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

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

Beijing Taiyanggong CCGT Trigeneration Project

Version 6

Date of completion: 19 July 2007

A.2. Description of the project activity:

The Beijing Taiyanggong CCGT Trigeneration Project (hereinafter referred to as "the project") proposes to install and operate a 780MW grid connected natural gas fired combined cycle power plant in the Taiyanggong area of Chaoyang District in Beijing.

The project will supply electricity to the Beijing grid (a fully integrated subsidiary of the North China Power Grid), the net annual power output of the project will be 3,266 GWh. In addition, the project will supply waste steam for heating and cooling to an area of 40 km^2 so that 78 existing boilers with a low efficiency will be removed. Only emissions reductions from electricity generated are claimed however.

The project comprises of the following activities:

- Installation of two sets of natural gas-fired combined cycle power generation units (including gas turbines, heat recovery steam generators, a steam turbine and power generators). The total capacity will be 780MW;
- Installation of two sets of diesel power generation units to supply electricity to shutdown turbines smoothly and safely;
- Installation of natural gas compressors;
- Installation of a monitoring and control system
- Installation of auxiliary systems to support the gas-steam combined cycle

In this system, natural gas is sent to the gas turbine for power generation. The flue gas is then sent to the heat recovery steam generator to generate steam with a high temperature and pressure. This steam drives the steam turbine to generate more electrical power.

The project will contribute to both local and global sustainable development in a number of ways:

- The project will lead to a reduction in greenhouse gas emissions compared to a business as usual approach;
- The project will reduce other pollutants (including SO_2, NO_X and particulates) resulting from the power generation industry in China, compared to a business as usual approach, thereby improving local environmental quality;
- The project will provide flexible generation capacity with rapid start-up and shut-down, meaning that it is suitable to serve as a source to regulate peak-loads, helping to improve the quality of the

power grid;
- The project will provide local employment for about 200 people.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*) (as applicable)**	**Party involved wishes to be considered as project participant (Yes/No)**
People's Republic of China (Host)	Beijing Taiyanggong Gas-fired Thermal Power Co. (Project Owner)	No
United Kingdom of Great Britain and Northern Ireland	Camco International Limited (Purchasing Party)	No
United Kingdom of Great Britain and Northern Ireland	Macquarie Bank Limited (Purchasing Party)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Beijing

A.4.1.3. City/Town/Community etc:

Chaoyang District

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

The project is located in the north-east of Beijing in Chaoyang District, between the North Third Ring-road and the North Fourth Ring-road. The site is 0.5km from the Fourth Ring-road in the north and 0.5km from Laiguangying Road. The site is about 450m long from north to south and between 120 and 260m wide, from east to west. The total land area for the project is 76,000 m^2. The geographical co-ordinates are:

39.967°N, 116.417°E

Figures 1 and 2 show the location of the project.

Figure 1: Map of the location of the proposed project in China

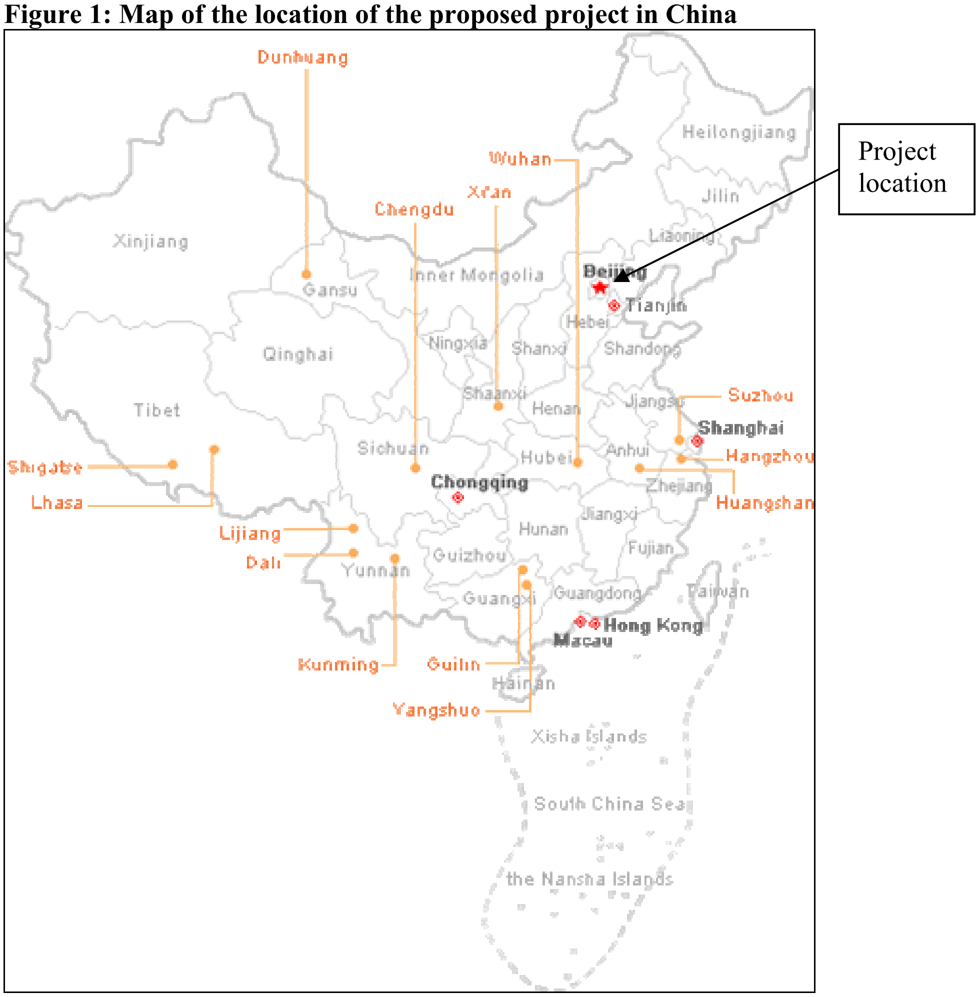
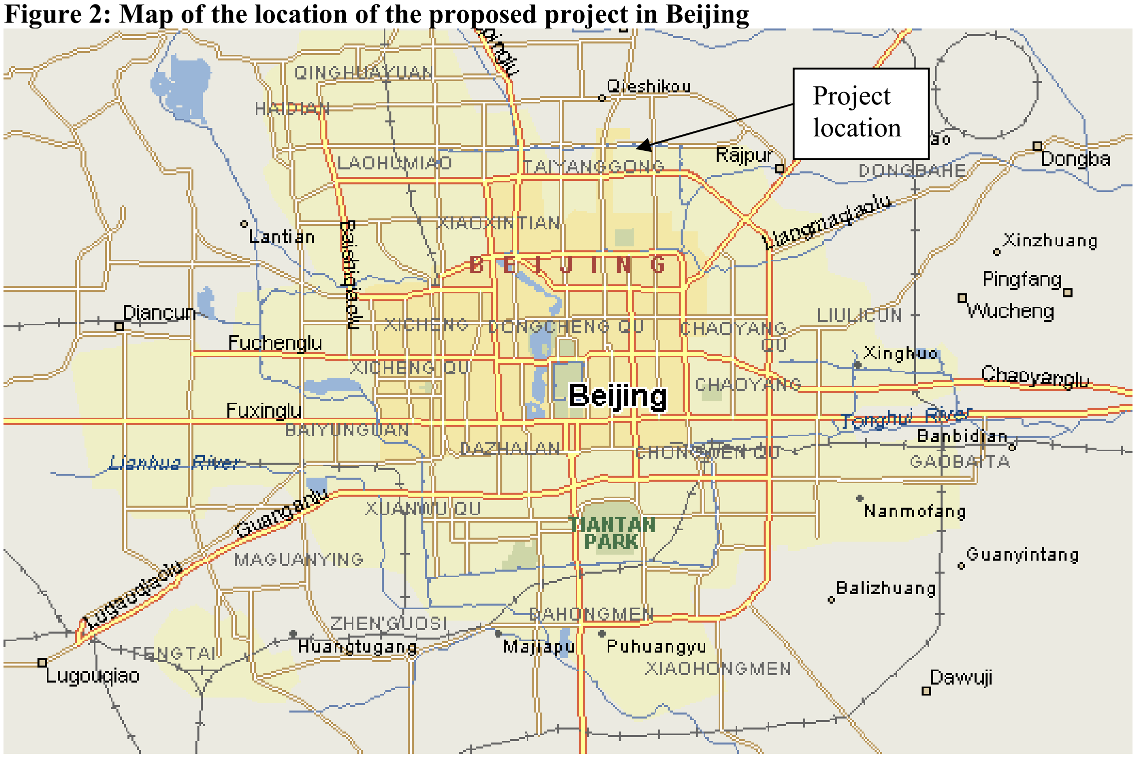


Figure 2: Map of the location of the proposed project in Beijing



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

Sectoral Scope 1: Energy Industries (non-renewable resources)

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

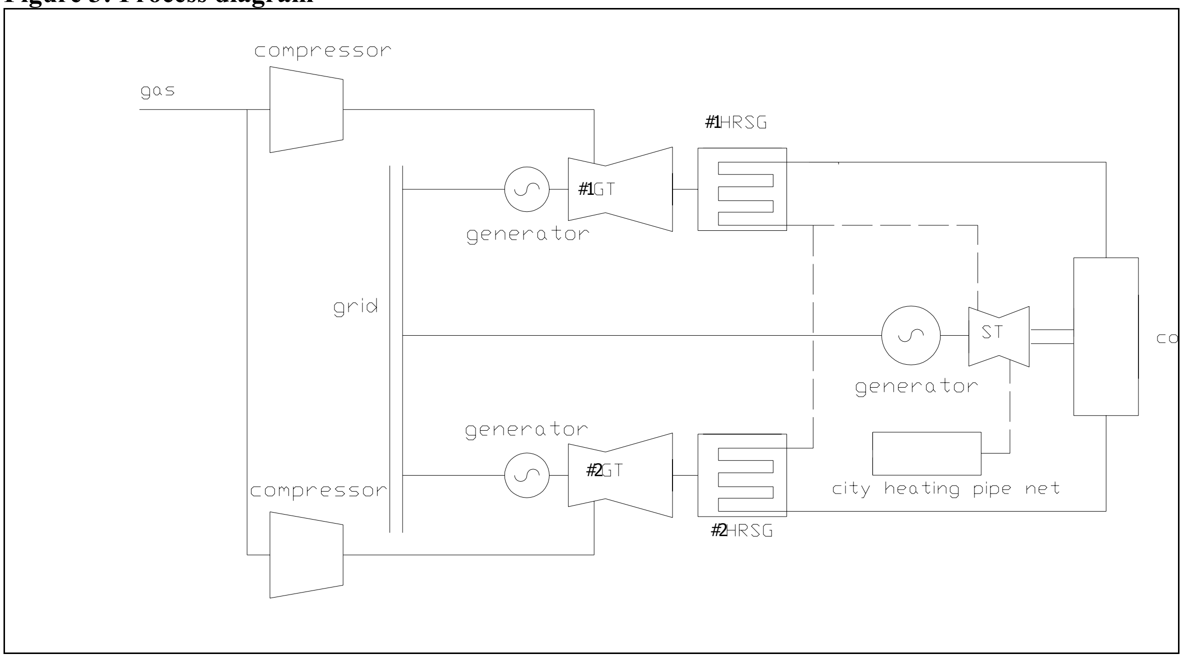
The project will comprise the following activities:

- Installation of a 780MW natural gas-fired combined cycle power generation system. This will consist of:
  - Two PG9351 gas turbines, (manufactured by GE and imported to China) and one LN273/CC1545-11.47/0.613/0.294/566/566 steam turbine (manufactured in Harbin, China) to give an overall efficiency of 58% for electricity generation[1]
  - 2 heat recovery steam generators (produced by CMI HRSG, a division of the Belgian Group Cockerill Maintenance Ingenierie, but manufactured in China)
- Installation of two sets of diesel power generation units (2 x 800kW) to supply electricity to shutdown turbines smoothly and safely;
- Installation of natural gas compressors;
- Installation of a monitoring and control system;
- Installation of auxiliary systems to support the gas-steam combined cycle.

