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

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Guizhou Qianxi Qinglong Coal Mine Methane Utilization Project
Version: 02
Date: 16/04/2008

A.2. Description of the project activity:

>>
The proposed project is located in Qinglong coal mine, which is owned by Qianxi Energy Development Co., Ltd. Coal geographic reserve of Qinglong mine arrives at approximately 190.21Mt leading to 2.72 billion m^3 CMM reverse. At present, the mine is extracting underground CMM. All the extracted CMM is released into atmosphere which leads to not only great waste of resources but also air pollution.

The total designed installation capacity is 2*500+4*700kW in the proposed project. 2*500kW generators have already been in operation since February of 2006. Other 2*700kW generators have also been in operation since January of 2008. It is designed that the last 2*700kW generators will be in operation in January of 2010. All the gensets will be fixed with compressors and waste heat recovery systems.

When the project is fully operated, the annual electricity generated is 18,240MWh. 97.5% of which is connected to the internal grid for coal mine use. The left 2.5% is consumed by the power generation. The anticipated annual methane consumed by generators will be up to 5.88Mm^3/y. Moreover, the project could recover approximately 28,621GJ waste heat annually, which will replace the thermal energy supplied from coal-fired boilers. In 10 years of crediting period, the proposed project could reduce a total of 851,309tCO_2e of green house gas (GHG) emissions.

The contribution of the proposed project to local sustainable development includes:

- Taking full advantage of clean energy that would have been released into the atmosphere for power generation;
- Guarantee of coal mine production safety;
- Decrease of the coal consumption by substituting coal fired heat supply and power generation from South China Power Grid;
- Increase of job opportunities in the coalmine area.

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 Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (Host)	Qianxi Energy Development Co., Ltd.	No
The Netherlands	Energy Systems International B.V.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>

The People's Republic of China

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

>>

Guizhou Province

A.4.1.3. City/Town/Community etc:

>>

Qianxi County, Bijie Area

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

>>

Qinglong mine is located in the Qianxi County, which is 14km away from the county centre. Qianxi County is in the midland of Bijie Area, Guizhou Province. The coordinate of Qinglong mine is east longitude 106°05′00″-106°10′00″, north latitude 26°57′51″-27°01′30″.

Figure A-1 Geographic position of the proposed project

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

>>

10: fugitive emissions from fuels
8: mining mineral production

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

>>
The proposed project will employ the following technologies:

1) Gas-fired Reciprocating Engines to Generate Electricity

The adopted gensets with unit capacity of 500kW and 700kW are all domestic made. So far, the two "500GF-RW" engines and two "BG700-LWS"have already been in operation. The advanced control systems could guarantee the safety and the effective operation of the engines by automatically adjusting the ratio of methane and air mass. The detailed parameters of the "500GF-RW" gensets are listed in Table A-1:

Table A-1 Technical parameters of the "500GF-RW" gensets

Genset Type	**500GF1-RW**
Rated Power	500kW
Rated Voltage	400V
Rated Frequency	50HZ
Rated Current	902A
Rated Speed	1000 r.p.m
Power Conversion Factor	0.8
Generator Type	$W12V190Z_L0$
Power	550kW

2) Recovery of Power Engines Waste Heat

The exhaust gas from power generators will be sent to the waste heat utilization equipment. The recovered heat will be utilized for miners' showers, which will replace the coal combustion of traditional boilers. The adopted heat exchangers could supply 28,621GJ/y heat. The detailed parameters of waste heat exchanger are listed in Table A-2:

Table A-2 Parameters of adopted waste heat exchanger

Type	QCF2.4-0.3-0.7
Working Pressure	0.6Mpa
Designed Pressure	1.0Mpa
Working Temperature	170℃
Designed temperature	200℃
Materials	Steam-water mixture

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

>>

Years	Annual estimation of emission reductions in tonnes of CO_2e
2008.10-12	14,084
2009	56,337
2010	89,244
2011	89,244
2012	89,244
2013	89,244
2014	89,244
2015	89,244
2016	89,244
2017	89,244
2018.1-9	66,933
Total estimated reductions (tonnes of CO_2e)	**851,309**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**85,131**

A.4.5. Public funding of the project activity:

>>

No public funding from Annex I Parties has been provided for this CDM project.

SECTION B. Application of a baseline and monitoring methodology:

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

>>

ACM0008 "Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction by flaring or catalytic oxidation" (Version 4) is applied for the proposed project.
(http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html)

"Tool to calculate the emission factor for an electricity system" (Version 01) is adopted for calculation of emission factor of South China Power Grid.

"Tool for the demonstration and assessment of additionality" (Version 04) is adopted to demonstrate the additionality of the proposed project.

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

>>

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

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

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

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

ACM0008 Applicability	Proposed CMM utilization activities
All or part of the methane captured is vented to the atmosphere in project baseline	All the methane is vented without usage in baseline
The methane is captured and destroyed through utilization to produce electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources	The methane is captured and destroyed by power generators.
The remaining share of the methane to be diluted for safety reason may still be vented	Part of CMM is still vented in the proposed project
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented	CMM captured in the project will be utilized for power generation

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

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

ACM0008 Inapplicability	Proposed project activities
Operate in opencast mines	Underground operating coal mines
Capture methane from abandoned/decommissioned coalmines	Both coal production and CMM extraction are under way in the coal mines
Capture/use of virgin coal-bed methane, e.g. methane of high quality extracted from coal seams independently of any mining activities	Extraction activities are concomitant with coal production
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place	No CBM extraction activities are involved in the project
This baseline methodology shall be used in conjunction with the approved consolidated monitoring methodology for "Consolidated monitoring methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring.	All necessary parameters required can be monitored

It can be concluded from the above analysis that the proposed project complies with both the baseline and the monitoring methodologies of ACM0008. Besides, ACM0008 refers to the "Tool for calculation of emission factor for electricity factor (version 01)" and the "Tool for the demonstration and assessment of additionality" (version 04) for demonstration of project additionality.

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

>>

GHG emissions included in the project boundary：

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions of methane as a result of venting	CH_4	Included	Main emission source
	Emissions from destruction of methane in the baseline	CO_2	Excluded	No CMM utilization in the baseline scenario
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Grid electricity generation (electricity provided to the grid)	CO_2	Included	Electricity generated from the project activity will substitute electricity purchasing from China Southern Power Grid
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Captive power and/or heat, and vehicle fuel use	CO_2	Included	Waste heat recovered from power generators will replace heat supply from coal combustion.

		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project activities	Emissions of methane as a result of continued venting	CH_4	Excluded	No CMM/CBM/VAM emission release change in this proposed project.
	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	Power used in the proposed project lead to this part of emissions.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emission from methane destruction	CO_2	Included	Emissions of methane combustion in power generators.
	Emission from NMHC destruction	CO_2	Excluded	In this project, NMHC accounts for less than 1% by volume of extracted coal mine gas.
	Fugitive emissions of unburned methane	CH_4	Included	Small amount of methane will remain unburned in power generation
	Fugitive methane emissions from on-site equipment	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	Excluded for simplification.
	Accidental methane release	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.

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

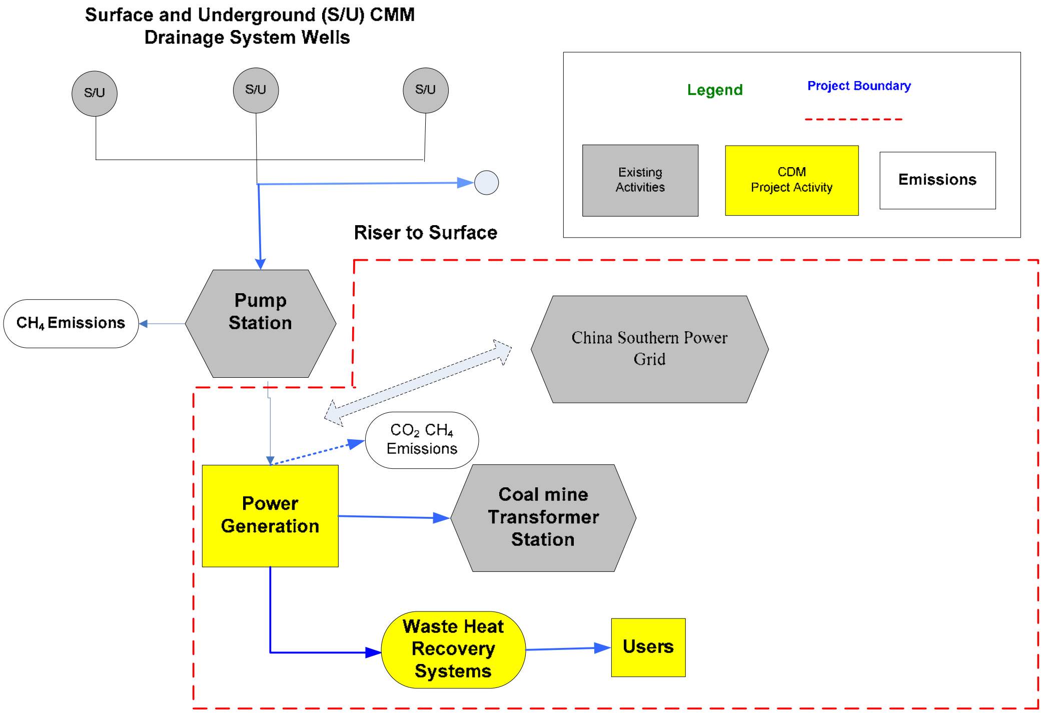

Figure B-1 The proposed project boundary

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

>>

ACM0008 baseline methodology is applied to identify baseline scenario.

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

Step 1a. Options for CMM extraction

A. Pre mining CMM extraction;
B. Post mining CMM extraction;
C. Combination of pre mining and post mining extraction, with pre mining extraction accounting for approximately 72.6% and post mining extraction accounting for approximately 27.4%. This is the continuation of current CMM extraction practice in Qinglong mine.

