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

**CONTENTS**



**Annexes**

## SECTION A. General description of project activity

### A.1 Title of the project activity:

>>

Daning Coal Mine Methane Power Generation Project in Jincheng City Shanxi Province, China

Version: 02

Date: 17/05/2008

### A.2. Description of the project activity:

>>

Daning Coal Mine Methane Power Generation Project in Jincheng City Shanxi Province, China (the proposed project) is to capture and utilize coal mine methane (CMM) in the coal mining area of Daning Coal Mine, Yangcheng County Jincheng City Shanxi Province. Jincheng Fengrun CMM Utilization Co., Ltd (the project owner) will construct the power station for power generation from CMM. Jincheng City Fengrun CMM Utilisation Co., Ltd is a private company (independent from the coal mines) established to development CMM utilisation projects on a BOT basis.

In the absence of the proposed project, the CMM is directly emitted to the air without any utilization. The proposed project only includes CMM, without CBM. Besides the electricity supplied to this power station, all the electricity generated from the proposed project will be supplied to Shanxi Power Grid and finally connected to the North China Power Grid.

The project activity include the installation of equipments allowing the gas collection, pre-treatment, the generator set and the gird connection facilities. After the full operation of the proposed project, the installed capacity of the proposed project will be up to be 16.3MW (9*0.5MW+13*0.6MW+2*2MW). On annual basis, it is expected to utilize 65,721,600 cubic meters gas, generate 93,888 MWh electricity and supply 93,240MWh electricity to the North China Power Grid.

To implement the proposed project will reduce greenhouse gas emissions: on one hand, it can destroy the gas by way of power generation so as to reduce the emissions of methane; on the other hand, the clean gas will be utilized to generate electricity, displacing electricity that would be otherwise be generated by power generations connected to the North China Power Grid so as to avoid the emissions of CO2 produced by fossil fuel. The annual emission reductions of the proposed project are estimated to be 416,565t CO2e.

The proposed project is in accordance with the national policy on enhancing the utilization of CMM and will have the following sustainable development benefits:

- help reduce coal mine accident and improve safe working conditions;
- reduce CMM emissions which is benefit for local and global environment;
- reduce local environment pollution in comparison to the fossil fuel currently used which produces CO2 and other pollutants ;
- promote comprehensive resource utilization and rational energy use practices through utilization of the clean gas which is currently wasted through venting to the atmosphere;
- provide local employment opportunities by approximately a total of 50 positions;

**A.3. Project participants:**

>>

| Name of Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable ) | Kindly indicate if the Part involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| P.R. China(host) | Jincheng City Fengrun CMM Utilization Co.Ltd China. | No |
| UK | Trading Emissions PLC | No |

**A.4. Technical description of the project activity:**

**A.4.1. Location of the project activity:**

>>

**A.4.1.1. Host Party(ies):**

>>

P.R. China

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

>>

Shanxi Province

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

>>

Tingdian Town Yangcheng County Jincheng City

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

>>

The proposed project is sited in Yangcheng County Jincheng City, south of Shanxi Province. The geographical coordinates are east longitude 112°24′30″, and north latitude 35°34′41″. Figure 1 shows the location of the proposed project.

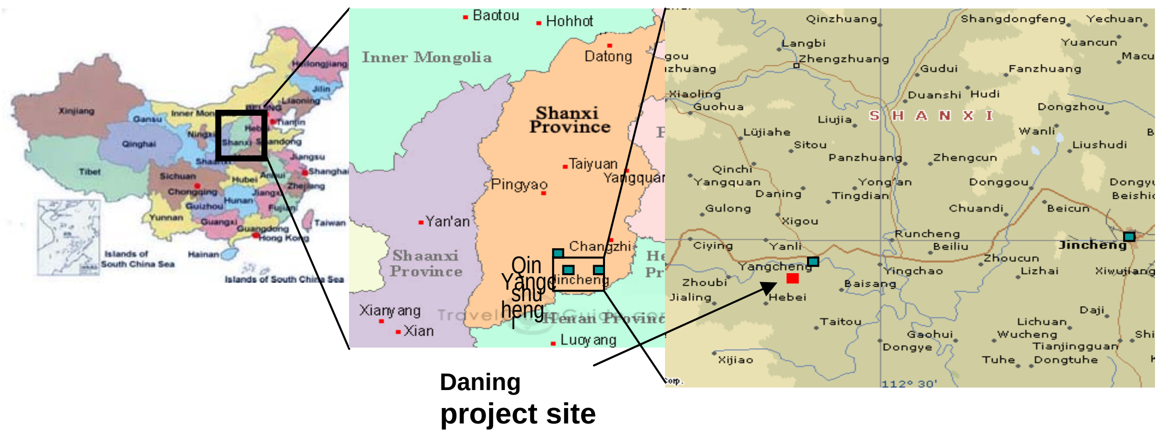



Figure 1 The site of the proposed project

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

>>

Category 1: Energy industries (non-renewable sources)

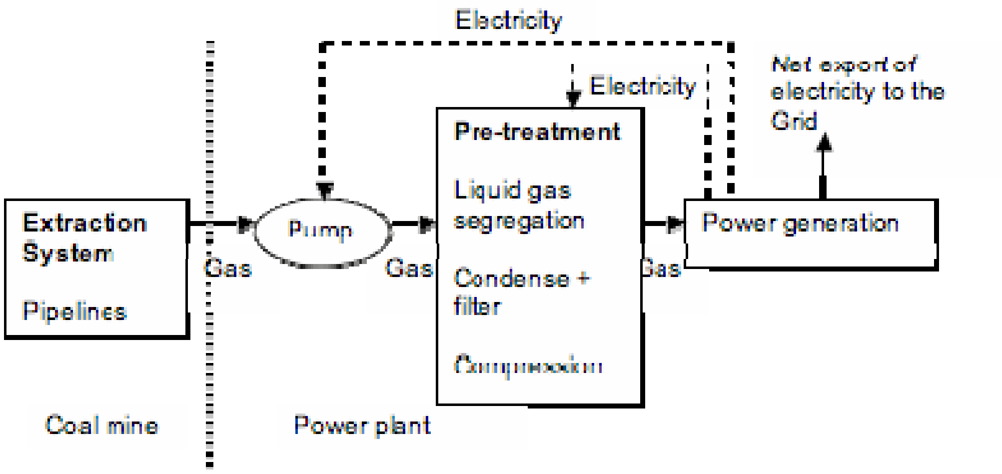
Category 8: Mining / Mineral Production

Category 10: Fugitive Emission from Fuels (solid, oil and gas)

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

>>

The proposed project will adopt advanced technology of power generation from CMM. Besides the electricity used by the power station, all the electricity generated from the proposed project will be connected to local power grid. The engineering process of the proposed project is shown in the following figure:




**Pre-treatment system**

The extracted CMM passes through a liquid-gas segregation treatment. It is then sent through the compressor prior to the generator sets.

**Gas generator sets**

The treated gas is transmitted to gas generator set. The exhaust from the gas engines will be vented outside the plant by pipes, muffler and chimney.

The gas engines adopted by the proposed project are a national made product with the type of 500GF-TK and 16-280GF-2000. The manufacturer is Shengli Oil Field Machinery and Shandong Zhibo Machinery.

The specification of the generator set:

| | | | |
|---|---|---|---|
| Model: | 500GF | 600GF | 2000GF |
| Unit: | 9 | 13 | 2 |
| Rated power: | 500kW | 600kW | 2,000kW |

The proposed project will only adopt domestic technology. So there is no foreign technology transfer involved.

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

>>

It is expected that the proposed project activities will generate annual emission reductions 416,565t$CO_2$e. The renewable crediting period (7*3 years) is chosen. In the first crediting period (from 2008 to 2014), the total emission reductions generated by the proposed project in the first seven years is 2,915,955t$CO_2$e.

| Years | Estimation of emission reductions (t$CO_2$e) |
|---|---|
| 2008 (Sep-Dec) | 138,855 |
| 2009 | 416,565 |
| 2010 | 416,565 |
| 2011 | 416,565 |
| 2012 | 416,565 |
| 2013 | 416,565 |
| 2014 | 416,565 |
| 2015 (Jan-Aug) | 277,710 |
| Total estimated reductions(t$CO_2$e) | 2,915,955 |
| Total number of crediting years | 7 |
| Annual average over the crediting period of estimated reductions(t$CO_2$e) | 416,565 |

**A.4.5. Public funding of the project activity:**

>>

No existing official development assistance (ODA) from Annex I countries is involved in the proposed project.

## SECTION B. Application of a baseline and monitoring methodology

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

>>

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 the proposed 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 Justification of the choice of the methodology and why it is applicable to the project activity:

>>

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

Table 1 Comparison of the proposed project with ACM0008 regarding CMM extraction activities

| ACM0008 Applicability | The proposed 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 underground boreholes, gas drainage galleries or other goaf gas capture techniques , but excluding surface goaf wells |
| Ventilation CMM that would normally be vented | Included |

Table 2 Comparison of the proposed project with ACM0008 regarding CMM utilization activities

| ACM0008 Applicability | The proposed project |
|---|---|
| The baseline is the partial or total atmospheric release of the methane | Yes, total release |
| The methane is captured and destroyed through flaring | No 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 3 Comparison of proposed project with inapplicable activities stated in the methodology

| The inapplicable activities stated in ACM0008 | The proposed project |
|---|---|
| Operate in open cast mines | Underground coal mines |
| Capture methane from abandoned/decommissioned coalmines | CMM extracted from working mines |
| Capture/use of virgin coal-bed methane | Extraction activities are concomitance with coal production |
| Use CO2 or any other fluid/gas to enhance CBM drainage before mining takes place | Not including CBM |

It can be seen that the proposed 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 the proposed project.

Since electricity generated from the proposed 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 the proposed 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 the proposed project.

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

>>

The spatial extent of the proposed project boundary comprises: all equipments (excluding the extraction pipelines installed prior to the project) installed and used for the extraction, compression, and storage of CMM at the project site and all the power plants connected to North China Power Grid.

| | Source | GHG | Included ? | Justification/Explanation |
|---|---|---|---|---|
| **Baseline** | Emissions of methane as a result of venting | $CH_4$ | Included | Main emission source |
| | Emissions from destruction of methane in the baseline | $CO_2$ | Excluded | The proposed project has none of CMM utilization. |
| | | $CH_4$ | 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. |
| **Project Activity** | Emissions of methane as a result of continued venting | $CH_4$ | Excluded | According to ACM0008 |

| | | | | |
|---|---|---|---|---|
| | On-site fuel consumption due to the project activity, including transport of the gas | $CO_2$ | Included | If additional equipment such as compressors are required on top of what is required for purely drainage, energy consumption from such equipment should be accounted for. |
| | | $CH_4$ | 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 | $CO_2$ | Included | From the combustion of NMHC in a flare, or heat/power generation, if NMHC accounts for more 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. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

>>

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

***Step 1a. Options for CMM extraction***

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

A. Ventilation air methane;

B. Pre mining CMM extraction;

C. Post mining CMM extraction;

D. the continuation of the current situation in Daning Coal Mine, combinations of options A, B and C;

where option A accounts for approximately 45% of all CMM extraction, option B and C of approximately 55%.

***Step 1b. Options for extracted CMM treatment***

The possible baseline scenario alternatives at Daning 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 by a third party, 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. Use for additional grid power generation by the coal mine;

viiii. Possible combination of the options above.

***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**

***2.a CMM extraction***

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 laws 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 density of methane in Daning 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.

***2.b CMM treatment***

For CMM utilization, it is regulated that methane concentration cannot 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.

In China, there is no compulsory requirement on the utilization of the captured CMM. So option i should not be excluded.

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 the proposed project and the North China Power 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 not viable and thus should be eliminated.

