-run power plants/units.

We calculate the OM emission factor according to Option B (based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system) of the Simple OM method, as

- Data required for Option A (based on net electricity generation and a CO_2 emission factor of each power unit) such as electricity generation, CO_2 emission factor for specific power plants/units serving the grid is not available to the public or to the project participants;
- According to the Chinese publicly available data such as China Electric Power Yearbook, nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
- Off-grid power plants are not included in the calculation (i.e. Option I has been chosen in Step 2).

Under Option B, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_y} \quad \text{(B.1)}$$

Where:

- $EF_{grid,OMsimple,y}$ is the simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh);
- $FC_{i,y}$ is the amount of fossil fuel type i consumed in the project electricity system in year *y* (in a mass or volume unit);
- $NCV_{i,y}$ is the Net Calorific Value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit);
- $EF_{CO2,i,y}$ is the CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ);
- EG_y is the net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh);
- i are all fossil fuel types combusted in power sources in the project electricity system in year *y*; and
- y is the three most recent years for which data is available.

For this approach (simple OM) to calculate the operating margin, the power plants delivering electricity to the grid don’t include low-cost/must-run power plants, but include electricity imports to the grid. Since NWCPG doesn’t import electricity from any other regional grids, electricity imports is zero. (For details, see Annex 3)

Choice of aggregated data sources

The published OM emission factor calculates the emission factor directly from published aggregated data on fuel consumption, net calorific values, power supply to the grid and IPCC default values at the lower limit of the uncertainty at a 95% confidence interval for the CO_2 emission factor.

Calculation of the OM emission factor as a three-year full generation weighted average

On the basis of these data, the Operating Margin emission factors for 2005, 2006 and 2007 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we refer to the publications cited above and the detailed explanation and demonstration of the calculation of the OM emission factor is provided in Annex 3. The Operation Margin Emission Factor is calculated as **1.0246** tCO_2e/MWh.

The calculation of the OM emission factor is done once (*ex ante*) and will *not* be updated during the crediting period. This has the added advantage of simplifying monitoring and verification of emission reductions.

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

Data vintage selection

In accordance with the 'Tool to calculate the emission factor for an electricity system', the BM is calculated according to Option I: For the first crediting period, the build margin emission factor is calculated ex-ante based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on most recent data available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

According to the 'Tool to calculate the emission factor for an electricity system', the sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

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

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});
Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation)

to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);
If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);
(f) The sample group of power units *m* used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{->}10yrs}$).

A direct application of this approach is difficult in China. The Executive Board (EB) has provided guidance on this matter with respect to the application of the AMS-1.D and AM0005 methodologies for projects in China on 7 October 2005 in response to a request for clarification by DNV on this matter. The EB accepted the use of capacity additions to identify the share of thermal power plants in additions to the grid instead of using power generation. The relevance of this EB guidance extends to the 'Tool to calculate the emission factor for an electricity system'. The calculation in Step 5 and the calculation of the published BM emission factor by the Chinese authorities are based on this guidance. The approach is explained below in step 5.

The Build Margin Emission Factor is, according to the 'Tool to calculate the emission factor for an electricity system', calculated as the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (B.2)$$

Where:
- $EF_{grid,BM,y}$ is the build margin CO_2 emission factor in year *y* (tCO_2/MWh);
- $EG_{m,y}$ is the net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh);
- $EF_{EL,m,y}$ is the CO_2 emission factor of power unit m in year *y* (tCO_2/MWh);
- m are the power units included in the build margin; and
- y is the most recent historical year for which power generation data is available.

The sample *m*, according to the methodology, should be over the latest 5 power plants added to the grid, or over the last added power plants accounting for at least 20% of power generation. We apply an indirect approach based on the EB decision as mentioned above.

First we calculate the newly-added installed capacity and the share of each power generation technology in the total capacity. Second, we calculate the weights of each power generation technology in the newly-added installed capacity.[58] Third, emission factors for each fuel group are calculated on the basis of an advanced efficiency level for each power generation technology and a weighted average carbon emission factor on the basis of IPCC default carbon emission factors of individual fuels.

Since the exact data are aggregated, the calculation will apply the following method: We calculate the share of the CO_2 emissions of solid fuel, liquid fuel and gas fuel in total emissions respectively by using the latest energy balance data available; the calculated shares are the weights.

Using the emission factor for advanced efficient technology we calculate the emission factor for thermal power; the BM emission factor of the power grid will be calculated by multiplying the emission factor of the thermal power with the share of the thermal power in the most recently added 20% of total installed capacity.

Detailed steps and formulas are as below:

First, we calculate the share of CO_2 emissions of the solid, liquid and gaseous fuels in total emissions respectively.

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \text{(B.3)}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \text{(B.4)}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \text{(B.5)}$$

Where:

- $F_{i,j,y}$ is the amount of the fuel *i* consumed in *y* year of *j* province (measured in a mass or volume unit);
- $NCV_{i,y}$ is the net calorie value of the fuel *i* consumed in *y* year (measured in GJ/mass or volume unit);
- $EF_{CO2,i,j,y}$ is the emission factor of fuel i (measured in tCO_2/GJ); and

[58] Newly added capacity is determined as follows. First, the latest year (2007) for which data on total installed capacity is available is identified. Then, the last year is identified in which the total installed capacity was below 80% of the total installed capacity in 2007. This defines “newly added capacity”. Note that this approach does not follow the EB decision in response to the DNV request as mentioned in the main text to the letter, but the approach taken is the one that has been followed in numerous PDDs since the EB decision.

- COAL,OIL and GAS subscripts stand for solid fuel, liquid fuel and gas fuel.

Second, we calculate the emission factor of the thermal power:

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

While $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ represent the emission factors of advanced coal-fired, oil-fired and gas-fired power generation technology, see detailed parameter and calculation in Annex 3.

Third, we calculate BM of the power grid:

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \cdot EF_{Thermal} \quad (B.7)$$

Where CAP_{Total} represents the total newly-added capacity and $CAP_{Thermal}$ represents newly-added thermal power capacity.

The λs are calculated on the basis of the weight of CO_2 emissions of each type of fuel in the total CO_2 emissions from thermal power. Subsequent calculation of the Build Margin emission factor yields a baseline emission factor of **0.6433** tCO_2e/MWh.

For details refer to Annex 3.

The calculation of the BM emission factor for the crediting period is done once (*ex ante*) and will *not* be updated during the crediting period. This has the advantage of simplifying monitoring and verification of emission reductions.

Step 6. Calculate the combined margin (CM) emission factor

The Baseline Emission Factor is calculated in accordance with the "Tool to calculate the emission factor for an electricity system" as the combined margin (CM) emission factor ($EF_{grid,CM,y}$), based on option a: weighted average of the Operating Margin and Build Margin.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot W_{om} + EF_{grid,BM,y} \cdot W_{BM} \quad (B.8)$$

Where:
- $EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
- $EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
- w_{OM} = Weighting of operating margin emissions factor (%)
- w_{BM} = Weighting of build margin emissions factor (%)

The "Tool to calculate the emission factor for an electricity system" provides the following default weights: w_{OM} = 0.5 and w_{BM} = 0.5.

We apply published data of 1.0246 for the Operating Margin Emission Factor and 0.6433 for the Build Margin Emission Factor. Applying the default weights and the published emission factors, a combined margin Baseline Emission Factor of **0.83395** tCO_2/MWh is calculated.

The Grid Power Emission Factor is calculated ex ante and will not be updated during the crediting period.

Leakage

Leakage of the proposed project activity is calculated as:

$$LE_y = LE_{d,y} + LE_{o,y} \qquad \textbf{(16)}$$

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)

Leakage emissions due to displacement of other baseline thermal energy uses of methane

As argued in Section B.4. there are no other baseline thermal energy uses of methane that do not face similar barriers as the proposed project activity. Therefore, no leakage as a result of other baseline thermal energy use will occur, i.e. $LE_{d,y} = 0$.