Step 1b. Options for extracted CMM treatment

The CMM treatment options in the proposed coal mines include:

i. Venting. This it the continuation of existing CMM treatment practice;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation;
v. Use for additional captive power generation;
vi. Use for additional heat generation;
vii. Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation);

Step 1c. Options for energy production

The alternatives for power generation include:

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

The alternatives for heat production include:
4. Continuation of existing heat supply by coal-fired boilers;
5. Heat supply by gas boilers;
6. Waste heat recovery from CMM-fueled engine. This is project activity not implemented as a CDM project.

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

Currently, methane control measures only come under the requirements of health and safety regulations governing the maximum methane concentration at various locations within an underground coal mine. It is only required that methane concentrations in the air to be below 1% to avoid the risk of explosion. (Adjusted "*National Coalmine Safety Regulation*" *(*2006 version), Section Two item 100 –150).[1],[2]. In CMM drainage process, solely adopting pre mining or post mining could not meet the underground safety requirements. Thus, alternative A and B in step 1 do not comply with the legal requirements in the proposed coalmine.

The Chinese government promotes the utilization of CMM, especially in June 2005, NDRC announced the *Coalmine Methane Treatment and Utilization Macro Plan*[3] to encourage the CMM drainage and utilization; it specifically called on the incentives from CDM to overcome barriers in the country to take such action. Therefore, we can deem it as an E- national policy according to EB 22 Annex 3.Thus all of the options meet local and regulatory requirements.

According to the Chinese power regulation, the construction of coal-fired power plant with a capacity of 135MW or below is prohibited in the national grid coverage area. [4] Thus, alternative 2 in energy generation stage does not comply with the local and regulatory requirements.

Step 3. Formulate optional baseline scenario alternatives

Baseline scenarios meet the regulatory requirements include:

---

[1] *No.16 Order of State Administration of Work Safety and State Administration of Coal Mine Safety, 2004.*
http://www.chinasafety.gov.cn/2004-11/23/content_53721.htm

[2] *No.10 Order of State Administration of Work Safety and State Administration of Coal Mine Safety, 2006.*
http://www.chinasafety.gov.cn/2006-11/06/content_201674.htm

[3] "*Notice on Coalmine Methane Treatment and Utilization Macro Plan by NDRC*"[2005] No.1137.
http://www.sdpc.gov.cn/zcfb/zcfbtz/zcfbtz2005/t20050714_35793.htm

[4] "*Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with Capacity of 135 MW or below issued by the General Office of the State Council*", decree no. 2002-6.。

Step 3a. Alternatives for CMM extraction

Alternative Scenario C
Combination of pre mining and post mining extraction, with pre mining extraction accounting for approximately 72.6% and post mining extraction accounting for approximately 27.4%. This is the continuation of current CMM extraction practice in Qinglong mine.

Step 3b. Alternatives for CMM treatment

Alternative Scenario i
CMM ventilation.

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

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

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

Alternative Scenario v
Recovered CMM could be combusted in reciprocating engines or gas turbines that generates electricity for use directly at the coalmine.

Alternative Scenario vi
Recovered CMM could be combusted in gas boilers to produce thermal energy or heat at the coal mine. This thermal energy could be in the form of hot water, hot air or steam.

Alternative Scenario vii
Extracted CMM could be delivered to the local pipeline for residential or commercial use.

Step 3c. Alternatives for energy production

Scenarios for power generation include:
Alternative Scenario 1
Electricity supply from China Southern Power Grid.

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

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

Alternative Scenario 5
Heat supply by gas boilers.

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

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers

Step4a. Barrier analysis of the alternatives for CMM extraction:

Alternative scenario C
This is the continuation of CMM extraction practice at the project site, thus it has no barriers.

Step4b. Barrier analysis of the alternatives for CMM treatment:

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

Alternative Scenario i
BAU, no barriers exist.

Alternative Scenario ii
Utilization of VAM is just on pilot stage. According to the pre-feasibility study of Huainan Coal Mine Group- one of the biggest coal mine group in China, the technology and the economic benefit are not satisfying. [5]

Alternative Scenario iii
Flaring does not utilize the energy potential of CMM, but requires great investment without any revenues. The fact that flaring is not widespread leads to an immature technology. Thus, it faces barriers from investment, technology and prevailing practice. This scenario is eliminated.

Alternative Scenario vi
Coal fired boilers are used to supply heat before implementation of the proposed project activity. There is no intention for the project owner to invest gas-fired boilers. Moreover, methane fuelled boilers require constant and stable gas supply so that heat provision to the coalmines would not be broken off. The current gas supply can not totally satisfy this condition. This scenario is eliminated from consideration

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

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

Alternative Scenario 1

---

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

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

Alternative Scenario 4
Continuation of existing practice – coal fired boilers for heat supply. No barrier exits.

Alternative Scenario 5
Heat supply by CMM gas boilers. Same as alternative *vi*.

According to the analysis above, Alternative *C* in CMM extraction process complies with regulatory requirements and does not face any barriers. In CMM treatment step, options *(i*, *iv* and *v*) that do not face any barriers will be discussed in the following step. In energy production process, Alternative *1* and *4* are continuation of the existing activities not facing any barriers. The possibility of implementing scenario *6* definitely depends on the scenario iv and v which will discussed in step 5.

Step 5. Identify most economically attractive baseline scenario alternative

Step 5a Simple cost analysis

Besides the CDM benefits, the project activity can also lead to the power generation benefits. Thus, "Simple cost analysis" is not applicable.

Sub-step 5b Investment comparison analysis

The method of "Benchmark analysis" is adopted to assess the economic attractiveness of the proposed project. Chinese National Development and Reform Commission and Ministry of Construction have jointly published "Economic Evaluation Codes and Parameters for Construction Projects" (Version 03), which offers the IRR benchmarks of different industries. For coal mining industry, the equity IRR benchmark (after tax) is 15%.[6] As the core business of coal mine, the money would be probably invested to the mining activities without the proposed project. Thus, 15% is adopted here as the benchmark IRR value of CMM power generation industry.

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

Table B-4 Parameters of the proposed project activities and the bench mark IRR

	alternative v
Total investment (10^4 RMB)	1,465.02
Annual operation& maintenance cost (10^4 RMB/y)	455
Floating capital (10^4 RMB)	5.24
City construction tax & additional charge for education (10^4 RMB)	8
Income tax (10^4 RMB)	13.25
Installation capacity (MW)	3.8
Operation hour (hr/y)	6000
Life of project (year)	22
Annual Power generation (MWh)	18,240

[6] NDRC and National Construction Committee，2006，*Economic Evaluation Code and Parameter for Construction Projects (Version 03)*P203

Self power consumption rate (%)	2.5
Waste heat recovered (GJ/y)	28.621
Power purchase price not including tax(RMB/MWh)	330
Coal price not including tax (RMB/t)	340
Equity IRR after tax	8.74%
Benchmark IRR	15%

Note: The sources of the parameter is listed in the IRR spreadsheet

The IRR of alternative *v* is much lower than the BAU benchmark IRR, so it can not be the baseline alternative. The scenario *iv* will face the similar economic barrier as v, which means that neither scenario iv nor v can be the baseline scenario of the project.

Alternatives for heat production:

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

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

Sub-step 5c. Sensitive Analysis

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

The following key parameters have been selected as sensitive elements to test the financial attractiveness for the proposed project. The total coal purchase saving is 560,000RMB which accounts only 8.7% of the total revenues (643,000 RMB). Thus, the effects of coal saving on IRR can be neglected.

i. Total investment
ii. Annual operation& maintenance cost
iii. Annual power supply
iv. Electricity phasing price

The effect of electricity price on IRR is same as that of Annual power supply. The effect of changes in Total investment, Annual operation& maintenance cost and Annual power supply/electricity purchasing price will be examined on the IRR. Assuming these four parameters to change within the range between (-10%~+10%), the outcomes of IRR sensitivity are presented in the following table.

Table B-5: Sensitive analysis of alternative *v*

	-10%	**-5%**	**0%**	**5%**	**10%**
Total Investment	10.11%	9.40%	8.74%	8.13%	7.56%
Annual operation& maintenance cost	11.99%	10.41%	8.74%	6.95%	5.02%
Annual power supply/ Electricity phasing price	3.80%	6.41%	8.74%	10.88%	13.72%

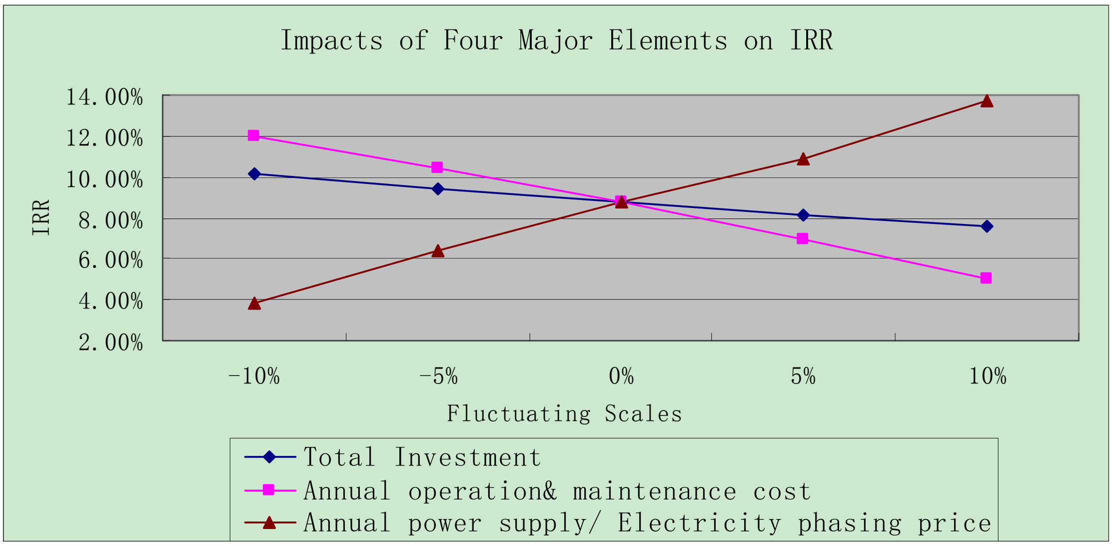

Figure B-2 Impacts of four major uncertain elements on IRR (alternative v)

From the calculation outcomes as shown in the Table above, the IRR of alternative *v* will vary to different degrees with these four uncertain parameters changing between -10% and +10%. It can be seen from Figure B-21that the highest IRR of the alternative do not exceed the benchmark value of 15% when the investment and operational cost decrease by 10% and annual power generation increases by 10%. Therefore, a conclusion can be made that none of those alternatives can be the baseline scenario even considering the key parameters sensitivity.

