Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Jincheng Sihe Coal Mine CMM Generation Project
Version number of the PDD	9.1
Completion date of the PDD	10 November 2015
Project participant(s)	Shanxi Jincheng Anthracite Mining Group Co.,Ltd.; International Bank for Reconstruction and Development as the Trustee of the Prototype Carbon Fund (PCF) and the Trustee of the IBRD-Netherlands Clean Development Mechanism Facility (NCDMF); Netherlands' Ministry of Infrastructure and the Environment (IenM) ; Electrabel S.A; Netherlands' Ministry of Economic Affairs, Agriculture and Innovation (EL&I); Japan Carbon Finance, Ltd.; Kyushu Electric Power Co., Inc. ; Japan International Cooperation Agency (JICA) ; The Chugoku Electric Power Co., Inc. ; Chubu Electric Power Co., Inc. ; Mitsubishi Corporation ; MIT Carbon Fund Co., Ltd. (withdrawn) ; Shikoku Electric Power Company, Incorporated ; Tohoku Electric Power Co., Inc. ; The Tokyo Electric Power Co., Inc; Mitsui & Co., Ltd.; BP Alternative Energy International Ltd. ; Deutsche Bank AG ; ICECAP Carbon Trading Ltd.; Government of Sweden - Swedish Energy Agency; Norsk Hydro ASA ; Government of Norway - Ministry of Foreign Affairs ; Statoil ASA; Fortum Corporation ; Government of Finland - Ministry of Foreign Affairs; GDF SUEZ; Government of Canada - Ministry of Foreign Affairs and International Trade; RWE Power AG
Host Party	China
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral scopes 8: Mining/mineral production Sectoral scopes 10: Fugitive emissions from fuels (solid, oil and gas) Methodology: ACM0008 (Version 03)
Estimated amount of annual average GHG emission reductions	3,016,714 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Jincheng Sihe Coal Mine CMM Generation Project (this project) is located within the Sihe Coal Mine, Jiafeng Town, Qinshui County, Jincheng City, Shanxi Province of China. It will utilize the coal mine methane (CMM) currently being vented to the atmosphere for grid-connected power generation with an installed capacity of 120 MW.

Sihe Coal Mine is operated by Shanxi Jincheng Anthracite Mining Group Co., Ltd. The mining field area of Sihe Coal Mine is 91.2 square kilometers with the geological coal reserve of 1.193 billion tons and the recoverable reserve of 545 million tons. Sihe Coal Mine was put into production on December 8, 2002. Sihe Coal Mine is high gassy coal mine rich of methane, with a total reserve of about 25 billion m^3, and the methane content in the eastern part of Sihe Coal Mine is 9.03 m^3/t-coal and that in the western part 16.6 m^3/t-coal.

Prior to the implementation of this project, the captured gas is vented directly to the atmosphere except that a very small part is currently used for residential purpose and power generation test purpose. The electricity generated by this project is supplied by North China Power Grid, which coal-fired power units dominate. The baseline scenario of this project is the same as the scenario existing prior to the start of implementation of this project.

In accordance with relevant Chinese laws and regulations, the Shanxi Jincheng Anthracite Mining Group Co. Ltd. (JMC) has installed a gas collection system in Sihe Coal Mine to capture a certain portion of the methane, with the aim of ensuring safe production. The captured gas is vented directly to the atmosphere except that a very small part is currently used for residential purpose and power generation test purpose. The existing grid-connected power generation unit, utilizing decommissioned aircraft engine, was firstly installed in 2000 and completed in 2003. The efficiency of the existing unit is 0.437 m^3/kWh (pure CH_4), 87% lower than that of the power technology utilized in this project, i.e. 0.234 m^3/kWh (pure CH_4).

After the full operation of this project, about 823,200MWh electricity (net of power station consumption) will be produced annually by this project and then sold to North China Grid, which is composed of Beijing, Tianjin, Hebei, Shanxi, Shandong and Inner Mongolia, and about 181.474 Mm^3 pure methane will be consumed annually. Waste heat from the power generation process is recovered and utilized for domestic purposes; however, to be conservative, CERs will not be claimed for this component. Through power generation, this project will reduce the direct emissions of methane to the atmosphere and replace certain amount of electricity generated by North China Grid, which coal-fired power units dominate. In the 10-year crediting period, the estimated annual emission reductions of this project would be 3,016,714 tCO_2e.

All of the methane utilized in this project activity comes from CMM and no CBM is involved in this project activity. This project will use CMM extracted with the current CMM recovery system and thus does not involve retrofit of the CMM recovery system.

The contribution of this project to local sustainable development includes:

- Utilization of clean energy resource that would have been released into the atmosphere for power generation;
- Reduction of local environmental pollution caused by coal combustion for power generation purpose;
- Decrease of coal usage by substituting coal fired power generation from North China Grid; Increase of working opportunities in the coalmine area.

A.2. Location of project activity

A.2.1. Host Party

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The People's Republic of China

A.2.2. Region/State/Province etc.

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Shanxi Province

A.2.3. City/Town/Community etc.

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Jincheng City

A.2.4. Physical/Geographical location

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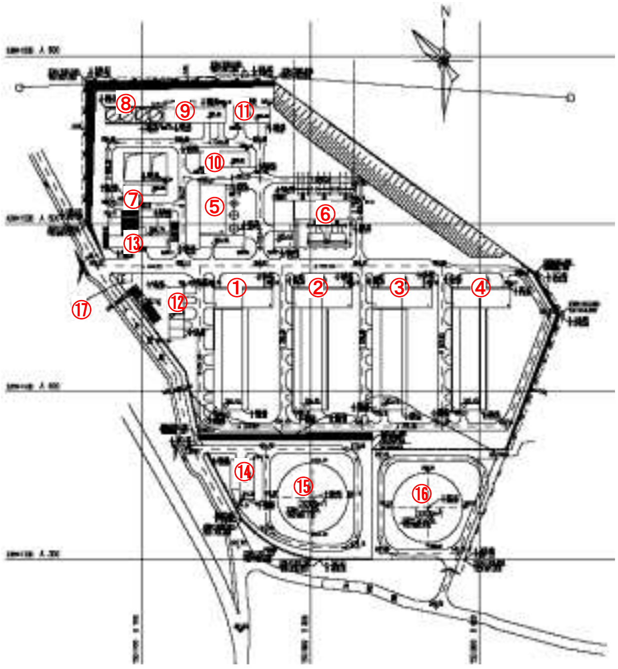
This project is located within Sihe Coal Mine, which is located in Jiafeng Town, Qinshui County, Jincheng City, Shanxi Province of China, the east longitude of 112°31'10" and north latitude of 35°35'15" , as shown in figure 1. Figure 2 illustrates the surface layout of the power generation part of this project activity.

Figure 1: Location of the Project Activity



1	No.1 power house
2	No.2 power house
3	No.3 power house
4	No.4 power house
5	Chemical water treating
6	220KV substation
7	Comprehensive pump house
8	Mechanical draft cooling tower
9	Circulation water pump room
10	Maintenance room
11	Material storage
12	Heat supply station
13	Administration building
14	CMM compressing station
15	No.1 gas storage tank
16	No.2 gas storage tank
17	Gate office

Figure 2: Layout of the Power Generation Part

A.3. Technologies and/or measures

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Prior to the implementation of this project, the captured gas is vented directly to the atmosphere except that a very small part is currently used for residential purpose and power generation test purpose. The electricity generated by this project is supplied by North China Power Grid, which coal-fired power units dominate.

The baseline scenario of this project is the same as the scenario existing prior to the start of implementation of this project activity.

The proposed Project will install internal combustion engines using combined cycling , which consists of internal combustion engines with CMM as fuel, and waste heat boilers and steam turbines for power generation. The power plant consists of four power houses, installing altogether 60 gas engines, 1.8MW for each, 12 sets waste heat boilers and 4 sets of steam turbines, 3000KW for each. In each power house, 15 gas engines, 3 waste heat boilers (6000kg/h), and 1 steam turbine (3000KW) will be installed. The gas extracted will be pumped to the gas tank in the power plant and will be mixed, stirred, and dehydrated. After that the gas will be delivered to the compressing station for compression and then injected to the gas engines for power generation. The waste heat from the gas engines will be lead into the waste heat boiler to heat the steam which will drive the steam turbine to generate electricity.

(1) Specifications of the gas engine:

Item	Specification
type	G3520C
rated power	1.8MW
power factor	0.8
generator voltage	10.5kV
excitation	permanent field coil

Gas	CMM
LHV	14.70MJ/Nm3 and above
Gas pressure	31.5～35kPa
Heat consumption of the engine	8.31MJ/kWh
NO2 emission	500mg/Nm3
Exhaustion temperature	463℃
Efficiency of the simple cycling	42.3%
Temperature of the cooling water in the inlet	82℃/90℃
Heat radiation to the cooling water	744kW
Gas consumption by the units	917.1Nm3/h（16.31 MJ/Nm3）
Air flow for combustion	7668Nm3/h

(2) Specifications for the waste heat boiler

Item	Specification
Type:	horizontal type with bypass natural cycling waste heat boiler
Model	EGS6.0033-2.5/400NSV
Rated output	6t/h
Rated pressure	2.5MPa(g)
Rated temperature	400℃
steam temperature decrease mode	saturated steam mixing
temperature of inlet water	105℃
exhaustion flow of the gas engine	9371 Nm³/h
exhaustion temperature of the gas engine	458℃
temperature of ejected smoke	≤150℃
resistance of the boiler	≤2.0kPa

(3) Steam turbine

a) Specification of the steam turbine

Item	Specification
Model	quick assembly coagulated
Type	N3-2.35
rated power	3MW
rated revolution	5600r/min
rated gas in take	15.99t/h
steam pressure in the main inlet	$2.35^{+0.2}_{-0.2}$ MPa
steam temperature in the main inlet	390^{+10}_{-20} ℃
rated steam discharge pressure	0.0105MPa
inlet water class	class 1（de-oxydren）
inlet water temperature under rated power output	105℃

b) Generator specifications

Item	Specification
Type	QF-W3-2,10500V
rated power	3000kW
rated voltage	10.5kV
rated flow	206.2A
Frequency	50Hz
Revolution	1500r/min
power factor	0.8
cooling method	air cooling
excitation method	AC excitation without brush

number of sets	4

The technological processes of this project are as follows:

CMM from current capture system → gas storage tank → compressor house → power plant → North China Grid

The energy and mass flows of this project activity is shown in Figure A.3-1.

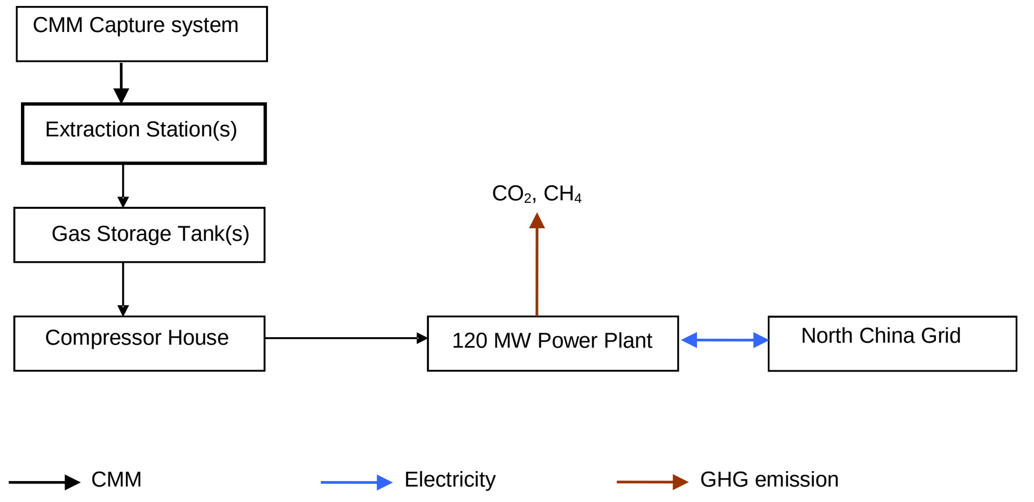

Figure A.3-1: The energy and mass flows of this project activity

Gas engines power generation sets, waste heat boilers and steam turbines produced respectively by Caterpillar Inc. of U.S.A., Shanghai Eagle New Technology Engineering Company and Hangzhou Steam Turbine & Power Group Company will be utilized in this project.

Along with the equipment procurement, intensive training programs will be carried out before the commission to help the local staff to be in command of these advanced technologies for stable performance. These training programs include:

Training course	Number of trainee	Duration(weeks)	Person week
Gas combustion engine	4	4	16
Dynamic system	4	2	8
Waste heat boiler	4	2	8
Steam turbine	4	2	8
Gas compressing station	4	2	8
Monitoring and control system	4	2	8
Total	24	14	56

Other parts of the power plant, e.g. grid connection, compressor and gas storage tanks, and pipelines etc. are conventional and will be sourced locally.

Therefore, this project will promote the transfer of advanced gas power technology to China.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
China (Host)	Shanxi Jincheng Anthracite Mining Group Co., Ltd.	No
Netherlands	International Bank for Reconstruction and Development as the Trustee of the Prototype Carbon Fund and the Trustee of the IBRD-Netherlands Clean Development Mechanism Facility	Yes
Japan	Japan Carbon Finance, Ltd.	No
UK	ICECAP Carbon Trading Ltd.	No

For detailed information, please refer to Annex I.

A.5. Public funding of project activity

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The public funds involved in this project exclude existing ODA. The sovereign Annex I participants of this project confirm that any public funding used to purchase emission reductions from this project does not result in a diversion of ODA and is separate from and is not counted towards its financial obligations as a Party included in Annex I.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Version 03 of the approved consolidated methodology ACM0008: “Consolidated methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring”.

Meanwhile, according to ACM0008, version 06 of approved consolidated methodology ACM0002 “consolidated methodology for grid connected power generation from renewable energy” is adopted to calculate the emission factor of the North China Grid.

Version 03 of the Tool for the Demonstration and Assessment of Additionality approved by the executive board is used to demonstrate and assess the additionality of this project activity.