Leakage emissions due to other uncertainties

- **CBM drainage from outside the de-stressed zone:**
  The project entity does not involve the capture of either virgin or pre-mining CBM and therefore potential leakage due to CBM drainage outside the de-stressed zone is not relevant to the proposed project activity.
- **Impact of CDM project activity on coal production:**
  CMM is extracted in the baseline scenario and does not pose a restriction on the expansion of coal production at Jingyuan Coal Group. Therefore, the impact of CDM on coal production is negligible.
- **Impact of CDM project activity on coal prices and market dynamics:**
  According to ACM0008, it is not necessary to consider this possibility at this stage.

We conclude that no leakage due to other uncertainties applies to the proposed project activity, i.e. $LE_{o,y}=0$.

Emission reductions

The total emission reductions are defined as the difference between the baseline emissions and project emissions (and potential leakage effects) and calculated as:

$$ER_y = BE_y - PE_y - LE_y \qquad \textbf{(17)}$$

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)
- PE_y, project emissions during the year y (tCO_2e)
- LE_y, leakage emissions in year y (tCO_2e)

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

Data / Parameter:	**$CMM_{BL,i}$**
Data unit:	tCH_4
Description:	CMM that would have been captured, used and destroyed by use *i* in the baseline scenario in year y
Source of data used:	Data provided by project entity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	The captured CMM is totally released into the atmosphere unused under the baseline scenario. Hence, $CMM_{BL,y}$ is 0.
Any comment:	-

Data / Parameter:	**$PMM_{BL,i}$**
Data unit:	tCH_4
Description:	PMM that would have been captured, used and destroyed by use *i* in the baseline scenario in year y
Source of data used:	Data provided by project entity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	The captured PMM is totally released into the atmosphere unused under the baseline scenario. Hence, $PMM_{BL,y}$ is 0.
Any comment:	-

Data / Parameter:	**$CMM_{BL,\ i,y}$**
Data unit:	tCH_4
Description:	Pre-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y
Source of data used:	Data provided by project entity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	The captured CMM is totally released into the atmosphere unused under the baseline scenario. Hence, $CMM_{BL,i,y}$ is 0.

Any comment:	-

Data / Parameter:	**$PMM_{BL,i,y}$**
Data unit:	tCH_4
Description:	Post-mining CMM that would have been captured , sent to and destroyed by use i in the baseline scenario in year y
Source of data used:	Data provided by project entity
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The captured PMM is totally released into the atmosphere unused under the baseline scenario. Hence, $PMM_{BL,i,y}$ is 0.
Any comment:	-

Parameters used for the calculation of the Operating Margin (OM) and Build Margin (BM) Emission Factors in accordance with the “Tool to calculate the emission factor for an electricity system”:

Data / Parameter:	**$EG_{m,y}$, EG_y, $EG_{j,y}$, $EG_{k,y}$ and $EG_{n,h}$**
Data unit:	MWh
Description:	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Electric Power Yearbook (Editions 2006, 2007 and 2008)
Value applied:	For more detailed values see annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	Total amount of electricity supplied by power plants is used in the calculation of operating margin emission factor. The data of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently is used in calculation of build margin emission factor. For more detailed information, please see Section B6.1.

Data / Parameter:	**$\eta_{m,y}$ and $\eta_{k,y}$**
Data unit:	%
Description:	Average net energy conversion efficiency of power unit *m* or *k* in year *y*
Source of data used:	See the downloadable files mentioned above for the full data set. Data are based on the best technologies available in China.
Value applied:	Coal: 38.10%; Oil: 49.99%; Gas: 49.99%
Justification of the choice of data or description of	These data are the best data available, and have been published by the Chinese authorities.

measurement methods and procedures actually applied:	
Any comment:	-

Data / Parameter:	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i.n.h}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of $FC_{i,y}$) in year *y* or hour *h*
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Energy Statistical Yearbook (Editions 2006, 2007 and 2008)
Value applied:	For more detailed values see annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ / mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Energy Statistical Yearbook 2006, 2007 and 2008 editions
Value applied:	For detailed values see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	-

Data / Parameter:	$EF_{CO2,i,y}$ and $EF_{co2,m,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type i used in power unit m in year y
Source of data used:	IPCC default value at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter of “2006 IPCC Guidelines for National Greenhouse Gas Inventories” Volume 2 Energy
Value applied:	For more detailed values see annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	These data are the best data available, and have been published by the Chinese authorities.

Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

The estimated net power supply produced by the project activity is 27,805MWh annually, with 10,008,999 m^3, referring to 6,706 tonnes CH_4 consumed.

The total emission reductions are defined as the difference between the baseline emissions and project emissions (and potential leakage effects) and are calculated as:

$$ER_y = BE_y - PE_y - LE_y$$

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)
- PE_y, project emissions during the year y (tCO_2e)
- LE_y, leakage emissions in year y (tCO_2e)

Baseline emissions

Baseline emissions are calculated according to the equations presented in Section B.6.1. The calculation method is described below while Table B.13 provides a transparent overview of the projected parameters and the application of the formulae.

Methane released into the atmosphere in the baseline scenario:
The baseline emission from the release of methane into the atmosphere are calculated as:

$$BE_{MRy} = GWP_{CH4} \times \left[\sum_i (CMM_{Pji,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y}) \right]$$

Baseline emissions due to displacement of power
The potential baseline emissions due the displacement of fossil fuels for the generation of power in the baseline scenario is calculated in accordance with formula (24), repeated here:

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

Displacement of power:
In Section B.6.1 the emission factor for grid power is calculated as 0.83395tCO_2e/MWh. Therefore baseline emissions (I in Table B.11) are calculated as power supply by the project to the grid (G in Table B.11) multiplied by 0.83395tCO_2e/MWh.

Total baseline emissions are calculated as the sum of methane released into the atmosphere in the baseline scenario and baseline emissions due to displacement of power.

Table B.13 Ex-ante projections of baseline emissions in crediting period[59]

Year	Baseline emissions CMM venting ($CMM_{PJ,I,y}+ PMM_{PJ,I,y}$)			Baseline emissions of displaced captive power			Total
	A	B	C=A*B	D	E	F=D*E	G=C+F
	Baseline emissions (tCH_4)	Global Warming Potential	Baseline emissions (tCO_2e)	Annual net power supply GEN_y (MWh)	Emission Factor EF_{ELEC} (tCO_2e/MWh)	Baseline emissions (tCO_2e)	Total baseline emissions (tCO_2e)
1	6,706	21x	140,826	27,805	0.83395	23,188	164,014
2	6,706	21x	140,826	27,805	0.83395	23,188	164,014
3	6,706	21x	140,826	27,805	0.83395	23,188	164,014
4	6,706	21x	140,826	27,805	0.83395	23,188	164,014
5	6,706	21x	140,826	27,805	0.83395	23,188	164,014
6	6,706	21x	140,826	27,805	0.83395	23,188	164,014
7	6,706	21x	140,826	27,805	0.83395	23,188	164,014
8	0	21x	0	0	0.83395	0	0
9	0	21x	0	0	0.83395	0	0
10	0	21x	0	0	0.83395	0	0

[59] As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0.

Project emissions

Project emissions are calculated according to the equations presented in Section B.6.1. The calculation method is described below while Table B.12 provides a transparent overview of the projected parameters and the application of the formulae.