In China, it is reasonable to believe that the Total investment and Annual operation& maintenance cost would not decrease, since the level represented by Consumer Price Index (CPI) in China has been increasing sharply these years especially in 2007.[7]

The annual power supply would not increase since the calculation is based on the full load of the generators. Before the project started, Project Owner had studied carefully on the generators chosen. Annual operation hours of the generators would not exceed 6000 hours in the long run. As CMM power generation is a new technology, no supplier could guarantee the engine's stable operation for a long time. The electricity price in China is regulated by government authority, once the price is set, it would not change. Even if the price can be increased in the future, it is because the power generation costs have increased and the increased tariff is for mitigating the loss rather than improving the project IRR.

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

---

[7] *National Bureau of Statistice of China*, "*Communique of National Economy & Social Development of 2007", 28th Feb 2008.*

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):

>>

The proposed project activity will not occur without CDM assistance. *"Tools for the Demonstration and Assessment of Additionality" (version 04)* will be used to test the additionality of the proposed project.

The starting date of the project is 29/09/2005. The validation is carried out after the starting date. The project owner has provided evidence of considering CDM assistant as part of the project in decision-making process,

On 1st December 2004, as a major annual event in the coal mining industry in China, the 4th International Symposium on CBM/CMM was held in Beijing China. On the symposium, CDM was a major topic of a way to encourage coalmines to utilize CMM. After the symposium, the concept of CDM was spread around the whole coal mine field in China. The project owner started to consider implementing its CMM utilization project with the assistance from CDM. During several months' contact with different CDM consulting companies, the project owner finally signed the consulting agreement with Millennium Capital Services at 20th, April 2005.

Then, the project owner has been prepared the feasibility study and finished it in August of 2005. Based on the financial analysis, the project can only be considered as financially realistic under CDM incentive.

Based on ACM0008, Step 1 can be omitted.

Step 2. Investment Analysis

The purpose of investment analysis is to determine whether the proposed project is economically attractive. The following sub steps are adopted to assess the investment analysis:

Sub-step 2a. Determine appropriate analysis method

Tools for Demonstration and Assessment of Additionality provides three analysis methods: "Simple cost analysis" (option I), "Investment comparison analysis" (option II), and "Benchmark analysis" (option III). Considering that there are not only CDM revenues but also the power sale revenues, option I is not adopted here. "Investment comparison analysis" method is not applicable either because the baseline is not an investment project. Thus the method of "Benchmark analysis" is applied to assess the economic attractiveness of the proposed project.

Sub-step 2b. Apply benchmark analysis

As discussed in step 5 of B.4, it is considered that only is the IRR of proposed project equal to or higher than the benchmark IRR, can the project be economically feasible.

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

IRR for the proposed project without CDM assistance is 8.74%, which is lower than the benchmark value of 15%. With CDM revenues, assuming the price of CERs is 10$/$tCO_2$e, the project IRR will reach 30.40% that is much higher than benchmark. Therefore, a conclusion can be made that the proposed project is not economically attractive without revenues from CDM.

Table B-6 Project IRR with and without CDM

	IRR without CDM	IRR with CDM
Qianxi Project	8.74%	30.40%

Sub-step 2d. Sensitivity analysis

Refer to step 5 of B.4.

Step 4. Common Practice Analysis

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

China is the largest emitter of CMM in the world, while the utilization rate of CMM is much lower. CMM power generation is quite a new technology which has been developed quickly only in these few years. The coal mine society realized that CDM could help to overcome the financial barriers of CMM power generation in the 4th International Symposium on CBM/CMM in December, 2004. From then on, the CMM power generation projects have been widely carried out under CDM assistance in China.

At present, other existing and planned CMM power generation projects in Guizhou province are owned mainly by Shuicheng Coal Minine Group, Panjiang Coal& Elec Group, Liuzhi Coal& Elec Group. All these owners are carrying out the project with CDM incentive.

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

In Guizhou Province, all the similar coal mine methane utilization projects are with CDM incentive. Without assistance from CDM, no methane utilization project could be carried out. So a conclusion can be made that the proposed project activity is not a common practice

In conclusion, it is obvious that the proposed project activity is not part of baseline scenario. Without additional incentive of CDM, the proposed scenario will not occur. The proposed project has additionality and will reduce the greenhouse gas emissions.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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

$$ER_y = BE_y - PE_y - LE_y$$

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

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

1. Project Emissions

Project emissions are defined by the following equation:

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

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

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

Additional power energy may be consumed for the operation of the power generation. Emissions from this energy use should be treated as project emissions. The formula is as follows:

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

PE_{ME}: Project emissions from energy use to capture and use methane (tCO_2e)
$CONS_{ELEC,\ PJ}$: Additional electricity consumption for capture and use of methane (MWh)
CEF_{ELEC}: Carbon emissions factor of electricity used by coal mine, which is the emission factor of China Southern Power Grid in this project (tCO_2e/MWh)

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

When the captured methane is burned in a power plant, combustion emissions are released. In addition, if NMHC accounts for more than 1% of the coalmine gas, combustion emissions from these gases should also be included. In each end-use, the amount of gas destroyed depends on the efficiency of combustion of each end use. The proposed project activity doesn't involve CMM fuelled boilers, gas for residential or vehicle utilization, or flaring. Therefore, the formula will be as following:

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

with:
$r = PC_{NMHC} / PC_{CH4}$

where:
PE_{MD}: Project emissions from CMM destroyed (tCO_2e)
MD_{ELEC}: Methane destroyed through power generation (tCH_4)
CEF_{CH4}: Carbon emission factor for combusted methane (tCO_2e/tCH_4)
CEF_{NMHC}: Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2e/tNMHC$)
r: Relative proportion of NMHC compared to methane
PC_{CH4}: Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}: NMHC concentration (in mass) in extracted gas (%)

$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$

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

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

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

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

where:
PE_{UM}: Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}: Global warming potential of methane ($21tCO_2e/tCH_4$)
MM_{ELEC}: Methane measured sent to power generation (tCH_4)
Eff_{ELEC}: Efficiency of methane destruction/oxidation in power generation (taken as 99.5% from IPCC)

2. Baseline Emissions

Baseline emissions are given by the following equation:

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

where:
BE_y: Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$: Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$BE_{MR,y}$: Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
$BE_{Use,y}$: Baseline emissions from the production of power or heat replaced by the project activity in year y (tCO_2e)

2.1 Methane destruction in the Baseline $BE_{MD,y}$

In baseline scenario, all the drained gas is vented without any utilization, thus $BE_{MD,y} = 0$.

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

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

Because both pre-mining and post-mining drainage exist, using the following equation to calculate $BE_{MR,y}$.

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

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

GWP_{CH4}: Global warming potential of methane (21tCO_2e/tCH_4)
$CMM_{PJ,ELEC,y}$: Pre-mining CMM captured, sent to and destroyed by power generation in the project activity in year y (tCH_4)
$PMM_{PJ,ELEC,y}$: Post-mining CMM captured, sent to and destroyed by power generation in the project activity in year y (tCH_4)

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

The power generation in the proposed project will avoid the grid-connected electricity consumption. The utilization of thermal energy produced in the power generation process will replace the coal consumption in the baseline scenario. The following equation is used to calculate $BE_{Use,y}$:

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

where:
$BE_{Use,y}$: Baseline emissions from the production of power or heat replaced by the project activity in year y (tCO_2e)
GEN_y: Electricity generated by project activity in year y (MWh)
EF_{ELEC}: Emissions factor of electricity (grid) replaced by project (tCO_2/MWh)
$HEAT_y$: Waste heat recovered by project activity in year y (GJ)
EF_{HEAT}: Emissions factor for heat production replaced by project activity (tCO_2/GJ)

2.3.1 Grid power emissions factor EF_{ELEC}

The emissions factor for displaced electricity is ex-ante calculated using tool to calculate of the emission factor for an electricity system. The proposed project will apply the following six steps:

Step 1. Identify the relevant electric power system

The DNA of China, National Development and Reform Commission, has published *Notification on Determining Baseline Emission Factor of China's Grid*[8], which defines seven national power grids including North China Power Grid, Northeast China Power Grid, East China Power Grid, Central China Power Grid, North China Power Grid, China Southern Power Grid and Hainan Power Grid. According to the tool to calculate of the emission factor for an electricity system, these delineations should be used.

The proposed project is located in Guizhou province connected to China Southern Power Grid, and electricity generation by the project will be exported to the Grid. So China Southern Power Grid should be adopted as the relevant electric power system of the project.

Step 2. Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

[8] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889

Any of the four methods can be used. While at present dispatch data of the grid can not be obtained from open channel in China, dispatch data analysis OM can not be adopted. Annual load duration curve of the grid must be provided to adopt simple adjusted OM (Method (b)), however at present annual load duration curve can not be obtained from open channel in China too, therefore method (b) should not be employed. For China Southern Power Grid which connected to the proposed project, low-cost/must run resources constitute 33.76% of total grid generation in 2001, 32.98% in 2002, 31.06% in 2003, 29.95% in 2004, and 30.90% in 2005[9], thus it can be seen that in the five most recent years (2001-2005) power generation of low-cost/must run power plant constitute less than 50% of total grid generation, meeting applicability of simple OM method.