For detailed information of the approved methodologies and relevant tool, please refer to the following website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

B.2. Applicability of methodology and standardized baseline

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The methodology ACM0008 is applicable to this project activity for the following reasons:

Table B-1 Comparison of this project with ACM0008 regarding CMM extraction activities

ACM0008 Applicability	This Project
underground boreholes in the mine to capture pre mining CMM	Included
surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	Included(excluding surface goaf wells)
ventilation CMM that would normally be vented	Included

Table B-2 Comparison of this project with ACM0008 regarding CMM utilization activities

ACM0008 Applicability	This Project
the baseline is the partial or total atmospheric release of the methane	Yes, partial release with very little utilization
The methane is captured and destroyed through flaring	Not included
The methane is captured and destroyed through utilization to produce electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources;	Capture methane is utilized for electricity generation and corresponding emission reductions are claimed
The remaining share of the methane to be diluted for safety reason may still be vented	Part of CMM is still vented in the proposed project
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented	Compliance with applicability

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

ACM0008 Inapplicability	This Project
Operate in open cast mines	Underground coal mines
Capture methane from abandoned/decommissioned	CMM extracted from working

coalmines	mines
Capture/use of virgin coal-bed methane	Extraction activities are concomitance with coal production
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place	Extraction activities are concomitance with coal production (never used CO_2 or any other fluid/gas to enhance drainage volume

It can be seen that this project meets all of the application conditions of ACM0008 (version 03) and does not involve any activity to which ACM0008 is not applicable. Therefore, ACM0008 (version 03) is applicable to this project activity.

Since electricity generated from this project will displace electricity from North China Grid, according to ACM0008 (version 03), the emission factor of North China Grid will be calculated following the guidance of the ACM0002 (version 06). Therefore, ACM0002 (version 06) is applicable to this project.

According to ACM0008, the latest version of the “Tool for the demonstration and assessment of additionality” (version 3) is used to demonstrate the additionality of this project.

B.3. Project boundary

The project boundary of this project activity is shown in Figure B.3-1.

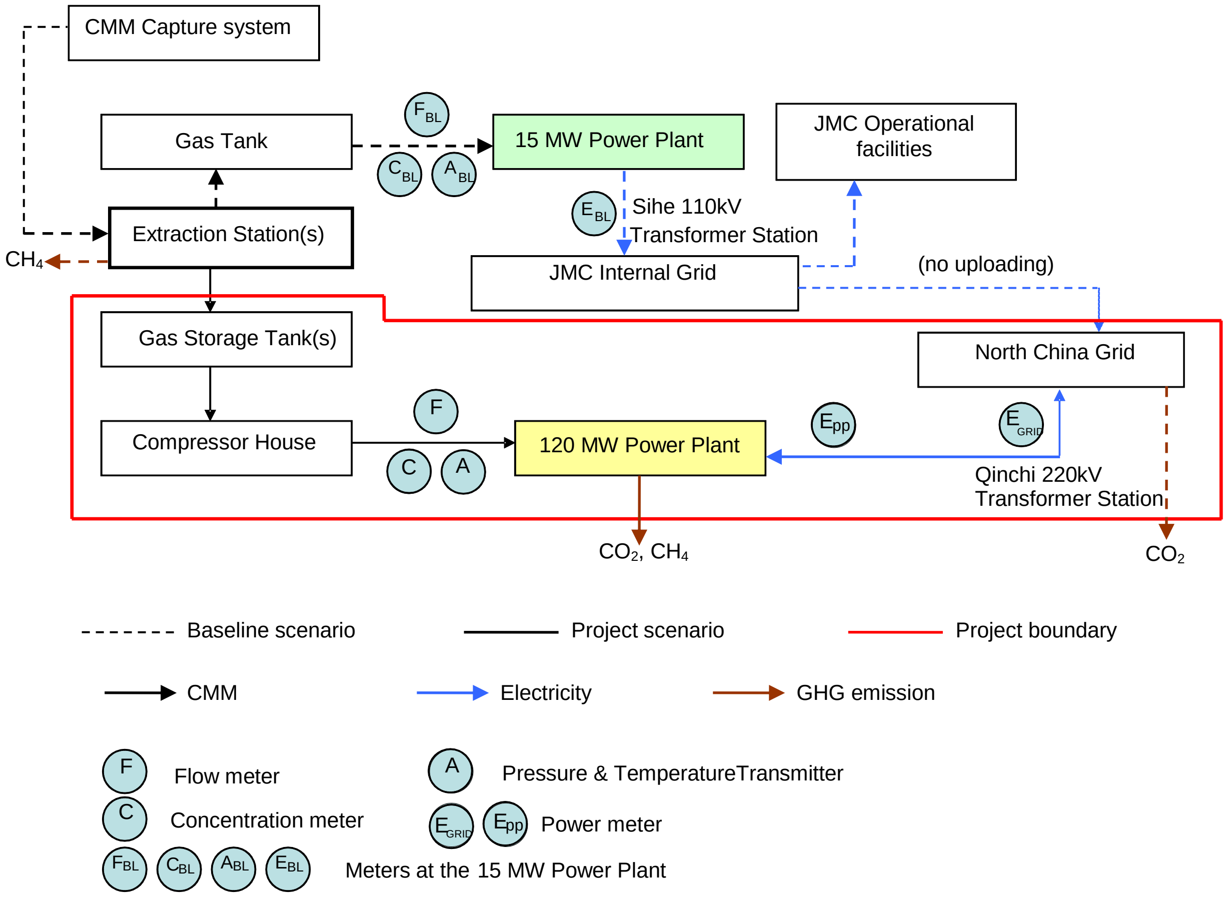

Figure B.3-1: The project boundary of this project activity

GHG emissions included in the project boundary:

	Source	GHGs	Included?	Justification/Explanation
Baseline scenario	Emissions of methane as a result of venting	CH_4	Included	Main emission source
	Emissions from destruction of methane in the baseline	CO_2	Included	A very small part of the methane is used for residential and power generation test purpose.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	North China Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Captive test power and heat use	CO_2	Excluded	Residential use and power generation test use of methane in the project remains the same as that in the baseline scenario.
		CH_4	Excluded	
		N_2O	Excluded	
Project scenario	Emissions of methane as a result of continued venting	CH_4	Excluded	According to ACM0008
	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	Additional equipment used in the project such as drainage pumps consume additional electricity.
		CH_4	Excluded	According to ACM0008
		N_2O	Excluded	According to ACM0008
	Emissions from methane destruction	CO_2	Included	From the combustion of methane in power generation.
	Emission from NMHC destruction	CO_2	Excluded	In this project, NMHC accounts for less than 1% by volume of extracted coal mine gas.
	Fugitive emissions of unburned methane	CH_4	Included	Small amounts of methane will remain unburned in power generation.
	Fugitive methane emissions from onsite equipment	CH_4	Excluded	According to ACM0008
	Fugitive methane emissions from gas supply pipeline	CH_4	Excluded	According to ACM0008
	Accidental methane release	CH_4	Excluded	According to ACM0008

B.4. Establishment and description of baseline scenario

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

Step 1a. Options for CMM extraction

Technically feasible options for CMM extraction for Sihe Coal Mine include:

A. Ventilation air methane;
B. Pre mining CMM extraction;
C. Post mining CMM extraction;
D. Combinations of options A, B and C, with ventilation air methane accounting for about 53%, pre-mining CMM 45% and post-mining CMM 2% of total extracted methane, i.e. the continuation of the current situation in Sihe Coal Mine.

Step 1b. Options for extracted CMM treatment

The possible baseline scenario alternatives at Sihe Coal Mine for treating extracted CMM include:

i. Venting;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation, but not implemented as a CDM project;
v. Use for additional captive power generation;
vi. Use for additional heat generation;
vii. Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation);
viii. Possible combinations of options i to vii.

Step 1c. Options for energy production

In the absence of this project, the electricity generated by this project could be supplied through the following options:

a. North China Grid supplies the same amount of electricity;
b. Generate electricity with the extracted CMM, but not implemented as a CDM project, i.e. option iv in step 1b;
c. Construction of a coal-fired power plant with equivalent amount of installed capacity.

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

China National People's Congress (NPC), Standing Committee of the NPC, State Council, and State Administration of Work Safety (State Administration of Coal Mine Safety) have issued respectively a series of laws, regulations, and sectoral rules on coal mine safety. All of the relevant documents could be found from the website: http://www.chinasafety.gov.cn. Currently, methane control requirements in these law and regulations are only for health and safety purpose and the only specific requirement is that methane concentrations in the air should be below 1% to avoid the risk of explosion (*National Coalmine Safety Regulation* 2001 version and 2005 version, Section Two item 100 –150).

The content of methane in Sihe Coal Mine is very high, hence in addition to ventilation, both pre-mining CMM and post-CMM extraction are necessary to keep the density of methane below 1% for guaranteeing the safety production. Therefore in the options of methane extraction, option A (ventilation air methane mine), option B (pre-mining CMM), or option C (post mining CMM) alone could not meet the safety production requirement and does not comply with relevant laws, regulations and sectoral rules. Options A, B, and C are thus eliminated.

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

While the Chinese Government promotes the utilization of CMM, especially in June 2005, NDRC announced the Coalmine Methane Treatment and Utilization Macro Plan to encourage the CMM drainage and utilization; it specifically called on the incentives from CDM to overcome barriers in the country to take such action. Therefore, we can deem it as an E- national policy according to EB 22 Annex 3. In China, there is no compulsory requirement on the utilization of the captured CMM.

To ensure safe electricity production of and reliable electricity supply of both the captive power plant and the electric grid, captive power plants in China are required be connected with the electric grid. In this project case, according to the electricity sales contract between Sihe Coal Mine and the North China Grid, electricity generated by this project must be supplied to the grid and cannot be used directly by the coal mine itself. Therefore, option v (use for additional captive power generation) is part of option iv and thus could be eliminated.

The treatment options from i to iv and vi to viii are all in compliance with China's relevant laws, regulations and sectoral rules.

This project is to build a 120 MW CMM-fired power plant. Building a coal-fired power plant of the same capacity is prohibited by the national regulation[1]. Therefore, option c for energy production (building coal fired power plant) does not comply with the national laws and regulations, then is eliminated.

Step 3. Formulate baseline scenario alternatives

Based on the previous discussion, the baseline scenario alternatives are the possible combination of CMM extraction options, CMM treatment options, and energy production options. More specifically, they may include:

3a. baseline scenario alternatives for CMM extraction

D. Combinations of ventilation air methane, pre-mining CMM extraction and post-mining CMM extraction, with respective ratios of about 53%, 45% and 2%, i.e. the current situation.

3b. Baseline scenario alternatives for CMM treatment

i. Venting;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation, but not implemented as a CDM project;
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 above options.

3c. Baseline scenario alternatives for energy production

a. North China Grid supplies the same amount of electricity;
b. Generate electricity with the extracted CMM, but not implemented as a CDM project, i.e. option iv in step 3b.

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers

4a. baseline scenario alternatives for CMM extraction

Option D given in 3a is feasible.

4b. Baseline scenario alternatives for CMM treatment

i. ventilation

There is no barrier for this option, and it is feasible.

ii. Using/destroying ventilation air methane rather than venting it

The average density of methane in the VAM in Sihe Coal Mine is 0.5%. Up to now, there is no commercialized matured technology in the world that could use the VAM of this density and there's no such project in the world[2]. Destroying VAM needs large amount of investment while generates no economic benefits, and thus faces investment barrier and is not feasible. Therefore this option is not feasible, and then can be eliminated.

iii. Flaring of CMM

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1 "Guiding List on Energy Industry Restructure" (http://www.gov.cn/gzdt/2005-12/30/content_142048.htm); "Notice on the Strict Prohibition of Construction of the Thermal Power Units below 135 MW by State Council" (http://www.zjjmw.gov.cn/zcfg/gjfg/2002/10/10/9318.shtml).

2 http://www.epa.gov/cmop/vam/whatisvam.html.

This option will also need large investment, but will bring no economic benefits. Therefore, it faces significant investment barrier and is not feasible.

iv. Use for additional grid power generation, but not implemented as a CDM project
This option will be discussed in Step 5.

vi. Use for additional heat generation
The heat demand in Sihe Coal Mine include cooking in the dining rooms for the coal miners and hot water for bathing purpose of the coal miners and district heating of on-site office buildings in winter time. Four boilers (3×4t + 1×2t) using CMM have already been built and operating for this purpose. Of these boilers, two 4t boilers were put into operation in 1999, one 4t in 2000 and the 2t in 2001. Currently, the capacity of these boilers is big enough to meet the heat demand of the coal mine. Since Sihe Coal Mine is now in full operation, the number of coal miners will not increase in the future according to JMC's development plan, especially considering that more and more mechanical equipments will be used. Therefore, there is no need and possibility to expand the heat utilization of CMM. This option is therefore not feasible.

vii. Feed into gas pipeline
Currently, there's no pipeline connection between Sihe Coal Mine and the nearby villages which may be potential CMM users. The nearest villages are 5 km far with less than 1000 households. However, the construction of the pipeline system for these dispersedly distributed villages needs large amount of investment, more than 10 million US$. Furthermore, because coal is very cheap, less than 200 yuan/t, in the local area, potential users of pipeline gas can only accept very cheap gas price which will thus make the investment not feasible even if the huge amount of initial investment could be motivated. All of these make this option infeasible.

viii. Possible combinations of above options.
According to above discussion, possible scenarios include the combination of scenarios i (ventilation) and iv (use for additional grid power generation, but not implemented as a CDM project). Since under scenario iv, some of the CMM will still be vented to the atmosphere, so this scenario is actually the same as scenario iv and thus could be eliminated.

4c. Baseline scenario alternatives for energy production

There are two baseline scenario alternatives for electricity production that are in compliance with legal and regulatory requirements in China.

(a) Purchase of electricity from the North China grid (Current situation);
(b) CMM utilization for power generation (Project implementation without CDM).