[1] Efficiency as quoted in equipment supply contract from manufacturer

In this system, natural gas is sent to the gas turbine for power generation. The flue gas is then sent to the heat recovery steam generator to generate steam with a high temperature and pressure. This steam drives the steam turbine to generate more electrical power.

Figure 3: Process diagram



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

The selected crediting period for the project is renewable – 3 x 7 years. The estimated emissions reductions for the first crediting period are given below:

Table 1: Estimated emissions reductions during the crediting period

Years	Annual estimation of emission reductions in Tonnes of CO_2 e
2007 (1.5 months)	189,536
2008	1,516,289
2009	1,516,289
2010	1,516,289
2011	1,516,289
2012	1,516,289
2013	1,516,289
2014 (10.5 months)	1,326,753
Total estimated reductions (tonnes of CO_2e)	**10,614,025**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**1,516,289**

A.4.5. Public funding of the project activity:

There are no public funds involved in the project activity.

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:

The baseline and monitoring methodology used is AM0029: "Grid Connected Electricity Generation Plants using Natural Gas" (AM0029/ version 01.1, sectoral scope 01, 19 May 2006)[2].

ACM0002: "Consolidated methodology for grid-connected electricity generation from renewable sources" (ACM0002/ version 06, sectoral scope 1, 19 May 2006)[3] is used to calculate the build margin and combined margin.

The additionality of the project activity is demonstrated and assessed using the "Tool for the demonstration and assessment of additionality" (Version 2)[4].

For more information, see http://cdm.unfccc.int/meth/approved.

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

The AM0029 baseline methodology and accompanying monitoring methodology are applicable to the Taiyanggong Natural Gas-Fired Combined Cycle Power Plant project because the proposed project meets all the applicability criteria stated in the methodology:

1. The proposed project will involve electricity capacity additions of 780MW from new gas-fired generation plant

2. The geographic and system boundary of the North China Power Grid can be clearly identified and information on the characteristics of the grid is available (refer to section B3)

3. There is sufficient gas supply in the region for the project. Natural gas for the project will be supplied via the Shaanjing Number 2 line which will bring gas from the Changqing gas field in western China to Beijing. Total natural gas reserves in this gas field amount to 4180 billion m^3 [5]. The present proved rate of the resource is only 8.2% meaning that the back-up resource is sufficient and the exploration potential is large.

   The combined total gas supply volume to Beijing from ShaanJing number 1 and number 2 lines is estimated to be 9.1 billion m^3 of natural gas each year, of which this project will use approximately 730

[2] http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

[3] ibid

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

[5] Beijing Guodian Huabei Power Engineering Co. Ltd., Beijing Taiyanggong Gas-fired Trigeneration Power Project Feasibility Study Report, June 2005

million m^3. Demand for natural gas in Beijing is growing and is predicted to reach 5.8 billion m^3 in 2008, and 8.5 billion m^3 2014[6].

On 14 December 2006, the Shaanjing Number 2 line began operation, supplying additional natural gas to Beijing from Changbei Natural Gas Station (which is part of the Changqing Oilfield Corporation). Total annual gas output is estimated to be 3 billion m^3 [7].

These figures indicate that sufficient natural gas will be available in Beijing for the project and that natural gas supply in the region will not be constrained by the use of natural gas in this project.

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

According to AM0029/ Version 01.1, in the calculation of project emissions, only CO_2 emissions from fossil fuel combustion at the project plant are considered. In the calculation of baseline emissions, only CO_2 emissions from fossil fuel combustion in power plants in the baseline are considered.

The greenhouse gases included in or excluded from the project boundary are listed as follows:

Table 2: Overview of emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Fossil fuel use	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	On-site fuel combustion due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

The Taiyanggong Natural Gas-Fired Combined Cycle Power Plant Project is situated in Beijing which is part of the North China Power Grid (NCPG). According to newly published information by the China DNA relating to the division of the regional power grids, this grid, historically, covered the provinces of Beijing, Tianjin, Hebei, Shanxi and Inner Mongolia. At the end of 2004, an interconnection was made between the NCPG and the previously independent Shandong power grid. For the purposes of this analysis therefore, the project boundary selected is Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong. Data is easily available from the China DNA, the annually published China Electric Power Yearbook and the annually published China Energy Statistical Yearbook.

Net exports from the province were about 3% in 2005 (see table 3 below).

[6] http://english.people.com.cn/200404/13/eng20040413_140287.shtml

[7] http://www.cnpc.com.cn/Paper/2006/12/19/Plate1/005.htm

Table 3: Transfers to and from the NCPG

	2000	2001	2002	2003	2004	2005
Total imports (100 GWh)	256.65	281.49	288.82	315.56	382.86	578.3
Total exports (100 GWh)	379.87	431.04	487.25	518.36	559.74	760.8
Total net transfers (100 GWh)	-123.22	-149.55	-198.43	-202.8	-176.88	-182.5
Total generation (100 GWh)	5581.4778	6086.24	6871.52	7795.82	8933.43	6210.16
%imports/ exports	-2%	-2%	-3%	-3%	-2%	-3%

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

According to Version 01.1 of AM0029, the following steps are used to define the baseline scenario

Step 1: Identify plausible baseline scenarios

Alternatives to be analysed should include:
A. The project activity not implemented as a CDM project;
B. Power generation using natural gas, but technologies other than the project activity;
C. Power generation technologies using energy sources other than natural gas;
D. Import of electricity from connected grids, including the possibility of new interconnections.

According to AM0029, these alternatives need not consist solely of power plants of the same capacity (i.e. several smaller plants, or the share of a larger plant may be a reasonable alternative to the project activity), but that they should: 1) deliver similar services (e.g. peak vs. baseload power); 2) include all relevant power plant technologies that have recently been constructed or are under construction or are being planned; and 3) exclude baseline scenarios that are not in compliance with all applicable legal and regulatory requirements.

The project activity will increase the installed capacity of the North China Power Grid (NCPG). The project activity is characterized by rapid startup/shutdown speed and flexible operation, suitable to serve as a regulating power source and therefore improves the operation quality of the power grid.

Potential baseline scenarios are listed in table 4 below.

Table 4: Baseline scenarios

Alternatives	**Plausibility / Eligibility**
A. The project activity not implemented as a CDM project	
Natural Gas CCGT	Plausible and meets eligibility criteria.
B. Power generation using natural gas, but technologies other than the project activity	
Natural Gas Open-Cycle	Not plausible. Open cycle plants are not economical for capacities as high as 700MW, due to their relatively low levels of efficiency.
C. Power generation technologies using energy sources other than natural	

gas	
Coal Super-critical	Plausible and meets eligibility criteria. 2 x 600MW plant is selected[8] for levelised cost analysis.
Coal Sub-critical	Plausible and meets eligibility criteria. According to statistics published by the China DNA, of new thermal power plants built between 2000-2005, 21% of new units were 600MW, 60% of new units were 300MW and above and the remainder had a unit capacity of less than 300MW per unit[9]. Therefore, 2 x 300MW and 2 x 600MW plant is selected for levelised cost analysis.
Oil	Not plausible. The use of fuel oil in the NCPG declined by over 65% between 2002 and 2005, and so cannot be seen as part of current or future power plant technologies[10].
Nuclear	Not plausible. There is currently no nuclear power in the NCPG. Further, nuclear power would not deliver similar services to the project.
Hydro	Not plausible. There are minimal hydro resources in north China and due to the long timelines for the development of projects; hydro power would be unable to provide regulation to the NCPG in the short to medium term.
Wind	Not plausible. Wind power plants have low plant load factors and so could not meet the 780MW capacity requirement. The intermittent nature of electricity generated by wind power means that wind could not act as a regulating power source.
D. Import of electricity from connected grids, including the possibility of new interconnections	
Import from neighbouring power grids	Not plausible. As can be seen above in Table 3 the NCPG has been a net exporter for the past 5 years, and so it is unlikely that neighbouring grids will be able to provide it with additional capacity.

To summarise, the following scenarios are deemed to be plausible and meet the baseline criteria:

A – New sub-critical coal plant (2 x 300MW)
B – New sub-critical coal plant (2 x 600MW)
C – New super-critical coal plant (2 x 600MW)
D – Project activity (Natural Gas CCGT) not under taken as a CDM project

[8] China Institute of Power Planning and Design, Thermal Power Engineering Design Reference Cost Index, 2005 edition

[9] http://cdm.ccchina.gov.cn/website/CDM/upfile/file1051.pdf

[10] According to the China Energy Statistical Yearbook, 359,500 tonnes of fuel oil were used to generate electricity on the NCPG in 2002 and just 125,400 tonnes in 2005, a reduction of over 65%.

Step 2: Identify the economically most attractive baseline scenario alternative.

According to Version 01.1 of AM0029, the economically most attractive baseline scenario alternative is identified using levelised cost as a financial indicator. The levelised cost is therefore calculated for scenarios A,B,C and D above.

The basic levelised cost methodology used in this PDD is based on Annex 5 of 'Projected Costs of Generation Electricity: 2005 update' published by IEA[11]. The formula applied to calculate the levelised electricity generation cost (EGC) is the following:

$$EGC = \frac{\Sigma_t [(I_t + M_t + F_t)(1+r)^{-t}]}{\Sigma_t [E_t (1+r)^{-t}]}$$

With:
- EGC: Average lifetime levelised electricity generation cost per kWh
- I_t: Capital expenditure in the year t
- M_t: Operation and maintenance expenditures in the year t
- F_t: Fuel expenditure in the year t
- E_t: Electricity generation in the year t
- r: Discount rate

Table 5: Assumptions and Parameters for Levelised Cost Calculations

	A. Sub-critical coal plant (2x300MW)[1]	**B. Sub-critical coal plant (2x600MW)[1]**	**C. Super-critical coal plant (2x600MW)[1]**	**D. CCGT (780MW)[2]**	**Unit**
Construction period	3	3	4	2	years
Lifetime	25	25	25	20	years
Operating hours	5,000	5,000	5,000	4,528	hours pa
Capital Cost	2,757,600,000	4,498,120,000	4,702,800,000	2,184,359,339	RMB
Coal Expenditure[3]	210	210	210	n/a	RMB/ tonne
Gas Expenditure	n/a	n/a	n/a	1.3485	RMB/ m^3
Coal used[4]	945,000	1,890,000	1,794,000	n/a	tonne
Gas used	n/a	n/a	n/a	484,795,046	m3
Fuel Expenditure	198,450,000	396,900,000	376,740,000	653,746,120	RMB
Electricity Generation	2,781,000	5,562,000	5,616,000	3,266,032	MWh
Discount Rate	0.08	0.08	0.08	0.08	
Material expenditure	*n/a*	*n/a*	*n/a*	*9,032,876*	*RMB*
Other O&M expenditure	*42,260,000*	*71,360,000*	*71,360,000*	*16,259,177*	*RMB*
Water expenditure	*21,000,000*	*36,000,000*	*36,000,000*	*4,128,133*	*RMB*
Desulferisation expenditure	*3,439,800*	*6,879,600*	*6,530,160*	*n/a*	*RMB*
Overhaul of equipment	*68,940,000*	*112,453,000*	*117,570,000*	*65,530,780*	*RMB*
Employee expenditure	*18,720,000*	*19,760,000*	*19,760,000*	*10,263,093*	*RMB*
Total O&M expenditure	154,359,800	246,452,600	251,220,160	105,214,060	RMB
Levelised cost	**0.228**	**0.198**	**0.201**	**0.303**	**RMB/ kWh**

[1] China Institute of Power Planning and Design, Thermal Power Engineering Design Reference Cost Index, 2005 edition

[2] Taiyanggong Natural Gas-Fired Combined Cycle Power Plant Project Feasibility Study Report. According to the FSR, the ratio of electricity generated: heat generated is 2:1. To ensure conservativeness, costs above are for the electricity element only.