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

***2.c Energy production***

This project is to build a 16.3 MW CMM-fired power plant. According to *Interim Rules on the Installation and Management of Small-scale Fuel-fired Generators* (issued in August 1997), the fossil fuel-fired power units with less than 100MW is strictly regulated for installation, building a coal-fired power plant of the same capacity is prohibited by the national regulation1. 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:

| Scenario | CMM extraction | CMM treatment | Power production |
|---|---|---|---|
| **Scenario 1** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | i. Venting | a. Electricity from grid |
| **Scenario 2** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | ii. Utilisation of VAM | a. Electricity from grid |
| **Scenario 3** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | iii. Flaring of CMM | a. Electricity from grid |
| **Scenario 4** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | iv. Use for additional grid power generation, but not implemented as a CDM project; | b. Generate electricity from the extracted CMM without CDM |
| **Scenario 5** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | vi. Use for additional heat generation | a. Electricity from grid |
| **Scenario 6** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | vii. Feed into gas pipeline | a. Electricity from grid |
| **Scenario 7** | D. Continuation of the current practice, VAM 45%; pre mining and post mining 55% | viii. Use for additional grid power generation by the coal mine | b. Generate electricity from the extracted CMM without CDM |

**Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers**

**Scenario 1** is the continuation of the current practice. It does not face barriers.

**Scenario 2** faces prohibitive technical barrier that the average concentration of methane in the VAM is 0.75%. Up to now, there is no commercialized matured technology in China that could use the VAM of this concentration. Effective technology for increasing the concentration of methane is not available but is being researched[1]. Scenario 2 is thus eliminated.

**Scenario 3** does not face prohibitive barriers.

**Scenario 4** will be discussed in the Step 5.

**Scenario 5** face barrier that there is no demand for additional heat generation.

There is no demand for additional heat generation. The current heat supply for the coalmine and local residents is delivered via coal-fueled boilers. No CMM has been used in this process. Located adjacent to the coal mining operation, local residents enjoy relatively cheap fuel prices and a stable supply.

Jincheng Engineering Consultancy Centre conducted an investigative research analysis on the existing gas usage in February 2005. It was found that the local residents were relying on local coal supply for domestic use. The report is submitted for review during the validation.

In addition, the DOE has conducted a site visit to the Daning project site. Baseline usage as described above has been verified.

**Scenario 6** face technical barrier that there is lack of infrastructure for the technology implementation.

The concentration and flux of CMM from coal mine is unstable, so it is not suitable to feed into gas pipeline. Furthermore, there is no municipal pipeline connection in place. The construction of the pipeline system for the few dispersedly distributed villages needs large amount of investment. To implement the gas pipeline, the villages will have to mothball the coal consumption equipments which have been used prevailingly. Plus the operation and maintenance costs for the pipeline system, it is impossible the cost of CMM can be competitive with coal since there are plenty coal production in Shanxi province. In the coal-mining areas, coal is easily accessible and affordable to the local residents. Hence, scenario 6 is eliminated from the baseline.

**Scenario 7** The CMM utilization by the coal mine owners for grid-connected electricity generation should also be eliminated, as discussed in Step 4 common practice analysis in Section B.5 the PDD, no CMM power generation project is identified with the investment from the coal mine owner without CDM benefit. It demonstrates this possible scenario (CMM utilisation by the coal mine owners) faces prohibitive barriers.

Barriers for coal mine owners to invest in a grid-connected CMM power plant are listed as below:

1. The core business of the coal mine owners is coal production, which is a high return business. The minimum investment return benchmark in the Chinese coal industry is 15% compared to only 10% in the electricity sector.[2] Since 2004, with the soaring coal price, the profitability of coal mining has grown, further increasing returns[3]. Therefore, coal mining owners generally consider it more economically attractive to invest in their core business and expand production rather than invest in ancillary businesses

---

[1] CSIRO Exploration and Mining, 2006, *Development of Two Case Studies on Mine Methane Capture and Utilisation in China*

[2] *Economical Assessment and Parameters for Construction Project*, 3rd Edition

[3] http://www.coalinfo.net.cn/

such as small scale power production.

2. For the coal mine owners, investment in a power plant requires high level of additional technical know-how. The coal mine owners are not familiar with the electricity market. Power generation is not the expertise of the coal producers. Developing projects in a different sector imposes technical risk.

3. Gas price has been stipulated by the Jincheng Pricing Bureau in 2003[4]. The coalmine saw it as a convenient business model to utilize its CMM by selling it to a third party (an energy generation company, i.e. the project owner). Given that the coalmine intends to focus on its core business, outsourcing power generation at a fixed price for its CMM is a sensible business deal.

Scenario 1 and 3 are the scenario alternatives that do not face prevailing barriers, with scenario 4 they will be discussed in the next step.

**Step 5. Identify most economically attractive baseline scenario alternative**

**Scenario 1** is the business as usual scenario, venting CMM does not create economic benefit, on the other hand, there is not investment required for this scenario.

**Scenario 3**, flaring of the CMM brings no economic benefit to the mine. Investment costs of the flare would results in the negative IRR for the investment. Since there is no mandatory requirement, flare is simply not the option that would be chosen by the coalmine.

**Scenario 4** is to implement the project without CDM. As it is demonstrated in the financial analysis of section B.5, the project's IRR is 4.61%. Such IRR is below the power sector benchmark. It is obviously not an alternative of economically attractiveness.

Based on the above analysis, the most feasible baseline scenario alternative of the proposed project is as followings:

Table 4 the most feasible baseline scenario alternative of the proposed project

| Project activity | The most feasible baseline scenario |
|---|---|
| CMM extraction | Option D: the continuation of the current situation in Daning Coal Mine |
| CMM treatment | Option i: ventilation |
| Electricity generation | Option a: North China Grid supplies the same amount of electricity |

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

Jincheng City Fengrun CMM Utilisation Co., Ltd is a private company (independent from the coal mines) established to develop CMM utilisation projects on a BOT basis. From the outset the project has been developed with serious consideration of CDM. The development history is shown in the table below.

[4] *Notice Regarding CMM Pricing, Jincheng City Pricing Bureau (Document no. 301 of 2003).*

| | Dates | Key documents | Approval | Remarks |
|---|---|---|---|---|
| Initial consideration | 08/2004 | FSR 1 (25MW) | No approval | The project owner initially considered a 25MW installation with several stages of development. 5MW was planned as the first stage of the development.<br>The FSR approval has been pending. |
| | 16/10/2004 | EIA 1 (5MW) | 09/11/2004 | Only the first stage (5MW) was submitted for and received the EIA approval. |
| CDM consideration and decision-making | 14/10/2004 | CMM methodology (NM66 published for comment) | Consolidated on 28/11/2005 | The first CMM methodology was proposed. |
| | 10/01/2005 | Correspondence with the CNUDC regarding CDM | n/a | The project developer consulted the Jincheng Municipal CMM and Natural Gas Utilisation Development Committee (CNUDC) regarding its CDM development plan in January 2005. (Please refer to the translation below.) |
| | 02/2005 | FSR 2<br>with CDM consideration (16.3MW) | 07/06/2005 | A FSR was conducted for the installation of 16.3MW with CDM consideration. (Please refer to the translation below.)<br>The extension approval was granted since there has been a pending application for the stage I installation. Considering the submitted FSR and the EIA approval granted for 5MW, this approval covers the pending application (08/2004) and the latter FSR (02/2005) covering the total 16.3MW. |
| | 13/03/2005 | Requested for CDM development advisory | 08/04/2005 | Project owner contacted the Agenda 21 Management Centre for advisory on CDM development. The Centre accepted the project on 08/04/2005.<br><br>In response to the project owner, the Centre indicated the project would be used as a pilot project to initiate the CDM service development on 08/04/2005. The CDM development has been in parallel with the project development. |
| | 28/11/2005 | ACM0008 version 1 published | n/a | ACM0008 version 1 was published |

| | | | | |
|---|---|---|---|---|
| Implementation | 11/12/2005 | Construction contract | n/a | The signing of the construction contract was considered as the start of the project activity. The construction contract specified the construction was to start in December 2005; and stage I installation was expected to be operational by March 2006. |
| | 22/12/2006 | ACM0008 version 3 published | n/a | During the negotiation with potential CER buyer, the PDD was revised according to the latest methodology version at the time. |
| | 08/01/2007 | CER purchase term sheet signed | n/a | |
| | 05/2007 | PDD published with 25MW | n/a | The start of the CDM application process enhanced the project owner's confidence in the project. Instead of the approved 16.3MW design, the project owner considered to develop the project in a larger scale and planned to follow up with a new 25MW feasibility study.<br>At the time of submission for validation, since no new design of 25MW installation has been conducted, the initial FSR (08/2004) was used as the basis of the financial analysis in the published PDD. Even the analysis demonstrates the financial unattractiveness of the project, this data source was later considered inappropriate in the validation process for the reasons below:<br>- The FSR (08/2004) did not receive a government approval or result in the actual project implementation;<br>- The financial analysis of the FSR only covered the 5MW units. It is inaccurate to assume the financial performance of a 25MW project to be proportional to a 5MW installation.<br>Given the reasons above, the financial analysis in the published PDD was revised with valid data in a later stage of the validation. |
| | 09/2007 | EIA 2 | 01/11/2007 | An EIA was conducted retrospectively for the installation extension. In addition to the initially approved 5MW, another 11.8MW was assessed and approved. |
| | 05/2008 | PDD revised as 16.3MW | n/a | At this stage of the validation, the project owner has decided to develop the 16.3MW project as designed and approved. No new feasibility study will be conducted for a |

| | | | | |
|---|---|---|---|---|
| | | | | 25MW installation. The PDD is revised to include the 16.3MW installation only. |

In February 2005, Jincheng Engineering Consultancy Centre completed the feasibility study report with consideration of CDM.

As quoted in the conclusion of the financial analysis, "When the CMM price is zero, the profit margin is small. When the CMM price is 0.15RMB/m$^3$, the project is not viable." The project is independent of the coalmine and therefore in this instance the project has to pay for the gas.

The FSR indicated that "The project contributes to the development of clean energy. CDM plays an important role for the project implementation. With the assistance of CDM under the current global and national political environment and regulations the project would achieve considerable economic performance and social benefits Otherwise with various persistent conditions, the project implementation is not economic viable."

During the feasibility study stage, the project owner has also consulted Jincheng Municipal CMM and Natural Gas Utilisation Development Committee regarding its CDM development plan in January 2005. The Committee provided supportive opinion on the CDM project development.

It is quoted from the letter that "… Considering the hindrance to the project development, in order to overcome the financial difficulty, we would like to apply for the Clean Development Mechanism to utilize the coal mine methane…" The Committee replied with its endorsement and advised the project owner to proceed as soon as possible.

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

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

According to ACM0008, this step is ignored.

**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 the proposed 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 the Internal Rate of Return (IRR) indicator, can be acquired and used for the investment analysis.

***Sub-step 2b Apply benchmark analysis***

According to the "Economical assessment and parameters for construction project, 3rd edition", a project will be financially acceptable when the Internal Return Rate (IRR) is better than the sectoral benchmark IRR. The FSR (02/2005) calculated the equity IRR (after tax) in the project's financial analysis. To be consistent with the financial indicator used at the time of decision-making, the equity IRR is used in the PDD.

In page 203 of "Economical assessment and parameters for construction projects, 3rd edition", the benchmark equity IRR (after tax) for the energy production industry is 10%, the benchmark IRR of the proposed project is chosen as 10%.

***Sub-step 2c.Financial indicator calculation and comparison***

The parameters needed in investment analysis are as the following table.

Table 5 the basic parameters for investment analysis

| **Parameters** | **Value** | **Source** |
|---|---|---|
| Installed capacity | 16.3MW | (1) |
| Net electricity output | 93,240 MWh | (1) |
| Total investment* | 40.358 M RMB | (1) |
| O&M cost | 6.98 M RMB/year[5] | (1) |
| Bus-bar tariff (inc. VAT) | 0.2754 RMB/kWh | (1) |
| CMM cost** | 0.15 RMB/m3 | (2) |
| Value added tax | 17% | (1) |
| Urban construction and education tax | 4% | (1) |

Note:

* The total investment includes the equipment costs, building and installation costs for the facilities relevant to the power generation project. The extraction system costs have been paid by the coal mine.