The option (b) (Project implementation without CDM) is not economically attractive and faces prohibitive financial barrier as it is demonstrated by the investment and sensitivity analysis in Section B.5. This option could be excluded at this step of the baseline identification.

The option (a) – Purchase of electricity from the North china grid (Current situation) - could be implemented without any prohibitive barriers.

In addition, the volume of the available CMM from the JMC Sihe mine is sufficient for power generation at the full capacity.

The "FSR for JMC Sihe CMM Utilization"[3] (2004) assessed the availability of CMM for the power generation capacity of 120MW for Jincheng Sihe CMM Project. This FSR was developed by the Chongqing Branch of China Coal Research Institute. The FSR indicates that the full implementation of the advanced underground CMM drainage technology at Sihe mine, expected by 2009[4], will ensure the availability of CMM at about 250 Million m^3 per year.[5] This extraction rate

[3] Chongqing Branch of China Coal Research Institute, "FSR for JMC Sihe CMM Utilization", (August 2004). The Chongqing Branch of China Coal Research Institute is an independent accredited organization.

[4] Loan Agreement (between P.R. of China and ADB), Coal Mine Methane Development Project, March 24, 2005, page 9.

can be maintained for 27 years according to the estimates of the resources available in the "CMM Resource Assessment Report for Sihe mine".[6]

The statistics of the Ventilation Department of the Sihe mine demonstrate that the actual rate of CMM drainage (including VAM, pre-mining and post-mining sources) was constantly increasing from 60.16 Million m^3 in 2003 to 191.32 Million m^3 in 2007 as a result of progressive implementation of the advanced underground CMM drainage technology (please see the table below).[7]

CMM Availability at JMC Sihe Mine, 2003-2008

Years	2003	2004	2005	2006	2007	2008 (est.)
CMM available, Million m^3	60.16	76.62	95.21	130.64	191.32	220.75

Source: Ventilation Department of Sihe Mine, "JMC Sihe Mine CMM Gas Extraction and Usage Volume Data Sheet".

The total CMM available from JMC Sihe Mine in 2008 is estimated at about 220.75 Million m^3. This is sufficient to cover the total needs in CMM of about 216 Million m^3 including[8]:

- the current use for the on-site heating and cooking (6.63 Million m^3 in 2006)
- the existing experimental 15MW power plant (27.65 Million m^3 in 2006);
- the Jincheng Sihe CMM Project 120 MW power plant (181.47 Million m^3 estimated for full capacity operation[9]).

To conclude, the continuation of the current situation, i.e. CMM extraction including ventilation air methane, pre-mining CMM extraction and post-mining CMM extraction, with respective ratios of about 53%, 45% and 2%; all of the extracted CMM will be released directly to the atmosphere; and JMC purchases of electricity from the North China grid – is not facing any prohibitive barriers and thus represents the baseline scenario.

B.5. Demonstration of additionality

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According to ACM0008, version 3 of Tool for the Demonstration and Assessment of Additionality approved by the EB is used to illustrate the additionality of this project.

From the very beginning of this project, potential CDM revenue was taken into account and played a critical role in the decision making process. In the stages of Loan Fact-finding and Loan Appraisal, ADB was mentioning about the CDM potential and taking it seriously into account. In the MOU of ADB Loan Appraisal Mission and the Report and Recommendation of the President to the Board of Directors of ADB dated October 2004, it is stated that "The Project may qualify for financial support under CDM or similar arrangements if certain conditions are met".

In 2002, when the World Bank started the discussion with the Government of China regarding development of CDM market in China, Jincheng project was among earliest project ideas recommended by the Chinese government.

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[5] "FSR for JMC Sihe CMM Utilization", pages 29-30. Ventilation Department of Sihe Mine, "JMC Sihe Mine CMM Gas Extraction and Usage Volume Data Sheet".

[6] Chongqing Branch of China Coal Research Institute, "CMM Resource Assessment Report for Sihe mine" (1998).

[7] Ventilation Department of Sihe Mine, "JMC Sihe Mine CMM Gas Extraction and Usage Volume Data Sheet", actual JMC 2007 statistic data.

[8] "JMC Sihe Mine CMM Gas Extraction and Usage Volume Data Sheet".

[9] "FSR for JMC Sihe CMM Power Plant Project", page 124.

Following table summarizes the key milestones of the project development that are relevant to CDM:

Date	Event
September, 2003	ADB Loan Fact-finding Mission visited the project owner, discussed about the land use, environment protection, poverty reduction, CDM project development etc., and stared preparation for the loan agreement negotiation.
January, 2004	The World Bank signed the Letter of Intent for potential purchase of emission reductions.
July, 2004	The World Bank signed the agreements with relevant experts to develop new CDM methodology for CMM utilization based on the project.
October, 2004	ADB Loan Appraisal Mission visited the project owner and negotiated the loan agreement, on the premise that the project would receive additional financial support under the CDM scheme.
December 1, 2004	The Emission Reduction Purchase Agreement was signed between the World Bank and the project owner.
February 9, 2005	Based on the project, NM102, which eventually became an element of ACM0008, was proposed by the World Bank and submitted to the CDM EB.
March 24, 2005	Loan agreement was signed between the Government of China and the Asian Development Bank.
January 25, 2007	The project started construction.

Below are the ADB loan conditions:

The Asian Development Bank (ADB) loan of USD 72.03 Million[10] was provided to the Shanxi Government with the conditions described below and translated into following repayment conditions for JMC:

- Maturity of 24 years including a grace period of 4 years, an interest rate determined in accordance with ADB's LIBOR-based (London Interbank Offered Rate) lending facility and applicable charges and fees;
- Loan Repayment Guarantee Agreement between Shanxi Government (Financial Bureau of Shanxi Province) and JMC[11] requiring JMC to pledge its land and coal resources as collateral and to provide guarantees from another coal mining group in Shanxi province[12].

The JMC CMM utilization project is a part of the "Overall ADB CMM demonstration project in Shanxi Province".[13] The main objective of the Project is the demonstration of latest technologies for CMM production, capture, and utilization which inherently implied high technological and implementation risks for JMC.

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[10] Loan Agreement (ordinary operations between People's Republic of China and Asian Development Bank), Coal Mine Methane Development Project, March 24, 2005.

[11] Loan Repayment and Collateral Agreement between Financial Bureau of Shanxi Province and JMC.

[12] Loan Guarantee Agreement between Shanxi Government and Shanxi Lu'an Coal Group, 2006.

[13] Loan Agreement (ordinary operations between People's Republic of China and Asian Development Bank), Coal Mine Methane Development Project, March 24, 2005, page 9.

As per requirements of the CDM framework, the ADB has confirmed that the loan does not result in a diversion of ODA and the funding for this project is separate from and is not counted towards its financial obligations[14].

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

Tool for the Demonstration and Assessment of Additionality provides three options for analysis: simple cost analysis, investment comparison analysis and benchmark analysis.

Since this project will generate financial benefits through sales of the electricity, therefore the simple cost analysis is not applicable. Furthermore, the other alternative is the continuation of the current situation which is not an investment, so investment comparison approach cannot be used. The benchmark approach, more specifically Internal Rate of Return (IRR) indicator, is used for the investment analysis.

Sub-step 2b. Apply benchmark analysis

At the time of the approval of the Feasibility Study Report[15] (October 18, 2004) and the investment decision[16] (March 24, 2005), JMC applied the 15% IRR benchmark, which was established by the "Methods and Parameters for Economic Evaluation of Construction Project (Edition 2)" [17] (referenced as "Methods and Parameters (Edition 2)" hereafter) for the coal mining sector. The project entity, JMC was applying the benchmark of 15% consistently for any new investment decisions at that time.

Moreover, the power generated by the Project will be used for captive power consumption by JMC through wheeling. The Project is thus classified as a coal mining sector investment project rather than a power sector project. Therefore, the coal mining sector benchmark is suitable for the Project rather than the power sector benchmark.

The suitability of the 15% IRR benchmark is demonstrated in further details as follows.

1. The applicability of Edition 2 of the "Methods and Parameters for Economic Evaluation of Construction Project" at the moment of the investment decision

The China National Planning Commission and Ministry of Construction issued the "Methods and Parameters (Edition 2)" in July 1993 that remained effective until August 2006 when it was replaced by the "Methods and Parameters (Edition 3)".[18] The IRR benchmark of 15% established for the Coal Pit or Shaft Mining (0810B)[19] by "Methods and Parameters (Edition 2)" was applicable because JMC is specialized in coal pit mining.

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[14] Letter from ADB of No ODA Diversion, November 19, 2008.

[15] "Feasibility Study Report for JMC Sihe CMM Power Plant Project", China Electric Design and Research Institute, February 2004.

[16] The Loan Agreement was signed on March 24, 2005 between the Government of China and the Asian Development Bank. In other words, Jincheng Anthracite Mining Corporation ("JMC") made an official and irreversible investment decision.

[17] "Methods and Parameters for Economic Evaluation of Construction Project (Edition 2)", published by the China National Planning Commission and Ministry of Construction, China Planning Press, July 1993.

[18] "Methods and Parameters for Economic Evaluation of Construction Project (Edition 3)", published by the China National Development and Reform Committee and Ministry of Construction, China Planning Press, August 2006. By August 2006, when "Methods and Parameters (Edition 3)" was published, more than 80% of total investment for the Project had been committed by JMC through equipment purchase agreements and contracts with construction service providers (according to the List of Contracts and Agreements signed from January 2004 to July 2006, investment committed by JMC).

[19] Section "Parameters for Economic Assessment" of "Methods and Parameters (Edition 2), page 115.

Consistent with the CDM EB Guidance on the Assessment of Investment Analysis of CDM Projects (41st Meeting, Annex 45), according to Guidance (6), "the input values used in all investment analysis should be valid and applicable at the time of the investment decision taken by the project participants". The rationale for this Guidance further clarifies: "This decision will therefore be based on the relevant information available at the time of the investment decision and not information available at an earlier or later point". Therefore, the IRR benchmark of 15% was the only applicable official IRR benchmark for the Project.

2. Consistent application of 15% benchmark in JMC investment practice

JMC applied the benchmark of 15% for its investment decisions in a consistent manner. The JMC management's requirement to use the 15% threshold for any new investment decisions was confirmed at its General Manager's meeting in February 2004.[20] Furthermore, the consistent application of 15% benchmark in JMC investment practice was demonstrated by the following examples:

- Approval of the Zhaozhuang coal mining and selection project (2004): the feasibility study report of the Zhaozhuang project specifies that the 15% benchmark was applied.[21] With the IRR of 18.2%, the project was approved by JMC management. After approval by the National Development and Reform Commission[22] the project was implemented.
- Rejection by the JMC of the Jinju stainless steel pipeline project (2004): The Jinju investment proposal consisted of construction of a stainless steel pipeline. The project was rejected by the General Manager's Meeting given that it was not a part of the JMC core business and the project IRR was below the 15% threshold.[23]

3. Suitability of using the coal mining sector rather than power sector benchmark

JMC investment strategy is driven by the objectives of its coal mining business development. The focus on the coal mining as a core competence, through expanding mining activities and mining resources, was confirmed at the JMC General Manager Meeting in early 2004.[24] Coal mining activities accounted for 78.9% of JMC's revenues in 2004.[25]

The Report of the Power Supply Division of JMC "Current Situation and Projection on JMC's Power Consumption"[26] issued in January 2005 indicated that the total power import of JMC from the Grid reached 4.93×10^8 kWh in 2004 and was expected to grow steadily in response to the accelerated development of JMC core coal mining business. Over the past three years (2006-2008), these projections were confirmed by the statistics of actual JMC power consumption from the grid (Table B-4).

The Report also indicated that JMC may consider using its own resources to install captive power generation capacities in order to cover a share of its total electricity needs and partially substitute the growing purchase from the grid. Thus, the decision to implement the Sihe 120MW CMM Power Plant under the CDM was planned to be a part of the response to the growing captive power needs

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[20] JMC General Manager Meeting Minutes No.8, February 10, 2004, page 2.

[21] Beijing Huayu Engineering Co. Ltd., China National Coal Engineering Group, "Zhaozhuang Project FSR" (2003)

[22] Approval of the Zhaozhuang Project by NDRC (04/2004)

[23] JMC General Manager Meeting Minutes No.8, February 10, 2004, page 2

[24] JMC General Manager Meeting Minutes No.8, February 10, 2004, page 2

[25] Shanxi Gouyuan (2005), Audit Report on JMC 2004 Financial Statement. Shanxi Guoyuan is an independent certified public accounting company.

[26] "Current Situation and Projection on JMC's Power Consumption", Power Supply Division of JMC, January 2005

of JMC and was not related to the business diversification or competition for a power market share. This is further substantiated by Table B-4.

Table B-4: Ratio of the Import of Power from Grid to the Export of Power to Grid by JMC

Year	Projection by the FSR for Sihe 120MW Power Plant (2004)		2005 Projections of JMC Power Import from the Grid (GWh)	Ratio (Projected Import / Projected Export)	Actual Power Import of JMC from the Grid (GWh)	Ratio (Actual Import / Projected Export)
	Intalled Capacity (MW)	Power Export to the Grid (GWh)				
	(1)	(2)	(3)	(3) / (2)	(4)	(4) / (2)
2006	60MW	411.6	630.0	**153%**	590.4	**143%**
2007	60MW	411.6	670.0	**163%**	731.3	**178%**
2008	90MW	617.4	1000.0	**162%**	977.2	**158%**
2009	120MW	823.2	1300.0	**158%**	N/A	**N/A**

Sources:

- Feasibility Study Report for JMC Sihe CMM Power Plant Project (China Electric Design and Research Institute), February 2004, "Overall Project Implementation Schedule", pages 78-80.
- "Current Situation and Projection on JMC's Power Consumption", Power Supply Division of JMC, January 2005, pages 4-8.
- Settlement invoices issued by the Grid for 2006-2008.
- JMC Annual Statistical Reports on Power Import from the Grid for 2006-2008.