[3] Typical coal price for the NEPN area. Based on coal price used in financial analysis in Shanxi Zhongshan FSR

---

[11] IEA, Projected Costs of Generating Electricity, 2005 update

Based on the above parameters and the levelised cost calculation formula, the levelised cost of each plausible generation technology can be calculated, and a sensitivity analysis performed.

Table 6: Results and Sensitivity Analysis for Levelised Cost Calculations

		Load Factor				
	Levelised Cost	(+)20%	(+)10%	0	(-)10%	(-)20%
A. 2x300 MW sub-critical coal plant	0.228	0.190	0.207	0.228	0.253	0.285
B. 2x600 MW sub-critical coal plant	0.198	0.165	0.180	0.198	0.220	0.248
C. 2x600 MW super-critical coal plant	0.201	0.170	0.186	0.201	0.227	0.255
D. 780 MW CCGT	0.303	0.253	0.276	0.303	0.337	0.379

		Fuel Cost				
	Levelised Cost	(+)20%	(+)10%	0	(-)10%	(-)20%
A. 2x300 MW coal plant	0.228	0.242	0.235	0.228	0.221	0.214
B. 2x600 MW sub-critical coal plant	0.198	0.212	0.205	0.198	0.191	0.184
C. 2x600 MW super-critical coal plant	0.201	0.215	0.208	0.201	0.195	0.188
D. 780 MW CCGT	0.303	0.343	0.323	0.303	0.283	0.263

Figure 4: Variation of levelised cost with load factor

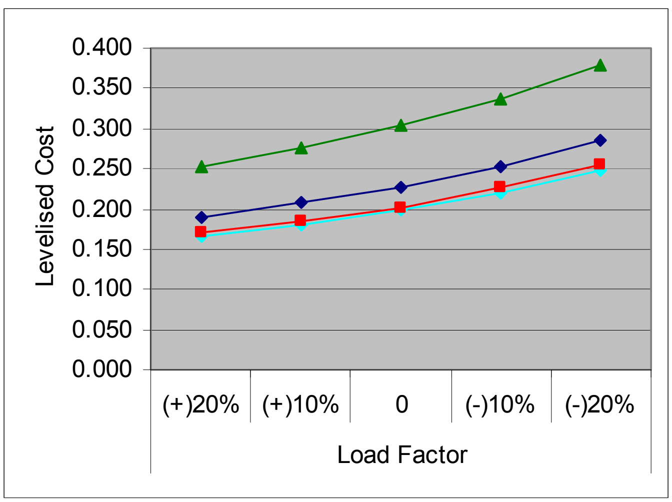
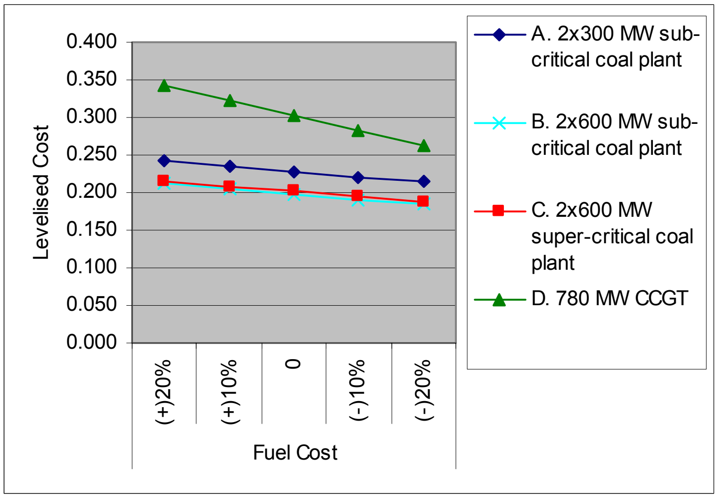


Figure 5: Variation of levelised cost with fuel cost



According to version 01.1 of AM0029, the baseline alternatives with the best financial indicator, i.e. the lowest levelised cost, can be selected as the most plausible scenario.

As can be seen above, even with changes in the critical variables of load factor and fuel cost, the 2x600 MW sub-critical coal-fired power plant has the lowest levelised cost. Therefore, the baseline selected is the 2x600 MW sub-critical coal-fired power plant.

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 tool for the demonstration and assessment of additionality is used in AM0029[12]. The tool provides a set of steps to demonstrate and assess additionality. For AM0029, the following steps, with reference to the Taiyanggong CCGT project, are required:

Step 1: Benchmark Investment Analysis. This step consists of the additionality tool step 2, sub-step 2b (Option III: Apply benchmark analysis); sub-step 2c (Calculation and comparison of financial indicators) and sub-step 2d (Sensitivity analysis)
Step 2: Common practice analysis. This step consists of step 4 of the additionality tool
Step 3: Impact of CDM registration. This step consists of step 5 of the additionality tool

Step 1: Benchmark Investment Analysis

With reference to the Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects, issued by the former State Power Corporation of China, the benchmark IRR for this project is 8%[13].

---

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

[13] State Power Corporation of China. Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects. Beijing: China Electric Power Press, 2003.

Calculations and comparison of financial indicators

(1) Basic parameters for calculation of financial indicators

Based on the feasibility study report of the proposed project, the basic parameters for the calculation of financial indicators are shown in the following table**:**

Table 7: Main parameters and assumptions for investment analysis

Parameter	**Value**	**Unit**	**Source**
installed capacity	780	MW	FSR p105
power generation	3,374,000	MWh	FSR p101
auxiliary electricity consumption rate	3.2%		FSR p101
net power generation	3,266,032	MWh	Calculated
heat generation	5,885,000	GJ	FSR p101
construction period	2	years	FSR p101
operation period	20	years	FSR FA
electricity tariff (inc VAT)	480	RMB/MWh	FSR p105
electricity tariff (ex VAT)	411.02	RMB/MWh	FSR p105
heat tariff (inc VAT)	25.96	RMB/ GJ	FSR p105
heat tariff (ex VAT)	23	RMB/ GJ	FSR p105
gas price (inc VAT)	1.55	RMB/ m3	FSR p105
gas price (ex VAT)	1.35	RMB/ m3	Calculated
gas consumption pa	727,445,800	m3	FSR p101
Fixed assets	3,277,680,000	RMB	FSR p100
Fixed assets residue	5%		FSR p101
Depreciation pa	6.33%		FSR p101
Depreciation period	15	years	FSR p101
Working capital	86,666,667	RMB	FSR p101
Material expenditure	4.15	RMB/MWh	FSR p101
Other O&M expenditure	7.47	RMB/MWh	FSR p101
Water expenditure	1.90	RMB/MWh	FSR p101
Overhaul of equipment	3%		FSR p101
Employee expenditure	15,400,000	RMB	FSR p101
Equity in fixed assets	20%		FSR p101
Interest rate for loan	6.12%		FSR p101
Repayment period for loan	15	years	FSR p101
Construction tax & Education surcharge	10.0%	of net VAT	FSR p102
Income tax	33%		FSR p102
Reserve	10%		FSR p102
CER revenue pa	145,000,000	RMB	FSR p103

(2) Comparison of IRR for the project and the financial benchmark

The financial indicators (IRR) with and without income from CERs sales as generated through the investment analysis are listed below. Without income from CERs sales, the IRR of the project activity is lower than the benchmark IRR, and the project activity is financially unacceptable. However, with income from CERs sales the project becomes financially attractive.

Table 8: Project IRR

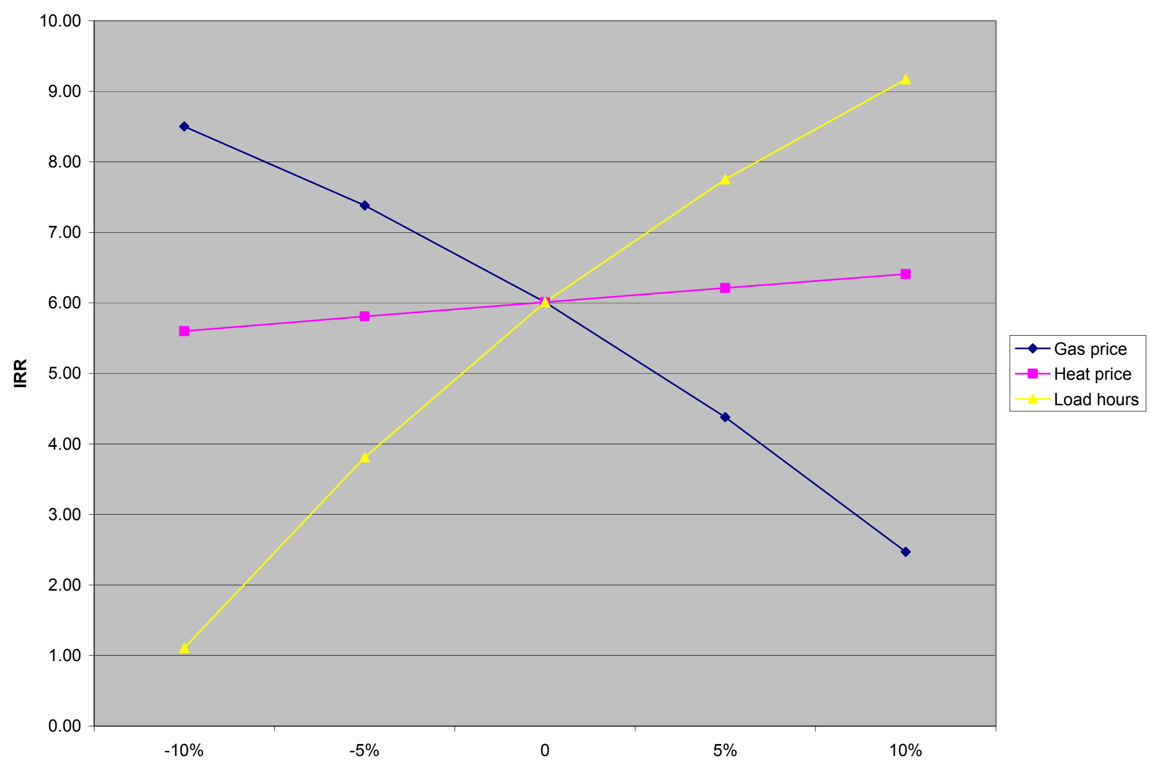
	Without income from CERs	Benchmark	With income from CERs
IRR on total investment	6.01%	8.00%	9.77%

Sensitivity analysis

Three factors are considered in the following sensitivity analysis:
1) Heat sales price
2) Gas price
3) Load hours

Assuming the factors above vary in the range of -10% to +10%, without the revenue from CERs, the IRR of the total investment will change accordingly as can be seen in the figure below.

Figure 6: Sensitivity analysis



As can be seen in figure 6 above, there is very little impact on the IRR due to changes in the heat sales price for the project. Even if the heat sales price is increased by 10%, the IRR of the project activity remains lower than the benchmark, and is not financially attractive.

Changes in gas price have a stronger impact on the IRR and if these costs decline, the IRR can increase to above the benchmark. However, it is unlikely that gas prices will fall over the course of the project as gas prices in China are currently rising and this trend is likely to continue as demand for natural gas increases.