** The project owner is developing the projects on a BOT basis and does not hold ownership of the CMM. Thus the CMM cost occurs here, in contrast to other CMM projects registered with the UNFCCC. According to the *Notice Regarding CMM Pricing, Jincheng City Pricing Bureau (Document no. 301 of 2003)*, the unit price of CMM gas with 40% methane concentration is 0.15RMB/$m^3$. For every 5% increase of concentration, the price is to be added with 0.01RMB/$m^3$. The project's gas concentration is 52.5%. As a conservative approach, 0.15RMB/$m^3$ is used in the financial analysis.

Sources:

(1) *CMM Power Generation Project Development Feasibility Study Reports, 2005, Jincheng Engineering Consultancy Centre*

(2) *Notice Regarding CMM Pricing, Jincheng City Pricing Bureau (Document no. 301 of 2003).* This is the latest published CMM price at the time of decision making in 2005. There was no price change announced by the government between the notice issued in 2003 and the FSR being prepared in 2005. The clarification letter from Jincheng Municipal CMM and Natural Gas Utilisation Development Committee further specifies the Daning CMM power plant's obligation in this price scheme.

Based on the above parameters, the total investment IRR of the proposed project without CDM and with CDM (CERs price is estimated to be 6Euro/ $tCO_2e$ and with 7*3years) is shown in the following table:

Table6 FIRR of the proposed project without/with CERs

---

[5] The O&M cost consists of salary and maintenance costs etc, but excluding CMM cost. The CMM cost will be discussed in the sensitivity study as an individual parameter.

| The proposed project | IRR |
|---|---|
| Without CERs | 4.61% |
| With CERs | 64.11% |

From the above table, the FIRR of the proposed project without CERs is negative, 4.61%. The proposed project is not feasible and economically attractive. With CERs, the IRR increases to 64.11%.

***Sub-step 2d. Sensitivity analysis***

Three factors are considered in following sensitivity analysis:

1) Total investment
2) Annual operation and maintenance cost
3) CMM price
4) Electricity tariff
5) Operating hours

The IRR of the project exceeds above the benchmark in the following scenarios:

- The total investment is 31% below assumption.

The capital expenditure was estimated based on *Shanxi Civil and Installation Engineering Project Budget Index 2003, Electric Power Project Development Investment Estimation Index* and the market price at the time. In the few months between project design and construction, significant cost variance is unlikely. In fact the consumer price has even been increasing in China due to the continued economic boom. At the time of decision making, the consumer price has grown 3.9% compared to the previous year.[6] Therefore it is unlikely the investment cost would be 31% less than the estimate.

- The O&M cost is 21% below estimate.

21% reduction of O&M cost is not possible. Salary and maintenance costs accounts for significant proportion of the O&M cost. In fact with rapid economic development, the income of Chinese labour has been increasing.[7] As discussed above, consumer prices have also been growing. It is unlikely there will be 21% reduction on O&M cost.

- CMM price is 14% below estimate.

A 14% reduction of the gas tariff is unlikely. Firstly, the CMM price is regulated by the Jincheng City Pricing Bureau.

Moreover, energy demand has been growing rapidly in China and energy source prices have been rising.According to the 4th Quarter Price Projection Report (2005) published by the Economic Research Centre for the Shanxi Provincial Government, the liquefied gas price has grown by 2.5% compared to the end of 2004; and liquefied petroleum gas has grown by 6.3%. The Report projected the continuous growth in the price of gas in many cities nation-wide.[8] With the soaring energy

6 http://www.chinanews.com.cn/news/2005/2005-03-31/26/557586.shtml

7 http://news.xinhuanet.com/fortune/2006-05/26/content_4602492.htm

8 http://www.sxnem.gov.cn/view.asp?ArticleID=1826

demand and gas price increase in China, a CMM price decrease of 14% is considered unlikely.- Electricity tariff is 11% higher than assumption.

It is impossible that the electricity tariff is increased by 11% unilaterally. Electricity tariff is highly regulated and controlled by the Central Government. The Government enforces a coal price-tariff correlation mechanism. Electricity tariff would only be adjusted based on significant increase of fuel costs and such a mechanism requires a complicated process of tariff adjustment approval. It is therefore common that electricity producers suffer an increasing fuel cost but are prevented from increasing the sales tariff.[9] The increase of electricity tariff alone to 11% without increased fuel costs is not currently legally viable.[10]

- The operating hours are 42% higher than assumption.

The operation hours cannot be increased by 42%. According to page 9 of the FSR, the annual electricity output of the project is estimated based on the installed capacity, average load coefficient of 80%[11], and 7,200 operation hours. Given a 42% increase of 7,200 hours would exceed the 8,760 hours in a year, the possible increase of operation hour would not result in reaching the IRR benchmark.

The financial analysis shows that the project is not the most financially attractive alternative, and the sensitivity analysis shows that it is unlikely to be financially attractive compared to the benchmark under even significant variations in the assumptions. However, the revenue from the CERs will greatly improve the financial feasibility of the proposed project.

**Step 3. Barrier analysis**

Step 3 is skipped as per the Tool for the demonstration and assessment of additionality (version 03): “If after the sensitivity analysis it is concluded that the proposed CDM project activity is unlikely to be the most financially attractive or it unlikely to be financially attractive, the proceed to Step 4 (Common practice analysis).”

**Step 4: Common practice analysis**

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

China is the world’s largest producer of coal and largest emitter of coal mine methane (CMM). However, to date, utilisation of the substantial CMM resources from China’s coal mines has been limited. Research has estimated that China’s total CMM emission was 11.674 billion cubic meters in 2003. In the same year, the CMM extracted by drainage systems was 1.521 billion cubic meters. Only 629.21 million cubic meters was utilised.[12] This accounts for less than 20% of the potential for capture. This is mainly due to technical and investment barriers and to prevailing market conditions, which mean that coal mines prioritise investment in increased coal production capacity over investments in technologies and systems for the utilisation of CMM.

At the same time, greater (and mandatory) attention to mine safety in China’s coal mining industry in recent years has lead to increased investments in methane drainage systems. Without accompanying

---

[9] http://finance.21cn.com/news/cjyw/2007/06/23/3311433.shtml

[10] http://www.china.org.cn/english/2006/Jul/173343.htm

[11] http://rl.cqepc.com.cn/content/kczy/dmtkj/content1/main5-1.htm

[12] Methane to Markets Partnership Coal Subcommittee, Table 7-4, *China, CMM Global Overview*

investments in gas utilisation technologies, the utilsation rate of CMM drained in China has begun to decline dramatically. Between 1998 and 2004 the total amount of methane drained from China's coal mines increased by almost 1.1 billion cubic meters, while over the same period the amount of gas utilized increased by only 250 million cubic meters[13]. As a result, CMM utilisation rates are actually falling in China and this trend is expected to continue as more investments continue to be made in gas drainage systems.

The CMM utilisation projects in China are dominated supplying householder consumers. There are few power generation schemes due to the capital cost of these types of plant. As of 2003, CMM utilisation consumed 629.21 million cubic meters of methane. Those that are CMM-to-power projects are generating over 100 MW of power.[14]

Research has been conducted on projects utilizing CMM in the province. The research was conducted via internet research and interview with the Agenda 21 Office of the Shanxi Provincial Government as local governmental representative. Based on the information accessible to public, the projects below have been identified.

Table 8 Similar activities in the region

| **Project** | **Capacity (MW)** | **CDM status** |
|---|---|---|
| 14 CMM power plants in Shanxi[15] | 25 | Not applying |
| Shanxi Liulin CMM utilization project | 12 | Registered |
| Shanxi Yangcheng CMM utilization project | 15 | Registered |
| Fengrun CMM power generation project | 24 | Applying |
| Shanxi Datuhe CMM utilization project | 17 | Applying |
| Yangquan Yinying CMM power generation | 5 | Applying |
| Shanxi Fengtai CMM utilization project | 6 | Applying |
| Shanxi Yangquan 13MW CMM Cogeneration project | 13 | Applying |
| Jincheng Chengzhuang 18MW CMM power generation project | 18 | Applying |
| Lanjin CMM power generation project | 24 | Applying |

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

It can be seen that except for the 14 projects with a total installation of 25MW, all the projects are applying for CDM assistance.

[13] http://cdm.ccchina.gov.cn/english/upfile/file125.pdf

[14] Methane to Markets Partnership Coal Subcommittee, *China, CMM Global Overview*

[15] Source: Page 7, *Daning CMM Power Generation Project Feasibility Study Report*, August 2004, Jincheng Coal and Coke Design Centre

Firstly it should be noted that the same data source, i.e. the Daning FSR (08/2004), emphasizes that the 14 plants in the Jincheng area altogether only utilized 1.3% of the total released CMM in the area. The utilisation of CMM for commercial ends is therefore not a common practice.

Furthermore, there are obvious distinction between these installed projects and the project activity, listed as below:

- These projects are developed and owned by the coalmines, enjoying a free supply of CMM gas; the project activity being independent of the mine, it has to pay for the gas supply.
- These are backup generation units for the coalmine's domestic use; the project exports electricity to the grid.
- The scale of each of the 14 projects is significantly smaller than the project. The maximum installed capacity is 2MW.

It can therefore be concluded that these 14 projects are not similar activities to the project.

From the above, it is demonstrated that the utilisation of CMM itself is not a common practice in China. The CMM to power projects accounts for a small proportion of the total utlisation. The market share of power produced from CMM is insignificant in the power sector. These similar projects are under development with CDM assistance. Therefore it can be concluded that the present project is not common practice in China.

The proposed project activity passed all criteria of "Tool for the demonstration and assessment of additionality". In conclusion, the proposed project is additional and not the baseline scenario.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

**1.Calculation of the project emissions**

Project emissions are calculated by the formulation below:

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

Where:

$PE_y$ Project emissions in year y (tCO2e)

$PE_{ME}$ Project emissions from energy use to capture and use methane in year y (tCO2e);

$PE_{MD}$ Project emissions from methane destroyed in year y (tCO2e);

$PE_{UM}$ Project emissions from un-combusted methane in year y (tCO2e).

***Combustion emissions from additional energy required for CMM capture and use***

CMM capture consumes only electricity. One additional pump will be utilized in the CMM recovery system and thus consumed certain amount of electricity. Emissions from the consumption of electricity are calculated as below:

$$PE_{ME} = CONS_{ELEC,PJ} * CEF_{ELEC} \qquad (2)$$

Where:

$CONS_{ELEC,PJ}$ Additional electricity consumption for capture and use of methane (MWh);

$CEF_{ELEC}$ Carbon emissions factor of electricity used by coal mine (tCO2e/MWh).

As for the proposed project, the project electricity consumption will be supplied by the project's generation itself. There is not additional consumption from the grid or external source. The power produced used for the baseline calculation is net of the self-consumption. Therefore, the emission of this source is considered as zero in the ex-ante calculation.

***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:

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

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

Where:

$MD_{ELEC}$ Methane destroyed through power generation in year y (tCH4);

$CEF_{CH4}$ Carbon emission factor for combusted methane (2.75 tCO2e/tCH4);

$CEF_{NMHC}$ Carbon emission factor for combusted non methane hydrocarbons (tCO2e/tNMHC);

r Relative proportion of NMHC compared to methane;

$PC_{CH4}$ Concentration of methane (in mass) in extracted gas (%), measured on wet basis;

$PC_{NMHC}$ NMHC concentration (in mass) in coal mine gas (%).

According to gas sample analysis in Daning 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 Daning Coal Mine to checkout whether its concentration is below or above 1% to determine whether NMHC combustion to be included in the project emissions.
MDELEC is calculated with the formulae below:

$$MD_{ELEC} = MM_{ELEC} * Eff_{ELEC} \quad (5)$$

where:

$MM_{ELEC}$ 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).
$MM_{ELEC}$ is calculated as follows:

$$MM_{ELEC} = CMM_{ELEC} \times D_{CH4} * PC_{CH4} \quad (6)$$

where:

$CMM_{ELEC}$ CMM measured delivered to power plant in year y (tCH4)

$D_{CH4}$ Density of methane under normal conditions of temperature and pressure (taken as 0.67kg$CH_4$/ $m^3CH_4$ from IPCC).