Thus, the suitability of coal mining sector benchmark can be further clarified by demonstrating that the electricity generated by the Sihe 120MW power plant was planned to be used for captive consumption by JMC through wheeling. The power supply to the grid for a captive power plant is a common practice in China to ensure safety and stability of power production and reliability of power supply.[27] In the case of this project, such practice is specified in the "Connection Agreement" between JMC and Grid.[28] In addition, the "Connection Agreement" stipulates that the electricity generated from Sihe CMM power plant should first be used for JMC captive consumption as a priority. This is also in line with NDRC's guideline on how to utilize CMM for power generation.[29]

Table B-4 shows that the amount of power purchased by JMC from the North China Grid[30] was projected to be consistently higher than the amount of power to be exported to the Grid by the Sihe 120MW CMM power plant. The ratio of Power Import to Export is provided beginning in 2006 when the first 60MW tranche of the Sihe Power Plant was expected to become operational (Sihe FSR, 2004).[31]

In Table B-4, the projected "Installed Capacity" **(1)** of the Sihe 120MW power plant reflects the project implementation schedule by tranches as indicated in the Feasibility Study Report (FSR) for the Sihe CMM power plant[32]. It was expected in the FSR that the project will reach full capacity in 2009. In practice, as the project is currently under commissioning, it is not yet supplying power to the Grid. The "Power Export to the Grid by JMC" **(2)** reflects the projections in the FSR in accordance with the expected timeline of project implementation.

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[27] This common practice is explained in the article on provincial government website of the Shanxi Province Energy Research Institute and Economic Commission: http://www.dss.gov.cn/Article_print.asp?ArticleID=197921.

[28] "Connection Agreement" between JMC and Grid signed in December 29, 2007, page 2, section 1.5.

[29] Notice on the utilization of CMM for power generation, NDRC (April, 2007), available at: http://202.123.110.5/zwgk/2007-04/16/content_583702.htm

[30] "Current Situation and Projection on JMC's Power Consumption", Report issued by the Power Supply Division of JMC, January 2005, pages 4-8.

[31] Feasibility Study Report for JMC Sihe CMM Power Plant Project (China Electric Design and Research Institute), February 2004, "Overall Project Implementation Schedule", pages 78-80).

[32] Feasibility Study Report for JMC Sihe CMM Power Plant Project (China Electric Design and Research Institute), February 2004, "Overall Project Implementation Schedule", pages 78-80).

The ratio of the Import of Power from the Gird to the Export of Power to the Grid is then calculated based on "2005 Projections of JMC Power Import from the Grid"[33] **(3)** and confirmed by the "Actual Power Import of JMC from the Grid" **(4)** for the period 2006-2008[34]. Given that the existing experimental 15MW power plant is not uploading power to the Grid, it is not included in the "2005 Projections of JMC Power Import from the Grid" **(3)** or in the "Actual Power Import of JMC from the Grid" **(4)**.

To summarize, the arguments provided above demonstrate that the power generated by the Project will be used for captive power consumption by JMC through wheeling. It is a common practice and a safety and stability requirement for coal mining sector captive power plants in China to export power to the Grid and supply the captive power needs through wheeling. Therefore, the Jincheng Project is classified as a coal mining sector investment project rather than a power sector project.

As JMC management must assess all investments to achieve, at a minimum, the applicable coal mining sector benchmark, the Project must equally compete with other coal mining sector investment options for the available capital.

Thus, the coal mining sector benchmark is suitable for the Project rather than the power sector benchmark.

Sub-step 2c.Financial indicator calculation and comparison

The input values applied in the investment analysis are derived from the Feasibility Study Report (FSR) of the Jincheng Sihe CMM Generation Project[35]. The FSR was developed by China Electric Design and Research Institute[36], a government accredited independent design organization. The assumptions of the investment costs, operational and maintenance costs, as well as other relevant economic parameters used in the FSR were made in accordance to the national standards. The FSR was then assessed by China National Engineering Consulting Corporation (independent expert organization designated by NDRC) and approved by the Development and Reform Commission of Shanxi Province[37]. The values are therefore reliable and suitable.

The parameters and the corresponding data values used in the calculation are listed in the Table B-5 below. The analysis (for details, please see the attached calculation sheet) shows that without CER revenues, the IRR of this project is 11.74%, much lower than the benchmark rate, 15%. Therefore, the project is not financially viable.

Table B-5: Financial Parameters

Parameter	**Value**	**Source**
Total Investment (Million Yuan)	793.2	Feasibility Study Report, P123
Annual Operation and Maintenance Cost (Million Yuan)	59.6	Feasibility Study Report, P145
Project Lifetime (Years)	25	Feasibility Study Report, P116

33 "Current Situation and Projection on JMC's Power Consumption", Power Supply Division of JMC, January 2005, pages 4-8.

34 The amounts are supported by the settlement invoices issued by the Grid. They are also confirmed by the Power Supply Division Annual Statistical Reports provided to the Grid as a reference for the expected power consumption in the subsequent year (JMC Annual Statistical Reports on Power Import from the Grid).

35 China Electric Design and Research Institute (February, 2004), "FSR for JMC Sihe CMM Power Plant Project". Please also see the Table b-4 of the PDD (Version 7.7, 24/06/2008).

36 Qualification rank: A. No.01005-sj, issued by National Ministry of Construction of P.R China.

37 Approval of the feasibility study, Document no.: [2004]612, 19 October 2004.

Annual Amount of Electricity Delivered to the Grid (GWh)	823.2	Feasibility Study Report, P124
Feed-in Tariff (million yuan/GWh, without VAT)	0.200	Feasibility Study Report, P124
Annual Heat Supply Amount (TJ)	233.665	Feasibility Study Report, P124
Heat Sales Price (million yuan/TJ, without VAT)	0.01026	Feasibility Study Report, P124
City Construction and Education Tax	1.36%	Feasibility Study Report, P116
Income Tax	33%	Feasibility Study Report, P116

With CER revenues, the IRR of this project will be increased to 26.46% (assuming a CER price of 7 Euros), higher than the benchmark IRR. Thus the registration of this project as CDM project will significantly improve the economic performance of this project and make it financially attractive.

Sub-step 2d. Sensitivity analysis

Table B-6 gives the sensitivity analysis of the financial performance of this project to the change of key variables, which include: total investment, annual operation and maintenance cost, annual amount of electricity delivered to the grid and feed-in tariff.

Table B-6: Impacts of Key Parameters on the IRR of CMM Recovery Component

Variation / Parameters	-52.6%	-20.9%	-10%	-5%	0	5%	10%	17.9%
total investment		15.00	13.15	12.41	11.74	11.11	10.53	
annual operation and maintenance cost	15.00		12.39	12.07	11.74	11.40	11.06	
annual amount of electricity delivered to the grid/feed-in tariff			9.73	10.75	11.74	12.69	13.61	15.00

It can be seen that when the total investment decreases by 20.9%, the annual operation and maintenance cost decrease by 52.6% or the annual amount of electricity delivered to the grid or the feed-in tariff increases by 17.9%, the IRR of this project will reach 15%, the benchmark IRR.

The project is now at its late stage of construction, and the real cost is about 3% higher than the estimated total cost due to the increase of equipments, construction material, labor cost, etc. It is therefore impossible for the total investment to decrease by 20.9%.

Because both the labor cost as well as the equipment maintenance parts prices have been increasing during the past several years in China, it is impossible for the annual operation and maintenance cost to decrease by 52.6%.

The feed-in tariff has already been determined by the price authority of China and it is impossible to change, not mentioning to have a substantial increase by 17.9%.

As for the annual amount of electricity delivered to the grid, it is also impossible to increase by 17.9% because the design of this project has already been optimized to the utmost extent.

Therefore, the sensitivity analysis confirms that within the realistic range of variation of main economic parameters of the project, the IRR remains below the benchmark. Thus, the project is not financially attractive and would not be implemented without CDM revenues.

Step 4: Common practice analysis

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

China is the largest emitter of CMM in the world, releasing over 12 billion cubic meters in 2000[38]. This represents nearly 37% of the world's CMM emissions. In 2002 only 196 coal mines in China had undertaken methane drainage. The average drainage rate in the country is less than 10%[39]. Moreover, less than 50% of China's drained CMM was utilized[40], which means that only less than 5% of the total CMM emitted by China is being used at coal mines. This means that the technology of CMM extraction and utilization is not widespread in China.

Among the 5% CMM utilized, the major purpose is to supply gas to coal miners' households, local small-scale industry or small scale power generation. Most of the CMM power generation schemes in China are small scale projects with poor financial performance due to various reasons such as immature drainage and domestic made power generator technologies and lack of capital and policy support, etc. Recent experience with power generation based on CMM has not been very positive[41].

This project is the largest CMM power generation project in China, about two times of the total accumulated installed capacity by the end of 2005 of the whole country, and from the very beginning of this project, CDM factor has been considered and played a critical role in the decision making process.

In 2002, when the World Bank solicited potential CDM projects form China, Government of China recommended this project in the first batch. Furthermore, in the MOU of ADB Loan Appraisal Mission and the Report and Recommendation of the President to the Board of Directors of ADB dated October 2004, it is stated that "The Project (this project) may qualify for financial support under CDM or similar arrangements if certain conditions are met".

Currently, several CMM power generation projects with installed capacity larger than 10MW are under development in china, while all of them are applying for CDM support. Therefore, there is no project that is similar to this project.

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

No similar project is observed and thus this project is not a common practice.

To conclude, this project is additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Step 1: Calculation of the project emissions

Project emissions are calculated by the formulation below:

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

[38] United States Environmental Protection Agency, Assessment of the Worldwide Market Potential for Oxidizing Coal Mine Ventilation Air Methane, Washington DC, July 2003. http://www.epa.gov/coalbed/pdf/ventilation_air_methane.pdf.

[39] China Coal Information Institute (CCII), Optimal Projects for China's Coal Mine Methane Mitigation, 3rd International Methane & Nitrous Oxide Mitigation Conference, Beijing, China, November 2003. http://www.coalinfo.net.cn/coalbed/meeting/2203/papers/coal-mining/001.pdf.

[40] China Coal Information Institute (CCII), Optimal Projects for China's Coal Mine Methane Mitigation, 3rd International Methane & Nitrous Oxide Mitigation Conference, Beijing, China, November 2003. http://www.coalinfo.net.cn/coalbed/meeting/2203/papers/coal-mining/001.pdf.

[41] CMM Power Generation Technology and Current Challenges in China, China Coalbed Methane, Vol.1 No.2, November 2004. http://engine.cqvip.com/content/td/87570x/2004/001/002/gc111_td3_11338714.pdf.

Where:

PE_y	Project emissions in year y (tCO2e);
$PE_{ME,y}$	Project emissions from energy use to capture and use methane in year y (tCO2e);
$PE_{MD,y}$	Project emissions from methane destroyed in year y (tCO2e);
$PE_{UM,y}$	Project emissions from un-combusted methane in year y (tCO2e).

Combustion emissions from additional energy required for CMM capture and use

CMM utilization component will consume certain amount of electricity; however the electricity will be supplied by the CMM power plant itself and is included in the plant electricity consumption. When calculate emission reductions, the net electricity delivered to the grid will be used. Therefore, emission from the consumption of electricity is calculated as below:

$$PE_{ME,y} = CONS_{ELEC,PJ} \times CEF_{ELEC} \quad (2)$$
$$= 0$$

Where:

$CONS_{ELEC,PJ}$	Additional electricity consumption for use of methane (MWh);
CEF_{ELEC}	Carbon emissions factor of electricity used by coal mine (tCO_2e/MWh).

The electricity consumed by the CMM recovery system is imported from North China Grid, so CEF_{ELEC} is the emission factor of North China Grid, i.e. $EF_{ELEC,y}$.

Project emissions from methane destroyed

The CMM recovered in this project will be used for power generation only, so the project emissions from methane destroyed can be calculated with the formulae below:

$$PE_{MD,y} = MD_{ELEC,y} \times (CEF_{CH4} + r \times CEF_{NMHC}) \quad (3)$$

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

Where:

$MD_{ELEC,y}$	Methane destroyed through power generation in year y (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 ($tCO_2e/tNMHC$);
r	Relative proportion of NMHC compared to methane;
$PC_{CH4,y}$	Concentration of methane (in mass) in extracted gas (%), measured on wet basis;
$PC_{NMHC,y}$	NMHC concentration (in mass) in coal mine gas (%).

According to gas sample analysis in Sihe Coal Mine, 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 NMHC concentration will be monitored annually in Sihe Coal Mine to checkout whether its concentration is below or above 1% to determine whether NMHC combustion to be included in the project emissions.

$MD_{ELEC,y}$ is calculated with the formulae below:

$$MD_{ELEC,y} = MM_{ELEC} \times Eff_{ELEC} \quad (5)$$

Where:

$MM_{ELEC,y}$	Methane measured delivered to power plant in year y (tCH4);

Eff_{ELEC}	Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC).

Un-combusted methane from power generation

Un-combusted methane from power generation can be obtained through following equation:

$$PE_{UM} = GWP_{CH4} \times MM_{ELEC,y} \times (1-Eff_{ELEC}) \quad (6)$$

Where:

GWP_{CH4}	Global warming potential of methane (21 tCO_2e/tCH_4).

Step 2: calculation of the baseline emissions

Baseline emissions BE_y are given by the following equation:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \quad (7)$$

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 the year y that is avoided by the project activity (tCO_2e);
$BE_{Use,y}$	Baseline emissions from power generation replaced by this project in year y (tCO_2e).

Baseline emissions from methane destroyed

There is residential CMM utilization in the baseline scenario, so it is necessary to inspect the thermal demand for each year of the crediting period. The existing residential gas utilization in Sihe Coal Mine has absolute priority over this project because it is a daily necessity for the coal miners, i.e. it is for public canteen cooking and bathing purposes. For the coal mine to operate normally, providing both basic diet and the bathing after mining work to the miners are both a must. Therefore, project participants do not anticipate possible overlap between baseline thermal use and this project use.