Total project emissions are calculated in accordance with equation (1) repeated here:

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

- **Combustion emissions from additional energy required for CMM capture and use (PE_{ME})**
  The Extraction Station is operated under prior scenario to capture methane for the safe operation of the coal mine. There are no additional installations or fuel consumption to supplement, heat or pump CMM for power generation using methane. The CMM transportation from outlet of the extraction system to the CMM power plant is realized by the pressure produced by the extraction system without additional electricity usage. The captured CMM will be cleaned within the CMM power plant and the electricity consumed will be provided by the proposed project as part of auxiliary consumption. Therefore, there is no additional electricity consumed by the project on gas transportation and cleaning, and $PE_{ME}=0$.
- **Combustion emissions from use of captured methane (PE_{MD})**
  Combustion emissions are calculated in accordance with equation (3), repeated here:
  $$PE_{MD} = MD_{ELEC} \times (CEF_{CH4} + r \times CEF_{NMHC})$$
  As the project only involves the destruction of methane through combustion in power generation equipment the combustion emissions (Q in Table B.12) can be calculated through the following steps:
  - Multiplying the volume of methane sent to power plant (N in Table B.12) by the oxidation factor of the power plant (O in Table B.12) which results in the volume of methane destroyed (MD_{ELEC}).
  - Multiplying the volume of destroyed methane by the carbon emission factor for methane (P in Table B.12) as the concentration of non-methane hydro carbons is lower than 1% and can therefore be ignored (note that the concentration is monitored and will be taken into account if the concentration exceeds the 1% threshold).
  $$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$$
  The efficiency of methane destruction/oxidation in power plant is taken as 99.5% from IPCC.
- **Un-combusted methane from flaring and end uses (PE_{UM})**
  Emissions from methane which is not destroyed through combustion is calculated in accordance with equation (9), repeated here:
  $$PE_{UM} = \left[GWP_{CH4} \times \sum_i MM_i \times (1 - Eff_i) \right] + PE_{flare}$$
  As the project does not involve the installation of flaring equipment, the emissions can be calculated by multiplying the volume of methane sent to power plant (N in Table B.12) by the fraction of methane which is not oxidized (1 minus oxidation factor of the power plant, i.e. 1-O in Table B.12) and the Global Warming Potential of methane (R in Table B.12).

Total project emissions are calculated as the sum of *Combustion emissions from use of captured methane* (Q in Table B.12) and *Un-combusted methane from flaring and end uses* (S in Table B.14).

Table B.14 Ex-ante projection of project emissions in crediting period[60]

Year	Project emissions from CMM destroyed				Project emissions from un-combusted methane		Total
	N	O	P	Q = N*O*P	R	S = N*(1-O)*R	T=Q+S
	Methane sent to power plant MM_{ELEC} (tCH_4)	Oxidation in power plant Eff_{ELEC} (%)	Emission factor of methane CEF_{CH4} (tCO_2e/tCH_4)	Project emissions PE_{MD} (tCO_2e)	Global Warming Potential	Project emissions PE_{UM} (tCO_2e)	Total project emissions PE_y (tCO_2e)
1	6,706	99.5%	2.75	18,349	21x	704	19,053
2	6,706	99.5%	2.75	18,349	21x	704	19,053
3	6,706	99.5%	2.75	18,349	21x	704	19,053
4	6,706	99.5%	2.75	18,349	21x	704	19,053
5	6,706	99.5%	2.75	18,349	21x	704	19,053
6	6,706	99.5%	2.75	18,349	21x	704	19,053
7	6,706	99.5%	2.75	18,349	21x	704	19,053
8	0	99.5%	2.75	0	21x	0	0
9	0	99.5%	2.75	0	21x	0	0
10	0	99.5%	2.75	0	21x	0	0

[60] As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0.

Leakage

Section B.6.1 discusses potential leakage effects and we concluded that the project does not involve leakage which is therefore assumed to be zero.

Emission reductions

The emission reductions due to the proposed project activity can be calculated as the difference between baseline emissions and project emissions minus leakage:

$$ER = BE_y - PE_y - LE_y$$

Therefore for the first crediting year, the emission reductions are calculated as follows:

$$ER = 164{,}014 - 19{,}053 - 0 = 144{,}961 tCO_2e$$ [66]

For a full overview of emission reductions during the crediting period see Table B.13 in Section B.6.4.

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

Table B.15 Ex ante estimate of emission reductions due to the project[67]

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Year 1	19,053	164,014	0	144,961
Year 2	19,053	164,014	0	144,961
Year 3	19,053	164,014	0	144,961
Year 4	19,053	164,014	0	144,961
Year 5	19,053	164,014	0	144,961
Year 6	19,053	164,014	0	144,961
Year 7	19,053	164,014	0	144,961
Year 8	0	0	0	0
Year 9	0	0	0	0
Year 10	0	0	0	0
Total (tonnes of CO_2e)				**1,014,727**

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

---

[66] 144,961tCO_2e is the ERs estimation on one year basis other than an annual average ERs over the ten year crediting period. As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0 and the annual average ERs over the ten year crediting period is 101,472tCO_2e.

[67] As the project started commissioning from 2009 and would have a lifetime of 10 years, the project will not generate any emission reductions after 10 years since 2009, even though the PP chose a fixed crediting period of 10 years. Therefore, for the last three years of the crediting period, the estimation of emission reductions is 0.

B.7.1 Data and parameters monitored:

Data / Parameter:	MM_{ELEC}
Data unit:	tCH_4
Description:	Methane measured delivered to power plant
Source of data to be used:	Calculated based on metered CMM flow, concentration and methane density
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6,706
Description of measurement methods and procedures to be applied:	In order to calculate the amount of methane sent to power engines the following parameters will be measured: • Concentration of methane in coalmine gas (measured by gas concentration meter) • Volume of coalmine gas (measured by gas flow meter which will record gas volume, pressure and temperature) Density of methane under normal conditions of temperature and pressure is $0.67kg/m^3$ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16) **Recording frequency:** Recorded monthly and aggregated annually
QA/QC procedures to be applied:	The instruments will be subjected to regular maintenance and calibration in accordance with industry standards.
Any comment:	-

Data / Parameter:	PC_{CH4}
Data unit:	%
Description:	Concentration (in mass) of methane in extracted gas (%)
Source of data to be used:	Directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	< 30%
Description of measurement methods and procedures to be applied:	The concentration of methane in extracted gas will be measured through gas analyzer. **Recording frequency:** Recorded monthly and aggregated annually
QA/QC procedures to be applied:	The instruments will be subject to regular maintenance and calibration.
Any comment:	See section B.7.2 for details

Data / Parameter:	PC_{NMHC}
Data unit:	%
Description:	NMHC Concentration (in mass) in extracted gas (%)
Source of data to be	Data used are obtained from analysis reports.

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<1%
Description of measurement methods and procedures to be applied:	The concentration of NMHC will be measured on an annual basis, by taking gas samples at the Weijiadi and Dashuitou pumping stations and submitting these samples to a third party laboratory with relevant qualifications. **Recording frequency:** Annually
QA/QC procedures to be applied:	The concentration of NMHC will be determined by a qualified third party laboratory. The analysis reports and qualification certificates of the laboratory will be made available to the verifier.
Any comment:	-

Data / Parameter:	CEF_{NMHC}
Data unit:	$tCO_2eq/tNMHC$
Description:	Carbon emission factor for combusted non methane hydrocarbons (various)
Source of data to be used:	Analysis report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not accounted as concentration of NMHC is below 1%
Description of measurement methods and procedures to be applied:	The concentration of NMHC will be measured on an annual basis, by taking gas samples at the Weijiadi and Dashuitou pumping stations and submitting these samples to a third party laboratory with relevant qualifications. And the CEFNMHC will be determined based on the analysis. **Recording frequency:** Annually
QA/QC procedures to be applied:	-
Any comment:	To be obtained through periodical analysis of the fractional composition of captured.

Data / Parameter:	GEN_y
Data unit:	MWh
Description:	Net electricity supplied to the grid by the project (which is the difference between the electricity supplied by the proposed project to the internal grid that is connected to the NWCPG and electricity delivered from the NWCPG to the proposed project)
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	27,805

Description of measurement methods and procedures to be applied:	Both electricity supplied by the proposed project to the internal grid which is connected to the NWCPG and electricity delivered from the NWCPG to the proposed project will be metered by electric meters. The electric meters are bidirectional. And the net electricity supply to the internal grid which is connected to the NWCPG is the difference between the two measurements. The measurements will be metered and manually logged. **Recording frequency:** Monthly
QA/QC procedures to be applied:	The metering instruments will be calibrated annually in accordance with the *Technical Administrative Code of Electric Energy Metering (DL/T448-2000)*.
Any comment:	See section B.7.2 for details

B.7.2 Description of the monitoring plan:

Monitoring is the key step to verify the exact emission reductions of the project. In order to achieve real, measured and long-time GHG emission reductions, the monitoring plan of the project is formulated.