$PC_{CH4}$ Concentration of methane (in mass) in extracted gas (%), measured on wet basis;

***Un-combusted methane from power generation***

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

$$PE_{UM} = GWP_{CH4} * MM_{ELEC} * (1\text{-}Eff_{ELEC}) \quad (7)$$

where:

$MM_{ELEC}$ 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).
$GWP_{CH4}$ Global warming potential of methane (21 tCO2e/tCH4).

**2. calculation of the baseline emissions**

Baseline emissions BEy are given by the following equation:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \qquad (8)$$

Where:

$BE_y$ Baseline emissions in year y (tCO2e);

$BE_{MD,y}$ Baseline emissions from destruction of methane in the baseline scenario in year y

(tCO2e);

$BE_{MR,y}$ Baseline emissions from release of methane into the atmosphere in the year y that is avoided by the project activity (tCO2e);

$BE_{USE,y}$ Baseline emissions from power generation replaced by this project in year y (tCO2e).

In the baseline scenarios, the proposed project has none of destruction of methane, so $BE_{MD,y}$ is zero. Therefore, formula (8) is simplified to the following:

$$BE_y = BE_{MR,y} + BE_{Use,y} \qquad (9)$$

***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:

$$BE_{MR,y} = GWP_{CH4} * (CMM_{PJ,ELEC,y} + PMM_{PJ,ELEC,y}) \qquad (10)$$

*Where:*

$BE_{MR,y}$ Emissions from the release of methane into the atmosphere in the year y that is avoided by the project activity (tCO2e);

$CMM_{PJ,ELEC,y}$ Pre-mining CMM captured, sent to and destroyed by power generation in year y(tCH4);

$PMM_{PJ,ELEC,y}$ Post-mining CMM captured, sent to and destroyed by power generation in year y(tCH4).

In the proposed project, the pre-mining CMM and post-mining CMM will be mixed and then sent to the generators , 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.:

$$CMM_{PJ,ELEC,y} + PMM_{PJ,ELEC,y} = MM_{ELEC,y} \qquad (11)$$

Therefore:

$$BE_{MR,y} = GWP_{CH4} \times (CMM_{PJ,ELEC,y} + PMM_{PJ,ELEC,y}) = 21 \times MM_{ELEC,y} \qquad (12)$$

***Baseline emissions from power generation replaced by project***

This project only involves power generation. The same electricity will be supplied by North China Power Grid. The emissions from same power generation in North China Power Grid are calculated as follows:

$$BE_{Use,y} = PBE_{Use,y} = GEN_y \times EF_{ELEC,y} \qquad (13)$$

Where:

GEN*y* Net electricity supplied by the proposed project activity in year y to North China Grid (MWh);

$EF_{ELEC,y}$ Emissions factor of North China Grid (tCO2e/MWh).

GEN*y* is calculated as follows:

$$GEN_y = GEN_{PJ\ to\ Grid,y} - GEN_{Grid\ to\ PJ,y} \qquad (14)$$

Where:

$GEN_{PJ\ to\ Grid,\ y}$ : Electricity supplied by the proposed project activity in year y to North China Grid (MWh);

$GEN_{Grid\ to\ PJ,\ y}$ : Electricity supplied by North China Grid in year y to the proposed project activity (MWh);

The baseline emission factor ($EF_{ELEC,y}$) is calculated as the simple average of the operating margin emission factor ($EF_{OM,\ y}$) and the build margin emission factor ($EF_{BM,\ y}$). In accordance with ACM0002, the baseline emission factor can be calculated with the following steps described below.

***Step 1 Calculate the Operating Margin emission factor ($EF_{OM,y}$)***

According to The Methodology, four alternatives could be used to calculate the OM:

a) Simple OM

b) Simple adjusted OM, or

c) Dispatch Data Analysis OM, or

d) Average OM.

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

1. In China, the State Grid Corporation run the interregional dispatch system and each regional grid corporation run the intraregional dispatch system. The dispatch information is regarded as business secrets and not available to the public.
2. In the most recent 5 years (2001-2005), the proportions of low-cost/must run resources in the total electricity output in North China Power Grid are respectively 1.1%, 0.8%,0.89%,0.86% and 0.76%, much less than 50%. The details can be seen in Annex 3.

As a result, the simple OM method can be used.

The Simple OM emission factor is calculated as the generation-weighted average emissions per electricity unit ($tCO_2e$/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (15)$$

Where $F_{i,j,y}$ is the amount of fuel *i* consumed (ton for solid and liquid fuel, $m^3$ for gas fuel) by relevant power sources *j* in years *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 to the grid.

$COEF_{i,j,y}$ is the $CO_2$ emission coefficient of fuel *i* ($tCO_2$/t for solid and liquid fuel, $tCO_2/m^3$ for gas fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in years *y*, and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*. In the China Electric Power Year Book and other data resources, only generation data is available. The generation from source *j* can be translated into electricity delivered to the grid by source *j* by the following formulation:

$$GEN_{j,y} = G_{j,y} * (1 - e_{j,y}) \quad (16)$$

Where $G_{j,y}$ is the amount of generation (in MWh) by source *j* in year *y*;

$e_{j,y}$ is the rate of plant self consumption of source *j* in year *y*.

The $CO_2$ emission coefficient of fuel type *i* $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i \quad (17)$$

Where:

$NCV_i$ is the net calorific value per ton or $m^3$ of a fuel *i* (TJ/tce, TJ/$m^3$).

$OXID_i$ is the oxidation factor of the fuel *i*.

$EF_{CO2,i}$ is the $CO_2$ emission factor per TJ of fuel type *i* ($tCO_2$/TJ).

According to the methodology ACM0002, the Simple OM emission factor is ex-ante calculated as electricity-to-the-grid weighted average in the North China Power Grid during the most recent 3 years (2003-2005), and will be fixed in the first crediting period.

The result of OM emission factor in North China Power Grid is based on the formula (1), formula (2) and formula (3) and the publication by Chinese DNA[16].

***Step 2 Calculate the Build Margin emission factor ($EF_{BM,y}$)***

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

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \quad (18)$$

Where:

$F_{i,m,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by plant *m* in year *y*;

$COEF_{i,m}$ is the $CO_2$ emission coefficient ($tCO_2e$ / a mass or volume unit) of fuel *i*, taking into account the carbon content of the fuels used by plant *m* and the percent oxidation of the fuel in year *y*;

$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by plant *m in year y*.

The result of BM emission factor in this project is based on the ex-ante calculation method provided by ACM0002, and the update for the emission factor is not needed in the first crediting period.

Because some data are not available, the BM calculation in this PDD adopts the deviation method agreed by the CDM EB. Calculate first the new installed capacity and its power generation technology mix, then the weights of new capacity in each power generation technology, and finally the BM emission factor at the commercialized optimal efficiency level of each power generation technology.

Because the capacity of the coal-fired, oil-fired and gas-fired technology can not be separated from the existing statistical data, the BM calculation in this PDD adopts the following method: First, use the

[16] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1052.xls

available data in the energy balance sheets on the most recent year to calculate the proportion of CO2 emissions from solid, liquid and gaseous fuels corresponding to the total emissions of CO2 emissions. Second, use the proportions as the weights, based on the emission factors at the commercialized optimal efficiency level of each power generation technology, calculate the emission factor of the thermal power in each grid. Finally, this thermal emission factor is multiplied by the proportion of thermal power in the new 20% capacity. The result is BM emission factor.

Concrete steps and the formula are as follows:

***Sub-step1: Calculation of the proportion of CO2 emissions from solid, liquid and gaseous fuels in the total emissions of CO2 emissions.***

$$\lambda_{Coal} = \frac{\sum_{i=Coal,j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \qquad (19)$$

$$\lambda_{Oil} = \frac{\sum_{i=Oil,j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \qquad (20)$$

$$\lambda_{Gas} = \frac{\sum_{i=Gas,j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \qquad (21)$$

Where:

$F_{i,m,y}$ is the amount of fuel *i* (tce) consumed by plant *m* in year *y*;

$COEF_{i,m}$ is the $CO_2$ emission coefficient ($tCO_2e$ / tce) of fuel *i*, taking into account the carbon content of the fuels used by plant *m* and the percent oxidation of the fuel in year *y*;

Coal, Oil and Gas is the feet for solid fuels, liquid fuels and gas fuels.

***Sub-step2: Cacluation the emission factor of thermal power.***

$$EF_{Thermal} = \lambda_{Coal} * EF_{Coal,Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas,Adv} \qquad (22)$$

$EF_{Coal,Adv}$、$EF_{Oil,Adv}$、$EF_{Gas,Adv}$ represent the emission factors of the optimal efficient and commercial coal-fired, oil-fueled and gas-fueled technologies.

***Sub-step 3: Calculation of BM in the grid.***

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} * EF_{Thermal} \qquad (23)$$

Where:

$CAP_{Total}$ is the total added installed capacity;

$CAP_{Thermal}$is the total added installed capacity for thermal power.

The result of BM emission factor in North China Power Grid is based on the above formula and the publication by Chinese DNA[17].

***Step3: Calculation the baseline emission factor ($EF_{ELEC,y}$)***

According to the baseline methodology (ACM0002), the baseline emission factor ($EF_{ELEC,y}$) is calculated as the weighted average of the Operating Margin emission factor ($\boldsymbol{EF_{BM,y}}$) and the Build Margin emission factor ($\boldsymbol{EF_{OM,y}}$ ):

$$EF_{ELEC,y} = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \qquad (24)$$

Where the weights $w_{OM}$ and $w_{BM}$ are 0.5 and 0.5 by the default.

**3. Leakage emissions**

$$LE_y = LE_{d,y} + LE_{o,y} \qquad (25)$$

Where:

$LE_y$ Leakage emissions in year y ($tCO_2e$)

$LE_{d,y}$ Leakage emissions due to displacement of other baseline thermal energy uses of methane in year y ($tCO_2e$)

$LE_{o,y}$ Leakage emissions due to other uncertainties in year y ($tCO_2e$)

**4. Emission reductions**

The emission reductions can be obtained from the equation below:

$$ER_y = BE_y - PE_y - LE_y \qquad (26)$$

where:

ERy emissions reductions of the project activity during the year y (tCO2e);

BE,y baseline emissions during the year y (tCO2e);

PEy project emissions during the year y (tCO2e).

$LE_y$ Leakage emissions in year y ($tCO_2e$)

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

| **Data / Parameter:** | $NCV_i$ |
|---|---|
| Data unit: | MJ/t, or $MJ/Km^3$ |
| Description: | the net calorific value per mass or volume unit of a fuel *i* |
| Source of data used: | China Energy Statistical Yearbook |
| Value applied: | The concrete value for each fuel please sees the Report on Determination of Baseline Grid Emission Factor by China DNA NDRC at http://cdm.ccchina.gov.cn. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the latest version of ACM0002, the proposed project uses the national values |