However, to be conservative, mean annual baseline thermal energy demand is also estimated[42]. A summary of the findings is as follows:

1. Currently, the annual coal output of Sihe Coal Mine is 10.8 million tons;
2. The CMM utilization for residential purpose is rather stable because it is for public use and not for individual household use and the operation of Sihe Coal Mine has been stable during the past years;
3. The annual coal output of Sihe Coal Mine will increase to 12.0 million tons according to the expansion plan.

Currently, the 4 boilers for cooking and heating purposes operate 18-19 hours a day, and all of the three 4t boilers operate in the winter times, while only two 4t boilers operate in the summer times due to decreased heating demand. The 2t boiler only operates during food preparation time and less than 6 hours a day. For conservative purpose, it is assumed that in the baseline scenario, the three 4t boilers operate for 8760 hours a year and the 2t boiler operates for 3000 hours a year in full capacity.

Under the very conservative circumstanced described above, it is estimated that the baseline annual thermal demand in the crediting period would be about 8,094,600m^3 CH_4, which is quite small compared with the total methane current extracted and vented to the atmosphere

[42] Detailed engineering/economic study of thermal energy demand has been provided to the DOE.

(210,000,000 m^3 CH_4).
Without the proposed project activity, the rest of methane except for the small part utilized would have been vented to the atmosphere and this part is far over the amount for power generation. In addition, the increase of gas extraction rate is much faster than the expansion of residential usage system because of the continuous improvement for gas drainage system and the limitation of employee's increase. Therefore, the overlap between residential gas usage and power generation would not occur in the proposed project and $BE_{MD,y} = 0$.

Baseline emissions from release of methane into the atmosphere

Since all of the methane utilized for power generation in this project will released into the atmosphere in the baseline emissions, so $BE_{MR,y}$ can be obtain with the equation below:

$$BE_{MR,y} = GWP_{CH4} \times (CMM_{PJ,ELEC,y} + PMM_{PJ,ELEC,y}) \quad (8)$$

Where:

$BE_{MR,y}$ Emissions from the release of methane into the atmosphere in the year y that is avoided by the project activity (tCO_2e);

$CMM_{PJ,ELEC,y}$ Pre-mining CMM captured, sent to and destroyed by power generation in year y(tCH_4);

$PMM_{PJ,ELEC,y}$ Post-mining CMM captured, sent to and destroyed by power generation in year y(tCH_4).

In this project, the pre-mining CMM and post-mining CMM will be sent to and stored in the same storage tank, so it is impossible to differ one from the other, so only the total amount of the CMM sent to the power generation station will be measured, i.e.:

$$CMM_{PJ,ELEC,y} + PMM_{PJ,ELEC,y} = MM_{ELEC,y} \quad (9)$$

Therefore:

$$BE_{MR,y} = 21 \times MM_{ELEC,y} \quad (10)$$

Baseline emissions from power generation replaced by project

This project only involves power generation. The electricity used for methane extraction in the project is the same as that in the baseline scenario, therefore $BE_{use,y}$ could be calculated with the following equation:

$$BE_{Use,y} = PBE_{Use,y} = GEN_y \times EF_{ELEC,y} = (GEN_{1,y} - GEN_{2,y}) \times EF_{ELEC,y} \quad (11)$$

Where:

GEN_y Net electricity supplied by project activity in year y to North China Grid (MWh);

$GEN_{1,y}$ Electricity supplied by project activity in year y to North China Grid (MWh);

$GEN_{2,y}$ Electricity consumed by project activity in year y which is supplied by North China Grid in case of emergency (MWh);

$EF_{ELEC,y}$ Emissions factor of North China Grid (tCO_2/MWh).

According to ACM0002 (version 6), $EF_{ELEC,y}$ is calculated with the equation below:

$$EF_{ELEC,y} = (EF_{OM,y} + EF_{BM,y})/2 \quad (12)$$

Where: $EF_{OM,y}$ is the operating margin emission factor of North China Grid;

$EF_{BM,y}$ is the build margin emission factor of North China Grid.

Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

The Operating Margin emission factor(s) ($EF_{OM,y}$) could be calculated using one of the four following methods:

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch Data Analysis OM, or
d) Average OM.

For the project, the simple Operating Margin emission factor was chosen based on the following two reasons:

1. In China, the dispatch information is regarded as business secrets and is not publicly available;
2. For the most recent 5 years (2000-2004), the low-cost/must run resources constitute less than 50% of total generation of North China Grid: 6.7%, 6.2%, 1.1%, 1.4% and 5.9% respectively for 2000, 2001, 2002, 2003 and 2004.

The OM in this PDD is calculated ex-ante based on the most recent 3 years (2002-2004) data and remains unchanged during the crediting period.

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \; COEF_{i,j,y}}{\sum_{j} GEN_{j,y}} \qquad (13)$$

Where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year y;
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants, and including imports[5] to the grid;
$COEF_{,i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year y; and
$GEN_{j,Y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_{,i}$ is obtained as

$$COEF_i = NCV_i \; EF_{co_2,i} \; OXID_i \qquad (14)$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i;
$OXID_i$ is the oxidation factor of the fuel;
$EF_{CO2,j}$ is the CO_2 emission factor per unit of energy of the fuel i.

Calculate the Build Margin emission factor (EFBM,y)

The Build Margin Emission Factor is calculated as the generation-weighted average emission factor (measured in tCO_2/MWh) of a sample of m power plants, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \qquad (15)$$

Where $F_{i,m,y}$, $COEF_{i,m,y}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants m.

The Build Margin emission factor $EF_{BM,y}$ is calculated ex ante and remain fixed for the crediting period and the sample group m is adopted by the following method: the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Because the data can not be obtained in China, CDM EB agreed to use the methodology deviation below:

- Use new installed capacity in last 1~3 years to estimate Operation Margin emission factor;
- Use installed capacity instead of generation-weighted average and the most advanced commercial generation technology efficiency in provincial/regional grid or national grid for conservation consideration.

Calculate the baseline emission factor EF_y

The baseline emission factor is the weighted average of operation margin emission factor ($EF_{OM,y}$) and the building margin emission factor ($EF_{BM,y}$):

$$EFy = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

Where the weights w_{OM} and w_{BM}, by default, are 50%.

Step 3: Calculation of the project leakage

The leakage of a CDM project activity could result from the following:

1. Displacement of baseline thermal energy uses;
2. CBM drainage from outside the de-stressed zone;
3. Impact of CDM project activity on coal production;
4. Impact of CDM project activity on coal prices and market dynamics.

Displacement of baseline thermal energy uses

As analyzed in step 2 of Section B6.1, the project activity would not prevent CMM from being used to meet baseline thermal energy demand, so there is no displacement of baseline thermal energy uses and the leakage emissions in this part are 0.

CBM drainage from outside the de-stressed zone

This project does not involve CBM, therefore the leakage emissions in this part are also 0.

Impact of CDM project activity on coal production

This issue should be considered only when no CMM extraction is present in the baseline scenario, but only ventilation is involved (i.e. the baseline scenario is ventilation of mine gas only). The baseline scenario of this project activity involves methane extraction, therefore the impact on the coal production is not relevant, and the leakage emissions of this part are 0.

Impact of CDM project activity on coal prices and market dynamics

According to ACM0008, it is not necessary to consider this possibility at this stage.

Therefore the leakage of this project is 0.

Step 4: Emission Reductions Calculation

The emission reductions can be obtained from the equation below:

$$ER_y = BE_y - PE_y \quad (16)$$

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).

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Data / Parameter	$F_{i,j,y}$
Unit	Mt, Mm^3
Description	the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources j in year(s) *y*
Source of data	China Energy Statistical Yearbook (2000~2005)
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	Official statistical data
Purpose of data	Official statistical data
Additional comment	

Data / Parameter	NCV_i
Unit	*TJ/ mass or volume unit of a fuel*
Description	the net calorific value (energy content) per mass or volume unit of a fuel *i*
Source of data	China Energy Statistical Yearbook (2005)
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	National and official data
Purpose of data	National and official data
Additional comment	

Data / Parameter	$OXID_i$
Unit	%
Description	the oxidation factor of the fuel *i*
Source of data	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*
Value(s) applied	see Annex3 for details
Choice of data or Measurement methods and procedures	National data not available, so IPCC default values are used.
Purpose of data	National data not available, so IPCC default values are used.

Additional comment	

Data / Parameter	$EF_{CO2,i}$
Unit	tCO_2e/TJ
Description	the CO_2 emission factor per unit of energy of the fuel *i*
Source of data	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*
Value(s) applied	see Annex3 for details
Choice of data or Measurement methods and procedures	National data not available, so IPCC default values are used.
Purpose of data	National data not available, so IPCC default values are used.
Additional comment	

Data / Parameter	$G_{j,y}$
Unit	MWh
Description	the amount of electricity generation by source *j* in year *y*
Source of data	China Electric Power Yearbook (2000~2005)
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	Official statistical data
Purpose of data	Official statistical data
Additional comment	

Data / Parameter	$e_{j,y}$
Unit	%
Description	station service power consumption rate of source *j* in year *y*
Source of data	See Annex 3 for details
Value(s) applied	Official statistical data
Choice of data or Measurement methods and procedures	China Energy Statistical Yearbook (2000~2005)
Purpose of data	China Energy Statistical Yearbook (2000~2005)
Additional comment	

Data / Parameter	$EE_{coal,adv}$
Unit	%
Description	Efficiency of most advanced coal-fired power technology that is commercially available
Source of data	Notice on the determination of emission factors of regional power grids by Chinese CDM DNA
Value(s) applied	36.53
Choice of data or Measurement methods and procedures	Official statistics of state power authority

Purpose of data	Official statistics of state power authority
Additional comment	

Data / Parameter	$EE_{oil,adv}$
Unit	%
Description	Efficiency of most advanced oil-fired power technology that is commercially available
Source of data	Notice on the determination of emission factors of regional power grids by Chinese CDM DNA
Value(s) applied	45.87
Choice of data or Measurement methods and procedures	Official statistics of state power authority
Purpose of data	Official statistics of state power authority
Additional comment	

Data / Parameter	$EE_{gas,adv}$
Unit	%
Description	Efficiency of most advanced gas-fired power technology that is commercially available
Source of data	Notice on the determination of emission factors of regional power grids by Chinese CDM DNA
Value(s) applied	45.87
Choice of data or Measurement methods and procedures	Official statistics of state power authority
Purpose of data	Official statistics of state power authority
Additional comment	

Data / Parameter	$CAP_{,j,y}$
Unit	MW
Description	Installed capacity of source *j* in year *y* in Northwest Power Grid
Source of data	China Energy Statistical Yearbook (2000~2005)
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	Official statistical data
Purpose of data	Official statistical data
Additional comment	

Data / Parameter	MM_{BL}
Unit	tCH_4
Description	Amount of methane consumed by the 15MW power plant
Source of data	Measured in m^3 and recorded in the log sheets and converted into tCH_4 using IPCC value of $0.00067t/m^3$
Value(s) applied	24,139.73

Choice of data or Measurement methods and procedures	Maximum annual value of the four years period prior to project implementation (year 2005-2008) is taken.
Purpose of data	Maximum annual value of the four years period prior to project implementation (year 2005-2008) is taken.
Additional comment	

Data / Parameter	GEN_{BL}
Unit	MWh
Description	Electricity generated by the 15MW power plant
Source of data	Measured
Value(s) applied	86,089.234
Choice of data or Measurement methods and procedures	Maximum annual value of the four years period prior to project implementation (year 2005-2008) is taken.
Purpose of data	Maximum annual value of the four years period prior to project implementation (year 2005-2008) is taken.
Additional comment	

B.6.3. Ex ante calculation of emission reductions

>>

Calculation of the project emissions

Project emissions are calculated by the formulation below:

$$PE_y = PE_{ME,y} + PE_{MD,y} + PE_{UM,y}$$
$$= PE_{ME,y} + MM_{ELEC} \times Eff_{ELEC} \times (CEF_{CH4} + r \times CEF_{NMHC}) + GWP_{CH4} \times MM_{ELEC,y} \times (1-Eff_{ELEC})$$
$$= 0 \times (1.0585+0.9066)/2 + MM_{ELEC} \times 0.995 \times (2.75 + 0) + 21 \times MM_{ELEC,y} \times (1-0.995)$$
$$= 0 + 2.84125 \times MM_{ELEC,y}$$
$$= 0 + 2.84125 \times 181.474 \times 10^6 \times 0.00067$$
$$= 345{,}461 \text{ } tCO_2e$$

Calculation of the baseline emissions

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y}$$
$$= BE_{MD,y} + GWP_{CH4} \times MM_{ELEC,y} + GEN_y \times (EF_{OM,y} + EF_{BM,y})/2$$
$$= 0 + 21 \times MM_{ELEC,y} + GEN_y \times (1.0585+0.9066)/2$$
$$= 0 + 21 \times 181.474 \times 10^6 \times 0.00067 + 823200 \times (1.0585+0.9066)/2$$
$$= 3{,}362{,}175 \text{ } tCO_2e$$

Calculation of emission reductions

The emission reductions can be obtained from the equation below:

$$ER_y = BE_y - PE_y$$
$$= 3{,}362{,}175 - 345{,}461$$
$$\mathbf{= 3{,}016{,}714 \text{ } tCO_2e}$$

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
2008(9-12)	1,120,725	115,154	0	1,005,571
2009	3,362,175	345,461	0	3,016,714
2010	3,362,175	345,461	0	3,016,714
2011	3,362,175	345,461	0	3,016,714
2012	3,362,175	345,461	0	3,016,714
2013	3,362,175	345,461	0	3,016,714
2014	3,362,175	345,461	0	3,016,714
2015	3,362,175	345,461	0	3,016,714
2016	3,362,175	345,461	0	3,016,714
2017	3,362,175	345,461	0	3,016,714
2018(1-8)	2,241,450	230,307	0	2,011,143
Total	**33,621,750**	**3,454,610**	**0**	**30,167,140**
Total number of crediting years	**10**			
Annual average over the crediting period	**3,362,175**	**345,461**	**0**	**3,016,714**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter	MM_{ELEC}
Unit	tCH_4
Description	Methane measured delivered to power plant in year y
Source of data	Measurements by project participants using gas flow meters, temperature & pressure transmitters and gas concentration meters.
Value(s) applied	121,588
Measurement methods and procedures	Continuous monitoring, meters in compliance with relevant standards and requirements will be used, and gas volumes, pressure, temperature and methane concentration will be read and consolidated by a digital control system (DCS).
Monitoring frequency	Continuous monitoring
QA/QC procedures	Flow meters, temperature & pressure transmitters and gas concentration meters are to be checked monthly and calibrated annually to ensure accuracy.
Purpose of data	Project emissions: - from methane destroyed MD_{ELEC} (Formula 3 & 5 in the B.6.1 of PDD); - from un-combusted methane PE_{UM} (Formula 6 in the B.6.1 of PDD); Baseline emissions: - for release of methane into atmosphere that is voided by the project

	BE_{MR} (Formula 10 in the B.6.1 of PDD)
Additional comment	The meters are indicated as points F, A and C on Figure 3.