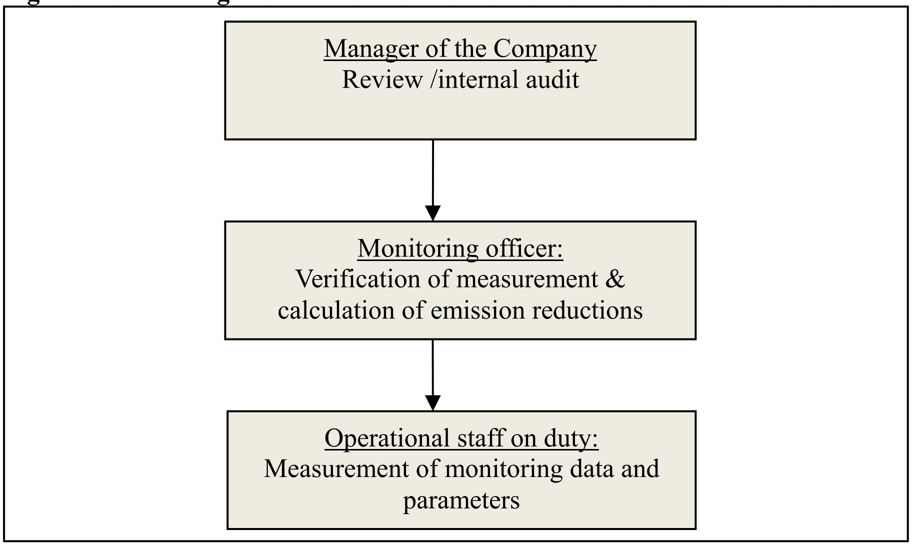
1. OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure B.3. The manager of the company will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the electrical energy supplied to the internal grid and reporting of daily operations, which will be carried out by the operational staff on duty.

The project owner will appoint a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the internal grid to the CMM power generation plant and the calculation of the emission reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the CMM power generation station including operating periods, power generation; power delivered to the internal grid, equipment defects, etc. Also the monitoring manager will be responsible for aggregating the monitoring data monthly and yearly, and for archiving it and keeping it during the whole crediting period and two years after the period. Finally, the monitoring reports will be reviewed by the manager of the company.

The project entity will conduct maintenance of metering instruments periodically as well as oversee them so that instruments are not damaged. Maintenance records will be formulated.

Figure B.3. Management structure in order to monitor emission reductions



Quality control and quality assurance (QC/QA) procedures

The whole CDM team will establish a quality management system, which ensures the quality and accuracy of the measured data, including corrective measures in case of non-conformity. The quality management system will include:

Data records

Data from all meters should be collected and entered in electronic worksheets, and recorded daily. The data will be checked by the operational staffs daily and stored in storage disk after the check. The monitoring officer will send the measurement table of the previous month to the manager for management every month. Periodic controls of the field monitoring records will be carried out to check any deviations from the estimated ERs following the guidelines for operation and monitoring for correction or future references.

Data evaluation

The whole CDM team will follow the main criteria, such as use and strict adherence to recognized standard methods, use of non-standard methods only after approved validation, use of standard reporting forms including process measures as well as emission data, etc. to guarantee that the data is reliable and accurate.

Equipment calibration and maintenance

Flow meters, gas analyzers and other critical CDM project equipment will be subject to regular maintenance and testing according to technical specifications from the manufacturers to ensure accuracy and good performance.

Calibration of equipment will be conducted periodically according to their technical specifications.

Corrective actions

The quality control and quality assurance procedures include the handling and correction of nonconformities in the implementation of the project or the monitoring plan. In case such nonconformities are observed:

- An analysis of the nonconformity and its causes will be carried out immediately by the CDM manager, with the help of other colleagues or external experts if necessary;
- A corrective action plan should then be developed to eliminate the non-conformity and its causes;
- Corrective actions are implemented and reported back to the CDM Manager and the General Manager;
- Relative information will be included in the monitoring report and reported to DOE during the verification.

Emergency procedures

In case of equipment malfunction or breakdown, corrective actions will be carried out to minimize the unintended emissions. In case of CMM meter failure, gas consumed by power engines will not be claimed for ERs. The time of failure will be recorded by the operator. In case of power meter failure, electricity supplied to the grid will not be claimed for ERs. The time of failure will be recorded by the operator.

Training of staff

The project entity has made the following arrangements for their staff to become familiar with the operation and maintenance of CMM to power projects.

Time	Attendants	Content
May 25th 2009	24	Knowledge on internal combustion generators
May 27th 2009	29	Knowledge on main parts and maintenance of internal combustion generators
May 28th 2009	29	Knowledge on internal systems
May 29th 2009	26	Generation set assembly
May 30th 2009	29	Questioning & closing

2. MONITORING DATA AND PARAMETERS

The data to be monitored is presented in Section B.7.1. The following figure indicates detailed monitoring instrument installation and the monitoring points.

Figure B.4 (a) Indicative lay-out of metering instruments for Weijiadi Coal Mine

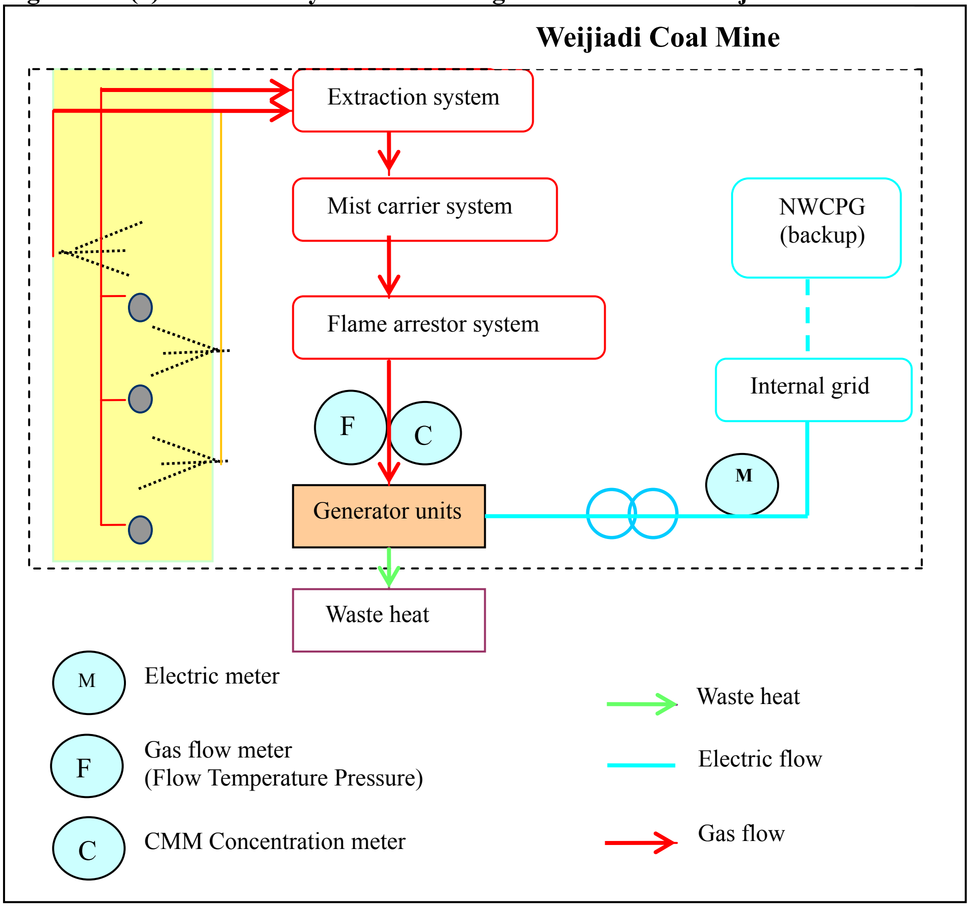
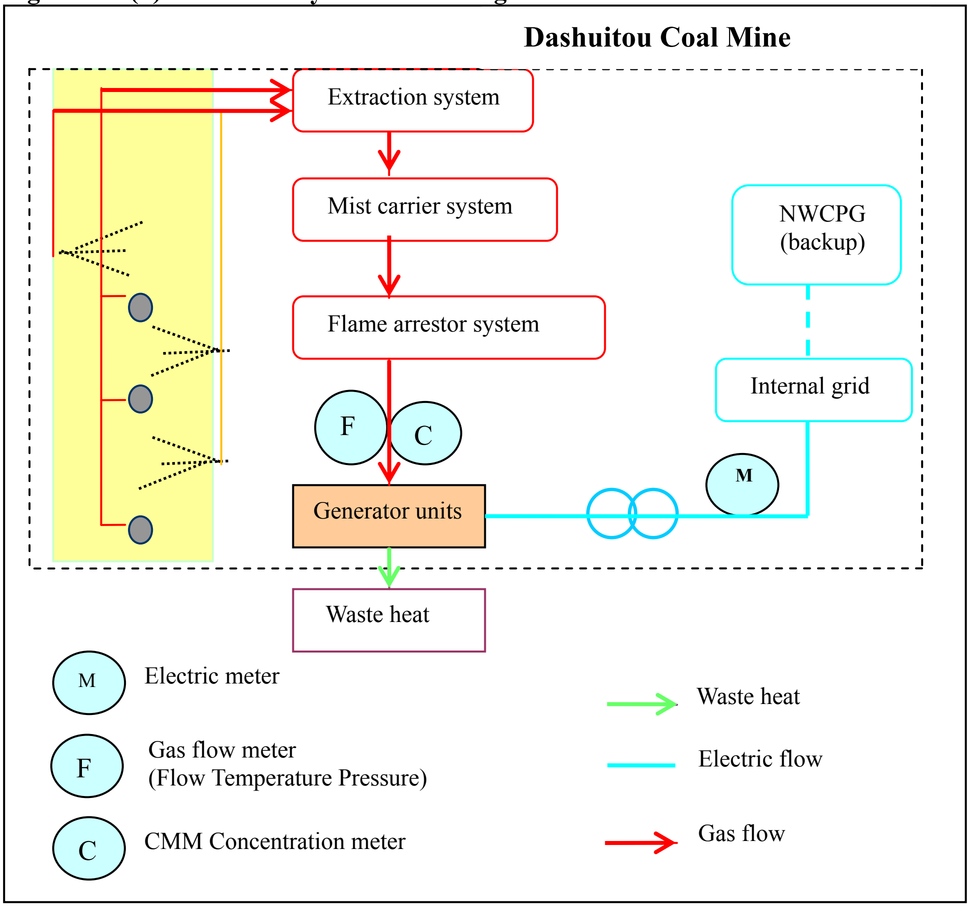