[17] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1051.pdf

| | |
|---|---|
| Any comment: | Reasonable |

| **Data / Parameter:** | $OXID_i$ |
|---|---|
| Data unit: | % |
| Description: | the oxidation factor of the fuel i |
| Source of data used: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook |
| Value applied: | The concrete value for each fuel please sees the Report on Determination of Baseline Grid Emission Factor by China DNA NDRC at http://cdm.ccchina.gov.cn. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the latest version of ACM0002, the proposed project uses the IPCC default values. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $EF_{CO2,i}$ |
|---|---|
| Data unit: | tC/TJ(which can be converted to $tCO_2e/TJ$) |
| Description: | the $CO_2$ emission factor per unit of energy of the fuel *i* |
| Source of data used: | 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook |
| Value applied: | The concrete value for each fuel please sees the Report on Determination of Baseline Grid Emission Factor by China DNA NDRC at http://cdm.ccchina.gov.cn. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the latest version of ACM0002, the proposed project uses the IPCC default values. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $F_{i,j,y}$ |
|---|---|
| Data unit: | a mass or volume unit of the fuel i |
| 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 used: | China Energy Statistical Yearbook |
| Value applied: | As for the amount of fuel i consumed by North China Power Grid in year 2003 to 2005, please sees the Report on Determination of Baseline Grid Emission Factor by China DNA NDRC at http://cdm.ccchina.gov.cn. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This kind of data accords with the latest version of ACM0002. |
| Any comment: | Accurate |

| **Data / Parameter:** | $G_{j,y}$ |
|---|---|

| | |
|---|---|
| Data unit: | MWh |
| Description: | Power generation of source *j* in year y |
| Source of data used: | *China Electric Power Yearbook* |
| Value applied: | For more information on the power generation of the North China Power Grid in the year from 2003 to 2005, please refer to annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This kind of data accords with the latest version of ACM0002. |
| Any comment: | |

| **Data / Parameter:** | $e_{j,\ y}$ |
|---|---|
| Data unit: | % |
| Description: | Rate of electricity consumption of the source j in year y |
| Source of data used: | *China Electric Power Yearbook* |
| Value applied: | Please see annex 3 for the rate of electricity consumption of the power plants in North China Power Grid in the year 2003 to 2005. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This kind of data accords with the latest version of ACM0002. |
| Any comment: | |

| **Data / Parameter:** | $D_{CH4}$ |
|---|---|
| Data unit: | kg $CH_4$/ $m^3$ $CH_4$ |
| Description: | Density of methane under normal conditions of temperature and pressure |
| Source of data used: | Revised 1996 IPCC Reference Manual p 1.24 and 1.16 |
| Value applied: | 0.67 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Accords with ACM0008. |
| Any comment: | |

| **Data / Parameter:** | $Eff_{ELEC}$ |
|---|---|
| Data unit: | % |
| Description: | Efficiency of methane destruction/oxidation in power plant |
| Source of data used: | IPCC value |
| Value applied: | 99.5% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Accords with ACM0008. |

| Any comment: | |
|---|---|

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

>>

Based on the formula in section B.6.1 and China DNA, the results of combined margin baseline emission factor of North China Power Grid are as follows:

- $EF_{OM,y}$: 1.1208t$CO_2$e/MWh;
- $EF_{BM,y}$ : 0.9397t$CO_2$e /MWh;
- $EF_{ELEC,y}$: 1.0303t$CO_2$e /MWh.

*Based on the* formula in section B.6.1, the annual emission reductions of the proposed project is as follows:

**1. Project emissions**

The paramerters adopted to cacluate the project emissions in section B6.1 is estimated to be:

| Parameters | Meanings | Values |
|---|---|---|
| $CONS_{ELEC,PJ}$ | Additional electricity consumption by one additional pump in the underground CMM recovery system (MWh) | 730 |
| $CEF_{ELEC}$ | Emission factor of North China Power Grid (MWh/t$CO_2$e) | 1.0303 |
| $MM_{ELEC}$ | Methane delivered to power plant in year y (t$CH_4$) | 17,613 |
| $CMM_{ELEC}$ | CMM measured delivered to power plant in year y ($m^3$) | 65,721,600 |
| $PC_{CH4}$ | Concentration of methane (in mass) in extracted gas (%) | 40%[18] |
| $D_{CH4}$ | Density of methane under normal conditions of temperature and pressure(kg $CH_4$/ $m^3$ $CH_4$) | 0.67 |
| $Eff_{ELEC}$ | Efficiency of methane destruction/oxidation in power plant(%) | 99.5% |
| $CEF_{CH4}$ | Carbon emission factor for combusted methane(t$CO_2$e/ t$CH_4$) | 2.75 |

Therefore:

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

$= CONS_{ELEC,PJ} \times CEF_{ELEC} + MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH4} + 21 \times MM_{ELEC} (1-Eff_{ELEC})$

$=730MWh \times 1.0303tCO_2e/MWh+17,613,000kg \times 0.995 \times 2.75+21 \times 17,613,00kg \times (1-0.995)$

$= 752+48,195+1,849=50,044$ t$CO_2$e.

**2. Baseline emissions**

The paramerters adopted to cacluate the baseline emissions in section B6.1 is estimated to be:

| Parameters | Meanings | Values |
|---|---|---|
| $MM_{ELEC}$ | Methane delivered to power plant in year y (t$CH_4$) | 17,613 |
| $CMM_{ELEC}$ | CMM measured delivered to power plant in year y | 65,721,600 |

18 According to page 5 of the FSR (02/2005), the average methane concentration of Daning coal mine is 55%. 40% is used for a conservative baseline estimate.

| | | |
|---|---|---|
| | ($m^3$) | |
| $PC_{CH4}$ | Concentration of methane (in mass) in extracted gas (%) | 40%[19] |
| $D_{CH4}$ | Density of methane under normal conditions of temperature and pressure(kg $CH_4$/ $m^3$ $CH_4$) | 0.67 |
| $GEN_y$ | The gross electricity produced (MWh) | 93,888 |
| $EF_{ELEC,y}$ | Emission factor of North China Power Grid(MWh/$tCO_2e$) | 1.0303 |

Therefore:

$BE_y = 21 \times MM_{ELEC,y} + GEN_y \times EF_{ELEC,y}$

$=21 \times 17{,}613 tons+93{,}888 MWh \times 1.0303 MWh/tCO_2e$

$=369{,}881+96{,}728=466{,}609\ tCO_2e$.

**3. 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.

Considering the following facts of the proposed project:

1. There has not been baseline thermal energy uses.
2. No CBM drainage involves.
3. No noticeable impact of CDM project activity on coal production since the baseline scenario is not ventilation only.
4. No reliable scientific information is currently available to assess the risk of impact of CDM project activity on coal prices and market dynamics.

Therefore, no leakage effects need to be accounted for under this proposed project.

**4. Emission reductions**

Therefore:

$ER_y = BE_y - PE_y - L_y$=466,609 $tCO_2e$ – 50,044 $tCO_2e$-0 $tCO_2e$ =416,565 $tCO_2e$.

Based on the above analysis, the emissions sources of the proposed project are shown in the following table:

| Years | $PE_{ME,y}$ ($tCO_2e$) | $PE_{MD,y}$ ($tCO_2e$) | $PE_{UM,y}$ ($tCO_2e$) | $PE_y$ ($tCO_2e$) | $BE_{MR,y}$ ($tCO_2e$) | $BE_{Use,y}$ ($tCO_2e$) | $BE_y$ ($tCO_2e$) | $L_y$ ($tCO_2e$) | $ER_y$ ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|
| 2008 (Sep-Dec) | 251 | 16,065 | 616 | 16,681 | 123,294 | 32,243 | 155,536 | 0 | 138,855 |
| 2009 | 752 | 48,195 | 1,849 | 50,044 | 369,881 | 96,728 | 466,609 | 0 | 416,565 |

[19] 40% is used as a conservative approach. According to page 5 of the FSR (02/2005), the average methane concentration of Daning coal mine is 55%.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2010 | 752 | 48,195 | 1,849 | 50,044 | 369,881 | 96,728 | 466,609 | 0 | 416,565 |
| 2011 | 752 | 48,195 | 1,849 | 50,044 | 369,881 | 96,728 | 466,609 | 0 | 416,565 |
| 2012 | 752 | 48,195 | 1,849 | 50,044 | 369,881 | 96,728 | 466,609 | 0 | 416,565 |
| 2013 | 752 | 48,195 | 1,849 | 50,044 | 369,881 | 96,728 | 466,609 | 0 | 416,565 |
| 2014 | 752 | 48,195 | 1,849 | 50,044 | 369,881 | 96,728 | 466,609 | 0 | 416,565 |
| 2015 (Jan-Aug) | 501 | 32,130 | 1,233 | 33,363 | 246,587 | 64,485 | 311,073 | 0 | 277,710 |
| Total ($tCO_2e$) | 5,264 | 337,365 | 12,943 | 350,308 | 2,589,167 | 677,096 | 3,266,263 | 0 | 2,915,955 |

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

>>

| Year | Estimation of project activity emission ($tCO_2e$) | Estimation of baseline emission ($tCO_2e$) | Estimation of Leakage emission ($tCO_2e$) | Estimation of emission reductions ($tCO_2e$) |
|---|---|---|---|---|
| 2008 (Sep-Dec) | 16,681 | 155,536 | 0 | 138,855 |
| 2009 | 50,044 | 466,609 | 0 | 416,565 |
| 2010 | 50,044 | 466,609 | 0 | 416,565 |
| 2011 | 50,044 | 466,609 | 0 | 416,565 |
| 2012 | 50,044 | 466,609 | 0 | 416,565 |
| 2013 | 50,044 | 466,609 | 0 | 416,565 |
| 2014 | 50,044 | 466,609 | 0 | 416,565 |
| 2015 (Jan-Aug) | 33,363 | 311,073 | 0 | 277,710 |
| Total ($tCO_2e$) | 350,308 | 3,266,263 | 0 | 2,915,955 |

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

### B.7.1 Data and parameters monitored:

| Data / Parameter: | $CONS_{ELEC, PJ}$ |
|---|---|
| Data unit: | MWh |
| Description: | Additional electricity consumption by one additional pump in the underground CMM recovery system |
| Source of data to be used: | Ammeters readings |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 730 |
| Description of measurement methods and procedures to be applied: | Monitored continuously by project participants with kilowatt-hour meter<br>The meters at the power plant are adopted to measure additional electricity consumption, and the project owner appoints the staff to record each month. All monitoring data will be archived during and at least two years after the crediting period. Accuracy: 99.8% (Grade 0.2S in line with the requirements by the |

| | |
|---|---|
| | Technical Administrative Code of DL/T448-20000 Electric Energy Metering). |
| QA/QC procedures to be applied: | Calibration of Meters & Metering should be implemented according to national standards and rules. The meters will be following manufacturers' instructions. And all the records should be documented and maintained by the project owner for DOE's verification. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $CMM_{ELEC}$ |
| Data unit: | $Nm^3$ |
| Description: | CMM measured delivered to power plant in year y |
| Source of data to be used: | The normalised readings of the flow meter installed at the inlet of the generators. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 65,721,600 |
| Description of measurement methods and procedures to be applied: | Continuous monitoring, flow meters in compliance with relevant standards and requirements will be used, and gas volumes, pressure and temperature will be read. All monitoring data will be archived during and at least two years after the crediting period. Accuracy: ≥ 99%. |
| QA/QC procedures to be applied: | Flow meters are to be periodically calibrated subject to a regular maintenance regime to ensure accuracy based on manufacturers' instructions. Calibration should be implemented according to national standards and rules. And all the records should be documented and maintained by the project owner for DOE's verification. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $PC_{CH4}$ |
| Data unit: | % |
| Description: | Concentration of methane (in mass) in extracted gas (%), measured on wet basis |
| Source of data to be used: | The readings of concentration meters |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 40% |
| Description of measurement methods and procedures to be applied: | Daily monitoring by the concentration meters, optical and calorific. All monitoring data will be archived during and at least two years after the crediting period. |
| QA/QC procedures to be applied: | Concentration meters are to be periodically calibrated subject to a regular maintenance regime to ensure accuracy based on manufacturers' instructions. Accuracy≥ 95%. Calibration should be implemented according to national standards and rules. And all the records should be documented and maintained |

| | |
|---|---|
| | by the project owner for DOE's verification. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $PC_{NMHC}$ |
| Data unit: | % |
| Description: | Concentration of NMHC (in mass) in extracted gas (%), measured on wet basis |
| Source of data to be used: | The readings of concentration meters |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Less than 1%<br>If greater than 1%, $CEF_{NMHC}$ will be tested. |
| Description of measurement methods and procedures to be applied: | Annual monitoring by the concentration meters, optical and calorific. All monitoring data will be archived during and at least two years after the crediting period. |
| QA/QC procedures to be applied: | Concentration meters are to be periodically calibrated subject to a regular maintenance regime to ensure accuracy based on manufacturers' instructions. Accuracy≥ 95%. Calibration should be implemented according to national standards and rules. And all the records should be documented and maintained by the project owner for DOE's verification. |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $GEN_{PJ\ to\ Grid,\ y}$ |
| Data unit: | MWh |
| Description: | Electricity supplied to North China Power Grid by the proposed project |
| Source of data to be used: | The readings of ammeters |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 93,240 |
| Description of measurement methods and procedures to be applied: | The readings of electricity meter will be hourly measured and monthly recorded. Automatic measurement and automatic recording will be made by computers. Double checking by the receipt of electricity sales. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period. Accuracy: 99.8% (Grade 0.2S in line with the requirements by the Technical Administrative Code of DL/T448-20000 Electric Energy Metering |
| QA/QC procedures to be applied: | The uncertainty level of this data is low. The meters will be installed following manufacturers' instructions. The measurement/ monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked every year. |
| Any comment: | |