Data / Parameter	**$PC_{CH4,y}$**
Unit	%
Description	Concentration of methane (in mass) in extracted gas (%), measured on wet basis
Source of data	Daily monitoring by JMC
Value(s) applied	-
Measurement methods and procedures	Concentration meters, optical and calorific, with accuracy in compliance with relevant national standards
Monitoring frequency	Continuous monitoring
QA/QC procedures	Concentration meters will be checked monthly and calibrated annually to ensure accuracy
Purpose of data	Integrated with the monitoring of MM_{ELEC} (methane delivered to the power plant)
Additional comment	The meters are indicated as point C on Figure 3.

Data / Parameter	**$PC_{NMHC,y}$**
Unit	%
Description	NMHC concentration in coal mine gas
Source of data	To be obtained through annual analysis of the fractional composition of captured gas
Value(s) applied	0
Measurement methods and procedures	Gas samples will be extracted annually in accordance with relevant industry standard and procedures. The samples will be analyzed by a qualified laboratory.
Monitoring frequency	Annual sampling
QA/QC procedures	A minimum of 3 samples will be collected in secure gas sample vessels, suitable for storage and transport to the laboratory. If one sample is found to be faulty (i.e. gas leakage), the replacement sample will be taken.
Purpose of data	Verifying whether $PC_{NMHC,y}$ is below 1%
Additional comment	Used to check if more than 1% of emissions and to calculate r

Data / Parameter	CEF_{NMHC}
Unit	$tCO_2e/tNMHC$
Description	Carbon emission factor for combusted non methane hydrocarbons
Source of data	To be obtained through analysis of the fractional composition of captured gas
Value(s) applied	-
Measurement methods and procedures	To be monitored only when NMHC concentration (in mass) in coal mine gas is higher than 1%
Monitoring frequency	Annual sampling
QA/QC procedures	This will be conducted by Qualified Organizations.
Purpose of data	Project emissions from combustion of NMHC (Formula 3 in the B.6.1 of PDD)
Additional comment	-

Data / Parameter	$GEN_{1,y}$
Unit	MWh
Description	Electricity supplied by project activity in year y to North China Grid
Source of data	Monitored with power meter to be installed by the electric grid company
Value(s) applied	823,200
Measurement methods and procedures	Continuous monitoring
Monitoring frequency	Continuous monitoring
QA/QC procedures	The electricity delivered to the grid will be recorded in the power settlement notice issued by the grid company based on the readings of the power meters installed at the Qinchi transformer station in accordance with relevant national and sectoral standards (indicated as point E_{GRID} on Figure 3). The amount of electricity delivered to the grid will be double-checked by the readings of the power meters installed at the project 120MW power plant (indicated as point E_{PP} on Figure 3).
Purpose of data	Baseline emissions from power generation replaced by the project $BE_{Use,y}$(Formula 11 in the B.6.1 of PDD)
Additional comment	-

Data / Parameter	$GEN_{2,y}$
Unit	MWh
Description	Electricity consumed by project activity in year y which is supplied by North China Grid in case of emergency
Source of data	Monitored with power meter to be installed by the electric grid company
Value(s) applied	0
Measurement methods and procedures	Continuous monitoring
Monitoring frequency	Continuous monitoring
QA/QC procedures	The electricity imported from the grid will be recorded in the power settlement notice issued by the grid company based on the readings of the power meters installed at the Qinchi transformer station in accordance with relevant national and sectoral standards (indicated as point E_{GRID} on Figure 3). The amount of electricity imported to the grid will be double-checked by the readings of the power meters installed at the project 120 MW power plant (indicated as point E_{PP} on Figure 3).
Purpose of data	Baseline emissions from power generation replaced by the project $BE_{Use,y}$ (Formula 11 in the B.6.1 of PDD)
Additional comment	-

Data / Parameter	$MM_{BL,y}$
Unit	tCH_4
Description	Amount of methane consumed by the 15MW power plant in year y or during the monitoring period.
Source of data	Measured and recorded in log sheets.
Value(s) applied	

Measurement methods and procedures	Continuous monitoring, flow meters in compliance with relevant standards and requirements will be used. Gas volumes, pressure, temperature and concentration will be read and consolidated by a digital control system.
Monitoring frequency	Continuous monitoring
QA/QC procedures	Flow meters, temperature & pressure transmitters and gas concentration meters are to be checked monthly and calibrated annually to ensure accuracy
Purpose of data	The data are not used for ER calculation, but for crossing-checking only.
Additional comment	The meters are indicated as point F_{BL}, A_{BL} and C_{BL} on Figure 3.The readings of these meters are not used for ER calculation, but for crossing-checking only. $MM_{BL,y}$ value will be compared against MM_{BL} to ensure no leakage ($MM_{BL,y} >= MM_{BL}$). In case $MM_{BL,y} < MM_{BL}$, the difference will be calculated in terms of the contributing emission reduction, which will be deducted from the total claimed emission reductions.

Data / Parameter	$GEN_{BL,y}$
Unit	MWh
Description	Electricity generated by the 15MW power plant in year y or during the monitoring period.
Source of data	Measured
Value(s) applied	
Measurement methods and procedures	Continuous monitoring.
Monitoring frequency	Continuous monitoring.
QA/QC procedures	The power meter will be calibrated in accordance with relevant national standard.
Purpose of data	The data are not used for ER calculation, but for reference only.
Additional comment	The meter is indicated as point E_{BL} on Figure 3.The readings of the meter are not used for ER calculation, but for reference only. $GEN_{BL,y}$ value will be compared against GEN_{BL} to ensure no leakage ($GEN_{BL,y} >= GEN_{BL}$). In case $GEN_{BL,y} < GEN_{BL}$, the difference will be calculated in terms of the contributing emission reduction, which will be deducted from the total claimed emission reductions.

B.7.2. Sampling plan

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Not applicable. Sampling plan is not required for the parameters in the project activity.

B.7.3. Other elements of monitoring plan

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The following monitoring plan will be implemented by the project owner, JMC, to ensure that real, measurable, long-term GHG emissions reductions will be monitored, recorded and reported.

1. Data to be monitored

The data that will be monitored are shown in Section B.7.1. The following figure (Figure 3) represents the generic diagram of flows and monitoring points of the new 120MW power plant and the existing 15MW experimental power plant. The Table 1 provides a list of monitoring meters, the corresponding parameters measured and the installed location. The Table 1 separately indicates the meters providing data used for calculation of emission reductions and other meters providing data not used for emission reduction calculation (e.g., used for cross-checking purposes).

Figure 3 Flow diagram and monitoring points within the project boundary

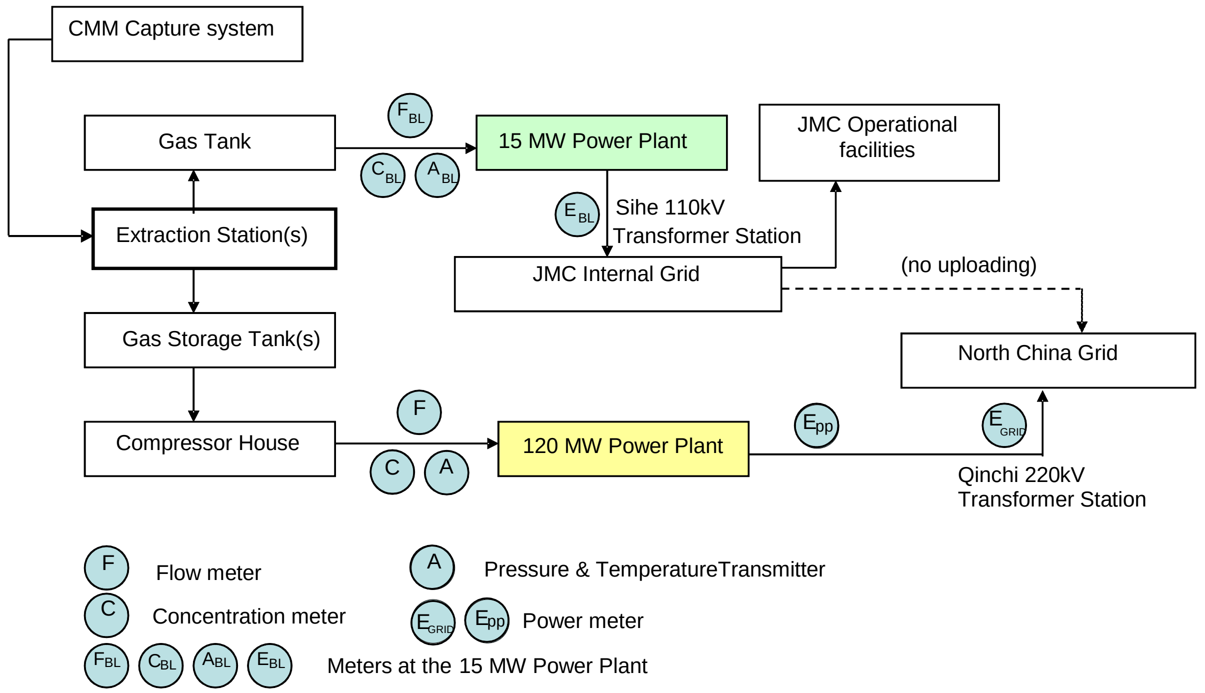

Table 1: Monitoring meters and parameters.

Symbol	Description	Monitored parameter	Installed location
Main meters used for calculation of emission reductions			
F	Gas Flow Meters	MM_{ELEC}	120MW power plant
A	Pressure & Temperature Transmitters	MM_{ELEC}	120MW power plant
C	Concentration Meters	$PC_{CH4,y}$	120MW power plant
E_{GRID}	Power Meters (main and backup meter)	$GEN_{1,y}$ $GEN_{2,y}$	Grid Company Qinchi 220kv transformer station
Monitoring meters not used for calculation of emission reductions			
E_{PP}	Power Meters (main and backup meter) (used for cross-checking)	$GEN_{1,y}$ $GEN_{2,y}$	120MW power plant
F_{BL}, C_{BL},	Gas Flow Meters, Concentration	$MM_{BL,y}$	15MW Power Plant

A_{BL}	Meters, Pressure & Temperature Transmitters		
E_{BL}	Power Meters	$GEN_{BL,y}$	15MW Power Plant

2. Monitoring, recording and management of data

All instruments installed in the proposed project will be in compliance with relevant national/sectoral standards and will be calibrated and maintained in accordance with the manufacturers' instructions and relevant national/sectoral standards. All relevant records will be kept for check.

JMC will establish a CDM project management office, consists of 4-6 people, and appoint an office director who will be responsible for checking, reviewing and issuing related data, documents and reports. Under the CDM project management office, a monitoring team, led by the director, will be established and is responsible for checking and maintaining related instruments, data recording, data handling and preparing reports. The monitoring staff will receive specific technical training before assuming their responsibilities. Each team will include at least one employee that has received comprehensive training.

JMC will establish a dedicated control centre at Sihe Cole Mine CMM Power Plant from where all electronic data will be remotely monitored and all records kept. Staff at the control centre will prepare a daily report on the operations of the project activity and the monitoring systems. This daily report will record data readings, equipment defects, outages, repairs and maintenance activities. All relevant information and documents will be kept at the controlling centre of the monitoring team.

The data are analyzed on a daily basis. In case of possible problems, the monitoring team will take quick and appropriate corrective actions.

Procedures for ensuring effective monitoring of this project are described in a document "CDM Project Management and Operating Procedures" which will be followed during the monitoring process. The document contains the following sections:

Chap 1 Introduction

Chap 2 Overall Project Management

Chap 3 CDM Project Management and Calculations

Sec 3.1 Data to be monitored and recorded

Sec 3.2 Emissions Reduction Calculation for the Project

Chap 4 Procedures to be followed

4.1 Monitoring Procedures

4.2 Calibration Procedures

4.3 Maintenance Procedures

4.4 Procedure for Training of Personnel engaged in the monitoring and verification processes

Chap 5 Records Keeping, Error Handling and Reporting Procedures

5.1 Records Keeping and Internal Reporting Procedure

5.2 Error Handling Procedure

5.3 External Reporting Procedure

5.4 Procedure for corrective actions arising

5.5 Change of CDM Manager

Chap 6 Confirmation of the Adoption of these CDM Operating Procedure.

3. Monitoring of power generation and CMM consumption of the existing experimental 15MW power plant

Monitoring of power generation and CMM consumption of the existing experimental 15MW power station is intended to demonstrate that the project 120MW power plant does not impose any limitations on the availability of CMM gas and the 15MW power plant remains to be in normal operation as part of the baseline gas usage.

The existing experimental 15MW power plant utilizing CMM at the Sihe mine generates electricity for the internal need of the Sihe mine (captive usage by JMC operational facilities). The electricity generated is supplied through the JMC internal 110 kV grid through the Sihe 110kV transformer station.

<u>The electricity flows from 15MW and 120 MW power plants are separate:</u> The JMC internal grid is connected to the North China Gird to comply with the Chinese grid requirements (however no uploading to the gird is taking place). The JMC internal grid is connected to the North China Grid in the point different from the Qinchi 220 kV transformer station, which is used as the monitoring point for the 120 MW plant.