For simple OM method, the emission factor can be calculated using either of the two following data vintages:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (*y-1*) may be used. If the data usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year (*y-2*) may be used. The same data vintage (*y, y-1 or y-2*) should be used throughout all crediting periods.

For the proposed project, ex ante option for the emission factor will be used.

Step3. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generation power plants serving the system, not including low-cost/ must-run power plants / units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and fuel types and total fuel consumption of the project electricity system (Option C)

Because data on fuel consumption and net electricity generation for each power plant / unit in the Grid is not available, Option A and Option B can not be adopted. Besides nuclear and renewable power generation are considered as low-cost / must-run power sources, and the quantity of electricity supplied to the grid by these sources is known, thus Option C should be used.

Where Option C is used, the simple OM emission factor ($EF_{grid,OMsimple,y}$) is calculated as follows:

[8] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889
9 China Eletric Power Yearbook 2002-2006

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:
$EF_{grid,OMsimple,y}$: Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$F_{i,y}$: Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i\,y}$: Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{,CO2,i,y}$: CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y: Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh)
i: All fossil fuel types combusted in power sources in the project electricity system in year *y*
y: Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option), following the guidance on data vintage in step 2

For simple OM to calculate the operating margin, an import from a connected electricity system should be considered as one power source.

Step 4. Identify the cohort of the power units to be included in the build margin

The sample group of power units *m* used to calculate the build margin consists of either:
a) The set of five power units that have been built most recently, or
b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Power plant registered as CDM project activities should be excluded from the sample group m. However, if group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power unit(s) that is (are) built more than 10 years age then:
(i) Exclude power unit(s) that is(are) built more than 10 years ago from the group; and
(ii) Include grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system.

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emission factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

According to the tool, the project will employ the sample group of power units *m* which consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently and Option 1 to ex-ante calculate build margin emission factor ($EF_{grid,BM,y}$).

Step 5. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

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

Consider of data availability, the project calculation adopts the following deviation[10] to methodology, accepted by CDM EB: Firstly, calculate the share of different power generation technology in the recent capacity additions. Secondly, calculate the weight for capacity additions of each power generation technology. Finally, calculate the emission factor using the efficiency level of the best technology commercially available in China.

Due to different power generation technology of fuel-coal, fuel-oil and fuel-gas can not be separated from thermal power in current statistical data, and in the calculation will adopt the methods as follows: Firstly, utilizing available data on energy balance form in the recent year, calculate ratio of CO_2 emissions among solid fuel, liquid fuel and gas fuel in the total emissions; Secondly, based on emission factor regarding the efficiency level of the best technology commercially, calculate thermal power emission factor to the grid with the share as weight. Finally, multiply the thermal power emission factor with thermal power weight in 20% capacity additions of the grid, then the calculation result as BM of the grid.

Detailed calculation step and formula as follows:

Step 1: Calculate ratio of CO2 emissions among solid fuel, liquid fuel and gas fuel.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

[10] http://cdm.unfccc.int/Projects/Deviations

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

Where:
$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant province *j* in years(s) *y*;
$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2/tce), taking into account the carbon content of the fuels and the percent oxidation of the fuel consumed in years y;
Coal, Oil and Gas mean separately solid fuel, liquid fuel and gas fuel.

Step 2: Calculate thermal power emission reduction $EF_{Thermal}$

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$$

Where:
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ correspond separately to emission factor of the best technology commercially efficiency level of fuel-coal, fuel-oil and fuel-gas, detailed parameters and calculation seen annex 3.
Step 3: Calculate BM of the Grid

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$

Where:
CAP_{Total} is capacity additions of the grid;
$CAP_{Thermal}$ is thermal power capacity additions of the grid.

Step 6. Calculate the combined margin emission factor

The combined margin emissions factor is calculated as follows:

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

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

For CMM power generation project activities, the following default values should be used for w_{OM} and w_{BM}: w_{OM} =0.5 and w_{BM} =0.5 for the first crediting period, and w_{OM} =0.25 and w_{BM} =0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to the tool.

The proposed project adopts emission factor data of China Southern Power Grid defined in *Notification on Determining Baseline Emission Factor of China's Grid*, which is calculated based on the above steps and issued by NDRC.

2.3.2 Heat generation emissions factor EF_{HEAT}

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

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

3. Leakage

Leakage is given by the following equation:

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

where:
LE_y: Leakage emissions in year y (tCO_2e)
$LE_{d,y}$: Leakage emissions due to displacement of other baseline thermal energy use of methane in year y (tCO_2e)
$LE_{o,y}$: Leakage emissions due to other uncertainties in year y (tCO_2e)

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

Data / Parameter:	$F_{i.j,y}$
Data unit:	tce
Description:	Amount of fuel *i* consumed by power sources *j* in year y
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$F_{i,m,y}$
Data unit:	tce
Description:	Amount of fuel *i* consumed by plant *m* in year y
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor

Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity delivered to the grid by source *j*
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$COEF_{i,j,y}$
Data unit:	$tCO_2/kg(m^3)$
Description:	CO_2 emission coefficient of fuel *i*
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	NCV_i
Data unit:	$MJ/t,km^3$
Description:	Net calorific value (energy content) of fuel *i* per mass or volume
Source of data used:	*"China Energy Statistical Yearbook"*
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	China Official Data of *National Bureau of Statistics of China* and *National Development and Reform Commission*
Any comment:	-

Data / Parameter:	$OXID_i$
Data unit:	-

Description:	Oxidation factor of the fuel
Source of data used:	IPCC default value
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC 2006
Any comment:	

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tC/TJ
Description:	CO_2 emission factor per unit of energy
Source of data used:	IPCC default value
Value applied:	See Annex 3 calculation of emission factor
Justification of the choice of data or description of measurement methods and procedures actually applied :	2006 IPCC
Any comment:	-

Data / Parameter:	$EF_{CO2,coal}$
Data unit:	tC/TJ
Description:	CO_2 emission factor of coal used in heat generation
Source of data used:	IPCC default value
Value applied:	25.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	2006 IPCC
Any comment:	-

Data / Parameter:	CEF_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data used:	ACM0008 default value

Value applied:	2.75
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008
Any comment:	-

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

Data / Parameter:	ρ_{CH4}
Data unit:	t/m^3
Description:	Methane density
Source of data used:	ACM0008 default value
Value applied:	0.00067
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008
Any comment:	-

Data / Parameter:	$CEF_{ELEC-PJ}$
Data unit:	tCO_2/MWh
Description:	Carbon emission factor of $CEF_{ELEC-PJ}$
Source of data used:	China DNA
Value applied:	0.84335
Justification of the choice of data or description of measurement methods and procedures actually applied :	China official data and IPCC 2006
Any comment:	

Data / Parameter:	$EF_{heat,y}$
Data unit:	tCO_2e/GJ
Description:	Emission factor for heat generation
Source of data used:	According to ACM0008 Option B of Section 7.4.4 calculation
Value applied:	0.0946
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008 option and conservative assumption.
Any comment:	-

Data / Parameter:	GWP_{CH4}:
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane
Source of data used:	ACM0008 default value
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008
Any comment:	-

Data / Parameter:	Eff_{ELEC}

Data unit:	%
Description:	Efficiency of methane destruction/oxidation in power plant
Source of data used:	ACM0008 refer this value to IPCC as 99.5%
Value applied:	99.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	ACM0008
Any comment:	-

Data / Parameter:	Eff_{heat}
Data unit:	%
Description:	Boiler efficiency of heat plant
Source of data used:	ACM0008 Option B of Section 7.4.4
Value applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied :	Assuming a boiler efficiency of 100% as a conservative approach
Any comment:	-

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

1. Project Emissions

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

1.1.1 China Southern Power Grid emissions factor $EF_{ELEC,y}$

According to the *Notification on Determining Baseline Emission Factor of China's Grid* published by China's DNA on August 9th, 2007, the project located in Guizhou province is connected to South China Power Grid. OM of China Southern Power Grid is 1.0119tCO2/MWh and BM is 0.6748tCO2/MWh. Therefore, EF_{ELEC} is 0.84335tCO_2/MWh. Calculation details can be seen in Annex 3

1.1.2 PE_{ME} calculation

It is estimated in the Feasibility Study that the self power consumption will account for 2.5% the total power generated, which can be used to estimate the value of $CONS_{ELEC,PJ}$. The actual power consumption will be monitored by ammeters in the crediting period.

$PE_{ME} = CONS_{ELEC,PJ} \times CEF_{ELEC} = 18,240 * 2.5\%*0.84335 = 385tCO_2e/y$

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

According to gas sample analysis, the NMHC concentration is too low to be measured, thus the combustion emissions from non-methane hydrocarbons will be ignored. The NMHC concentration will be monitored annually in Qinglong coalmine to checkout whether its concentration is below or above 1% to determine whether NMHC combustion is to be included in the project emissions.