Changes in the load hours and the amount of electricity generated also have a strong impact on the IRR, and if these increase, the IRR can pass the benchmark. However, it is unlikely that the electricity generated by the project will exceed the average annual expectation of 3,374,000 MWh, as the power output of the project is dependent on base load heat demand.

Based on the information above, the sensitivity analysis shows that with reasonable variations in critical assumptions, the IRR of the project activity remains lower than the benchmark. Only with additional income from the sale of CERs does the IRR of the project approach the benchmark of 8%.

Step 2: Common Practice Analysis

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

Table 9: Other CCGT projects in the NCPN area

Location	**Size**	**Details**
Beijing	1 x 350MW	Jingfeng, Power only
Beijing	2 x 250MW	Zhengchangzhuang, CHP
Inner Mongolia	2 x 150MW	Sulige, Power only
Beijing	2 x 60MW	Yizhuang, CHP
Beijing	2 x 50MW	
Tianjin	1 x 56MW	

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

From table 9 above, in the NCPG area, only the Zhengchangzhuang CCGT plant is of a similar size to the Taiyanggong plant. The Zhengchangzhuang plant is also in the process of applying for CDM registration. This demonstrates that all similar activities are also financially unattractive.

This project faces additional financial barriers (compared to other power plant projects of this scale) as it is located within a large city, and therefore additional investment is required. For example, this project faced additional costs in measures to reduce noise levels, installing de-nitrogenation equipment and ensuring safety and security in an urban environment.

In addition to being distinctive for its scale and siting in an urban area, the project activity is undertaking a certain amount of technological risk as it will use GE's PG9351 gas turbines that have not been used extensively in China. There is currently limited experience of operating and maintaining this type of turbine in China.

Step 3: Impact of CDM Registration

When the project activity is successfully approved and registered, the following positive benefits can be predicted:

1. The project will significantly reduce the emissions of the North China Power Grid while increasing capacity, voltage and peaking power.
2. The income from CERs sales will greatly improve the financial indicators of the project activity and increase the financial attractiveness of the project.
3. The use of new turbine technologies in China will lead to improved technical knowledge both on the part of those that are manufacturing the steam generators, and those that are operating and maintaining the overall power plant.
4. The project will set a benchmark for the use of low emission technologies in an urban area, with special consideration taken, and additional investment made, to ensure reduced noise and high levels of environmental protection on the construction and plant site.

It is only through the inclusion of CDM revenues that the project becomes financially attractive and the intention to register the project under the CDM was a determining factor in the decision to proceed with the project[14]. It is therefore concluded that the project is not the baseline scenario and is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to AM0029 (version 01.1), the baseline emission factor (EF_y) can be calculated using the following steps, described below:

Step 1: Calculating Baseline Emissions

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline CO_2 emission factor ($EF_{BL,CO2,y}$), as follows:

$BE_y = EG_{PJ,y} * EF_{BL,CO2,y}$

For construction of large new power capacity additions under the CDM, there is a considerable uncertainty relating to which type of other power generation is substituted by the power generation of the project plant. As a result of the project, the construction of an alternative power generation technology(s) could be avoided, or the construction of a series of other power plants could simply be delayed.

Furthermore if the project were installed sooner than these other projects might have been constructed, its near-term impact could be largely to reduce electricity generation in existing plants. This depends on many factors and assumptions (e.g. whether there is a supply deficit) that are difficult to determine and

[14] Beijing Taiyanggong Gas-fired Trigeneration Power Project – Revised Financial Analysis and Feasibility Study Report, October 2005

that change over time. In order to address this uncertainty in a conservative manner, the lowest emission factor from the following three options for $EF_{BL,CO2,y}$ was used:

- Option 1. The build margin, calculated according to ACM0002; and
- Option 2. The combined margin, calculated according to ACM0002, using a 50/50 OM/BM weight.
- Option 3. The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above, and calculated as follows:

$$EF_{BL,CO2}\,(tCO_2/MWh) = \frac{COEF_{BL}}{\eta_{BL}} * 3.6\ GJ/MWh$$

where,

$COEF_{BL}$: the fuel emission coefficient (tCO_2e/GJ), based on national average fuel data, if available, otherwise IPCC defaults can be used
η_{BL} : the energy efficiency of the technology, as estimated in the baseline scenario analysis above.

According to AM0029, the determination of the build margin and the combined margin will be made based on an ex ante assessment at validation and again at the start of each crediting period. Further, according to AM0029, if either option 1 (BM) or option 2 (CM) are selected as the baseline, they will be estimated ex post, as described in ACM0002.

Sub-step 1.1: Calculating the Operating Margin Emission Factor ($EF_{OM,y}$)

Four methods are suggested in ACM0002 for the calculation of the Operating Margin:

1. Simple OM;
2. Simple adjusted OM;
3. Dispatch data analysis OM; and
4. Average OM.

For this project, the Simple OM was calculated. This was the as only feasible option as:

a) Dispatch data analysis OM (recommended as the first choice option) cannot be calculated as hourly dispatch data for all power plants in the top 10% of the grid system dispatch order is not made publicly available in China;
b) Simple adjusted OM cannot be calculated for the same reason as above (unavailable data);
c) Average OM calculation is not appropriate as the low-cost/must-run resources constitute less than 50% of the total grid generation, as demonstrated in Table 10 below.

Table 10: Power generation by sources in the NCPG over the past 5 more recent years

	Generation (2001) GWh	%	Generation (2002) GWh	%	Generation (2003) GWh	%	Generation (2004) GWh	%	Generation (2005) GWh	%
	China Electric Power Yearbook 2002, page 617		*China Electric Power Yearbook 2003, page 585*		*China Electric Power Yearbook 2004, page 709*		*China Electric Power Yearbook 2005, page 474*		*China Electric Power Yearbook 2006, page 568*	
Thermal	358,066	99.19%	403,919	99.11%	457,675	99.14%	526,772	99.24%	510,886	99.38%
Hydro	2,927	0.81%	3,455	0.85%	3,798	0.82%	3,758	0.71%	2,912	0.57%
Nuclear	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Other (Wind)	0	0.00%	170	0.04%	181	0.04%	274	0.05%	301	0.06%
Total	**360,993**	**100.00%**	**407,544**	**100.00%**	**461,654**	**100.00%**	**530,804**	**100.00%**	**514,099**	**100.00%**

The operating margin (OM) is calculated for the generation mix of the NCPG, excluding zero-emission sources. Emissions of CO_2 for the generation mix of the NCPG can be directly calculated from the data provided in the China Energy Statistical Yearbook (published annually). This yearbook provides annual data on generation by fuel source and by province. The North China Power Grid, once zero emission sources have been removed, consists of thermal power plants, the vast majority of which are powered by coal.

Sub-step 1.2: Calculating the Build Margin Emission Factor ($EF_{BM,y}$)

The BM emissions factor ($EF_{BM,y}$) is the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m,* excluding power plant capacity additions registered as CDM project activities.

The Build Margin is calculated *ex-ante*, based on the most recent information available on plants already built at the time of PDD submission. As such the Build Margin emission factor will be constant throughout the selected crediting period. According to ACM0002 the sample group *m* could consist of either:

- the five power plants that have been built most recently, or
- the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently; whichever comprises the larger annual generation.

The calculation of the Build Margin for this project makes use of aggregated data to identify the 20% most recent capacity additions (sample group *m*). This was identified by direct comparison of the total installed capacity on the North China Power Grid in the most recent year where data is available, in this case 2005, and with historical data from preceding years until the 20% threshold is achieved (refer to Table A3 in Annex 3).

The percentage is calculated as follows:

$$\% \text{ Recent Capacity Additions} = [(C_{2005} - C_{n}) / C_{2005}] * 100$$

Where: C_{2004} is the capacity in 2005 (most recent year for which published data are available); and
C_{n} is the capacity in the reference year *n*.

This provides the percentage of new capacity additions that have been added since year *n*.

It will not always be possible to determine exactly the most recent 20% of capacity additions from published sources. Therefore, in the interest of accuracy and of transparency, the year since which the new capacity additions relative to the current year amount to at least 20% of total current capacity is selected.

Comparing the installed capacity data from the latest China Electric Power Yearbook and from previous editions, it can be seen that the Build Margin is most accurately represented by new capacity added to the system since 2003. The vast majority of this new capacity was thermal power plant, with the remainder being hydro and wind[15].

Following guidance issued by the CDM Executive Board in response to a request for guidance from an accredited DOE[16] on the determination of the Build Margin in methodology AM0005 in China, $EF_{BM,y}$ is calculated as the capacity weighted average emissions factor of new installed capacity rather than the generation weighted factor. Furthermore, it is suggested in the same guidance note that the efficiency level of the best technology commercially available in the provincial/regional or national grid of China is used as a conservative proxy for each fuel type in estimating the fuel consumption when calculating the Build Margin. The suggested approach is followed in the determination of the Build Margin for the purposes of this project.

In China, capacity data for fossil-fuelled power plants other than coal-fired plants is not publicly available. Therefore it is not possible to calculate the BM using the weighted average Carbon emission Factor for different fossil fuels.

According to the China Energy Statistical Yearbooks, it can be found that the emissions from burning coal to generate the electricity accounts for the majority of CO_2 emissions from fossil-fuel fired plants (99.2%, 99.3% and 99.2% for 2003-05). Therefore, the impact of other fossil-fuel fired plants is considered negligible. It should also be noted that the standard fossil fuel consumption of 320 g/kWh applied to determine the BM is conservative and therefore compensates for not all fossil fuel consumed for power generation being coal[17].

Sub-step 1.3: Calculating the Combined Margin Emission Factor (EF_{cm})

The combined margin emission factor (tCO_2/MWh) is calculated as the weighted average of the OM emission factor and the BM emission factor where the weights are w_{OM} and w_{BM}. The weighting of the OM and BM emissions factors used are the default values suggested by the AM00029 methodology as follows:

---

[15] Comparing the installed capacity data for the years 2003 and 2005 from the relevant China Electric Power Yearbooks, it can be seen that 23.8% of new capacity was added to the system during this period. The new capacity was made up of new thermal (99.19%) and wind (0.81%)

[16] DNV letter to the CDM Executive Board; *Request for Guidance: Application of AM0005 and AMS-I-D in China* dated 07/10/2005 available online at http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM

[17] Letter from DNV to UNFCCC Secretariat 'Response for requests for review: Saihanba North 45.05MW Windfarm Project', 14 November 2006

w_{OM} = 0.5
w_{BM} = 0.5

Sub-step 1.4: Calculating the emission factor of the baseline technology (EF_{BL})

The baseline technology is sub-critical coal (refer to section B4)

$EF_{BL,CO2} = (COEF_{BL} / \eta_{BL}) * 3.6$

According to the China Institute of Power Planning and Design, Thermal Power Engineering Design Reference Cost Guide (2005 edition), for a typical new sub-critical coal-fired power station

$\eta = 315\ t_{SCE} / GWh$
$\eta = 0.003175\ GWh / t_{SCE}$
$= 11.4286\ GJ / t_{SCE}$

According to the General Code for Comprehensive Energy Consumption Calculation (Chinese National Standard GB2589-90), the Calorific Value of coal in China is equal to 29.3 GJ/ t_{SCE}:

$\eta = (11.4286 / 29.3) * 100\%$
$\eta = 39.0055$

Therefore,

$EF_{BL,CO2} = 0.8731\ tCO_2 / MWh$

Where;

$\eta_{BL} = 39.01\%$

$COEF_{BL} = 0.0946\ tCO2/GJ$[18]

Summary:

- $EF_{BM} = 0.8798\ tCO_2 / MWh$ (Option 1)
- $EF_{CM} = 0.9526\ tCO_2 / MWh$ (Option 2)
- $EF_{BL,CO2} = 0.8731\ tCO_2 / MWh$ (Option 3)

According to AM0029, the lowest emission factor from EF_{BM}, EF_{CM} and $EF_{BL,CO2}$ is chosen. So in this case, EF_{BL} is used.