To monitor power generation and CMM consumption of the existing experimental 15MW power plant, the following monitoring equipment will be used by JMC:

- Electricity metering: electricity meters (point E_{BL} on Figure 3) have been installed at the outlet of the existing 15MW power plant to continuously monitor the electricity generated. The electricity meters at the Sihe 110 kV transformer station are monitoring the electricity supplied to/imported from the internal JMC Power Grid.
- Gas concentration meter: to be installed at the inlet to the existing power plant(point C_{BL} on Figure 3). This meter will monitor the concentration of the CMM gas sent to the existing 15MW power plant.
- Gas flow meter: to be installed at the inlet to the existing power plant (point F_{BL} on Figure 3) to meter the volume of CMM supplied to the existing 15 MW power plant.
- Separate meters to measure respectively the temperature and pressure of the CMM sent to existing power plant will be installed (point A_{BL} on Figure 3).

All the above monitoring equipment will be installed before the starting date of the crediting period. The accuracies of the equipment will be in compliance with the relevant national standards. The metering equipment will be maintained under JMC regular maintenance regime and calibrated and monitored according to the Chinese regulation and manufacturer specifications.

The relevant gas and electricity data will be monitored by JMC qualified staff. Data will be backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.

4. Details of checking the flow and concentration meters

Flow meters and concentration meters will be calibrated annually and regularly maintained to ensure accuracy. There is a dedicated control centre at the project site which will read all the measured parameters. JMC staff in charge of the monitoring will manually record the readings hourly and archive the data daily. The archived data will be sent to the CDM manager every month for his review.

The monthly checking and maintenance of the flow meter and concentration meter by JMC staff will include:

- Checking the physical appearance of the meters;

- Checking whether the shelters for these meter are in good condition;
- Checking the condition of the sensors and whether they are well connected and the connection lines are in good condition;
- Checking whether the lead-seal of these meters are in good condition.

5. Consistency with the monitoring methodology in monitoring of methane fraction in CMM gas

The percentage of methane (%) in CMM will be measured in volumetric units by a continuous gas analyzer, on wet basis. These data will be recorded hourly and archived daily.

The temperature and pressure indicators will also be measured and recorded. These indicators will be used to normalize the measurements obtained from the gas analyzer. As a result, the concentration in mass of methane in extracted gas will be obtained.

The monitoring of the PC_{NMHC} can be clarified as follows:

- Gas samples will be extracted annually in accordance with relevant industry standard and procedures. The samples will be analyzed by a qualified laboratory.
- QA/QC procedures: A minimum of 3 samples will be collected in secure gas sample vessels, suitable for storage and transport to the laboratory. If one or more samples are found to be faulty (i.e. leaking gas sample vessel) replacement samples will be taken. Scanned copies of the analyses will be backed up and archived in two different locations. The data will be stored for the longer of two years after the crediting period or two years after the last issuance of CERs.

6. Monitoring of electricity to be supplied to and imported from the grid for the project activity

Total amount of electricity generated from each power house installed by the project will be sent to the North China Power Grid. As clarified above in item 3, the power generated by the existing 15MW experimental power plant is not supplied to the grid and is monitored separately.

The 220kV transformer station of the project power plant will be connected to Qinchi 220kV transformer station of the grid.

At the 220kV transformer station of the project power plant, 3 electricity meter cupboards (#1, #2, #3) are installed.

Meter cupboard #1

Four multi-function digital electricity meters (0.2 grade) are the Gate Meters installed by the Power Grid at the Project site. All the 4 meters are two-way digital meters so they can monitor the electricity supplied to and imported from the Grid. The functions of these meters (including 2 back-up meters) are as follows:

- 2 meters monitoring the electricity supplied to/imported from the grid (point E_{PP} on Figure 3),
- 2 meters monitoring the electricity through each of the two 220KV main transforming lines to the Power Grid.

The readings from these meters will not be the counted as the basis for invoicing and settlement with the Grid.

Meter cupboard #2

Four multi-function digital electricity meters (0.5 grade) are installed by JMC. These 4 meters have the same functions as the 4 meters in cupboard #1, but have lower accuracy. These meters will be used for the internal performance review purpose only.

Meter cupboard #3

Eleven digital electricity meters (0.5 grade) with the following functions:

- monitoring the power generations from each of the 4 power houses (4 meters).
- monitoring the electricity consumed by 6 on-site workshops (compressor station, water pumping station, chemical water workshop and maintenance workshop),
- monitoring the total electricity used by the power plant and other on-site auxiliary needs.

The cupboard in Qinchi 220kV transformer station of the Power Grid (off-site)

Two multi-function two-way electricity meters (0.2 grade): one main and one backup meter. These meters will monitor the electricity supplied to/imported from the Power Grid. These meters are installed and operated by the Grid company (point E_{GRID} on Figure 3), responsible for the maintenance and annual calibration. The readings from the E_{GRID} meters will be used by the Grid Company to issue the power settlement notice every month.

The power amounts in the power settlement notice will be cross-checked by JMC using the readings from meters installed at the project 120MW power plant, in cupboard #1 (point E_{PP} on Figure 3).

Usually, the difference of the readings between meters in points E_{GRID} and E_{PP} represents the transmission loss. Thus, the power amounts in the power settlement notice (readings from E_{GRID} meters) will be used for calculation of the emission reductions, which is conservative.

7. Calibration of Instruments

The following procedures will be followed to calibrate the equipment used in this project:

1) The metering instruments will be calibrated in accordance with relevant national/sectoral and manufacturers' requirements;

2) The electricity meters will be calibrated by authorized entities and tested by the local grid company.

8. Combined Measurement of pre-mining CMM and post-mining CMM

As stated in the registered PDD, MM_{ELEC} is the consolidated monitoring parameter, which combine pre-mining CMM and post-mining CMM flows given that common extraction systems are used in the underground mine. Although we cancel the **$MM_{total,y}$, $MM_{release,y}$**, no monitoring to them, but the monitoring method and system to the pre-mining CMM and post-mining CMM flows remain unchanged. This is in line with the decision of the CDM EB55 meeting (Paragraph 22 (i) of the Report), which allows project proponents to measure the pre-mining CMM together with the post-mining CMM.

9. No Monitoring to $MM_{total,y}$, $MM_{release,y}$

According to the approved consolidated methodology ACM0008, we should only monitor the methane sent to power plant. We monitored the $MM_{total,y}$, $MM_{release,y}$ before, the recordings were not used for ER calculation, but for crossing-checking only. Actually the data of MM_{ELEC} plus $MM_{BL,y}$ and/or $GEN_{1,y}$ plus $GEN_{BL,y}$ have same function to demonstrate that the project 120MW power plant does not impose any limitations on the availability of CMM gas and the 15MW power plant remains to be in normal operation as part of the baseline gas usage. For easy works, we do not collect and count the data of $MM_{total,y}$, $MM_{release,y}$ from Jan. 1, 2014, delete these two data in the monitoring report.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
The baseline study was done by Mr. Duan Maosheng, Institute of Nuclear and New Energy Technology of Tsinghua University, Song Yanqin, Energy Research Institute, and Kentaro Yabe, The World Bank Carbon Finance Unit,. The study was completed on 01/08/07.

Contact information:

1. Duan Maosheng, Institute of Nuclear and New Energy Technology of Tsinghua University, Room C-202, Energy Science Building, Tsinghua University, Beijing, 100084, China Email: duanmsh@mail.tsinghua.edu.cn; Tele: (8610) 62772596.
2. Song Yanqin, Energy Research Institute, B1416 Guohong Plaza, A11 Muxidi Beili, Xicheng district, Beijing, Email: yq_song@263.net; Tele: (8610) 63908475.
3. Tao Wang, The World Bank Carbon Finance Unit, 1818 H Street, NW, Washington D.C., 20433, USA, Tel: +1-202-458-8784; Fax: +1-202-522-7432; twang2@worldbank.org

The World Bank is the participant of this project, while Mr. Duan Maosheng and Mr. Song Yanqin are not participants of this project.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
24/03/2005

C.1.2. Expected operational lifetime of project activity

>>
25 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Fixed crediting period

C.2.2. Start date of crediting period

>>
01/09/2008 or the date of registration, whichever is later

C.2.3. Length of crediting period

10 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
Meteorological Science Research Institute of China was engaged by JMC to prepare the environmental impact assessment (EIA) report of this project. The EIA report has already been approved by State Environmental Protection Administration (SEPA). Main contents of the approved EIA report are summarized below:

This project can reduce emissions of significant amount of CH4 and in comparison with coal-fired power plant of the same capacity, the CMM power plant can save 367,770 tons of coal every year and reduce emissions of SO_2 by 3,677 tons per year, smoke dust by 722 tons per year, and slag by 72,628 tons per year.

The power plant will occupy 54,628 m^2 of land, which is barren loess. The gas transportation pipeline is about 100 m long from the gas extraction station to gas tanks, and the water intake pipe goes through flood land along the banks of the Qinhe River, which will have little or no impact on the agricultural and ecological environment.

The major pollutant of this project will be emissions of NO_x during operations will be in compliance with ground level NO_x (Class II of Ambient Air Quality Standard, GB3095-1996).

Industrial water for this project comes from shallow groundwater on the banks of Qinhe River and can be guaranteed without affecting the balance of groundwater.

The wastewater discharged from this project includes water used for cooling and other production purposes, as well as water containing domestic sewage. Cooling water (23 tons per hour with a relatively high salt content—for which there are as yet no standards from China or the Bank) will be partially used for greening and floor washing, and others will be discharged into the Wastewater Treatment Plant of the Sihe mine. Other wastewater (acid and alkali wastewater, oil-contaminated wastewater, domestic sewage) will be treated in the Wastewater Treatment Plant of the Sihe Coal Mine, as well after in-plant pre-treatment. Therefore, the wastewater of this project will not result in pollution of ambient environment.

Noise sources of the plant are mainly from engines, steam turbines, CMM compressors, water pumps, and exhaust noise. The impact on the area 200 m beyond the boundaries of the plant is within 55 dB(A), fully in compliance with Class 3 of Ambient Noise Standard of Urban Area (GB3096-93). Therefore, the impact of noise on nearby villages is negligible.

The transmission line may have an impact on the environment, however, at the 1.5 m height, the maximum power frequency electric field intensity is 1.38 kV per meter, far less than the limit of 4 kV per meter; the magnetic field intensity is 0.049×10^{-3}~0.257×10^{-3} MT, far less than the maximum 0.1 MT permitted by the International Radiant Protection Association for public exposure to radiation in one day and limit permitted by China.

Other environmental impacts related to construction are dust from excavation and from the transport of materials, construction wastewater, and sewage from construction labourers, and noise. Those will not bring significant impact to the surrounding area.

D.2. Environmental impact assessment

>>
The environmental impact assessment (EIA) report of this project has already been approved by SEPA and neither the host party nor the project participants considers that this project will have significant environmental impact.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
The key local stakeholders are the local people whose land will be acquired for this project, and villages that may be affected by construction and operation.

The Public consultation was conducted by the Power Plant Preparation Office of SJCMG in August 2003, particularly through the following activities:

- Interviews with affected households;
- Socioeconomic surveys of affected households;
- Village meetings;
- Informal discussion with the village leaders and selected displaced persons (DPs);
- Measurement surveys;
- Meetings with various stakeholders.

A total of 25 people have been consulted, and the EIA report has been disclosed to the public in this project office and village communities. Announcement of the report disclosure was made in the local newspaper, Taihang Daily.

E.2. Summary of comments received

>>
Survey results show that 90% of local residents support this project and the left 10% people didn't indicate their opinion. All the affected people knew this project at the time of surveys.

Based on the results of consultations with the village committees and the households, the major issues raised during the consultation process include: i) fair compensation; ii) compensation should be based on related laws and regulations; iii) minimization of the land acquisition if possible; and iv) assurance of restoration of livelihood through land readjustment.

E.3. Report on consideration of comments received

>>
For those affected by land losses, based on extensive consultation among affected villages, adequate compensation will be paid and detailed economic rehabilitation measures will be adopted, which include reallocating village reserve land to the affected people and using compensation to develop other income-generating activities.

More efforts will be made during the resettlement implementation to encourage further participation by the resettled people, such as increasing fairness in land readjustment and increasing transparency in delivering and using compensation funds. In order to ensure that all compensations will be used effectively, they will be delivered to the affected villages. The use of such funds will be approved by all villagers and monitored by the township government.

Following both Chinese law and World Bank policy, this project resettlement office disclosed the content of the resettlement action plan (RAP) and informed the affected people about the impacts of resettlement impacts, compensation policies, and rehabilitation options. The resettlement information booklet was distributed to all affected households in May 2004, and the RAP documents were made available in the village communities and this project office.

In order to effectively address any complaints by DP, a grievance procedure has been set up by JMC. If one group of DP is not satisfied with the compensation amount or rehabilitation measures, they could first voice their complaint to the village, which should document the complaint and

resolve the matter within two weeks. If the affected people are not satisfied with the decision, they could bring their case to the concerned township or JMC resettlement office, which will provide a formal resolution within two weeks. If the DP do not agree with the resolution, they could bring their case to Qinshui County Land Administration Bureau, which will make a decision within 30 days. If the DP are still not satisfied with the resolution from the county, they could go to the city civil court to appeal. The affected people will be informed about these grievance procedures through meetings, information booklets, and public notices.

SECTION F. Approval and authorization

>>

This project was approved by Chinese DNA on 01/08/2007 and by Netherlands DNA on 27/04/2007 and by Japan DNA on 31/10/2006 and by the United Kingdom DNA on 08/05/2007.