Figure B.4 (b) Indicative lay-out of metering instruments for Dashuitou Coal Mine



The above parameters will be monitored at the locations of the project activity and be available for DOE to verify. An indicative lay-out map of the metering instruments which will be installed is indicated in Figure B.4.

An overview of detailed information on minimum accuracy requirements of the metering instruments, measuring intervals, recording form, calibration and available documentation is provided in Table B.16.

Table B.16 (a) Details of metering instruments in Weijiadi Coal Mine

Meter	Measurement	Recording	Calibration	Accuracy	Documentation
Flow	Continuous	Monthly	Annual calibration conducted by a certified company	2 or more accurate [68]	Paper log books
Pressure	Daily	Monthly		1.0 or more accurate	Paper log books
Temperature	Daily	Monthly		1.0 or more accurate	Paper log books
Concentration	Daily	Monthly		1.0 or more accurate	Paper log books
Electric meter	Continuous	Monthly		0.5 or more accurate	Paper log books

[68] The accuracy of meters is consistent with the "General principle for equipping and managing of the measuring instrument of energy in organization of energy using (2006)", which refer to *www.bjjnhb.com.cn/zytz/200910/P020091118629556217605.doc*

Table B.16 (b) Details of metering instruments in Dashuitou Coal Mine

Meter	Measurement	Recording	Calibration	Accuracy	Documentation
Flow	Continuous	Monthly	Annual calibration conducted by a certified company	2 or more accurate	Paper log books
Pressure	Daily	Monthly		1.0 or more accurate	Paper log books
Temperature	Daily	Monthly		1.0 or more accurate	Paper log books
Concentration	Daily	Monthly		1.0 or more accurate	Paper log books
Electric meter	Continuous	Monthly		0.5 or more accurate	Paper log books

Methane sent to power plant
The project entity will meter the flow of the Coal Mine Gas continuously on the basis of measurements of gas volume, pressure and temperature of the gas. The instruments are indicated as GFM in Figure B.4. Readings will be daily logged by the electronic metering instruments.

Concentration (in mass) of methane in extracted gas (%)
The concentration of CH_4 concentration will be measured on a wet basis through concentration meters installed at the inlet pipe of generators of each station. The project entity will ensure that the concentration meters are positioned before de-humidification equipment to make sure measurement is done on a wet basis. The instruments will record concentration data four times a day, and the average concentration data will be used to calculate mass flow of methane as average concentration for a day.

NMHC Concentration (in mass) in extracted gas (%)
The ACM0008 methodology requires annual monitoring of the concentration of non-methane hydrocarbons. The project entity will take gas samples of the Coal Mine Gas at Weijiadi and Dashuitou locations. These samples will then be analyzed by a qualified laboratory which will provide a report on the composition of the Coal Mine Gas. The project entity will ensure that these reports will be made available to the verifier.

Electricity supplied to/ imported from the grid by the project
The project is connected to the internal transformer station of Jingyuan Coal Group at Dashuitou mine and Weijiadi mine (Due to the difference of the project locations, the project is respectively connected to Dashuitou transformer station and Weijiadi transformer station). The electric power consumption of the proposed project will be supplied through the same power lines that supply power from the project to the transformation. The electric meters are bidirectional. And therefore the electricity imported from the grid will be deducted from the electricity supplied by the project to the internal grid and the net power supply will be accounted and cross-checked against the Electricity Transaction Notes. The power consumption of the pumping station is not included as it is identical to power consumption in the baseline scenario.

The calibration of the said meters is carried out by a qualified calibration company. The calibration is carried out annually and the calibration results are submitted to the project entity.

3. VERIFICATION

The main objective of verification is to independently verify if the emission reductions achieved by the project correspond to the ones estimated in the PDD. The following table outlines the key documents relevant to monitoring and verification of the emission reductions of the project.

Table B.17 Key documents relevant to monitoring and verification

Document	Main content	Source
PDD of the project	Calculation procedure of emission reduction and monitoring items	Project owner, or CDM consultant, or directly download from UNFCCC website
Meter calibration reports	Equipment and national and industry standards	Qualified institution or entity
Process Report for Calibration	Time of calibration; reasons for maintenance and calibration and the precision after maintenance and calibration.	Project owner
Operation Report Forms	The data of metering equipments, abnormal situations	Project owner
Emergency Situation Report	The process of the event and the countermeasures	Project owner
Monitoring Report	CO_2 emission reductions calculation	Project owner or CDM consultant

The project owner will implement a monitoring plan to make sure that the emission reductions for the proposed project are accurately measured.

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)

Date of completion of the baseline study and monitoring methodology: 22/07/2010

The persons responsible for the determination of the baseline study and the monitoring methodology are listed below:

Minghua Guo, Consultant, Caspervandertak Consulting
Tel: +86-10-84505756; Fax: +86-10-84505758
Email: jessica@cdmasia.org

Casper van der Tak, General Director, Caspervandertak Consulting
Tel: +86-10-84505756; Fax: +86-10-84505758
Email: casper@cdmasia.org

Yu Rong, Consultant, Gansu Tonghe Investment Project Consulting Co., Ltd.
Tel: +86-931-8440723; Fax: +86-931-8440721
E-mail: phoebe.yu@gstonghe.com

Jin Yuebing, General Director, Gansu Tonghe Investment Project Consulting Co., Ltd.
Tel: +86-931-4663436; Fax: +86-931-8440721
E-mail: yuebing.jin@gstonghe.com

Caspervandertak Consulting and Gansu Tonghe Investment Project Consulting Co., Ltd. are not project participants.

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:

02/06/2008 (date signed the equipment purchase contract)

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

10 years

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

A fixed crediting period is chosen

C.2.1. Renewable crediting period

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

10/11/2012 (or the effective date of registration)

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

An Environmental Impact Assessment (EIA) was designed by Lanzhou Coal Mine Design Institute and was approved by Baiyin Environmental Protection Bureau on June 23rd 2008. A summary of the main findings of the EIA is provided as below.

SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT

The main impacts on environment are air pollution due to the dust caused by construction, noise pollution due to the vehicles and machines, waste water and solid wastes due to construction during construction period. During operation period, the main impacts are noises caused by various operating machines, daily sewage and production waste water, daily wastes, and risks during methane compressed, storage and production process. The negative impacts caused directly or indirectly by the project will be alleviated through the following protection and preventative measures.

1. Air pollution
   - During construction period, the main pollution source is dust. Therefore it is necessary to spray water on the construction site, wash the wheels of vehicles, spray water on the road, and cover the materials on the dumping site. During operation period, the waste gas will be discharged after reaching standards.

2. Daily sewage and production waste water.
   - During construction period , the waste water is produced by washing the machines and vehicles , the waste water is not much and pollution is not serious which will not have significant impacts on surrounding water environment, and will be managed well not to be discharged randomly.
   - During operation period, the waste water is mainly caused by cleaning the workshops and daily sewage caused by the staff. This waste water will be discharged to the current water drainage network in the mining area through waste water treatment facilities.

3. Noise
   - During construction period, the noise is mainly caused by the machines and vehicles. It is forbidden to construct during night from 10:00 pm to 7:00am of the next morning and to use high-decibel tools at the same time.
   - During operation period, the noise is mainly caused by various machines. The windows and doors of the workshops which make noises such as generation workshop, water disposal workshop and compressing workshop will be sealed and will install new two layers of glass and sound absorbent to protect and prevent noises.

4. Solid wastes
   - During construction period, the solid wastes are from daily rubbish and construction wastes. There will set a temporary rubbish disposal pit, and the rubbish will be regularly transported to Pingchuan Landfill.

- During operation period, there will not produce solid wastes and other solid wastes are mainly daily rubbish, and the daily rubbish will be collected by relevant environment and public health department and then disposed in Pingchuan Landfill.

5. Environmental risk due to coal methane
   - Due to its highly flammable and explosive characteristic, there exits high risks in the process of CMM transportation. In order to meet safety requirements, some protective devices have been installed in the gas pipe lines such as water-sealed fire arrestor, CMM special fire arrestor of CMM pipeline and water spraying producer, making friction fire the process of CMM transportation impossible. In addition, the security system of CMM collection and transportation has been strengthened through the safety precautions of equipment and management.

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

The environmental impacts of the project are not considered significant by the Chinese government and the project participants. The Environmental Impact Assessment Form (EIA) was accepted by Baiyin Environmental Protection Bureau.

SECTION E. Stakeholders' comments

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

In order to ensure wide participation of stakeholders, 60 questionnaires had been sent out to the involved villages by the project owner from March 11th to April 16th 2009. And 60 questionnaires were received. In addition, the project owner made stakeholder consultation announcements through the following website:

- http://www.gstonnesghe.com

Meanwhile, the contact way of the project owner and consulting company, telephone and e-mail, is available in the announcement. During the period from March 11th to April 20th 2009, the public can express their concerns and suggestions about the project activity through the above ways.

The stakeholders are mainly consulted about the following aspects:

- Impact on the local environment due to the project activity;
- Impact on the local residents' life due to the project activity;
- Impact on the local economy due to the project activity and what kind of work the project owner need to do.

E.2. Summary of the comments received:

Comments received at stakeholder consultation activity:

Each attendant of the stakeholder consultation activity expressed his or her opinion on the proposed project. No negative opinions were received. An overview of the main comments & suggestions expressed during the meeting is provided below:
1. All the participants support the construction of the proposed project;
2. All the participants confirm the positive impact on the local economy, social, environment and daily life due to the proposed project activity, especially in promoting economy, saving energy, creating job opportunities and increasing revenues;
3. All the participants satisfied with the construction of the proposed project activity.

The results from the stakeholder consultation activity show that all the participants support the construction of the project and confirm the benefits of the project to local environment and economy such as reducing the amount of CMM vented into the atmosphere and saving energy, etc. Although negative impacts on the local environment occurred during the construction period, they can be eliminated by taking effective environmental measurements.

Summary of the questionnaire results

The questionnaire collects the comments about the impact of the project to the villagers in the following aspects: local environment, economy, impacts on residents' life and whether support the project or not.

The results are shown as follows:

Participants		Number	Percentage（%）
Gender	Male	46	76.67
	Female	14	23.33
Age	20-29	10	16.67
	30-39	32	53.33
	Above 40	18	30.00
career	Farmers	18	30.00
	worker	39	65.00
	Teacher & technician	2	3.33
	Cadre	1	1.67
	others	0	0

No.	The impacts due to the construction and operation of the project on the following aspects			Number of people	Number of people consulted	Percentage（%）
1	Economic aspect	Employment opportunity	Positive impact	30	60	50.00
			No impact	30		50.00
			Negative impact	0		0
		Boost related industries development increase income	Positive impact	36	60	60.00
			No impact	23		38.33
			Negative impact	1		1.67
		Local financial revenue	Positive impact	34	60	56.67
			No impact	26		43.33
			Negative impact	0		0
		Economic development	Positive impact	51	60	85
			No impact	9		15
			Negative impact	0		0
2	Living aspect	Power supply	Positive impact	48	60	80.00
			No impact	12		20.00
			Negative impact	0		0
		Air quality	Positive impact	48	60	80.00
			No impact	12		20.00
			Negative impact	0		0
		Local people's income	Positive impact	44	60	73.33
			No impact	16		26.67
			Negative impact	0		0
3	Environment aspect	Impact from the project's construction	No impact	25	60	41.67
			dust	6		10.00
			Waste water	7		11.67
			noise	22		36.67
			Solid waste	0		0
		Impact from the project's operation	No impact	49	60	81.67
			Waste water	9		15.00
			Waste gas	1		1.67
			Waste oil	0		0

			noise	1		1.67
		Saving energy, reducing pollution	Positive impact	53	60	88.33
			No impact	7		11.67
			Negative impact	0		0
		General trend	Positive impact	51	60	85.00
			No impact	9		15.00
			Negative impact	0		0
4	Whether support the project's construction or not		support	60	60	100
			Do not support	0		0

No comments were received through telephone or e-mail.

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

Responses by the project entity in reaction to the findings of the Environmental Impact Assessment (EIA):

The CDM project (CMM power generation) environmental stakeholders questionnaires had been sent out to the involved villages by the project owner from March 11th to April 16th, 2009. The results were formed as follows:

Through the understanding of significance and necessity of CDM project of Gansu Jingyuan Coal Mine Group Jieneng Thermoelectricity Company CMM Power Generation Project, the attitude of local villager delegates to the project, and the realization of contribution from the project to local sustainable development and environment protection, it is considered that the construction of the project is necessary and feasible. The CMM resource can be utilized maximally by the project. Using CMM for power generation, one hand, it promotes the development of environment protection, on the other hand, it also brings the tremendous environmental benefits and creates more job opportunities.

As a result, the construction of the project can make a contribution towards local sustainable development, bring preferable environmental benefit to Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd. economy benefit, social benefit and environmental benefit are notable.

All the participants of the questionnaire agree and support the construction of this project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Entity:

Organization:	Jingyuan Coal Group Baiyin Jieneng Thermoelectricity Co., Ltd.
Street/P.O.Box:	Dashuitou St. of Pingchuan District
Building:	-
City:	Baiyin City
State/Region:	Gansu Province
Postfix/ZIP:	730913
Country:	People's Republic of China
Telephone:	+86-943-6657072
FAX:	+86-943-6657072
E-Mail:	13309433599@163.com
URL:	-
Represented by:	Ma Peiyao
Title:	Engineer
Salutation:	Mr.
Last Name:	Ma
Middle Name:	-
First Name:	Peiyao
Department:	-
Mobile:	-
Direct FAX:	+86-943-6657072
Direct tel:	+86-943-6657072
Personal E-Mail:	13309433599@163.com

The Purchasing Party:

Organization:	Gazprom Marketing & Trading Singapore Pte. Ltd.
Street/P.O.Box:	10 Collyer Quay #41-00
Building:	Ocean Financial Centre
City:	-
State/Region:	-
Postfix/ZIP:	049315
Country:	Singapore
Telephone:	+65 6671 9100
FAX:	+65 6435 6201
E-Mail:	global_carbon@gazprom-mt.com
URL:	www.gazprom-mt.com
Represented by:	Arthur Tait
Title:	Regional Manager, Global Carbon
Salutation:	Mr.
Last Name:	Tait
Middle Name:	-
First Name:	Arthur
Department:	Global Carbon
Mobile:	-
Direct FAX:	+65 6435 6201
Direct tel:	+65 6671 9100
Personal E-Mail:	global_carbon@gazprom-mt.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project does not receive any public funding.