Step 2: Calculating project emissions (PEy)

[18] According to 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Chapter 1) Table 1.3, the default carbon content of coal is 25.8 kg/ GJ

The project activity is on-site combustion of natural gas to generate electricity. On site combustion of diesel is also included in the project activity. This is used in additional generators to supply electricity to shut down turbines smoothly and safely. The CO_2 emissions from electricity generation were calculated as follows:

$PE_y = \Sigma_t FC_{f,y} * COEF_{f,y}$

Where:

$FC_{f,y}$: is the total volume of natural gas or other fuel 'f' combusted in the project plant or other startup fuel (m^3 or similar) in year(s) 'y'

$COEF_{f,y}$: is the CO_2 emission coefficient (tCO_2/m^3 or similar) in year(s) for each fuel and is obtained as:

$COEF_{f,y} = \Sigma NCV_y * EFCO_{2,f,y} * OXID_f$

Where:

$NCV_{gas,y}$: is the net calorific value (energy content) per volume unit of natural gas in year 'y' (GJ/m3) as determined from the fuel supplier, wherever possible, otherwise from local or national data;

$EFCO_{2,gas,y}$: is the CO_2 emission factor per unit of energy of natural gas in year 'y' (tCO_2/GJ) as determined from the fuel supplier, wherever possible, otherwise from local or national data;

$OXID_{gas}$: is the oxidation factor of natural gas

$NCV_{diesel,,y}$: is the net calorific value (energy content) per volume unit of diesel in year 'y' (GJ/m3) as determined by the IPCC;

$EFCO_{2,diesel,y}$: is the CO_2 emission factor per unit of energy of diesel in year 'y' (tCO_2/GJ) as determined by the IPCC;

$OXID_{diesel}$: is the oxidation factor of diesel

Step 3: Calculating Leakage (LE_y)

According to AM00029, leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring. For this project, the following leakage emission source was considered:

- Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.

No LNG is used in the project plant; therefore no leakage from this source is considered here.

Thus, leakage emissions were calculated using the following equation:

$LE_y = LE_{CH4,y}$

where:

LE_y : Leakage emissions during the year y in tCO_2e
$LE_{CH4,y}$:Leakage emissions due to fugitive upstream CH_4 emissions in the year y in tCO_2e

Fugitive methane emissions
For the purpose of estimating fugitive CH_4 emissions, the quantity of natural gas consumed by the project in year y was multiplied with an emission factor for fugitive CH_4 emissions ($EF_{NG,upstream,CH4}$) from natural gas consumption and then the emissions occurring from fossil fuels used in the absence of the project activity subtracted, as follows:

$$LE_{CH4,y} = [FC_y * NCV_y * EF_{NG,upstream,CH4} - EG_{PJ,y} * EF_{BL,upstream,CH4}]\ GWP_{CH4}$$

where:

$LE_{CH4,y}$: Leakage emissions due to fugitive upstream CH_4 emissions in the year y in tCO_2e
FC_y : Quantity of natural gas combusted in the project plant during the year *y* in m³
$NCV_{NG,y}$: Average net calorific value of the natural gas combusted during the year *y* in GJ/m³
$EF_{NG,upstream,CH4}$: Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, in tCH_4 per GJ fuel supplied to final consumers
$EG_{PJ,y}$: Electricity generation in the project plant during the year in MWh
$EF_{BL,upstream,CH4}$: Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in tCH_4 per MWh electricity generation in the project plant, as defined below
GWP_{CH4} : Global warming potential of methane valid for the relevant commitment period

According to AM0029, the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the project activity ($EF_{BL,upstream,CH4}$) should be calculated consistent with the baseline emission factor ($EF_{BL,CO2}$) used above. In the case of this project, the lowest emission factor was 'option 3'. Therefore, the following equation was used to calculate the upstream fugitive CH_4 emissions occurring in the absence of the project activity:

$$EF_{BL,upstreamCH4} = \frac{EF_{k,\ upstream,CH4}}{\eta_{BL}} * 3.6\ GJ/MWh$$

where:

$EF_{BL,upstream,CH4}$: Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH4 per MWh electricity generation in the project plant
$EF_{k,upstream,CH4}$: Emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or oil type) in t CH4 per MJ fuel produced
η_{BL} Energy efficiency of the most likely baseline technology

Step 4: Emissions Reductions

To calculate the emission reductions, the following equation was applied:

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$

Where:
ER_y : emissions reductions in year y (t CO_2e)
BE_y : emissions in the baseline scenario in year y (t CO_2e)
PE_y : emissions in the project scenario in year y (t CO_2e)
LE_y : leakage in year y (t CO_2e)

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

Data / Parameter:	**$EF_{CO2,gas}$**
Data unit:	tCO_2/GJ
Description:	The CO_2 emission factor per unit of energy of natural gas
Source of data used:	IPCC default value in 2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	0.0561
Justification of the choice of data or description of measurement methods and procedures actually applied :	No country default value available, IPPC default value used.
Any comment:	

Data / Parameter:	**$OXID_{gas}$**
Data unit:	-
Description:	The oxidation factor of natural gas
Source of data used:	IPCC default value in 2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	No country default value available, IPPC default value used.
Any comment:	

Data / Parameter:	NCV_{diesel}
Data unit:	TJ/Gg
Description:	Net calorific value (energy content) per unit of diesel
Source of data used:	IPCC default value in 2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	43.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to AM0029, IPCC default calorific values are acceptable, if local or national estimates are unavailable
Any comment:	

Data / Parameter:	$EF_{CO2,diesel}$
Data unit:	tCO_2/GJ
Description:	The CO_2 emission factor per unit of energy of diesel
Source of data used:	IPCC default value in 2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	0.0741
Justification of the choice of data or description of measurement methods and procedures actually applied :	No country default value available, IPPC default value used.
Any comment:	

Data / Parameter:	$OXID_{diesel}$
Data unit:	-
Description:	The oxidation factor of diesel
Source of data used:	2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	No country default value available, IPPC default value used.
Any comment:	

Data / Parameter:	**EF_{OM}**
Data unit:	tCO_2/ MWh
Description:	Operating Margin Emission Factor
Source of data used:	Own calculation based on data supplied in the China Electric Power Yearbook
Value applied:	1.0255 tCO_2/ MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission factor calculated *ex ante* according to the methodology presented in ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006). See Annex 3.
Any comment:	-

Data / Parameter:	**EF_{BM}**
Data unit:	tCO_2/ MWh
Description:	Build Margin Emission Factor
Source of data used:	Own calculation based on data supplied in the China Electric Power Yearbook
Value applied:	0.8798 tCO_2/ MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission factor calculated *ex ante* as weighted average emission factor of the 20% most recent power plants built according to the methodology presented in ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006) and DNV letter to the CDM Executive Board; *Request for Guidance: Application of AM0005 and AMS-I-D in China* dated 07/10/2005. See Annex 3.
Any comment:	-

Data / Parameter:	**NCV_{coal}**
Data unit:	GJ/t_{SCE}
Description:	Net calorific value of coal
Source of data used:	The General Code for Comprehensive Energy Consumption Calculation (Chinese National Standard GB2589-90)
Value applied:	29.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Chinese National Standard value
Any comment:	-

Data / Parameter:	$OXID_{coal}$
Data unit:	-
Description:	The oxidation factor of coal
Source of data used:	2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	No country default value available, IPPC default value used.
Any comment:	-

Data / Parameter:	$COEF_{BL}$
Data unit:	tCO_2/GJ
Description:	Fuel emission co-efficient for coal
Source of data used:	2006 IPPC Guidelines for National GHG Inventories (Chapter 1)
Value applied:	0.0946
Justification of the choice of data or description of measurement methods and procedures actually applied :	No country default value available, IPPC default value used.
Any comment:	-

Data / Parameter:	η_{BL}
Data unit:	-
Description:	Baseline scenario efficiency
Source of data used:	Calculated according to AM00029
Value applied:	39%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Baseline technology determined in section B4 above and based on data supplied in the China Institute of Power Planning and Design, Thermal Power Engineering Design Reference Cost Index, 2005 edition
Any comment:	

Data / Parameter:	$EF_{NGupstream,CH4}$
Data unit:	tCH_4/ PJ
Description:	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation and distribution
Source of data used:	IPCC default value[19]
Value applied:	296
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is based on the IPCC default value, according to AM0029.
Any comment:	-

Data / Parameter:	$EF_{k,,upstream,CH4}$
Data unit:	tCH4/ kt coal used
Description:	Emission factor for upstream fugitive methane emissions from the production of coal
Source of data used:	IPCC default value[20]
Value applied:	13.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is based on the IPCC default value, according to AM0029.
Any comment:	-

Data / parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH_4.
Source of data used:	UNFCCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	-

[19] Volume 3 of the *1996 Revised IPCC Guidelines* Table 1-63 and 1-64, p1.130 and p1.131

[20] Volume 3 of the *1996 Revised IPCC Guidelines* Equations 1 and 4, p.1.105 and 1.110

B.6.3 Ex-ante calculation of emission reductions:

(Refer also to Annex 3)

Step 1: Calculating project emissions (PEy)

For combusted gas,

$COEF_{gas} = NCV_{gas} * EFCO_{2,gas} * OXID_{gas}$

$COEF_{gas} = 0.0018\ tCO_2/m^3$

$PE_{gas} = FC_{gas} * COEF_{gas}$

$PE_{gas} = 1,335,294\ tCO_2$

Where:

$NCV_{gas} = 0.0327\ GJ/m^3$

$EFCO_{2,gas} = 0.0561\ tCO_2/\ GJ$

$OXID_{gas} = 1$

$FC_{gas} = 727,445,800\ m^3$

For diesel,

$COEF_{diesel} = NCV_{diesel} * EFCO_{2,diesel} * OXID_{diesel}$

$COEF_{diesel} = 3.1849\ tCO_2/\ tonne$

$PE_{diesel} = FC_{diesel} * COEF_{diesel}$

$PE_{diesel} = 24.4617\ tCO_2$

Where :

$NCV_{deisel} = 43.00\ GJ/\ tonne$

$EFCO_{2,diesel} = 0.0741\ tCO_2/\ GJ$

$OXID_{diesel} = 1$

$FC_{diesel} = 7.6806\ tonnes$

$PE_y = 1,340,735 + 24.4617$

PE_y = 1,335,318 tCO_2

Step 2: Calculating Baseline emissions (BEy)

Calculating Baseline emissions

As discussed in section B6.1 above,

$EF_{BL,CO2}$ = 0.8731 tCO_2/ MWh (Option 3)

Therefore:

$BE_y = EG_{PJ,y} * EF_{BL,CO2}$

BE_y = 2,851,607 tCO_2

Where:

$EG_{PJ,y}$ = 3,266,032 MWh

Step 3: Calculating Leakage (LEy)

For baseline option 3,

$$EF_{BL,upstreamCH4} = \frac{EF_{k,\ upstream,CH4}}{\eta_{BL}} * 3.6\ GJ/MWh$$

$EF_{BL,upstreamCH4}$ = 0.0042 tCH_4/MWh

Where:

$EF_{k,\ upstream,CH4}$ = 13.4 tCH_4/ kt coal

η_{BL} = 39.01%

$$LE_{CH4,\ y} = [FC_y * NCV_y * EF_{NG,upstream,CH\ 4} - EG_{PJ,y} * EF_{BL,upstream,CH4}] * GWP_{CH4}$$

$LE_{CH4,\ y}$ = -141,551 tCO_2e

Where:

FC_{gas} = 727,445,800 m^3

NCV_{gas} = 0.0327 GJ/m^3

$EF_{NG,upstream,CH}$ = 296 tCH_4/ PJ

$EG_{PJ,y} = 3{,}266{,}032$ MWh

$GWP_{CH4} = 21$ tCO_2e/tCH_4

According to AM0029, where total net leakage effects are negative ($LE_y < 0$), project participants should assume $LE_y = 0$.