$PE_{MD} = MD_{ELEC}$ x CEF_{CH4}

According to ACM0008, the concentration of CH_4 is 0.00067 t/m^3(IPCC default value).The value of MM_{ELEC} is given in the feasibility study of the proposed project: MM_{ELEC} = 5.88Mm^3/y = 3,939t/y
Thus:

$PE_{MD} = MM_{ELEC}$ x Eff_{ELEC} x CEF_{CH4} = 3,939*99.5%*2.75 = 10,780tCO_2e

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

MM_{ELEC} in the formula of PE_{UM} is calculated based on the value of MD_{ELEC} and the Eff_{ELEC}:

$PE_{UM} = GWP_{CH4}$ x MM_{ELEC} x $(1 - Eff_{ELEC})$ = 21*3,939*(1-99.5%) = 414tCO_2e/y

1.4 The calculation results of project emissions

Table B-7 Project emissions at the proposed coalmines (tCO_2e)

Year	**PE_{ME}**	**PE_{MD}**	**PE_{UM}**	**PE_y**
2008.10-12	61	1,700	65	1,826
2009	243	6,801	261	7,305
2010	385	10,780	414	11,578
2011	385	10,780	414	11,578
2012	385	10,780	414	11,578
2013	385	10,780	414	11,578
2014	385	10,780	414	11,578
2015	385	10,780	414	11,578
2016	385	10,780	414	11,578
2017	385	10,780	414	11,578
2018.1-9	288	8,085	310	8,683
Total	3,669	102,825	3,946	**110,439**

2. Baseline Emissions

2.1 Methane destruction in the Baseline $BE_{MD,y}$

In baseline scenario, all the drained gas is vented without any utilization, thus $BE_{MD,y}$ = 0.

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

After the project is fully operated:
$BE_{MR,y}$ = GWP_{CH4} x MM_{ELEC} = 21*3,939= 82,732tCO_2e/y

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

2.3.1 Grid power emissions factor EF_{ELEC}

As stated in 1.1.1, EF_{ELEC} = 0.84335tCO_2e/MWh

2.3.2 Heat generation emissions factor EF_{HEAT}

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

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

2.3.3 Calculation of $BE_{MR,y}$

The value of GEN_y and $HEAT_y$ are given in feasibility study of the proposed project. In crediting period, they will be obtained by monitoring.

After the project is fully operated:

$BE_{Use,y}$ = GEN_y x EF_{ELEC} + $HEAT_y$ x EF_{HEAT} = 18,240*0.84335 + 28,621*0.0946 = 18,091tCO_2e/y

2.4 The calculation results of baseline emissions

Table B-8 Baseline emissions of proposed project（tCO_2e）

Year	BE_{MD}	BE_{MR}	BE_{Use}	BE_y
2008.10-12	0	13,050	2,861	15,911
2009	0	52,200	11,442	63,642
2010	0	82,732	18,091	100,822
2011	0	82,732	18,091	100,822
2012	0	82,732	18,091	100,822
2013	0	82,732	18,091	100,822
2014	0	82,732	18,091	100,822
2015	0	82,732	18,091	100,822
2016	0	82,732	18,091	100,822
2017	0	82,732	18,091	100,822
2018.1-9	0	62,049	13,568	75,617
Total	0	789,151	172,597	**961,748**

3. Leakage

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

4. Emission Reductions

No leakage occurs outside the project boundary, so the emission reduction (ER_y) by the project activity during a given year y is the difference between the baseline emissions (BE_y) and project emissions (PE_y).

After the project is fully operated:

$ER_y = BE_y - PE_y$ = 961,748- 110,439 = 851,309tCO_2e/y

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

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2008.10-12	1,826	15,911	0	14,084
2009	7,305	63,642	0	56,337
2010	11,578	100,822	0	89,244
2011	11,578	100,822	0	89,244
2012	11,578	100,822	0	89,244
2013	11,578	100,822	0	89,244
2014	11,578	100,822	0	89,244
2015	11,578	100,822	0	89,244
2016	11,578	100,822	0	89,244
2017	11,578	100,822	0	89,244
2018.1-9	8,683	75,617	0	66,933
Total (tonnes of CO_2e)	**110,439**	**961,748**	**0**	**851,309**

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

B.7.1. Data and parameters monitored:

>>

Data / Parameter:	MM_{ELEC}
Data unit:	tCH_4/y
Description:	Methane sent to power plant
Source of data to be used:	The volume of CMM and the CH_4 concentration are online monitored. Based on the density 0.00067 tCH_4/m^3CH_4, the mass value of CH_4 is calculated in the crediting period.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,939 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuously monitored by gas flow meters adjusted by temperature and pressure
QA/QC procedures to be applied:	Flow meters will be subject to a regular maintenance regime to ensure accuracy. More procedures can be seen in CDM manual.
Any comment:	-

Data / Parameter:	PC_{CH4}
Data unit:	%
Description:	Concentration of methane in extracted gas
Source of data to be used:	To be obtained through monitoring methane concentration captured gas
Value of data applied for the	Not accounted

purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuously monitoring concentration using optical and calorific meters on wet basis.
QA/QC procedures to be applied:	Thermal meter will be subject to a regular maintenance regime to ensure its accuracy and measurement errors not exceeding industry standard.
Any comment:	-

Data / Parameter:	PC_{NMHC}
Data unit:	%
Description:	NMHC concentration in coal mine gas
Source of data to be used:	To be obtained through annual analysis of the fractional composition of captured gas. If NHMC concentration is less than 1%, it is not accounted.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not accounted
Description of measurement methods and procedures to be applied:	Annually monitoring NHMC concentration to determine whether its emissions to be included in the calculation.
QA/QC procedures to be applied:	Instruments will be subject to a regular maintenance regime before analysing gas components to ensure accuracy.
Any comment:	-

Data / Parameter:	GEN_y
Data unit:	MWh/y
Description:	Power generated by the proposed project
Source of data to be used:	The value can be obtained by monitoring in the crediting period.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	18,240 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Continuous measured by electricity meters
QA/QC procedures to be applied:	Ammeters will be subject to a regular maintenance regime to ensure its accuracy and measure errors not exceeding industry standard.
Any comment:	

Data / Parameter:	$CONS_{ELEC, PJ}$
Data unit:	MWh/y
Description:	Additional electricity consumption by project
Source of data to be used:	The value can be obtained by monitoring in the crediting period.
Value of data applied for the purpose of calculating expected emission reductions	456 (After the project is fully operated)

in section B.5	
Description of measurement methods and procedures to be applied:	Continuously measured by ammeter
QA/QC procedures to be applied:	Ammeters will be subject to a regular maintenance regime to ensure its accuracy and measurement errors not exceeding industry standard.
Any comment:	-

Data / Parameter:	$HEAT_y$
Data unit:	GJ/y
Description:	Total waste heat recovered by the project
Source of data to be used:	The value can be obtained by monitoring in the crediting period.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	28,621 (After the project is fully operated)
Description of measurement methods and procedures to be applied:	Thermometer and flow meter are adopted to continuously monitor the temperature difference of the heated medium and its flow rate to determine the amount of waste heat recovery.
QA/QC procedures to be applied:	Thermal meter will be subject to a regular maintenance regime to ensure its accuracy and measurement errors not exceeding industry standard.
Any comment:	

B.7.2. Description of the monitoring plan:

>>

The implementation of the monitoring plan is to ensure that real, measurable, long-term Greenhouse Gas Emissions Reduction can be monitored, recorded and reported. It is a crucial procedure to identify the final CERs of the proposed project. This monitoring plan for the proposed project activity will be implemented by the project owner, Qianxi Energy Development Co., Ltd. and supervised by the CDM project developer, Millennium Capital Services.

1. What data will be monitored?

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

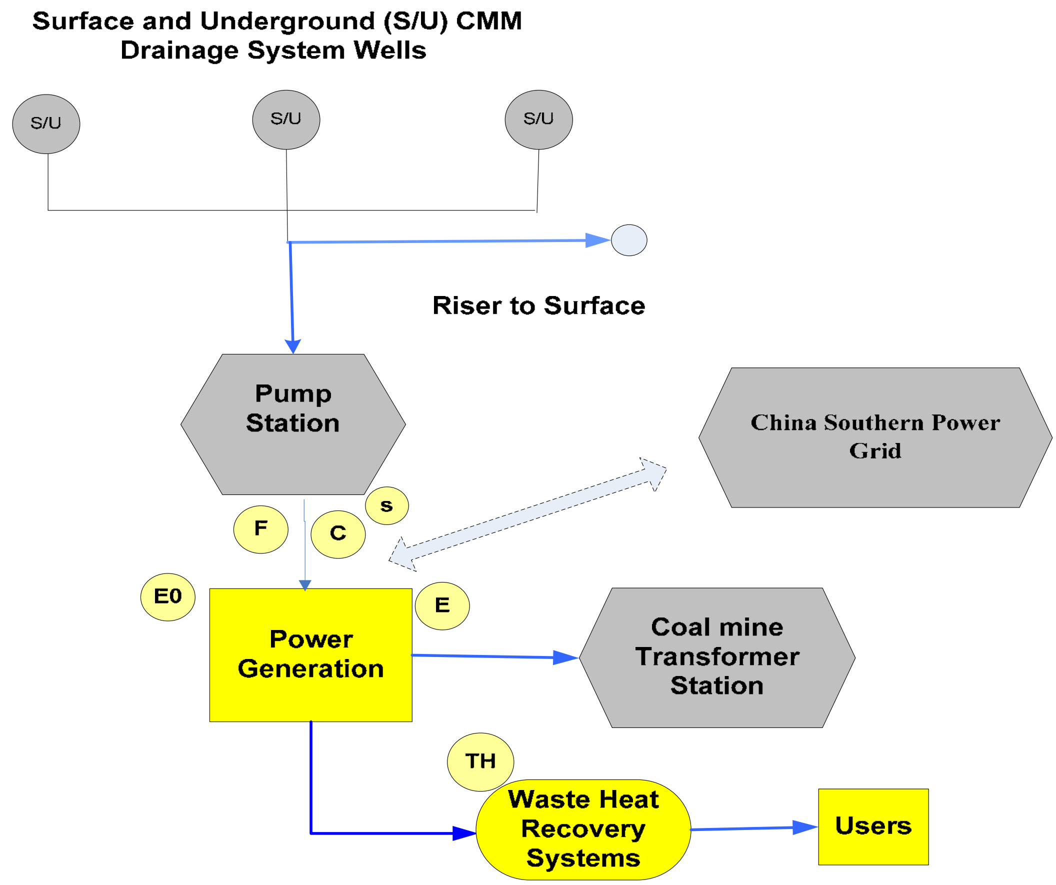

Figure B-2 Monitoring plan of Proposed Project Activity

For power generation and waste heat recovery monitoring, the following instruments are required. (Table B-9)