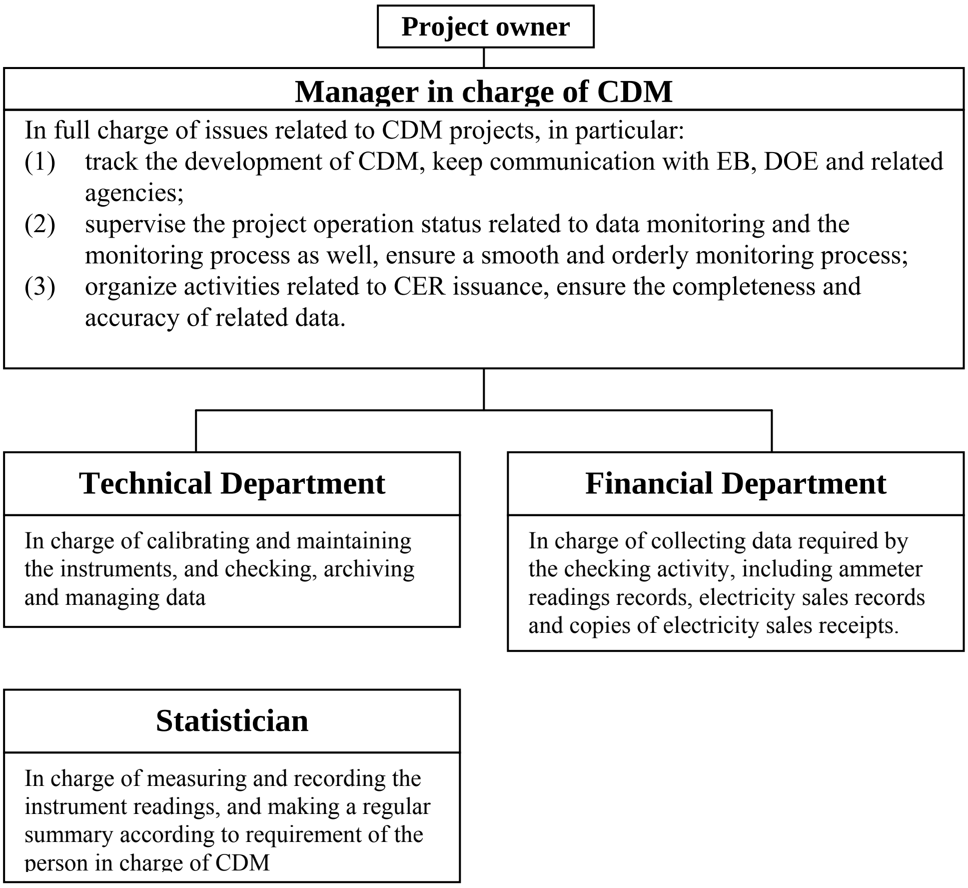
| | |
|---|---|
| Data / Parameter: | $GEN_{Grid\ to\ PJ,\ y}$ |
| Data unit: | MWh |
| Description: | Electricity supplied to the proposed project by North China Power Grid used for self-consumption. |
| Source of data to be used: | The readings of ammeters |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0 |
| Description of measurement methods and procedures to be applied: | The readings of electricity meter will be hourly measured and monthly recorded. Automatic measurement and automatic recording will be made by computers. Double checking by the receipt of electricity sales. Electronic data will be archived within the crediting period and 2 years after the end of the crediting period. Accuracy: 99.8% (Grade 0.2S in line with the requirements by the Technical Administrative Code of DL/T448-20000 Electric Energy Metering |
| QA/QC procedures to be applied: | The uncertainty level of this data is low. The meters will be installed following manufacturers' instructions. The measurement/ monitoring equipment should adopt the colligated automation system complying with state standard and technology. These equipment and systems should be calibrated and checked every year. |
| Any comment: | |

**B.7.2 Description of the monitoring plan:**

>>

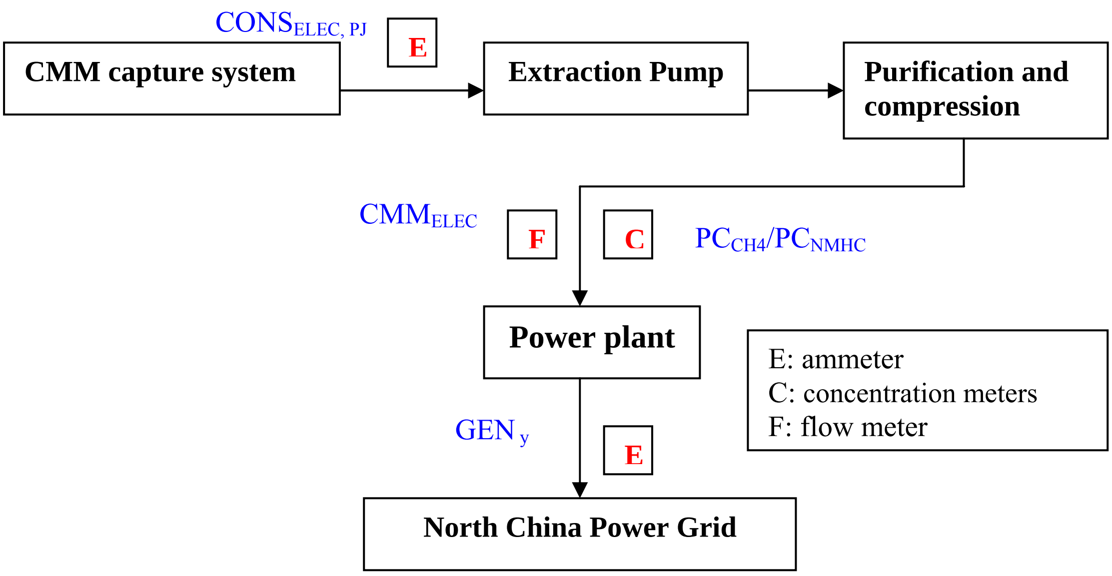
Monitoring is a key procedure to verify the real and measurable emission reductions from the proposed project. To guarantee the proposed project's real, measurable and long-term GHG emission reductions, the monitoring plan is established. The monitoring plan is applicable for all the power plants in the propped project. The proposed project owner is the user of this monitoring plan.

**1. The organizational structure of monitoring**




**2. The data which needs to be monitored**

The data which needs to be monitored is shown in section B.7.1. Following figure indicates the detailed instruments installation:



**3. The installation, measurement and calibration of the instruments**

The instruments installed in the proposed project include ammeters, concentration meters and flow meter. All instruments 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. The following gives explanation respectively for ammeters, concentration meters and flow meter.

**Ammeters**

The electric energy metering should be equipped according the requirements of the *Technical Administrative Code of Electric Energy Metering* (DL/T448-2000). Before the operation of the proposed project, the project owner and the power grid corporation should examine the electric energy metering according to the *Technical Administrative Code of Electric Energy Metering* (DL/T448-2000).

The proposed project will install the ammeters which have two-way at the grid-connection point. The positive way of the ammeter measures the electricity that the proposed project supplied to North China Power Grid ($GEN_{PJ\ to\ Grid,\ y}$) and the reverse way of the ammeter measures the electricity that North China Power Grid supplied to the proposed project($GEN_{Grid\ to\ PJ,\ y}$). The net grid-connected electricity by the proposed project ($GEN_y$) is $GEN_{PJ\ to\ Grid,\ y}$ minus $GEN_{Grid\ to\ PJ,\ y}$.

The proposed project owner is responsible for installation of the ammeters, and North China Power Grid takes charge of check and supervision. The ammeters should be examined and undergo regular field calibration according the relevant standards and regulations of the power industry so as to ensure the sophistication of the meters. After the examination, the meters should be sealed. The lift of the seals requires the presence of both the project owner and the grid corporation. One party must not lift the seals or fiddle with the meters without the presence of the other party. If the ammeter or the power check meter requires repair due to the inaccurate readings beyond the error range or the breakdown of the meters, the project owner and the grid corporation should jointly commission a qualified metering verification institution to make tests and the two parties should keep records on calibration and maintenance.

The steps to monitor the grid-connected power of the proposed project are as follows:

a) The project owner and the grid corporation will get and record the readings of ammeters at the grid-connection point within the 24 hours of the last day of every month and check the reading;

b) The grid corporation provides the project owner the readings and collection of $GEN_{PJ\ to\ Grid,\ y}$ and $GEN_{Grid\ to\ PJ,y}$;

c) According to the contract of electricity purchase and sale signed by the two parties and $GEN_{Grid\ to\ PJ,y}$, the project owner pay for the power company and the power company provides the invoices for the project owner.

d) According to the contract of electricity purchase and sale signed by the two parties and $GEN_y$, the power company pay for the project owner and the project owner provides the invoices for the power company.

e) The project owner provides the readings of the ammeter and copies of invoices to DOE checking personnel.

**Concentration meters and flow meter**

The concentration meters and flow meter need to be installed at the inlet of the generators. The flow meter measures the CMM entering the generators continuously. The concentration meters are adopted daily to

measure the concentration of methane (in mass) in extracted gas (%, on wet basis). The concentration meters are adopted annually to measure the concentration of NMHC (in mass) in extracted gas (%, on wet basis). The personnel of the proposed project should record and collect the readings of the two instruments. These instruments should be calibrated according to the manufacturers' instructions and relevant national/sectoral standards. Two series of instruments should be installed, one as the main instruments and the other one as the standby.

**4.Data collection and management**

The integrated automatic measurement system will automatically read, send and backup all the measurement data which is the original data for monitoring. The person in charge of monitoring should ask the generator operation and management staff to collect and manage the data of monthly grid-connected power generation. At the end of each month, they should backup the monitoring data of that month onto discs and print the data out. The person in charge of monitoring should also keep the copy of electricity sales receipts provided by the project owner to the grid corporation and the settlement certificates given by the grid corporation to the project owner for data check. The yearly grid-connected power generation should be worked out by adding the monthly monitoring data. The discs and written records of the monitoring data and the original data should be kept no less than two years after the crediting period. Moreover, it must be ensured that CDM verification personnel can get the authentic readings of the meters.

**5. Monitoring Report**

After the proposed project is registered and begins its operation, the monitoring report should be submitted at the end of every year for the verification of DOE. The report should cover the monitoring of grid-connected power generation, check report, report on calculation of the emission reductions and records of monitoring instrument repair and calibration, etc.

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

>>

The baseline study and monitoring methodology of the proposed project was completed on 03/06/2007. The entities involved in baseline and monitoring study are:

EEA Clean Energy China, email: China@eeafm.com; and

Shanxi Taiyuan Zihuan Environmental Protection Technology Ltd, e-mail: zj590601@163.com.

The above entities are not the project participants listed in Annex 1.

## SECTION C. Duration of the project activity / crediting period

### C.1 Duration of the project activity:

#### C.1.1. Starting date of the project activity:

>>

11/12/2005 (the issuing date of construction notice)

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

>>

20years

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

#### C.2.1. Renewable crediting period

7*3 years

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

>>

01/09/2008 or the actual date of CDM registration, whichever is latter.

##### C.2.1.2. Length of the first crediting period:

>>

7years

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

>>

Not applicable.

##### C.2.2.2. Length:

>>

Not applicable.

## SECTION D. Environmental impacts

>>

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

>>

The Environment Impacts Assessment (EIA) of the proposed project was completed by Shanxi Jincheng City Environment Protection Study Institution. This institution is approved and qualified as B level by National Environment Protection Bureau to write EIA. The EIA was approved by Jincheng City Environment Protection Bureau which permitted the construction of the power stations.

Based on the EIA and the feasibility study report, the environment impacts of the proposed project and related measures taken by the project owner are as follows:

**1 Air quality impacts and prevention measures**

Gas combustion: The main air pollutants produced by the proposed project are the waste gases from the combustion of the gas by gas engines for power generation. The waste gases mainly consist of NOx, water and CO2. Because there is very small percentage of NOx, the proposed project will meet the requirements on waste gases emissions. The air pollutants from the Project reach the second level of Environment Air Quality Standard (GB3095-1996).