Therefore for the Project

$LE_y = 0$

Step 4: Calculating Emission Reductions

$ER_y = BE_y – PE_y – LE_y$

$ER_y = 1{,}516{,}289$ tCO_2

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 emissions reductions (tonnes of CO_2e)
2007 (1.5 months)	166,915	356,451	0	189,536
2008	1,335,318	2,851,607	0	1,516,289
2009	1,335,318	2,851,607	0	1,516,289
2010	1,335,318	2,851,607	0	1,516,289
2011	1,335,318	2,851,607	0	1,516,289
2012	1,335,318	2,851,607	0	1,516,289
2013	1,335,318	2,851,607	0	1,516,289
2014 (10.5 months)	1,168,403	2,495,157	0	1,326,753
Total (tonnes of CO_2e)	**9,347,227**	**19,961,252**	**0**	**10,614,025**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	FC_{gas}
Data unit:	m^3
Description:	Annual natural gas consumption
Source of data to be used:	The consumption of natural gas will be monitored and recorded by the project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	727,445,800
Description of measurement methods and procedures to be applied:	Natural gas consumption will be monitored using gas flow meters and cross-checked using sales receipts from the gas supply company
QA/QC procedures to be applied:	Gas flow meters will be maintained and calibrated according to Chinese regulations and industry standards The quality assurance and quality control procedures for recording, processing and archiving data will be followed and improved for this CDM project activity according to EB rules and requirement to allow easy verification of the emission reductions on an annual basis.
Any comment:	-

Data / Parameter:	FC_{diesel}
Data unit:	Tonnes
Description:	Annual diesel consumption
Source of data to be used:	The consumption of diesel will be monitored using volume flow meters and recorded by the project participants. This will be converted to the mass of diesel consumed using the standard density of diesel (0.85 kg/litre).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7.6806
Description of measurement methods and procedures to be applied:	Diesel consumption will be monitored and cross-checked using sales receipts from the diesel supply company
QA/QC procedures to be applied:	Volume flow meters will be maintained and calibrated according to Chinese regulations and industry standards The quality assurance and quality control procedures for recording, processing and archiving data will be followed and improved for this CDM project activity

	according to EB rules and requirement to allow easy verification of the emission reductions on an annual basis.
Any comment:	-

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Electricity supplied to the grid by the project net of any on-site parasitic usage
Source of data to be used:	The kWh output from the project will be monitored and recorded.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,266,032
Description of measurement methods and procedures to be applied:	EGy will be monitored automatically by the project participant and will be cross-checked using electricity sales invoices. EG_y data will be aggregated monthly and presented as a summary in the annual monitoring report.
QA/QC procedures to be applied:	The quality assurance and quality control procedures for recording, processing and archiving data will be followed and improved for this CDM project activity according to EB rules and requirement to allow easy verification of the emission reductions on an annual basis.
Any comment:	-

Data / Parameter:	**NCV_{gas}**
Data unit:	GJ/m^3
Description:	Net calorific value (energy content) per volume unit of natural gas
Source of data to be used:	The NCV of the gas supplied to the project will be measured periodically
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0327
Description of measurement methods and procedures to be applied:	Fuel sampling and calculating of the NCV of the gas supplied will be the responsibility of the gas supply company.
QA/QC procedures to be applied:	The quality assurance and quality control procedures for recording, processing and archiving data will be followed and improved for this CDM project activity according to EB rules and requirement to allow easy verification of the emission reductions on an annual basis.
Any comment:	-

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

Refer also to annex 4

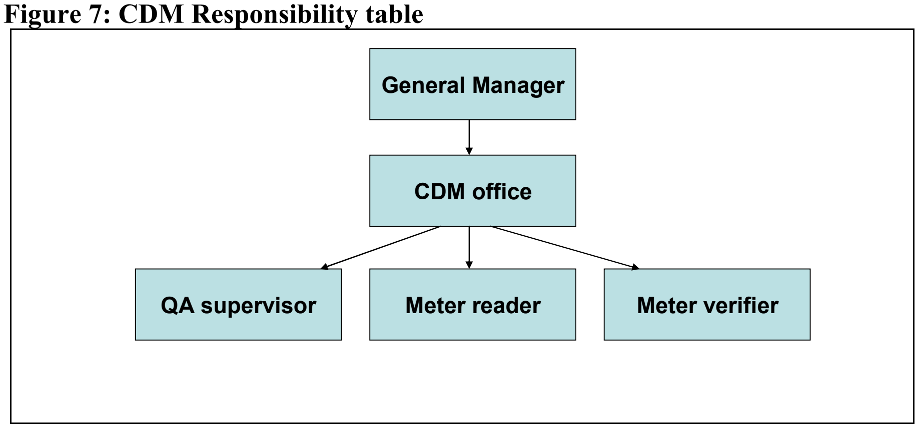
CDM Project Management and Calculations

The project sponsor will establish a CDM office which will be responsible for monitoring project emissions and other CDM related activities. An organisation chart is illustrated below. The meter reader will be responsible for compiling meter readings regularly and ensuring that the parameters identified in B7.1 are monitored. The meter reader will then send these records to the auditor who will ensure that they correspond to third party records (e.g. meter readings by the grid company or gas supply company). Any discrepancies will be reported to the office head and general manager. Following this cross-checking procedure, the readings will be stored electronically in the CDM information management system.

The supervision of the calibration and maintenance of the meters will be the responsibility of the quality supervisor. The quality supervisor will supervise meter maintenance and manage the calibration process according to the company's quality control programme.

To ensure that this monitoring plan is fully implemented, a CDM manual will be prepared giving full instructions for implementation. In addition, responsibility will be assigned to an individual (the CDM project officer) in the CDM office to prepare the monitoring report for verification by the DoE and issuance of CERs.

Figure 7: CDM Responsibility table



Procedures to be followed

A detailed monitoring plan will be developed in accordance with the company's management system.

Gas consumption monitoring

- There are four meters monitoring gas consumption: meters 1 and 2 measuring gas to each compressor and a third meter as back-up. Meter 4 measures gas to the start-up boiler.

- As a further back-up, receipts of gas supplied by the gas company will be used.

Monitoring of electricity generated

- There are 2 connections to the 220kV Beijing Power Grid, each with a meter (m_4 and m_5). These meters will measure total electricity sent to the grid.
- Each of the 3 electricity producing generators has a meter to monitor the electricity produced and sent to the main internal line (m_1, m_2 and m_3). On-site, auxiliary use of power generated is measured by a separate meter (m_a). Back up readings will be taken from these meters
- Finally, there are two meters (m_x and m_z) owned by the Beijing Power grid company measuring the electricity supplied to the grid from the project. Readings from these will be used as a further back-up, if necessary.

In summary,

$$\text{Net electricity generated} = m_4 + m_5 = (m_1 + m_2 + m_3) - m_a$$

Monitoring of diesel consumption

- The diesel generators will be used in an emergency only to supply electricity to shutdown turbines smoothly and safely. They will also be tested once a week.
- A flow meter will be used to measure diesel consumption. As a back-up, receipts will be used to monitor diesel consumption.

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

Date of completion of the baseline study and monitoring methodology: 22 January 2007

Camco International Ltd. Suite 906 Lucky Tower A No.3 North Road East 3rd Ringroad Chaoyang District Beijing 100027 China	Tel: +8610 84483025 Fax: +8610 8448 2499 Email: rachel@camco-international.com.cn Website: www.camco-international.com

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:

13 July 2006

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

30 years[21]

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

C.2.1. Renewable crediting period

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

15 November 2007

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

n/a

C.2.2.2. Length:

n/a

[21] According to the project owner, the expected project lifetime is 30 years. However to ensure consistency with the financial analysis in the FSR, a project lifetime of 20 years is assumed for the financial analysis and levelised costs in section B4 and B5.

SECTION D. Environmental impacts

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

An Environmental Impact Assessment for the project was carried out by Guodian North China Power Engineering (Beijing) Co., Ltd., and was approved by the Beijing Environmental Protection Bureau in June 2005.

A summary of the impacts is presented below:

Impacts on air quality: this project will lead to an improvement in air quality as natural gas (considered a clean fuel) will be burned and a dry-type low-nitrogen burner will be installed. It is predicated that SO_2 and NO_x emission concentration will be 0.65 mg/m^3 and 150 mg/m^3 once the plant is put into operation, which is 3.25% and 75% of Beijing's emission standards[22] respectively, and the total emissions will be 3.52 tonnes pa of SO_2 and 813.1 tonnes of NO_x.

Measures to prevent water pollution: the following procedures will be followed:
- the cooling water used in this project is treated water from the municipal waste water treatment plant. Using this water helps to decrease freshwater consumption and also reduces the quantity of waste water.
- rainwater in the plant area and any excess water from the circulating cooling water will be discharged into the urban rainwater pipeline network;
- industrial waste water will generally be recycled after treatment, with a small amount of waste water entering the urban sewage pipeline network after treatment;
- domestic sewage will be discharged into the urban sewage pipeline network after primary treatment.

Therefore, the discharge of waste water from this project is in full compliance with national and local waste water requirements

Measures to control noise pollution: the principal environmental problem anticipated from this project is noise from, in particular, the gas turbine and mechanical draft cooling tower. A series of measures will be undertaken to control the noise level of the project including:

- controlling the noise from equipment and the installation of a silencer;
- optimizing the general layout of the site so as to arrange noisy equipment indoors,
- improving the sound-proofing installed

186.32million RMB (equivalent to 5.76% of total project static investment) was invested in measures to reduce noise (see table 11 below). The target noise level from the project is 55dB in the daytime and 48dB at night. This is fully in compliance with national and local requirements

[22] Boiler pollutant total discharge standards (DB11/139-2002)

Table 11: Investment in noise reduction measures for the Taiyanggong project

Item	Investment (million RMB)
Main workshop building	102.32
Interior absorbing material in main workshop	10
Bases of HRSG boiler and bypass chimney	2.89
Bases of gas turbine and steam generator	14.87
Inlet muffler of gas turbine	2
Gas drainage muffler of HRSG	0.5
Semi close sound insulation board for main transformer	0.6
Water treatment system workshop construction	8.18
Circulation water pump workshop construction	7.96
Noise reduction material used in accessory production workshop such as feed water pump and air pressure workshops	3.0
Integrated control for noise from power ventilation cooling towers	25
Noise reduction material for horizontal flue gas channel and HRSG boiler	4.0
Noise reduction material used in gas pressure station building	5.0

Source: Taiyanggong Natural Gas-Fired Combined Cycle Power Plant Project Environmental Impact Assessment Report

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

The impacts on the environment are not considered significant

SECTION E. Stakeholders' comments

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

During the course of writing the Environmental Impact Assessment report, stakeholder comments were collected at two stages. Firstly, two meetings were held and 160 questionnaires distributed in December 2004 and January 2005. 118 completed forms were received and in these forms 48 people (40.68%) supported the project, 36 people objected (30.51%) and 34 people did not have an opinion. The key reasons for the objections to the project were in relation to concerns about noise and emissions from flue gases due, in the main, because local stakeholders had limited knowledge about gas-fired plants.