Table B-9 Information of the Monitoring Instruments of the Proposed Project

Symbol	Instrument	Function
C	Methane concentration meter	Measure methane concentration in the CMM imported to generators
F	Gas flow meter	Measure CMM flow rate imported to generators
E	Ammeter	Measure electricity generated by the project
E0	Ammeter	Measure electricity consumption by the project
s	Regular sampling	Monitor NMHC concentration in CMM
TH	Calorimeter	Measure the heat recovered by waste heat recovery system

2. Management Structure

The management structure chart is shown in Figure B-3

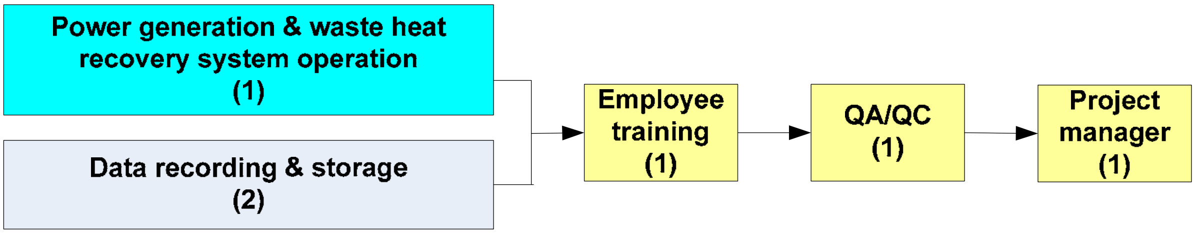

Figure B-3 Operational management structure chart of the project

3. Calibration of Meters and Metering

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

4. Verification Procedure

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

Main verification activities for the proposed project include:
1) The project owner, Qianxi Energy Development Co., Ltd. will sign a verification service agreement with specific DOE in accordance with relevant EB regulations;
2) The project owner will provide the completed data records and other CDM related information to DOE during verification;
3) The project owner will cooperate with DOE to implement the verification process, i.e. the personnel in charge of monitoring and data handling should be available for interviews and answer questions honestly.

5. Quality Assurance:

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

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

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

>>

The baseline and monitoring study was completed on: 15/04/2008

The entity determining the methodology is:

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

SECTION C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
29/09/2005

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

>>
22 years

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

>>
Fixed crediting period

C.2.1. Renewable crediting period

>>
Not applied

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>
01/10/2008

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

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

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

AIR QUALITY
In construction period, construction equipment and transport activities as well as raw construction materials will bring air pollution. Dust is mainly brought by construction materials, dust piling up, loading activities, etc. Some measures are adopted in order to mitigate the air pollution. They are: 1) reducing the height of pulverous materials and frequently watering them; 2) covering the transportation trucks or adopting special tight trucks in case of necessity.

Based on the air quality impact assessment, the maximum ground concentration of NO_2 is far lower than the requirement of secondary standard of "Ambient air quality standard" (GB3095-1996), which only brings slight effects to the environment. As a clean fuel, CMM power generation will result in obvious environmental benefits.

WATER QUALITY
The wastewater pollutants mainly come from drained water of construction site, equipment cleaning water, and municipal water of workers in construction period. The drained wastewater will be clarified first and then discharged. The oily water from equipment cleaning will be treated in wastewater treatment plant of Qinglong mine. The municipal wastewater will be transmitted to the municipal wastewater treatment station of the mine. Once all the above measures are adopted, the adverse effects on the water environment will be greatly mitigated.

In operation period, municipal wastewater is the main source of the pollution. It is estimated that the volume of discharged water will be $2.0m^3/d$, which only accounts for 0.16% of the designed capacity of the municipal wastewater station of Qinglong mine. This will not greatly affect the water treatment system. Thus, it can be concluded that the wastewater from the power generation will not bring adverse effects to the surrounding water environment.

NOISE
Potential sources of noise during construction period include construction equipment and transporting. There are no sensitive receptors such as residents within 200m distance. When the noise level of construction equipment is 100dB (A), it has the 54.0dB (A) of noise level at the place 200m away from the equipment. When noise level from the equipment is 105dB (A), it is 59.0dB (A) at the place of 200m away. Thus, the noise pollution from the construction site can not affect the residents.

In operation period, the noise sources are power engines and the circulating cooling tower. It will adopt sound proof doors and windows, de-noised PVC boards and other sound proof materials to reduce the noise level. In addition, intake and outtake pipelines are all sound proof to mitigate the noise level. No residents will be affected since the power station is located in the middle of hillside without any residents living nearby.

SOLID WASTE

The construction and municipal solid waste will be carried to rubbish dump for storage and recover the valuable components. Once management is effectively adopted, the solid waste will not lead to adverse effects on the environment.

In operation period, the municipal waste will be centralized treated so that no adverse effects will be left to the environment.

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

>>

No significant negative environmental impacts are expected to result in from the project activity. On the contrary, the project will lead to a significant reduction of local pollution along with a great decrease of GHG emissions.

SECTION E. Stakeholders' comments

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

>>

During the environmental impact assessment process, the public participation is organised by the project owner and supported by the EIA operator. The interviewees are mainly the villagers nearby and workers who probably be directly affected by the proposed power generation. Public participation process adopted the method of sending "Public Opinion Questionnaires" and publishing documents on the billboard of the village.

The questionnaire was mainly focused on the economic development, water quality, air quality, noise and other hot issues. 30 questionnaires were sent out during the investigation with replied number of 29 (rate 96.7%).

E.2. Summary of the comments received:

>>

The following 7 questions are sent out for public comments:

1) What do you think the proposed project would affect the local economy?
2) Does the proposed project bring adverse effects on local water quality?
3) What kind of effects on local air quality would the proposed project bring?
4) Does the proposed project bring adverse effects on public healthy?
5) What is the noise pollution would the proposed project bring?
6) Does the proposed project bring adverse effects on traffic?
7) In total, implementation of project would lead to advantages or disadvantages?
8) What is your attitude to the project?

The results show that most of people think that the local economy is good and agree that the proposed project could stimulate the economic development. No one denied the stimulation effects of the project on economic development.

For environmental problems, most of people agree that the construction of the project would not bring adverse effects to the water quality, air quality and public health. Part of publics has no idea of the effects on the environment. All the public think that there is no effect on the local transportation and agree that the benefits of the proposed project will overwhelm the flaws. 96.6% of the interviewees support the implementation of the project while 1 person has no idea.

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

Question	Options	Number	Ratio (%)
1	Promote the economy development	28	96.6
	No effects	1	3.4
	Prohibit the economy development	0	0
2	Yes	0	0
	No	23	79.3
	No idea	6	20.7
3	Beneficial effects	17	58.6
	Adverse effects	6	20.7
	No idea	6	20.7
4	Yes	1	3.4
	No	26	89.7
	No idea	2	6.9
5	Great noise	1	3.4
	Tiny noise	28	96.6
	No idea	0	0
6	Yes	0	0
	No	29	100
	No idea	0	0
7	Advantages	29	100
	Disadvantages	0	0
	No idea	0	0
8	Support	28	96.6
	Oppose	0	0
	No idea	1	3.4

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

>>

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

For noise pollution in construction period, properly arranging working time can avoid high noise equipment running at the same time. Night working time should be reduced. In addition, the construction site should be reasonably arranged to fix the high noise equipment in the centre and add sound panel around the fixed equipment.

The noise in operation period mainly comes from power engines. The corresponding measures can be: 1) distinguishing areas by different functions and; 2) selectively planting.

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

The conclusion is made that the proposed project will lead to environmental and social benefits so that the stakeholders support the implementation of the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Qianxi Energy Development Co., Ltd.
Street/P.O.Box:	Qinglong Coal Mine, Guli Town
Building:	
City:	Qianxi County
State/Region:	Bijie Area
Postfix/ZIP:	551507
Country:	P.R. China
Telephone:	0857-4289566
FAX:	0857-4698008
E-Mail:	qxnybgs@163.com
URL:	
Represented by:	Zhou Weiguang
Title:	Engineer
Salutation:	
Last Name:	Zhou
Middle Name:	
First Name:	Weiguang
Department:	Qinglong Coal Mine
Mobile:	13195276577
Direct FAX:	0857-4698008
Direct tel:	0857-4289566
Personal E-Mail:	qlmkzwg@163.com

Organization:	Energy Systems International B.V.
Street/P.O.Box:	2F No.298 Tianlin Rd.
Building:	
City:	Shanghai
State/Region:	
Postfix/ZIP:	200233
Country:	P. R. China
Telephone:	(8621) 5450 4666
FAX:	(8621) 5490 2166
E-Mail:	Morley_Su@energysystemsintl.com
URL:	www.energysystemsintl.com
Represented by:	Mr. Morley Su
Title:	
Salutation:	
Last Name:	Su
Middle Name:	
First Name:	Morley
Department:	
Mobile:	
Direct FAX:	(8621) 5490 2166
Direct Tel:	(8621) 5450 4666
Personal E-Mail:	Morley_Su@energysystemsintl.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been provided for this CDM project.

Annex 3

BASELINE INFORMATION

Data recommended in the *Notification on Determining Baseline Emission Factor of China's Grid* for the China Southern Power Grid revised using latest values in IPCC2006 are adopted for the proposed project activity.

The following tables summarise the numerical results from the equations listed in the "Tool to calculate the emission factor for an electricity system" (version 01). The information provided by the tables includes data, data sources and the underlying calculations.