Gas distribution system: The gas distribution system will be underground without producing waste gases and noxious gases emissions. So there will be no impacts on air quality during normal operation.

However, during abnormal operation of the distribution system (for example, during maintenance of distribution equipment and pipelines), it is possible to bring in certain amounts of gas emissions. In such circumstance, the gas extraction station will be informed to shut off valve.

At the meantime, the distribution system will strictly follow the rules in *Technical Regulations on Distribution Pipelines Design*. The automatic shutoff valves will be set up on the gas distribution pipelines; maintain the normal operation of pipelines; set up obvious fire forbidden signs in fire forbidden and explosive proof areas; check the safety of gas distribution system and gas leakage periodically to eliminate potential risks of accidents in time.

The power generation equipment will be monitored and maintained according to the above requirements to ensure safe and stable operation of the power station. With the above adopted measures, the air pollutants emissions from the proposed project will reach the set standard and have very little risk on environment.

**2 Water impacts and prevention measures**

Sources of waste water from the proposed project will mainly include waste water from the daily lives of workers and waste water from production. Water used for electricity generation will be recycled. There will be a very small amount of water from the gas distribution pipelines and the water quality meets the requirement of second level standard set in *Integrated wastewater discharge standard* (GB8978-1996). Aqua privies and composting toilets will be constructed to treat daily wastewater. So there will no wastewater discharged directly to nearby river and the wastewater treated by the aqua privies will be used for irrigation.

As for waste engine oil: engines for power generation need to use engine oil during operation. It will have bad impacts on environment if the waste engine oil discharged directly. The waste engine oil will be collected and sold to enterprises qualified for waste engine oil treatment. The leakage of the waste engine oil should be cleaned in time without discharging to nearby river.

**3 Solid waste impacts and prevention measures**

**Waste residue from gas distribution pipelines and generators:** The residue produced by pipelines due to long time use should be cleaned periodically to keep the smooth gas distribution; the residue produced from gas liquid separator and filter due to long time use will be collected and treated in Dangerous Wastes Treatment Center in Jincheng City.

**Solid waste from daily lives:** The solid waste from workers' daily lives will be treated by landfill on landfill site and covered with soil to grow plants.

Treated by the above measures, the solid waste from the proposed project will be appropriately disposed without polluting the domestic environment.

**4 Noise impacts and prevention measures**

Major source of noise pollution include noise from gas engines, cooling tower and circulating water pump. The proposed project will take measures below to lessen noise impacts on environment: construct a closed power plant with ventilation system, sound absorption material on walls and ceiling and double doors and windows; install separate base for generators, silencer for air outlet and vibration isolator for equipment producing noise; build a bounding wall with the minimized height as 5m and plant trees in the power plant area to prevent noise spread; meanwhile set up sound proof operation room and provide earplugs to workers.

Besides the measures taken above and the noise natural attenuation, the gas extraction system and power generation system are far from residential area, school and other sensitive areas. As a result, noise emitted reach II category standard in Standard of noise at boundary of industrial enterprises (GB12348-90).

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

>>

The EIA has been approved by the local Environmental Protection Bureau without serious impacts on the environment.

## SECTION E. Stakeholders' comments

>>

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

>>

From 1st to 20th April, 2007, the project owner and CDM developers visited each power station of the proposed project and asked for comments and suggestions from stakeholders by Stakeholders' Comments Questionnaire for CMM Utilization for Power Generation CDM Project constructed and operated by Jincheng Fengrun CMM Utilization Co., Ltd.

There were eight organizations and 9 individuals participating in this investigation. The eight organizations were respectively Jincheng City Coal CMM (natural gas) Utilization Office, Yangcheng County Development and Reform Bureau, Yangcheng County Environment Protection Bureau, Jincheng City Environment Protection Study Institute, Yangcheng State-run Yicheng Coal Mine, Qinshui County Jiafeng Town Nan Wa Si Coal Mine and Qinshui County Jiafeng Town Wuli Miao Coal Mine. The nine individuals were all villager representatives at domestic coal mines respectively in Qinshui County Jiafeng Town, Qinshui County Zhengcun Town and Yangcheng County Tingdian Town, etc.

The general information about the nine individuals is as follows:

In terms of gender, they were all male; in terms of age, three of them (33.3%) were under 30, four of them (44.4%) were between 30 and 39 and two of them (22.2%) were between 40 and 49; in terms of education, two of them (22.2%) had junior high school education, four of them (44.4%) had senior high school education, two of them (22.2%) had technical secondary school education and one of them (11.1%) had college education.

The questions in this Questionnaire are as follows:

- Whether understand the proposed project, namely CMM utilization for power generation project at Jincheng Fengrun Gas Utilizatino Co., Ltd
- What do you think are the necessities of developing power generation from CMM: help reduce coal mine accidents and improve safe working conditions; reduce wasting CMM resource and realize comprehensive resource utilization; increase the amount of electricity supply
- Whether the proposed project would have the following positive impacts on the local area: increase taxes and revenues; increase local employment opportunities; reduce gas emissions and improve the local and global environment.
- Whether on-grid power generation from CMM will face the following difficulties: the difficulty of gas collection will make high cost on it; the immature technology will result in high operation and maintenance costs; the difficulty of connecting to the grid will make high cost and uncompetitive in on-grid price bidding.
- Whether the proposed project will have some environment impacts: noise pollution; waste gases pollution due to gas combustion; other pollution by waste oil, waste residue from daily lives.
- What do you think are the measures the proposed project should take for environment protection: noise control to mitigate noise pollution; more gas extraction to reduce its venting to the atmosphere; increase on the budget for environment protection, for example, the equipment.
- What are the impacts on the local economic and environmental development after the construction of the proposed project? Whether you would like to support the proposed project applying for CDM to realize GHG emission reductions?

**E.2. Summary of the comments received:**

>>

There were 17 copies of the Questionnaire giving to people and 17 of them were given back. The answers in this Questionnaire are as follows:

- 100% of the stakeholders understood the proposed project.
- 88.24% of the stakeholders thought the proposed project would reduce wasting CMM resource, help reduce coal mine accidents and improve safe working conditions; 41.18% of the stakeholders thought the proposed project would increase the amount of electricity supplied to the local area.
- 29.41% of the stakeholders agreed that the proposed project would increase taxes and revenues and provide job opportunities; 100% of the stakeholders believed that the proposed project would reduce gas emissions and improve the local and global environment.
- 82.35% of the stakeholders thought the main difficulty would be connecting to the grid, which will have high costs and lead to uncompetitive power in on-grid price bidding.
- 100% of the stakeholders believed the main pollution would be caused by noise.
- As 100% of the stakeholders believed the main pollution would be caused by noise, they thought the project owner should pay attention to noise control devices to reduce noise pollution.
- 100% of the stakeholders held the opinion that the proposed project has more advantages than disadvantages and will benefit the local economic and environmental development. They would like to supply the application for CDM.

  Besides, some stakeholders also proposed the following suggestions and comments:

- The proposed project is to utilize the clean energy which should be an environment protection project and will reduce GHG emission reductions. So the power generation from CMM project needs full support from governmental departments;
- The proposed project should install more equipment to use more CMM for power generation;
- The proposed project should enhance the implementation of noise control to reduce noise pollution;
- It is the hope that power grid department would provide support on electricity connected to the grid and the on-grid price.

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

>>

Based on the suggestions and comments, the project owner will adopt the following measures:

- With the CDM support, the project owner has more capital to buy the power generation equipment, so more CMM can be utilized;
- Based on the measures in the approved EIA by the local Environmental Protection Bureau, the project owner will carry out the measures in order to reach the II category standard in Standard of noise at boundary of industrial enterprises (GB12348-90).

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Jincheng City Fengrun CMM Utilization Co.Ltd China. |
| Street/P.O.Box: | No.1072 Taihang Road Jincheng City Shanxi Province |
| Building: | |
| City: | Jincheng City |
| State/Region: | Shanxi Province |
| Postfix/ZIP: | 048026 |
| Country: | People’s Republic of China |
| Telephone: | |
| FAX: | |
| E-Mail: | |
| URL: | |
| Represented by: | Shi Yuancheng |
| Title: | Mr. |
| Salutation: | |
| Last Name: | Shi |
| Middle Name: | |
| First Name: | Yuancheng |
| Department: | |
| Mobile: | 86-13015359768 |
| Direct FAX: | |
| Direct tel: | 86-356-2060178 |
| Personal E-Mail: | zxk877@126.com |

| | |
|---|---|
| Organization: | Trading Emissions PLC |
| Street/P.O.Box: | 54/62 Athol Street |
| Building: | Exchange House |
| City: | Douglas |
| State/Region: | Isle of Man |
| Postfix/ZIP: | IM1 1JD |
| Country: | UK |
| Telephone: | +44 (0) 16 2468 1250 |
| FAX: | +44 (0) 16 2468 1391 |
| E-Mail: | eb@tradingemissionsplc.com |
| URL: | http://www.tradingemissionsplc.com |
| Represented by: | Philip Scales |
| Title: | Director |
| Salutation: | Mr. |
| Last Name: | Scales |
| Middle Name: | |
| First Name: | Philip |
| Department: | |
| Mobile: | |
| Direct FAX: | +44 (0) 16 2468 1391 |
| Direct tel: | +44 (0) 16 2468 1250 |
| Personal E-Mail: | philips@iomafim.co.im |

## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

No existing official development assistance (ODA) from Annex I countries is involved in the proposed project.

## Annex 3

## BASELINE INFORMATION

Table A3-1. 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 A3-2. 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 A3-3. Electricity generation from fossil fuels in 2005 of North China Grid

| Province | Beijing | Tianjin | Hebei | Shanxi | Inner Mongolia | Shandong | Total |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electricity generation from fossil fuels (MWh) | 20880000 | 36993000 | 134348000 | 128785000 | 92345000 | 189880000 | |
| station service power consumption rate（%） | 7.73 | 6.63 | 6.57 | 7.42 | 7.01 | 7.14 | |
| Electricity delivered to the grid from fossil fuels（MWh) | 19,265,976 | 34540364 | 125521336 | 119229153 | 85871616 | 176322568 | 560,751,013 |

*Source*：China Electric Power Yearbook 2006

Table A3-4 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, 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 | 714.73 | 1052.74 | 5482.64 | 4528.51 | 3949.32 | 6808 | 22535.94 | 25.8 | 100 | 20908 | 445737636 |
| Cleaned coal | 10000 t | | | | | | 9.41 | 9.41 | 25.8 | 100 | 26344 | 234511 |
| Other washed coal | 10000 t | 6.31 | | 67.28 | 208.21 | | 450.9 | 732.7 | 25.8 | 100 | 8363 | 5796681 |
| Coke | 10000 t | | | | | 2.8 | | 2.8 | 25.8 | 100 | 28435 | 75319 |
| Coke oven gas | 100 Mm$^3$ | 0.24 | 1.71 | | 0.9 | 0.21 | 0.02 | 3.08 | 12.1 | 100 | 16726 | 228560 |
| Other gas | 100 Mm$^3$ | 16.92 | | 10.63 | | 10.32 | 1.56 | 39.43 | 12.1 | 100 | 5227 | 914400 |
| Crude oil | 10000 t | | | | | | 29.68 | 29.68 | 20 | 100 | 41816 | 910139 |
| Gasoline | 10000 t | | | | | | 0.01 | 0.01 | 18.9 | 100 | 43070 | 298 |
| Diesel oil | 10000 t | 0.29 | 1.35 | 4 | | 2.91 | 5.4 | 13.95 | 20.2 | 100 | 42652 | 440693 |
| Fuel oil | 10000 t | 13.95 | 0.02 | 1.11 | | 0.65 | 10.07 | 25.8 | 21.1 | 100 | 41816 | 834672 |
| LPG | 10000 t | | | | | | | 0 | 17.2 | 100 | 50179 | 0 |
| Refinery gas | 10000 t$^3$ | | | 0.27 | | | 0.83 | 1.1 | 18.2 | 100 | 46055 | 33807 |
| Natural gas | 100 Mm$^3$ | | 0.5 | | | | 1.08 | 1.58 | 15.3 | 100 | 38931 | 345077 |
| Other petroleum products | 10000 t | | | | | | | 0 | 20 | 100 | 38369 | 0 |
| Other coking products | 10000 t | | | | | | | 0 | 25.8 | 100 | 28435 | 0 |
| Other energy | 10000 tce | 9.83 | | | | | 39.21 | 49.04 | 0 | 100 | 0 | 0 |
| **Total** | | | | | | | | | | | | 455551793 |

Date source：2006 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual; China Energy Statistical Yearbook 2004.