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Shanxi Jincheng Anthracite Mining Group Co., Ltd.
Street/P.O. Box	Beishidian
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City	Jincheng
State/Region	Shanxi
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Fax	86-356-3669562
E-mail	jmjtcdm@163.com
Website	
Contact person	Li Zhanliang
Title	Vice Chief Accountant
Salutation	Mr.
Last name	Li
Middle name	
First name	Zhanliang
Department	
Mobile	
Direct fax	86-356-3669562
Direct tel.	86-356-3669562, 3669561
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	International Bank for Reconstruction and Development as the Trustee of the Prototype Carbon Fund and the Trustee of the IBRD-Netherlands Clean Development Mechanism Facility
Street/P.O. Box	1818 H Street, NW
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State/Region	D.C.
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Country	United States of America
Telephone	+1-202-473-6381
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Website	www.carbonfinance.org
Contact person	Lasse Ringius
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Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Japan Carbon Finance, Ltd.
Street/P.O. Box	-
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State/Region	Tokyo
Postcode	102-0073
Country	Japan
Telephone	+81-3-5212-8870
Fax	+81-3-5212-8886
E-mail	cn004@jcarbon.co.jp
Website	http://www.jcarbon.co.jp/
Contact person	Kimura Joichi
Title	Director General
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Last name	Joichi
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Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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City	St Helier
State/Region	
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Country	Jersey
Telephone	+44 (0) 1534 601910
Fax	+44 (0) 1534 605037
E-mail	dave@ictjltd.com
Website	
Contact person	David Allen
Title	Managing Director
Salutation	Mr.
Last name	Allen
Middle name	
First name	David
Department	
Mobile	+44 (0) 7797 753710
Direct fax	+44 (0) 1534 605037
Direct tel.	+44 (0) 1534 601910
Personal e-mail	dave@ictjltd.com

Appendix 2. Affirmation regarding public funding

The public funds involved in this project exclude existing ODA.

The sovereign Annex I participants of this project confirm that any public funding used to purchase emission reductions from this project does not result in a diversion of ODA and is separate from and is not counted towards its financial obligations as a Party included in Annex I.

Appendix 3. Applicability of methodology and standardized baseline

Refer to the B.2 of PDD.

Appendix 4. Further background information on ex ante calculation of emission reductions

BASELINE INFORMATION

Table A3-1: Summary of coal output of Sihe Coal Mine

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Output (Mt)	10.19	10.80	10.80	10.80	10.80	12.00	12.00	14.80	14.80	14.80

Table A3-2: Key Parameters Used in Baseline Thermal Energy Demand Calculations

Parameter	Value	Unit/Note
CMM consumption rate of the 4t hot water boiler in full capacity	5	m^3/min.unit
CMM consumption rate of the 2t steam boiler in full capacity	1.17	m^3/min.unit

Table A3-3. Electricity generation from fossil fuels in 2002 of North China Grid

Province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Electricity generation from fossil fuels (MWh)	17886000	27263000	100970000	82256000	51382000	124162000	
station service power consumption rate (%)	7.95	7.08	6.72	7.98	7.93	6.79	
Electricity delivered to the grid from fossil fuels (MWh)	16464063	25332779.6	94184816	75691971.2	47307407.4	115731400.2	374712437.4

Source：China Electric Power Yearbook 2003

Table A3-4. Electricity generation from fossil fuels in 2003 of North China Grid

Province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Electricity generation from fossil fuels (MWh)	18608000	32191000	108261000	93962000	65106000	139547000	

station service power consumption rate（%）	7.52	6.79	6.5	7.69	7.66	6.79	
Electricity delivered to the grid from fossil fuels （MWh)	17208678.4	30005231.1	101224035	86736322.2	60118880.4	130071758.7	425364905.8

Source：China Electric Power Yearbook 2004

Table A3-5. Electricity generation from fossil fuels in 2004 of North China Grid

Province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Electricity generation from fossil fuels (MWh)	18579000	33952000	124970000	104926000	80427000	163918000	
station service power consumption rate（%）	7.94	6.35	6.5	7.7	7.17	7.32	
Electricity delivered to the grid from fossil fuels （MWh)	17103827.4	31796048	116846950	96846698	74660384.1	151919202.4	489173109.9

Source：China Electric Power Yearbook 2005

Table A3-6 Calculation of emissions of North China Grid in 2002

		Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D		E	F=A+B+C +D+E	G	H	I	J=F*G*H*I* 44/12/10000 (mass unit) J=F*G*H*I* 44/12/1000 (volume unit)
Raw coal	10000 t	691.84	1052.74	4988.01	4037.39	3218	5162.86	19150.84	25.8	98	20908	371208174.5
Cleaned coal	10000 t						80.71	80.71	25.8	98	26344	1971179.968
Other washed coal	10000 t	3.43		65.2	135.56		106.32	310.51	25.8	98	8363	2407436.829
Coke	10000 t							0	29.5	98	28435	0
Coke oven gas	100 Mm^3	0.17	1.71		0.75	0.16	0.04	2.83	13	99.5	16726	224500.0238
Other gas	100 Mm^3	15.82		7.34		10.35		33.51	13	99.5	5227	830739.3673
Crude oil	10000 t						14.98	14.98	20	99	41816	454769.0717
Gasoline	10000 t						0.65	0.65	18.9	99	43070	19206.87269
Diesel oil	10000 t	0.26	2.35	4.12		1.6	10.02	18.35	20.2	99	42652	573896.3513
Fuel oil	10000 t	13.94	0.04	1.22		0.42	20.33	35.95	21.1	99	41816	1151411.233
LPG	10000 t							0	17.2	99.5	50179	0
Refinery gas	10000 t^3			0.27				0.27	18.2	99.5	46055	8256.698951
Natural gas	100 Mm^3		0.55			0.02		0.57	15.3	99.5	38931	123867.2104
Other petroleum products	10000 t							0	20	99	38369	0

Other coking products	10000 t							0	25.8	98	28435	0
Other energy	10000 tce					1.1	15.92	17.02	0	0	0	0
Total												378973438.1

Date source：Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual; China Energy Statistical Yearbook 2003.

Table A3-7 Calculation of emissions of North China Grid in 2003

		Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km³)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D		E	F=A+B+C +D+E	G	H	I	J=F*G*H*I* 44/12/10000 (mass unit) J=F*G*H*I* 44/12/1000 (volume unit)
Raw coal	10000 t	714.73	1052.74	5482.64	4528.51	3949.32	6808	22535.94	25.8	98	20908	436822883.4
Cleaned coal	10000 t						9.41	9.41	25.8	98	26344	229820.3878
Other washed coal	10000 t	6.31		67.28	208.21		450.9	732.7	25.8	98	8363	5680747.688
Coke	10000 t					2.8		2.8	29.5	98	28435	84397.73393
Coke oven gas	100 Mm³	0.24	1.71		0.9	0.21	0.02	3.08	13	99.5	16726	244332.1814
Other gas	100 Mm³	16.92		10.63		10.32	1.56	39.43	13	99.5	5227	977500.8431
Crude oil	10000 t						29.68	29.68	20	99	41816	901037.7869
Gasoline	10000 t						0.01	0.01	18.9	99	43070	295.490349
Diesel oil	10000 t	0.29	1.35	4		2.91	5.4	13.95	20.2	99	42652	436286.327
Fuel oil	10000 t	13.95	0.02	1.11		0.65	10.07	25.8	21.1	99	41816	826325.7251
LPG	10000 t							0	17.2	99.5	50179	0
Refinery gas	10000 t³			0.27			0.83	1.1	18.2	99.5	46055	33638.40313
Natural gas	100 Mm³		0.5				1.08	1.58	15.3	99.5	38931	343351.2148
Other petroleum products	10000 t							0	20	99	38369	0

Other coking products	10000 t							0	25.8	98	28435	0
Other energy	10000 tce	9.83					39.21	49.04	0	0	0	0
Total												446580617.2

Date source：Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual; China Energy Statistical Yearbook 2004.

Table A3-8 Calculation of emissions of North China Grid in 2004

		Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D		E	F=A+B+C+D+E	G	H	I	J=F*G*H*I*44/12/10000 (mass unit) J=F*G*H*I*44/12/1000 (volume unit)
Raw coal	10000 t	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	25.8	98	20908	527776527.1
Cleaned coal	10000 t						40	40	25.8	98	26344	976919.8208
Other washed coal	10000 t	6.48		101.04	354.17		284.22	745.91	25.8	98	8363	5783167.065
Coke	10000 t					0.22		0.22	29.5	98	28435	6631.250523
Coke oven gas	100 Mm^3	0.55		0.54	5.32	0.4	8.73	15.54	13	99.5	16726	1232766.915
Other gas	100 Mm^3	17.74		24.25	8.2	16.47	1.41	68.07	13	99.5	5227	1687509.064
Crude oil	10000 t							0	20	99	41816	0
Diesel oil	10000 t	0.39	0.84	4.66				5.89	20.2	99	42652	184209.7825
Fuel oil	10000 t	14.66		0.16				14.82	21.1	99	41816	474656.87
LPG	10000 t							0	17.2	99.5	50179	0
Refinery gas	10000 t^3		0.55	1.42				1.97	18.2	99.5	46055	60243.32197
Natural gas	100 Mm^3		0.37		0.19			0.56	15.3	99.5	38931	121694.1015
Other petroleum products	10000 t							0	20	99	38369	0
Other coking products	10000 t							0	25.8	98	28435	0
Other energy	10000 tce	9.41		34.64	109.73	4.48		158.26	0	0	0	0

Total												538304325.3

Date source：Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual; China Energy Statistical Yearbook 2005.

Table A3-9 Calculation of simple OM emission factor of North China Grid

Year	2002	2003	2004
Electricity delivery to the grid (MWh)	377617637.4	429609285.8	493687659.9
Emissions (tCO_2)	382216597.5	451291526.4	543504173.1
Simple OM (tCO_2e/MWh)	1.01217888	1.050469674	1.100906944
Weighted average OM (tCO_2e/MWh)	1.0585		

Table A3-10 Calculation of emissions from solid, liquid and gas fuels combusted for power generation of North China Grid

fuel	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shan dong	Total	Heat value (MJ/t, km^3)	Emissions factor (tc/TJ)	Oxidation rate (%)	Emissions (tCO_2e)
Raw coal	10000 t	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	20908	25.8	98	527776527
Cleaned coal	10000 t	0	0	0	0	0	40	40	26344	25.8	98	976920
Other washed coal	10000 t	6.48	0	101.04	354.17	0	284.2	745.91	8363	25.8	98	5783167
Coke	10000 t	0	0	0	0	0.22	0	0.22	28435	29.5	98	6631
Sub-total												534,543,245
Crude oil	10000 t	0	0	0	0	0	0	0	41816	20	99	0
Gasoline	10000 t	0	0	0	0	0	0	0	43070	18.9	99	0
Kerosene	10000 t	0	0	0	0	0	0	0	43070	19.60	99	0
Diesel oil	10000 t	0.39	0.84	4.66	0	0	0	5.89	42652	20.20	99	184，210
Fuel oil	10000 t	14.66	0	0.16	0	0	0	14.82	41816	21.10	99	474，657
Other petroleum products	10000 t	0	0	0	0	0	0	0	38369	20.00	99	0
Sub-total												685，867
Natural gas	10 Mm^3	0	3.7	0	1.9	0	0	5.6	38931	15.3	99.5	121694
Coke oven gas	10 Mm^3	5.5	0	5.4	53.2	4.0	87.3	155.4	16726	13.00	99.5	1,232,767
Other gas	10 Mm^3	177.4	0	242.5	82.0	164.7	14.1	680.7	5227	13.00	99.5	1,687,509
LPG	10000 t	0	0	0	0	0	0	0	50179	17.20	99.5	0
Refinery gas	10000 t	0	0.55	1.42	0	0	0	1.97	46055	18.20	99.5	60,244
Sub-total												3,102,214
Total												538,304,326

Accordingly: λ_{Coal} =99.30%, λ_{Oil} =0.12%, λ_{Gas} =0.58%

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

Table A3-11 Installed Capacity of North China Grid in 2004

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal	MW	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro	MW	1055.9	5	783.8	787.3	567.9	50.8	3250.7
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	13.5	0	111.8	12.4	137.7
total	MW	4514.4	6013.5	20730	18480.5	14321.2	32923.6	96983.2

Source: China Electric Power Yearbook 2005

Table A3-12 Installed Capacity of North China Grid in 2002

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal	MW	3407.5	6245.5	16745.7	14327.8	9778.7	25102.4	75607.6
Hydro	MW	1038.5	5	775.9	795.3	592.1	50.8	3257.6
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	13.5	0	76.6	0	90.1
total	MW	4446	6250.5	17535.1	15123.1	10447.4	25153.1	78955.2

Source: China Electric Power Yearbook 2003

Table A3-13 Installed Capacity of North China Grid in 2001

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal	MW	3412.5	5632	16474.9	13415.8	8898.3	20957.7	68791.3
Hydro	MW	1058.1	5	742.6	795.9	566.2	56.2	3224
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	9.9	0	46.7	0	56.6
total	MW	4470.6	5637	17227.4	14211.8	9511.2	21013.9	72071.9

Source: China Electric Power Yearbook 2002

Table A3-14 Calculation of BM of North China Grid

	Installed capacity in 2001	Installed capacity in 2002	Installed capacity in 2004	Increase between 2001-2004	Ratio of the increase
	A	B	C	D=C-A	
Thermal（MW）	68791.3	75607.6	93594.9	24803.6	99.58%
Hydro（MW）	3224	3257.6	3250.7	26.7	0.10%
Nuclear (MW）	0	0	0	0	0.00%
Wind and others（MW）	56.6	90.1	137.7	81.1	0.32%
total（MW）	72071.9	78955.2	96983.2	24911.3	100.00%
Ratio of 2004	74.31%	81.41%	100%		

$EF_{BM,y}$=0.9104×99.58%=0.9066 tCO_2/MWh

Therfore, CM = 0.5*OM + 0.5*BM = 0.98255 tCO_2/MWh.

Appendix 5. Further background information on monitoring plan

No additional information.

Appendix 6. Summary of post registration changes

The monitoring plan has been revised twice. The first revised monitoring plan was approved on 15/03/2011 and the second revised monitoring plan was approved on 07/07/2014.
Please refer to the web-link below for further details on the approved revision to the monitoring plan.
http://cdm.unfccc.int/Projects/DB/DNV-CUK1214826895.32/view

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