1． OM Calculation

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

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	Emission Factor	Oxidation Rate	Average Low Heat Value	CO_2Emissions （tCO_2e）
							（tc/TJ）	（%）	（MJ/t,km3）	I=G*H*F*E*44/12/ 10000（Mass Unit）
		A	B	C	D	E=A+B+C +D	F	G	H	I=G*H*F*E*44/12/ 1000 (Volume Unit)
Raw Coal	Mtons	4491.79	831.84	2169.11	1405.27	**8898.01**	25.8	100	20908	175993455.05
Cleaned Coal	Mtons	0.05				**0.05**	25.8	100	26344	1246.07
Other Washed Coal	Mtons			36.38	20.37	**56.75**	25.8	100	8363	448971.84
Coke	Mtons				0.5	**0.5**	25.8	100	28435	13449.76
Coke Oven Gas	10^9m^3				0.04	**0.04**	12.1	100	16726	2968.31
Other Coke Gas	10^9m^3	3.21			11.27	**14.48**	12.1	100	5227	335797.81
Crude Oil	Mtons	6.85				**6.85**	20	100	41816	210055.71
Gasoline	Mtons	0.02				**0.02**	18.9	100	43070	596.95
Diesel Oil	Mtons	31.9			0.76	**32.66**	20.2	100	42652	1031759.27
Fuel Oil	Mtons	627.22	0.3			**627.52**	21.1	100	41816	20301304.48
Liquefied Petroleum Gas	Mtons					**0**	17.2	100	50179	0.00
Refinery Gas	Mtons	2.85				**2.85**	18.2	100	46055	87592.00
Natural Gas	10^9m^3					**0**	15.3	100	38931	0.00
Other Petroleum Production	Mtons	11.35				**11.35**	20	100	38369	319357.98
Other Coke Production	Mtons					**0**	25.8	100	28435	0.00
Other Energy	Mtons Standard Coal	93.21			22.35	**115.56**	0	100	0	0.00
									Subtotal	**198746555.23**

Data source: China Energy Statistical Yearbook 2004

Electricity generation of the China Southern Power Grid in 2003

Province	Power Generation	Self Power Consumption Rate	Power Supply
	(MWh)	(%)	(MWh)
Guangdong	143351000	5.5	135,466,695
Guangxi	17079000	8.43	15,639,240
Guizhou	43295000	7.4	40,091,170
Yunnan	19055000	8.01	17,528,695
Total			**208,725,800**

Data source: China Electric Power Yearbook 2004.

In 2003, power supplied to China Southern Power Grid from Central China Power Grid is 11,100MWh. Emission factor of Central China Power Grid is 0.7974. Thus it can be calculated that the OM of China Southern Power Grid is 0.9522tCO_2e/MWh based on its total power supply of 208,736,900MWh and the total CO_2 emissions of 198,755,407tCO_2e.

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

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	Emission Factor	Oxidation Rate	Average Low Heat Value	CO_2Emissions （tCO_2e）
							（tc/TJ）	（%）	（MJ/t,km3）	I=G*H*F*E*44/12/ 10000（Mass Unit）
		A	B	C	D	E=A+B+C +D	F	G	H	I=G*H*F*E*44/12/ 1000 (Volume Unit)
Raw Coal	Mtons	6017.7	1305	2643.9	1751.28	**11717.88**	25.8	100	20908	231767573.55
Cleaned Coal	Mtons	0.21				**0.21**	25.8	100	26344	5233.50
Other Washed Coal	Mtons					**0**	25.8	100	8363	0.00
Coke	Mtons					**0**	25.8	100	28435	0.00
Coke Oven Gas	10^9m^3					**0**	12.1	100	16726	0.00
Other Coke Gas	10^9m^3	2.58				**2.58**	12.1	100	5227	59831.38
Crude Oil	Mtons	16.89				**16.89**	20	100	41816	517932.98
Gasoline	Mtons					**0**	18.9	100	43070	0.00
Diesel Oil	Mtons	48.88			1.83	**50.71**	20.2	100	42652	1601975.28
Fuel Oil	Mtons	957.71				**957.71**	21.1	100	41816	30983494.25
Liquefied Petroleum Gas	Mtons					**0**	17.2	100	50179	0.00
Refinery Gas	Mtons	2.86				**2.86**	18.2	100	46055	87899.34
Natural Gas	10^9m^3	0.48				**0.48**	15.3	100	38931	104833.40
Other Petroleum Production	Mtons	1.66				**1.66**	20	100	38369	46707.86
Other Coke Production	Mtons					**0**	25.8	100	28435	0.00
Other Energy	Mtons Standard Coal	79.42				**79.42**	0	100	0	0.00
									Subtotal	**265175481.54**

Data source: China Energy Statistical Yearbook 2005

Electricity generation of the China Southern Power Grid in 2004

Province	Power Generation	Self Power Consumption Rate	Power Supply
	(MWh)	**(%)**	**(MWh)**
Guangdong	169389000	5.42	160,208,116
Guangxi	20143000	8.33	18,465,088
Guizhou	49720000	7.06	46,209,768
Yunnan	24322000	7.56	22,483,257
Total			**247,366,229**

Data source: China Electric Power Yearbook 2005.

In 2004, power supplied to China Southern Power Grid from Central China Power Grid is 10,951,240MWh. Emission factor of Central China Power Grid is 0.8264. Thus it can be calculated that the OM of China Southern Power Grid is 1.0616tCO_2e/MWh based on its total power supply of 258,317,469MWh and the total CO_2 emissions of 274,226,117tCO_2e.

Calculation of simple OM emission factor of the China Southern Power Grid in 2005

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	Emission Factor	Oxidation Rate	Average Low Heat Value	CO_2Emissions（tCO_2e）
							（tc/TJ）	（%）	（MJ/t,km3）	I=G*H*F*E*44/12/ 10000（Mass Unit）
		A	B	C	D	E=A+B+C +D	F	G	H	I=G*H*F*E*44/12/ 1000 (Volume Unit)
Raw Coal	Mtons	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	20908	263442601.85
Cleaned Coal	Mtons				0.15	**0.15**	25.8	100	26344	3738.21
Other Washed Coal	Mtons			10.39	33.88	**44.27**	25.8	100	8363	350237.59
Coke	Mtons	4.79			8.05	**12.84**	25.8	100	28435	345389.71
Coke Oven Gas	10^9m^3				0.79	**0.79**	12.1	100	16726	58624.07
Other Coke Gas	10^9m^3	1.87			15.96	**17.83**	12.1	100	5227	413485.84
Crude Oil	Mtons	10.91				**10.91**	20	100	41816	334555.88
Gasoline	Mtons	0.68				**0.68**	18.9	100	43070	20296.31
Diesel Oil	Mtons	31.96	2.02		1.81	**35.79**	20.2	100	42652	1130638.84
Fuel Oil	Mtons	887.21				**887.21**	21.1	100	41816	28702703.26
Liquefied Petroleum Gas	Mtons					**0**	17.2	100	50179	0.00
Refinery Gas	Mtons	4.92				**4.92**	18.2	100	46055	151211.46
Natural Gas	10^9m^3	0.93				**0.93**	15.3	100	38931	203114.71
Other Petroleum Production	Mtons	1.7				**1.7**	20	100	38369	47833.35
Other Coke Production	Mtons					**0**	25.8	100	28435	0.00
Other Energy	Mtons Standard Coal	104.66	133.15		59.72	**297.53**	0	100	0	0.00
									Subtotal	**295204431.07**

Data source: China Energy Statistical Yearbook 2006

Electricity generation of the China Southern Power Grid in 2005

Province	Power Generation	Self Power Consumption Rate	Power Supply
	(MWh)	(%)	(MWh)
Guangdong	176453000	5.58	166,606,923
Guangxi	25023000	7.95	23,033,672
Guizhou	58430000	7.34	54,141,238
Yunnan	27281000	6.94	25,387,699
Total			**269,169,531**

Data source: China Electric Power Yearbook 2006.

In 2005, power supplied to China Southern Power Grid from Central China Power Grid is 96,363,000MWh. Emission factor of Central China Power Grid is 0.7712. Thus it can be calculated that the OM of China Southern Power Grid is 1.0109tCO_2e/MWh based on its total power supply of 365,532,531MWh and the total CO_2 emissions of 369,521,975tCO_2e.

Therefore, the EF_{OM} of South China Power Grid is **1.0119tCO_2e/MWh**

2．BM Calculation:

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

		Guangdong	**Guangxi**	**Guizhou**	**Yunan**	**Total**	**Average low caloric value ($kJ/kg,m^3$)**	**Effective CO_2 emission factor (tc/TJ)**	**Oxidation Rate**	**CO_2 Emissions (tCO_2e)**
Fuel	Unit	A	B	C	D	E=A+…+D	F	G	H	I= E*F*G*H*44/12
Raw coal	Mt	66.9647	14.35	32.1231	19.7555	133.1933	20,908	25.8	1	263,442,602
Cleaned coal	Mt	0	0	0	0.0015	0.0015	26,344	25.8	1	3,738
Other washed coal	Mt	0	0	0.1039	0.3388	0.4427	8,363	25.8	1	350,238
Coke	Mt	0.0479	0	0	0.0805	0.1284	28,435	25.8	1	345,390
Sub-total										**264,141,967**
Crude oil	Mt	0.1091	0	0	0	0.1091	41,816	20	1	334,556
Gasoline	Mt	0.0068	0	0	0	0.0068	43,070	18.9	1	20,296
Kerosene	Mt	0	0	0	0	0	43,070	19.6		0
Diesel Oil	Mt	0.3196	0.0202	0	0.0181	0.3579	42,652	20.2	1	1,130,639
Fuel Oil	Mt	8.8721	0	0	0	8.8721	41,816	21.1	1	20,702,703
Other Petroleum Products	Mt	0.017	0	0	0	0.017	38,369	20	1	47,833
Sub-total										**30,236,028**
Natural gas	10^9m^3	0.093	0	0	0	0.093	38931	15.3	1	203,115
Coke Oven Gas	10^9m^3	0	0	0	0.079	0.079	16,726	12.1	1	58,624
Other Coal Gas	10^9m^3	0.187	0	0	1.596	1.783	5,227	12.1	1	413,486
Liquefied Petroleum Gases	Mt	0	0	0	0	0	50,179	17.2	1	0
Refinery Gas	Mt	0.0492	0	0	0	0.0492	46,055	18.2	1	151,211
Sub-total										**826,436**
Total										**295,204,431**

Source: China Energy Statistical Yearbook (2006)

Step2. $EF_{Thermal}$ calculation

From Table below, λ_{Coal} = 89.48%,
λ_{Oil} = 10.24%,
λ_{Gas} =0.28%.