Prior to publication of the Environmental Impact Assessment report, one further stakeholder meeting was held and 100 questionnaires distributed. The project owner explained to local residents the characteristics of gas-fired plants and the measures being taken to reduce noise and emissions of air pollutants from the plant. Of the residents questioned at this stage, 86.7% supported the establishment of the project and 13.3% expressed objections to it.

A further stakeholder meeting was held on Wednesday 18 October 2006 in the meeting room of Beijing Taiyanggong Gas-fired Thermal Power Co. Ltd. Local residents were invited to the meeting through posters placed in the vicinity of the site of the plant.

There were a total of 56 local residents at the meeting. Also present were:

- representatives from Beijing City Environment Protection Bureau
- representatives from Beijing Chaoyang District Environment Protection Bureau
- representatives from Beijing City Taiyanggong Village Government

The meeting was composed of three main parts:

1. Wang Jian, the manager of the team in charge of the project gave an introduction to the Beijing Taiyanggong CCGT Trigeneration CDM Project including:
    - The technological process that will be followed by the project for generating electricity with natural gas and supplying heating and cooling;
    - General information about the project including the installed capacity and investment etc.;

2. Opportunity for those attending the meeting to ask any questions they have about the project or to raise any concerns about it

3. Completion of a questionnaire to capture the views of those attending the meeting on the project

E.2. Summary of the comments received:

Those attending the meeting said unanimously that they support the construction of the project. In particular, it was recognised that the project, by using natural gas, will improve the air quality of the local area.

Other questions were raised about the potential for noise pollution and water pollution that could arise from the project.

All 56 local residents completed a questionnaire and the results are summarised below:

- 55 respondents thought this project was important
- All 56 respondents agreed with the construction of this project
- 48 respondents thought that the local environment would be improved by this project
- 50 respondents thought that the project would have a positive benefit on the local economy

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

The comments and questions raised were responded to as follows:

- Impact on the local environment - the fuel to be used in this project is natural gas which is a clean source of energy. The use of natural gas can reduce emissions of air pollutants, improve the air quality of the local area and increase energy utilization efficiency. It is an environmentally friendly source of energy and its use is in accordance with national guidelines for energy saving and sustainable development.
- Noise pollution – An extra 186 million RMB has been invested in measures to reduce noise levels from the project (as described in table 11 above) and to ensure that the noise levels of the plant site do not exceed 55db in the daytime and 45db at night. For example, special designs were used for the waste water treatment building and other buildings to reduce noise and noise proofing materials were used where appropriate. Further, the project company has adopted measures to avoid disturbing near-by residents such as arranging the transportation of materials to and from the site to take place during the day so as to avoid disturbing the sleep of local residents.
- Water resources – treated water from the City Sewage Water Treatment Plant will be used for cooling water for the power plant. This can help to save water resources and is in accordance with national industry policy. Water from the power plant will be discharged into the city's sewage system and prior to this, treatment at the plant will follow the "Beijing City Water Pollutants Discharge Standard (Trial Version)".

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Beijing Taiyanggong Gas-fired Thermal Power Co. Ltd.
Street/P.O.Box:	No. 98 North Village, Taiyanggong District
Building:	
City:	Beijing
State/Region:	
Postfix/ZIP:	100102
Country:	P.R. China
Telephone:	010-52036023
FAX:	010-52036008
E-Mail:	
URL:	
Represented by:	Song Hui
Title:	Project Manager
Salutation:	Miss
Last Name:	Song
Middle Name:	
First Name:	Hui
Department:	Planning and Financial Department
Mobile:	138 1038 3527
Direct FAX:	010 5203 6008
Direct tel:	010 5203 6023
Personal E-Mail:	songh@bjsunhouse.com

Organization:	Camco International Limited
Street/P.O.Box:	Channel House, Green Street
Building:	-
City:	St. Helier
State/Region:	-
Postfix/ZIP:	JE2 4UH
Country:	Jersey
Telephone:	+44 (0)20 7665 1865
FAX:	+44 (0)20 7665 1871
E-Mail:	info@camco-international.com
URL:	www.camco-international.com
Represented by:	-
Title:	Mr
Salutation:	China Operation Director
Last Name:	DALSGARD
Middle Name:	-
First Name:	Henrik
Department:	-
Mobile:	13911112710
Direct FAX:	+86 (10) 8448 2499
Direct tel:	+86 (10) 8448 1385
Personal E-Mail:	Henrik @camco-international.com.cn

Organization:	Macquarie Bank Limited
Street/P.O.Box:	Level 35, Citypoint
Building:	1, Ropemaker Street
City:	London
State/Region:	
Postfix/ZIP:	EC2Y 9HD
Country:	United Kingdom
Telephone:	+44 207 065 2000
FAX:	+44 207 065 2115
E-Mail:	john.marlow@macquarie.com
URL:	www.macquarie.com
Represented by:	John Marlow
Title:	Head of Environmental Financial Products
Salutation:	Mr
Last Name:	Marlow
Middle Name:	
First Name:	John
Department:	Treasury & Commodities Group
Mobile:	+44 7786 362 069
Direct FAX:	+44 207 065 2115
Direct tel:	+44 207 065 2371
Personal E-Mail:	john.marlow@macquarie.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There are no public funds involved in the project activity.
.

Annex 3

BASELINE INFORMATION

Table A1: Project emissions

Data type	ID number	Value	Unit	Source
Gas				
Net Calorific Value	NCV_{gas}	0.0327	GJ/m^3	Taiyanggong Feasibility Study Report
Emission Factor		15.3	kgC/GJ	2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Emission Factor	$EF_{CO2,gas}$	0.0561	tCO_2/ GJ	
Oxidation factor	$OXID_{gas}$	1.0000		2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
CO_2 emission co-efficient	$COEF_{gas}$	0.0018	tCO_2/ m^3	Calculated
Annual gas consumption	FC_{gas}	727,445,800	m^3	Taiyanggong Feasibility Study Report
Annual emissions due to gas combustion	**PE_{gas}**	**1,335,294**	**tCO_2**	
Diesel				
Net Calorific Value		43.00	TJ/ Gg	2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Net Calorific Value	NCV_{diesel}	43.00	GJ/ tonne	
Emission Factor		20.20	kg/ GJ	2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
Emission Factor	$EF_{CO2,diesel}$	0.0741	tCO_2/ GJ	
Oxidation factor	$OXID_{diesel}$	1.0000		2006 IPCC Guidelines for National GHG Inventories (Chapter 1)
CO_2 emission co-efficient	$COEF_{diesel}$	3.1849	tCO_2/ tonne	Calculated
Annual diesel consumption	FC_{diesel}	7.6806	tonnes	Estimated (based on diesel generators (2 x 800kW, 90% efficiency) both operating for 1 hour per week, 52 weeks and a calorific value for diesel of 43.33 GJ/ tonne)
Annual emissions due to diesel	**PE_{diesel}**	**24.4617**	**tCO_2**	
Total project emissions		**1,335,318**	**tCO_2e**	

Table A2: Operating Margin

				A	B	C	D	E	F	G	H	I	J	K	L	M
				China Energy Statistical Yearbook 2004, China Statistics Press (CESY 2004)									IPCC 2006	=I *J /1000	=H * K	
	2003 Fuel	Unit	Total Fuel NCPN	Beijing	Tianjin	Hebei	Shanxi	Shandong	Inner Mongolia	Unit	Total Fuel NCPN	NCV (GJ/Unit)	Emission factor (tCO2/ TJ)	$COEF_i$ (CO_2/unit of fuel)	tonnes CO_2e	% CO2 Emissions
China Energy Statistical Yearbook 2004, China Statistics Press	Raw Coal	x10(4) tn	**22535.94**	714.73	1052.74	5482.64	4528.51	6808.00	3949.32	t	**225,359,400**	20.908	94.600	1.978	**445,737,636**	97.8%
	Cleaned coal	x10(4) tn	**9.41**	0.00	0.00	0.00	0.00	9.41	0.00	t	**94,100**	26.340	94.600	2.492	**234,475**	0.1%
	Other washed coal	x10(4) tn	**732.70**	6.31	0.00	67.28	208.21	450.9	0.00	t	**7,327,000**	8.363	94.600	0.791	**5,796,681**	1.3%
	Coke	x10(4) tn	**2.80**	0.00	0.00	0.00	0.00	0.00	2.80	t	**28,000**	28.435	107.000	3.043	**85,191**	0.0%
	Coke oven gas	x10(8) m3	**3.08**	0.24	1.71	0.00	0.90	0.02	0.21	000 m3	**308,000**	16.730	44.400	0.743	**228,786**	0.1%
	Other gas	x10(8) m3	**39.43**	16.92	0.00	10.63	0.00	1.56	10.32	000 m3	**3,943,000**	5.227	44.400	0.232	**915,087**	0.2%
	Crude oil	x10(4) tn	**29.68**	0.00	0.00	0.00	0.00	29.68	0.00	t	**296,800**	41.816	73.300	3.065	**909,725**	0.2%
	Gasoline	x10(4) tn	**0.01**	0.00	0.00	0.00	0.00	0.01	0.00	t	**100**	43.070	74.100	3.191	**319**	0.0%
	Diesel oil	x10(4) tn	**13.95**	0.29	1.35	4.00	0.00	5.40	2.91	t	**139,500**	42.652	74.100	3.161	**440,892**	0.1%
	Fuel oil	x10(4) tn	**25.80**	13.95	0.02	1.11	0.00	10.07	0.65	t	**258,000**	41.816	77.400	3.237	**835,032**	0.2%
	LPG	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	50.179	63.100	3.166	**0**	0.0%
	Refinery gas	x10(4) tn	**1.10**	0.00	0.00	0.27	0.00	0.83	0.00	t	**11,000**	46.055	57.600	2.653	**29,180**	0.0%
	Other petroleum products	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	40.190	73.300	2.946	**0**	0.0%
	Natural gas	x10(8) m3	**1.58**	0.00	0.50	0.00	0.00	1.08	0.00	000 m3	**158,000**	38.931	56.100	2.184	**345,077**	0.1%
	Other energy (e.g. renewables or waste heating)	x10(4) tce	**49.04**	9.83	0.00	0.00	0.00	39.21	0.00	tce	**490,400**	29.271	0.000	0.000	**0**	0.0%
Total emissions of NCPN (tCO2e)		**455,558,082**													**455,558,082**	**100.0%**
Fossil based electricity delivered to the NCPN (TWh)		**454.01**		188.33	325.60	1085.69	945.71	1355.20	639.53							
OM emissions factor of the NCPN (tCO2e/MWh)		**1.0034**														