Table A3-5 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 | 100 | 20908 | 538547477 |
| Cleaned coal | 10000 t | | | | | | 40 | 40 | 25.8 | 100 | 26344 | 996857 |
| Other washed coal | 10000 t | 6.48 | | 101.04 | 354.17 | | 284.22 | 745.91 | 25.8 | 100 | 8363 | 5901191 |
| Coke | 10000 t | | | | | 0.22 | | 0.22 | 25.8 | 100 | 28435 | 5918 |
| Coke oven gas | 100 Mm$^3$ | 0.55 | | 0.54 | 5.32 | 0.4 | 8.73 | 15.54 | 12.1 | 100 | 16726 | 1153187 |
| Other gas | 100 Mm$^3$ | 17.74 | | 24.25 | 8.2 | 16.47 | 1.41 | 68.07 | 12.1 | 100 | 5227 | 1578574 |
| Crude oil | 10000 t | | | | | | | 0 | 20 | 100 | 41816 | 0 |
| Gasoline | 10000 t | 0.39 | 0.84 | 4.66 | | | | 5.89 | 18.9 | 100 | 43070 | 0 |
| Diesel oil | 10000 t | 14.66 | | 0.16 | | | | 14.82 | 20.2 | 100 | 42652 | 186070 |
| Fuel oil | 10000 t | | | | | | | 0 | 21.1 | 100 | 41816 | 479451 |
| LPG | 10000 t | | 0.55 | 1.42 | | | | 1.97 | 17.2 | 100 | 50179 | 0 |
| Refinery gas | 10000 t$^3$ | | 0.37 | | 0.19 | | | 0.56 | 18.2 | 100 | 46055 | 60546 |
| Natural gas | 100 Mm$^3$ | | | | | | | 0 | 15.3 | 100 | 38931 | 122306 |
| Other petroleum products | 10000 t | | | | | | | 0 | 20 | 100 | 38369 | 0 |
| Other coking products | 10000 t | 9.41 | | 34.64 | 109.73 | 4.48 | | 158.26 | 25.8 | 100 | 28435 | 0 |
| Other energy | 10000 tce | 823.09 | 1410 | 6299.8 | 5213.2 | 4932.2 | 8550 | 27228.29 | 0 | 100 | 0 | 0 |
| **Total** | | | | | | | | | | | | 549031578 |

Date source：2006 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual; China Energy Statistical Yearbook 2005.

Table A3-6 Calculation of emissions of North China Grid in 2005

| | | 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 | 897.75 | 1675.2 | 6726.5 | 6176.5 | 6277.23 | 10405.4 | **32158.53** | 25.8 | 100 | 20908 | 636062535.8 |
| Cleaned coal | 10000 t | | | | | | 42.18 | **42.18** | 25.8 | 100 | 26344 | 1051185.664 |
| Other washed coal | 10000 t | 6.57 | | 167.45 | 373.65 | | 108.69 | **656.36** | 25.8 | 100 | 8363 | 5192725.191 |
| Coke | 10000 t | | | | | 0.21 | 0.11 | **0.32** | 25.8 | 100 | 28435 | 8607.8432 |
| Coke oven gas | 100 Mm$^3$ | 0.64 | 0.75 | 0.62 | 21.08 | 0.39 | | **23.48** | 12.1 | 100 | 16726 | 1742396.483 |
| Other gas | 100 Mm$^3$ | 16.09 | 7.86 | 38.83 | 9.88 | 18.37 | | **91.03** | 12.1 | 100 | 5227 | 2111027.27 |
| Crude oil | 10000 t | | | | | 0.73 | | **0.73** | 20 | 100 | 41816 | 22385.49867 |
| Gasoline | 10000 t | | | 0.01 | | | | **0.01** | 18.9 | 100 | 43070 | 298.4751 |
| Diesel oil | 10000 t | 0.48 | | 3.54 | | 0.12 | | **4.14** | 20.2 | 100 | 42652 | 130786.3867 |
| Fuel oil | 10000 t | 12.25 | | 0.23 | | 0.06 | | **12.54** | 21.1 | 100 | 41816 | 405689.6325 |
| LPG | 10000 t | | | | | | | **0** | 17.2 | 100 | 50179 | 0 |
| Refinery gas | 10000 t$^3$ | | | 9.02 | | | | **9.02** | 18.2 | 100 | 46055 | 277221.0107 |
| Natural gas | 100 Mm$^3$ | 0.28 | 0.08 | | 2.76 | | | **3.12** | 15.3 | 100 | 38931 | 681417.0792 |
| Other petroleum products | 10000 t | | | | | | | **0** | 20 | 100 | 38369 | 0 |
| Other coking products | 10000 t | | | | | | | **0** | 25.8 | 100 | 28435 | 0 |
| Other energy | 10000 tce | 8.58 | | 32.35 | 69.31 | 7.27 | 118.9 | **236.41** | 0 | 100 | 0 | 0 |
| **Total** | | | | | | | | | | | | 647686276.3 |

Date source：2006 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual; China Energy Statistical Yearbook 2006.

Table A3-7 Calculation of simple OM emission factor of North China Grid

| Year | 2003 | 2004 | 2005 |
|---|---|---|---|
| Emission from North China Gird ($tCO_2$) | 455551793 | 549031578 | 647686276.3 |
| Average Emission Factor of Northeast China Gird ($tCO_2e/MWh$) | 1.1366 | 1.1741 | 1.1578 |
| Electricity Import from Northeast China Grid (MWh) | 4,244,380 | 4,514,550 | 23,423,000 |
| Total Electricity delivery to North China Grid (MWh) | 429609285.8 | 493687659.9 | 584,174,013 |
| Total Emissions ($tCO_2$) | 451291526.4 | 543504173.1 | 674,805,425 |
| Simple OM ($tCO_2e/MWh$) | 1.050470 | 1.100907 | 1.155145 |
| Weighted average OM ($tCO_2e/MWh$) | 1.1208 | | |

Table A3-8 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 | Emissions factor (tc/TJ) | Oxidation rate (%) | Heat value (MJ/t, km$^3$) | Emissions ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw coal | 10000 t | 897.75 | 1675.2 | 6726.5 | 6176.45 | 10405.4 | 6277.23 | 32158.53 | 20908 | 25.8 | 100 | 636,062,536 |
| Cleaned coal | 10000 t | 0 | 0 | 0 | 0 | 42.18 | 0 | 42.18 | 26344 | 25.8 | 100 | 1,051,186 |
| Other washed coal | 10000 t | 6.57 | 0 | 167.45 | 373.65 | 108.69 | 0 | 656.36 | 8363 | 25.8 | 100 | 5,192,725 |
| Coke | 10000 t | 0 | 0 | 0 | 0 | 0.11 | 0.21 | 0.32 | 28435 | 25.8 | 100 | 8,608 |
| Sub-total | | | | | | | | | | | | 642,315,054 |
| Crude oil | 10000 t | 0 | 0 | 0 | 0 | 0 | 0.73 | 0.73 | 41816 | 20 | 100 | 22,385 |
| Gasoline | 10000 t | 0 | 0 | 0.01 | 0 | 0 | 0 | 0.01 | 43070 | 18.9 | 100 | 298 |
| Kerosene | 10000 t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43070 | 19.6 | 100 | 0 |
| Diesel oil | 10000 t | 0.48 | 0 | 3.54 | 0 | 0 | 0.12 | 4.14 | 42652 | 20.2 | 100 | 130,786 |
| Fuel oil | 10000 t | 12.25 | 0 | 0.23 | 0 | 0 | 0.06 | 12.54 | 41816 | 21.1 | 100 | 405,690 |
| Other petroleum products | 10000 t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38369 | 20 | 100 | 0 |
| Sub-total | | | | | | | | | | | 100 | 559,160 |
| Natural gas | 100 Mm$^3$ | 2.8 | 0.8 | 0 | 27.6 | 0 | 0 | 31.2 | 38931 | 15.3 | 100 | 681,417 |
| Coke oven gas | 100 Mm$^3$ | 6.4 | 7.5 | 6.2 | 210.8 | 0 | 3.9 | 234.8 | 16726 | 12.1 | 100 | 1,742,396 |
| Other gas | 100 Mm$^3$ | 160.9 | 78.6 | 388.3 | 98.8 | 0 | 183.7 | 910.3 | 5227 | 12.1 | 100 | 2,111,027 |
| LPG | 10000 t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50179 | 17.2 | 100 | 0 |
| Refinery gas | 10000 t | 0 | 0 | 9.02 | 0 | 0 | 0 | 9.02 | 46055 | 18.2 | 100 | 277,221 |
| Sub-total | | | | | | | | | | | | 4,812,062 |
| Total | | | | | | | | | | | | 647,686,276 |

Accordingly: $\lambda_{Coal}$ =99.17%， $\lambda_{Oil}$ =0.08%， $\lambda_{Gas}$ =0.74%

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9465 \ (tCO_2e/MWh)$$

Table A3-9 Installed Capacity of North China Grid in 2005

| Installed capacity | Unit | Beijing | Tianjin | Hebei | Shanxi | Inner Mongolia | Shandong | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal | MW | 3833.5 | 6149.9 | 22333.2 | 22246.8 | 19173.3 | 37332 | 111068.7 |
| Hydro | MW | 1025 | 5 | 784.5 | 783 | 567.9 | 50.8 | 3216.2 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind and others | MW | 24 | 24 | 48 | 0 | 208.9 | 30.6 | 335.5 |
| total | MW | 4882.5 | 6178.9 | 23165.7 | 23029.8 | 19950.2 | 37413.4 | 114620.5 |

*Source: China Electric Power Yearbook 2006*

Table A3-10 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 A3-11 Installed Capacity of North China Grid in 2003

| Installed capacity | Unit | Beijing | Tianjin | Hebei | Shanxi | Inner Mongolia | Shandong | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal | MW | 3347.5 | 6008.5 | 17698.7 | 15035.8 | 11421.7 | 30494.4 | 84006.6 |
| Hydro | MW | 1058.1 | 5 | 764.3 | 795.7 | 592.1 | 50.8 | 3266 |
| 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 | 4405.6 | 6013.5 | 18476.5 | 15831.5 | 12090.4 | 30545.2 | 87362.7 |

*Source: China Electric Power Yearbook 2004*

Table A3-12 Calculation of BM of North China Grid

| | Installed capacity in 2003 | Installed capacity in 2004 | Installed capacity in 2005 | Increase between 2003-2005 | Ratio of the increase |
|---|---|---|---|---|---|
| | A | B | C | D=C-A | |
| Thermal（MW） | 84006. 6 | 93594. 9 | 111068. 7 | 27062.1 | 99.28% |
| Hydro（MW） | 3266. 0 | 3250. 7 | 3216. 2 | -49.8 | -0.18% |
| Nuclear (MW） | 0 | 0 | 0 | 0 | 0.00% |
| Wind and others（MW） | 90. 1 | 137. 5 | 335. 5 | 245.4 | 0.90% |
| total（MW） | 87362. 7 | 96983. 1 | 114620. 4 | **27257.7** | **100.00%** |
| Ratio of 2005 | 76. 22% | 84. 61% | 100% | | |

$EF_{BM,y}$=0.9465×99.28%=0.9397 $tCO_2$/MWh

So, CM = 0.5*OM + 0.5*BM = 1.0303 $tCO_2$/MWh

**<u>Annex 4</u>**
**MONITORING INFORMATION**

No other information.

- - - - -