Annex 3

BASELINE INFORMATION

Our baseline calculation follows the methodology used in the OM and BM emission factors baseline calculation published by the Department of Climate Change of the National Development and Reform Commission. Full information on the calculation of the baseline and underlying data can be found at: http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Below we provide the main data used in the calculation of the baseline emission factor.

Table A1. Calculation of the Combined Margin Emission Factor

	Emission factor	Value and Source	Weight	Weighted value
	A	**B**	**C**	**D = B * C**
1	EF_{OM}	1.0246	0.5	0.5123
		Table A2, D		
2	EF_{BM}	0.6433	0.5	0.32165
		Table A5, C		
3	CM			0.83395
				Table A3c, C6

Table A2. Calculation of the Operating Margin Emission Factor

	Variable	2007	2006	2005	Total
		A	**B**	**C**	**D**
1	Supply of thermal power to the NWCPG (MWh)	178,920,940	156,142,241	125,496,682	460,559,864
		Table A3c, C6	Table A3b, C6	Table A3a, C6	D1 = A1 + B1 + C1
2	Imports of power from other grids (MWh)	0	0	0	0
		Files cited above	Files cited above	Files cited above	D2 = A2 + B2 + C2
3	Total power supply for calculation EF_{OM} (MWh)	178,920,940	156,142,241	125,496,682	460,559,864
		A3 = A1 + A2	B3 = B1 + B2	C3 = C1 + C2	D3 = D1 + D2
4	CO_2 emissions associated with thermal power generation on NWCPG (tCO_2)	180,940,805	154,812,639	136,146,341	471,899,785
		Table A4c, E	Table A4b, E	Table A4a, E	D4 = A4 + B4 + C4
5	CO_2 emissions associated with power imports from other grids (tCO_2)	0	0	0	0
		Table A9c, E	Table A9b, E	Table A9a, E	D5 = A5 + B5 + C5
6	Total CO_2 emissions for calculation EF_{OM} (tCO_2)	180,940,805	154,812,639	136,146,341	471,899,785
		A6 = A4 + A5	B6 = B4 + B5	C6 = C4 + C5	D6 = D4 + D5
7	EF_{OM} (tCO_2/MWh)	1.01129	0.99148	1.08486	1.02462
		A6 / A3	B6 / B3	C6 / C3	D6 / D3

Table A3a. Calculation of thermal power supply to NWCPG, 2005.

	Grid	Thermal Power generation (MWh)	Losses (%)	Thermal power supply (MWh)
		A	B	C = A * (100 - B) / 100
1	Shaanxi	41,100,000	7.16	38,157,240
2	Gansu	33,106,000	4.23	31,705,616
3	Qinghai	5,500,000	2.69	5,352,050
4	Ningxia	27,643,000	5.73	26,059,056
5	Xinjiang	26,560,000	8.8	24,222,720
6	Northwest China			125,496,682
				C6 = C1 + C2 + C3 + C4 + C5

Source: Files mentioned above, original data are from China Electric Power Yearbook 2006, p. 559-560 and 568.

Table A3b. Calculation of thermal power supply to NWCPG, 2006

	Grid	Thermal Power generation (MWh)	Losses (%)	Thermal power supply (MWh)
		A	B	C = A * (100 - B) / 100
1	Shaanxi	54,482,000	6.97	50,684,605
2	Gansu	35,738,000	4.29	34,204,840
3	Qinghai	7,204,000	2.57	7,018,857
4	Ningxia	36,731,000		36,731,000
5	Xinjiang	29,901,000	8.02	27,502,940
6	Northwest China			156,142,241
				C6 = C1 + C2 + C3 + C4 + C5

Source: Files mentioned above, original data are from Chian Energy Statistics Book 2007 p42.

Table A3c. Calculation of thermal power supply to NWCPG, 2007

	Grid	Thermal Power generation (MWh)	Losses (%)	Thermal power supply (MWh)
		A	B	C = A * (100 - B) / 100
1	Shaanxi	59,100,000	6.77	55,098,930
2	Gansu	42,400,000	5.89	39,902,640
3	Qinghai	9,700,000	7.19	9,002,570
4	Ningxia	43,500,000		43,500,000
5	Xinjiang	34,600,000	9.2	31,416,800
6	Northwest China			178,920,940
				C6 = C1 + C2 + C3 + C4 + C5

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2008, p. 733-734.

Table A4a. Calculation of CO_2 emissions from fuels for thermal power production, NWCPG, 2005.

Fuel	Unit	Gansu	Shaanxi	Ningxia	Qinghai	Xinjiang	NWCPG	NCV	Oxidation factor	Carbon coefficient	CO_2 emissions
								(TJ/unit)	(Fraction)	($kgCO_2/TJ$)	(tCO_2)
							A	B	C	D	E = A*B*D*/1000
Raw coal	10^4 Tonnes	1,597.00	2,461.28	1,467.70	345.1	1,358.09	7,229.17	209.08	1	87,300	131,951,756
Clean coal	10^4 Tonnes	0	16.22	0	0	0	16.22	263.44	1	87,300	373,033
Other washed coal	10^4 Tonnes	0	35.56	101.95	0	10.2	147.71	83.63	1	87,300	1,078,416
Coke	10^4 Tonnes	0	3.23	0	0	0	3.23	284.35	1	95,700	87,896
Coke oven gas	10^8 m^3	0	0	0	0	0	0.00	1672.6	1	37,300	0
Other gas	10^8 m^3	0	0	0	0	0	0.00	522.7	1	37,300	0
Crude oil	10^4 Tonnes	0	0	0	0	0.18	0.18	418.16	1	71,100	5,352
Gasoline	10^4 Tonnes	0	0.02	0	0	0.01	0.03	430.7	1	67,500	872
Diesel	10^4 Tonnes	0.46	2.24	0	0.06	0.5	3.26	426.52	1	72,600	100,947
Fuel oil	10^4 Tonnes	0.57	0.01	0	0	0.25	0.83	418.16	1	75,500	26,204
LPG	10^4 Tonnes	0	0	0	0	0	0.00	501.79	1	61,600	0
Refinery gas	10^8 m^3	0	0	0	0	7.71	7.71	460.55	1	48,200	171,151
Natural gas	10^8 m^3	0.52	1.46	0	1.33	7.81	11.12	3893.1	1	54,300	2,350,716
Other petroleum products	10^4 Tonnes	0	0	0	0	0	0.00	4181.6	1	75,500	0
Other coking products	10^4 Tonnes	0	0	0	0	0	0.00	284.35	1	95,700	0
Other E (standard coal)	10^4 Tce	1.3	8.24	0	0	0	9.54	0	1	0	0
Total											136,146,341
											$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2006. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2008 p. 284; Oxidation factors and fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 (energy).

Table A4b. Calculation of CO_2 emissions from fuels for thermal power production, NWCPG, 2006.