Therefore, the thermal power emission factor of the grid is determined as follows:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal} + \lambda_{Oil} \times EF_{Oil} + \lambda_{Gas} \times EF_{Gas} = \mathbf{0.9117tCO_2e/MWh}$$

Step3. EF_{BM} Calculation

Installed capacity of the China Southern Power Grid in 2005

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	35182.6	4931.2.1	4758.4	9634.8	54507
Hydro power (MW)	9035.7	6085.3	7993.1	7233	30347.1
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	83.4
Total (MW)	48081.7	11016.5	12751.5	16867.8	88717.5

Data source: China Electric Power Yearbook 2006, of which the Tianshengqiao Power Plant is involved in the data of Guizhou.

Installed capacity of the China Southern Power Grid in 2004

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	30172.9	4378.1	4306.9	7801.8	46659.7
Hydro power (MW)	8584.6	5040.4	7058.6	6896.5	27580.1
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	83.4
Total (MW)	42621	9418.5	11365.5	14698.3	78103.3

Data source: China Electric Power Yearbook 2005, of which the Tianshengqiao Power Plant is involved in the data of Guizhou.

Installed capacity of the China Southern Power Grid in 2003

	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Thermal power (MW)	27231.4	3190.1	3556.8	6465.8	0	40444.1
Hydro power (MW)	8107.2	4525.2	6543.2	3713.7	2520	25409.3
Nuclear power (MW)	3780	0	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	0	83.4
Total (MW)	39202	7715.3	10100	10179.5	2520	69716.8

Data source: China Electric Power Yearbook 2004.

Installed capacity of the China Southern Power Grid in 2002

	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Thermal power (MW)	25237.8	3156.2	2932.7	4642.5	0	35969.2
Hydro power (MW)	7775.3	4363.3	5836.3	2426.1	2520	22921
Nuclear power (MW)	2790	0	0	0	0	2790
Wind power and Other (MW)	76.8	0	0	0	0	76.8
Total (MW)	35879.9	7519.5	8769.1	7068.6	2520	61757.1

Data source: China Electric Power Yearbook 2003.

Calculation of BM emission factor of the China Southern Power Grid

	Installed capacity in 2003 (MW) A	Installed capacity in 2004 (MW) B	Installed capacity in 2005 (MW) C	Capacity additions from 2003 to 2005 (MW) D=C-A	Share in total capacity additions
Thermal power	40444.1	46659.7	54507	14062.9	74.01%
Hydro power	25409.3	27580.1	30347.1	4937.8	25.99%
Nuclear power	3780	3780	3780	0	0.00%
Wind power and Other	83.4	83.4	83.4	0	0.00%
Total	69716.8	78103.2	78103.2	19000.7	100.00%
Share in total installed capacity of 2004	78.58%	88.04%	100%		

$EF_{BM,y}$ =0.9117×74.01%=0.6748 tCO_2e/MWh.

Therefore, the EF_{ELEC} of South China Power Grid is:
$EF_{ELEC} = 0.5*EF_{OM}+0.5*EF_{BM} = 0.5*1.0119+0.5*0.6748 =$ **0.84335tCO_2e/MWh**

Annex 4

MONITORING INFORMATION

CDM Monitoring & Quality Control Manual

1. Project Monitoring Systems

1.1 Monitoring Systems & Instruments

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

Table 1 Information of the Monitoring Instruments of the Proposed Project

Symbol	Instrument	Precision	Purpose	Monitoring Frequency
C	Methane concentration meter	<10%	Measure methane concentration in CMM imported to generators	Hourly
F	Gas flow meter	<2%	Measure CMM flow rate imported to generators	Continuous
E	Ammeter	≤2% class2	Measure electricity generated	Continuous
E0	Ammeter	≤2% class2	Measure electricity by the power generation	Continuous
s	Regular sampling		Monitor NMHC concentration in CMM	Annually
TH	Calorimeter	<2%	Measure heat recovered by waste heat recovery system	Continuous

1.2 Data monitoring and recording

1) Electricity monitoring (E0& E1)

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

2) CMM flow rate & Methane concentration (F&C)

In this project, coal mine gas flow rate and concentration monitoring are achieved by collecting electric signal. The probe is installed in the gas pipeline. The collected signal is automatically converted for exportation.

3) Waste heat recovered (TH)

Waste heat recovered is continuously measured by the calorimeter. The collected is automatically converted for exportation.

4) NMHC monitoring (s)

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

1.3 Data keeping and recording procedure

All the signals collected on site will be exported to the control centre for data recording and storage. The day to day electric data will be saved in the computer and printed out for filing each month. The assigned person will be responsible to make file list. All the electric files will be backed up, well kept and filed. All the files will be examined every month by the project owner and signed. All the data will be kept two years after the crediting period.

1.4 Instruments maintenance and emergency handling

For monitoring methane consumed by the project, there is an extra set of monitoring equipment as standby. When there is something wrong with the working system or the instruments are sent to be calibrated, the standby equipment will be used. If the standby equipment is not installed in time, the emission reductions in this period will not be counted.

Ammeters used in the project are maintained according to the requirements of local grid company. When ammeter E0 does not work, the power consumed by the project will be conservatively calculated as that of equipment operated at maximum load over that period of time until ammeter can be used again. There is standby for ammeter E so that power supplied by the project can be monitored when something is wrong with the instrument or the meter needs to be calibrated. If the standby ammeter does not work, emission reductions associated with electricity substitution will not be counted.

As for heat recovered by the project, if TH is not available for working, then this part of emission reductions will not be counted.

If malfunction occurs in power generators or waste heat recovery equipment, methane supply pipelines will be closed. Thereby this period do not generate GHG Emission Reductions. If gas-supplying pipelines do not close in time, gas flux value monitored during machine malfunction should be deducted from the total gas flux monitored, for ensuring conservativeness of Emission Reductions calculation.

When errors resulting in data highly discrepancy or missing, etc. occur in the process of monitoring methane consumption, conservative measures will be adopted to calculate Emission Reductions as follows:

In a period of time, without taking into account data monitored by flow meter and concentration meter, calculation of emission reductions means calculating methane quantity that have been consumed by engines for generating a certain amount of electricity. Electricity generation of this period is measured and low calorific value of methane is determinate. Power transformation efficiency of the generators in this project is around 35%, and generally not more than 42%. For conservativeness, when errors result in data discrepancy or missing in the process of methane flux and concentration monitoring, power transformation efficiency of 50% is adopted to calculate emission reductions of the project. It can also be demonstrated that emission reductions calculation in this way is fully conservative according to project practice in the past year.

2. Project management

2.1 Project Management Structure

The project owner assigns the project manager for the whole monitoring. One QA/QC auditor and one training staff will assist the manager for monitoring management. See Figure B-3

2.2 Position Responsibilities

Power generation & waste heat recovery system operation and data recording & storage positions include three teams rotating every 8 hours.

Each position has the following responsibilities:

- Power generation & waste heat recovery system operation： Ensuring normal operation of compressors, generator sets, waste heat recovery equipment and all the other monitoring instruments. When malfunction appears in monitoring instrument, the operator is supposed to contact the producers for maintenance and replace. At the same time, he is responsible for spare meters operation.
- Data recording and saving staff: Two people are responsible for data handling. Staff A is responsible for supervising, controlling all the instruments, and reading data timely. Staff B is responsible for supervising accuracy of data reading, data saving and reporting. When malfunction occurs in monitoring instrument, Staff B should assist the power generation operator to complete tasks, such as monitoring and data reading.
- Employee training: periodic training operator, supervising and controlling (new) staff and assisting quality assurance staff and project manager to complete internal verification. The contents of training are described in Section 2.3.
- QA/QC auditor: responsible for data recording and periodic internal verification, including data keeping in the archives and documents numbering, checking data saved, inspecting behaviour criterion of operator on site and central controlling staff, participating in employee training.
- Project manager: responsible for implementing of the whole monitoring plan including internal staff management, operation process controlling, communication with external party (consulting party and DOE).

2.3 Employee Training

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

Employee training mainly includes:

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

B. Daily management system, operation specification and equipment maintenance
   - Position responsibilities and operation management system introduction

- Operation rules and safety operation notes of generators
- Daily maintenance and repair of generators and CMM boilers.

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

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

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

3. QA & QC

Quality assurance& verification personnel will carry out termly internal verification of project, contents of the verification including operation specification of staff on site, operation status of monitoring instruments, data reading, record keeping and emergency measures, etc. And simulated tests will be carried out if necessary.

The quality assurance and quality control procedure is perfected based on the requirement of CDM. Most of the required data is monitored, recorded, and archived automatically by computer. All the workers are trained in advance in order to make sure the exactitude of reading and appropriateness of monitoring operation. In each coal mine, the operations and data will be examined by the QA/QC auditor termly.

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

To insure accuracy, power generated by the project will be crosschecked by monthly settlement receipt; methane consumed for power generation can be crosschecked by calculation according to power generated.

Internal audit will be carried out periodically, which aims to ensure the rationality of data collection, accuracy of the value recording, appropriateness of data reporting and recording and the conservative of ER calculation. All these procedures are essential to ensure that the ER can be honestly, transparently and effectively verified