Fuel	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	NWCPG	NCV	Oxidation factor	Carbon coefficient	CO_2 emissions
								(TJ/unit)	(Fraction)	($kgCO_2$/TJ)	(tCO_2)
							A	B	C	D	E = A*B*D*/1000
Raw coal	10^4 Tonnes	2,834.44	1,660.92	421.86	1,833.72	1,547.69	8,298.63	209.08	1	87,300	151,472,271
Clean coal	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	263.44	1	87,300	0
Other washed coal	10^4 Tonnes	0.00	0.00	0.00	112.70	8.45	121.15	83.63	1	87,300	884,504
Coke	10^4 Tonnes	0.00	0.00	0.00	0.01	0.00	0.01	284.35	1	95,700	272
Coke oven gas	10^8 m^3	0.20	0.00	0.00	0.00	0.08	0.28	1672.6	1	37,300	17,469
Other gas	10^8 m^3	0.10	0.00	0.00	0.00	0.00	0.10	522.7	1	37,300	1,950
Crude oil	10^4 Tonnes	0.00	0.00	0.00	0.00	0.02	0.02	418.16	1	71,100	595
Gasoline	10^4 Tonnes	0.01	0.00	0.00	0.00	0.00	0.01	430.7	1	67,500	291
Diesel	10^4 Tonnes	1.14	0.24	0.61	0.00	1.25	3.24	426.52	1	72,600	100,328
Fuel oil	10^4 Tonnes	0.00	0.60	0.00	0.00	0.11	0.71	418.16	1	75,500	22,415
LPG	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	501.79	1	61,600	0
Refinery gas	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	460.55	1	48,200	0
Natural gas	10^8 m^3	1.59	0.56	1.06	0.00	7.49	10.70	3893.1	1	54,300	2,261,930
Other petroleum products	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	4181.6	1	75,500	0
Other coking products	10^4 Tonnes	1.86	0.00	0.00	0.00	0.00	1.86	284.35	1	95,700	50,615
Other E (standard coal)	10^4 Tce	33.57	8.81	0.00	0.00	2.20	44.58	0	1	0	0
Total											154,812,639
											$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2007. Net calorific values are from the China Energy Statistical Yearbook, 2008 p. 284; Oxidation factors and fuel emission coefficients are IPCC default values; see 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 (energy).

Table A4c. Calculation of CO_2 emissions from fuels for thermal power production, NWCPG, 2007.

Fuel	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	NWCPG	NCV	Oxidation factor	Carbon coefficient	CO_2 emissions
								(TJ/unit)	(Fraction)	($kgCO_2$/TJ)	(tCO_2)
							A	B	C	D	E = A*B*D*/1000
Raw coal	10^4 Tonnes	3,303.44	1,969.03	470.85	2,165.80	1,762.11	9,671.23	209.08	1	87,300	176,525,905.08
Clean coal	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	263.44	1	87,300	0.00
Other washed coal	10^4 Tonnes	3.73	0.00	0.00	124.31	7.73	135.77	83.63	1	87,300	991,243.06
Briquettes	10^4 Tonnes	3.53	0.00	0.00	0.00	0.00	3.53	209.08	1	87,300	64,431.97
Coke	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	284.35	1	95,700	0.00
Coke oven gas	10^8 m^3	0.52	0.65	0.00	0.00	0.26	1.43	1672.6	1	37,300	89,214.81
Other gas	10^8 m^3	14.14	0.71	0.00	0.00	0.00	14.85	522.7	1	37,300	289,526.14
Crude oil	10^4 Tonnes	0.00	0.00	0.00	0.00	0.09	0.09	418.16	1	71,100	2,675.81
Gasoline	10^4 Tonnes	0.02	0.00	0.00	0.00	0.00	0.02	430.7	1	67,500	581.45
Diesel	10^4 Tonnes	1.12	0.26	0.42	0.00	1.77	3.57	426.52	1	72,600	110,546.31
Fuel oil	10^4 Tonnes	0.01	1.05	0.04	0.00	0.05	1.15	418.16	1	75,500	36,306.74
LPG	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	501.79	1	61,600	0.00
Refinery gas	10^4 Tonnes	0.00	0.00	0.00	0.00	5.99	5.99	460.55	1	48,200	132,969.07
Natural gas	10^8 m^3	1.68	0.49	1.93	0.00	8.66	12.76	3893.1	1	54,300	2,697,404.41
Other petroleum products	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	4181.6	1	75,500	0.00
Other coking products	10^4 Tonnes	0.00	0.00	0.00	0.00	0.00	0.00	284.35	1	95,700	0.00
Other E (standard coal)	10^4 Tce	94.36	9.73	0.00	0.00	0.00	104.09	0	1	0	0.00
Total											180,940,804.85
											$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2008, p.222-242. Net calorific values are from the China Energy Statistical Yearbook, 2008 p. 284; Oxidation factors and fuel emission coefficients are IPCC default values; see 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 (energy).

Table A5. Calculation of the BM Emission Factor, NWCPG

$EF_{thermal}$ (tCO_2/MWh)	Share of thermal power in added capacity, 2007-2005	EF_{BM} (tCO_2/MWh)
A	B	C = A * B
0.81695	78.74%	0.6433
Table A6	Table A9	

Table A6. Calculation of EF thermal

		λ	EF_{adv}	$EF_{thermal}$ calculation
		A	B	C = A * B
1	Coal	98.14%	0.82488	0.80957
		Table A8	Table A7	
2	Gas	1.77%	0.39104	0.00694
		Table A8	Table A7	
3	Oil	0.08%	0.54371	0.00045
		Table A8	Table A7	
4	$EF_{thermal}$			0.81695

Table A7. Calculation of Emission factors of fuel using advanced technologies

Fuel	Efficiency (%) A	Carbon coefficient ($kgCO_2$/TJ)	Oxidation factor	EF_{adv} (tCO_2/MWh)
		B	C	D=(3.6/(A*1000000))*B*C
Coal	38.10%	87,300	1	0.8249
Gas	49.99%	54,300	1	0.3910
Oil	49.99%	75,500	1	0.5437

Table A8. Calculation of λs for the calculation of the BM, NWCPG

Fuel	Unit	NWCPG	NCV	Total energy consumption NWCPG	Oxidation factor	Carbon coefficient	CO_2 emissions
			(TJ/unit)	TJ	(Fraction)	($kgCO_2$/TJ)	(tCO_2)
		A	B		C	D	E = A*B*D/1000
Raw coal	10^4 Tonness	9,671.23	209.08	2,022,060.77	1	87,300	176,525,905
Clean coal	10^4 Tonness	0.00	263.44	0.00	1	87,300	0
Other washed coal	10^4 Tonness	135.77	83.63	11,354.45	1	87,300	991,243
Briquettes	10^4 Tonness	3.53	209.08	738.05	1	87,300	64,432
Coke	10^4 Tonness	0.00	284.35	0.00	1	95,700	0
Other coking products	10^4 Tonness	0.00	284.35	0.00	1	95,700	0
Coal, total				***2,034,153.27***	1		***177,581,580***
Coke oven gas	10^8 m^3	1.43	1672.6	2,391.82	1	37,300	89,215
Other gas	10^8 m^3	14.85	522.7	7,762.10	1	37,300	289,526
LPG	10^4 Tonness	0.00	501.79	0.00	1	61,600	0
Refinery gas	10^4 Tonness	5.99	460.55	2,758.69	1	48,200	132,969
Natural gas	10^8 m^3	12.76	3893.1	49,675.96	1	54,300	2,697,404
Gas total				***62,588.56***	1		***3,209,114***
Crude oil	10^4 Tonness	0.09	418.16	37.63	1	71,100	2,676
Gasoline	10^4 Tonness	0.02	430.7	8.61	1	67,500	581
Diesel	10^4 Tonness	3.57	426.52	1,522.68	1	72,600	110,546
Fuel oil	10^4 Tonness	1.15	418.16	480.88	1	75,500	36,307
Other petroleum products	10^4 Tonness	0.00	41816	0.00	1	75,500	0
Oil total				***2,049.81***			***150,110***
Total							***180,940,805***
							$\Sigma(E_i)$

Lambda	
λcoal	98.14%
λgas	1.77%
λoil	0.08%

Table A9. Calculation of the share of thermal power in recently added capacity

Installed capacity	2005	2006	2007	Capacity added in 2005-2007	Share in added capacity
	A	**B**	**C**	**D=C-A**	
Thermal (MW)	25,362.6	29,627	35,620	10,257.4	78.74%
Hydropower (MW)	12,219.8	14,074	14,590	2,370.2	18.20%
Nuclear (MW)	0.0	0	0	0.0	0.00%
Other (MW)	399.5	399	799	399.0	3.06%
Total (MW)	37981.9	44100	51008.5	13,026.6	100.00%
Percentage of 2007 capacity	74.46%	86.46%	100%		

Source: China Electric Power Yearbook 2006-2008

Annex 4

MONITORING INFORMATION

- - -