				A	B	C	D	E	F	G	H	I	J	K	L	M
				China Energy Statistical Yearbook 2005, China Statistics Press (CESY 2005)									IPCC 2006	=I *J /1000	=H * K	
	2004 Fuel	Unit	Total Fuel NCPN	Beijing	Tianjin	Hebei	Shanxi	Shandong	Inner Mongolia	Unit	Total Fuel NCPN	NCV (GJ/Unit)	Emission factor (tCO2/ TJ)	$COEF_i$ (CO_2/unit of fuel)	tonnes CO_2e	% CO2 Emissions
China Energy Statistical Yearbook 2005, China Statistics Press	Raw Coal	x10(4) tn	**27228.29**	823.09	1410.00	6299.80	5213.20	8550.00	4932.20	t	**272,282,900**	20.908	94.600	1.978	**538,547,477**	98.1%
	Cleaned coal	x10(4) tn	**40.00**	0	0.00	0.00	0.00	40.00	0.00	t	**400,000**	26.340	94.600	2.492	**996,706**	0.2%
	Other washed coal	x10(4) tn	**745.91**	6.48	0.00	101.04	354.17	284.22	0.00	t	**7,459,100**	8.360	94.600	0.791	**5,899,074**	1.1%
	Coke	x10(4) tn	**0.22**	0.00	0.00	0.00	0.00	0.00	0.22	t	**2,200**	28.435	107.000	3.043	**6,694**	0.0%
	Coke oven gas	x10(8) m3	**15.54**	0.55	0.00	0.54	5.32	8.73	0.40	000 m3	**1,554,000**	16.730	44.400	0.743	**1,154,330**	0.2%
	Other gas	x10(8) m3	**68.07**	17.74	0.00	24.25	8.20	1.41	16.47	000 m3	**6,807,000**	5.227	44.400	0.232	**1,579,760**	0.3%
	Other coking products	x10(4) tn	**15.05**	15.05	0.00	0.00	0.00	0.00	0.00	t	**150,500**	28.435	29.200	0.830	**124,960**	0.0%
	Crude oil	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	41.816	73.300	2.084	**0**	0.0%
	Gasoline	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	43.070	74.100	3.099	**0**	0.0%
	Diesel oil	x10(4) tn	**5.89**	0.39	0.84	4.66	0.00	0.00	0.00	t	**58,900**	42.652	74.100	3.191	**187,979**	0.0%
	Fuel oil	x10(4) tn	**14.82**	14.66	0.00	0.16	0.00	0.00	0.00	t	**148,200**	41.816	77.400	3.301	**489,247**	0.1%
	LPG	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	50.179	63.100	2.639	**0**	0.0%
	Refinery gas	x10(4) tn	**1.97**	0.00	0.55	1.42	0.00	0.00	0.00	t	**19,700**	46.055	57.600	2.890	**56,939**	0.0%
	Other petroleum products	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	40.190	73.300	3.376	**0**	0.0%
	Natural gas	x10(8) m3	**0.56**	0.00	0.37	0.00	0.19	0.00	0.00	000 m3	**56,000**	38.931	56.100	2.255	**126,261**	0.0%
	Other energy (e.g. renewables or waste heating)	x10(4) tce	**158.26**	9.41	0.00	34.64	109.73	0.00	4.48	tce	**1,582,600**	29.271	0.000	0.000	**0**	0.0%
Total emissions of NCPN (tCO2e)		**549,169,427**													549,169,427	**100.0%**
Fossil based electricity delivered to the NCPN (TWh)		**536.27**		200.4	343.22	1250.90	1057.75	1693.70	816.74							
OM emissions factor of the NCPN (tCO2e/MWh)		**1.0241**														

2005	Fuel	Unit	Total Fuel NCPN	Beijing	Tianjin	Hebei	Shanxi	Shandong	Inner Mongolia	Unit	Total Fuel NCPN	NCV (GJ/Unit)	Emission factor (tCO2/ TJ)	COEF$_i$ (CO_2/unit of fuel)	tonnes CO_2e	% CO2 Emissions
	Raw Coal	x10(4) tn	**32158.53**	897.75	1675.20	6726.50	6176.45	10405.40	6277.23	t	**321,585,300**	20.908	94.600	1.978	**636,062,536**	98.2%
	Cleaned coal	x10(4) tn	**42.18**	0.00	0.00	0.00	0.00	42.18	0.00	t	**421,800**	26.340	94.600	2.492	**1,051,026**	0.2%
	Other washed coal	x10(4) tn	**656.36**	6.57	0.00	167.45	373.65	108.69	0.00	t	**6,563,600**	8.360	94.600	0.791	**5,190,862**	0.8%
	Coke	x10(4) tn	**0.32**	0.00	0.00	0.00	0.00	0.11	0.21	t	**3,200**	28.435	107.000	3.043	**9,736**	0.0%
	Coke oven gas	x10(8) m3	**23.48**	0.64	0.75	0.62	21.08	0.00	0.39	000 m3	**2,348,000**	16.730	44.400	0.743	**1,744,123**	0.3%
China Energy	Other gas	x10(8) m3	**91.03**	16.09	7.86	38.83	9.88	0.00	18.37	000 m3	**9,103,000**	5.227	44.400	0.232	**2,112,613**	0.3%
Statistical	Other coking products	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	28.435	29.200	0.830	**0**	0.0%
Yearbook	Crude oil	x10(4) tn	**0.73**	0.00	0.00	0.00	0.00	0.00	0.73	t	**7,300**	41.816	73.300	2.084	**15,215**	0.0%
2006, China	Gasoline	x10(4) tn	**0.01**	0.00	0.00	0.01	0.00	0.00	0.00	t	**100**	43.070	74.100	3.099	**310**	0.0%
Statistics	Diesel oil	x10(4) tn	**4.14**	0.48	0.00	3.54	0.00	0.00	0.12	t	**41,400**	42.652	74.100	3.191	**132,128**	0.0%
Press	Fuel oil	x10(4) tn	**12.54**	12.25	0.00	0.23	0.00	0.00	0.06	t	**125,400**	41.816	77.400	3.301	**413,979**	0.1%
	LPG	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	50.179	63.100	2.639	**0**	0.0%
	Refinery gas	x10(4) tn	**9.02**	0.00	0.00	9.02	0.00	0.00	0.00	t	**90,200**	46.055	57.600	2.890	**260,706**	0.0%
	Other petroleum products	x10(4) tn	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	t	**0**	40.190	73.300	3.376	**0**	0.0%
	Natural gas	x10(8) m3	**3.12**	0.28	0.08	0.00	2.76	0.00	0.00	000 m3	**312,000**	38.931	56.100	2.255	**703,454**	0.1%
	Other energy (e.g. renewables or waste heating)	x10(4) tce	**236.40**	8.58		32.35	69.30	118.90	7.27	tce	**2,364,000**	29.271	0.000	0.000	**0**	0.0%
Total emissions of NCPN (tCO2e)		**647,696,687**													647,696,687	**100.0%**
Fossil based electricity delivered to the NCPN (TWh)		**621.02**		209.8	376.36	1332.46	1291.65	1989.68	1010.21							
OM emissions factor of the NCPN (tCO2e/MWh)		**1.0430**														

Generation Weighted 3-year Average OM (tCO2e/MWh) **1.026**

Table A3: Build Margin

		2000 yearbook data	2001 yearbook data	2002 yearbook data	2003 yearbook data	2004 yearbook data	2005 yearbook data
Yearbook Data							
Calculation cells							
		Year Book 2001	Year Book 2002	Year Book 2003	Year Book 2004	Year Book 2005	Year Book 2006
Baseline Data North China Power Network							
Beijing							
Capacity		P666	P616	P584	P709	P473	P571
Thermal	10MW	339.35	341.25	340.75	334.75	345.85	383.35
Hydro	10MW	105.81	105.81	103.85	105.81	105.59	102.5
Nuclear	10MW	0	0	0	0	0	0
Other	10MW	0	0	0	0	0	0
Total	**10MW**	**445.16**	**447.06**	**444.6**	**440.56**	**451.44**	**485.85**
Generation		P667	P617	P585	P709	P474	P568
Thermal	100GWh	179.4885	173.91	178.86	186.08	185.79	208.8
Hydro	100GWh	9.4734	2.75	4.66	6.79	3.47	4.52
Nuclear	100GWh	0	0	0	0	0	0
Other	100GWh	0	0	0	0	0	1.49
Total	**100GWh**	**188.9619**	**176.66**	**183.52**	**192.87**	**189.26**	**214.81**
Efficiency Factor		P671	P624	P592	P670	P472	P559
Coal(power generation)	gCoal/kWh	329	317	319	316	317	315
Coal(power supply)	gCoal/kWh	359	352	350	340	348	348

Tianjin

Capacity		P666	P616	P584	P709	P473	P571
Thermal	10MW	502.8	563.2	624.55	600.85	600.85	614.99
Hydro	10MW	0.5	0.5	0.5	0.5	0.5	0.5
Nuclear	10MW	0	0	0	0	0	0
Other	10MW	0	0	0	0	0	2.4
Total	**10MW**	**503.3**	**563.7**	**625.05**	**601.35**	**601.35**	**617.89**

Generation		P667	P617	P585	P709	P474	P568
Thermal	100GWh	*216.2104*	*221.66*	*272.63*	*321.91*	*339.52*	*369.93*
Hydro	100GWh	*0.1377*	*0.09*	*0.12*	*0.09*	*0*	*0*
Nuclear	100GWh	*0*	*0*	*0*	*0*	*0*	*0*
Other	100GWh	*0*	*0*	*0*	*0*	*0*	*0.07*
Total	**100GWh**	**216.3481**	**221.75**	**272.75**	**322**	**339.52**	**370**

Efficiency Factor		P671	P624	P592	P670	P472	P559
Coal(power generation)	gCoal/kWh	335	328	328	327	323	321
Coal(power supply)	gCoal/kWh	364	355	353	351	344	343

Hebei

Capacity		P666	P616	P584	P709	P473	P571
Thermal	10MW	*1509.37*	*1647.49*	*1674.57*	*1769.87*	*1993.27*	*2233.32*
Hydro	10MW	*72.72*	*74.26*	*77.59*	*76.43*	*78.38*	*78.45*
Nuclear	10MW	*0*	*0*	*0*	*0*	*0*	*0*
Other	10MW	*0*	*0*	*1.35*	*1.35*	*1.35*	*4.8*
Total	**10MW**	**1582.09**	**1721.75**	**1753.51**	**1847.65**	**2073.00**	**2316.57**

Generation		P667	P617	P585	P709	P474	P568
Thermal	100GWh	839.5328	928.65	1009.7	1082.61	1249.7	1343.48
Hydro	100GWh	4.6973	3.12	4.1	5.04	5.25	3.1
Nuclear	100GWh	0	0	0	0	0	0
Other	100GWh	0	0	0.36	0.37	0.4	0.25
Total	**100GWh**	**844.2301**	**931.77**	**1014.16**	**1088.02**	**1255.35**	**1346.83**

Efficiency Factor		P671	P624	P592	P670	P472	P559
Coal(power generation)	gCoal/kWh	361	351	348	350	350	345
Coal(power supply)	gCoal/kWh	388	377	373	375	375	370

Shanxi

Capacity		P666	P616	P584	P709	P473	P571
Thermal	10MW	1177.08	1341.59	1432.78	1503.58	1769.33	2224.68
Hydro	10MW	97.77	79.59	79.53	79.57	78.73	78.3
Nuclear	10MW	0	0	0	0	0	0
Other	10MW	0	0	0	0	0	0
Total	**10MW**	**1274.85**	**1421.18**	**1512.31**	**1583.15**	**1848.06**	**2302.98**

Generation		P667	P617	P585	P709	P474	P568
Thermal	100GWh	604.47466	694.19	822.56	939.62	1049.26	1287.85
Hydro	100GWh	16.1198	16.8	18.78	18.9	20.32	21.5
Nuclear	100GWh	0	0	0	0	0	0
Other	100GWh	0	0	0	0	0	0
Total	**100GWh**	**620.59446**	**710.99**	**841.34**	**958.52**	**1069.58**	**1309.35**

Efficiency Factor		P671	P624	P592	P670	P472	P559
Coal(power generation)	gCoal/kWh	378	370	368	366	361	357
Coal(power supply)	gCoal/kWh	413	403	399	397	391	386

Inner Mongolia

Capacity		P666	P616	P584	P709	P473	2005 Power Generation Yearbook
Thermal	10MW	850.29	889.83	977.87	1142.47	1364.15	1917.33
Hydro	10MW	41.06	56.62	59.21	59.21	56.79	56.8
Nuclear	10MW	0	0	0	0	0	0
Other	10MW	0	0	7.66	7.66	11.17	20.89
Total	**10MW**	**891.35**	**946.45**	**1044.74**	**1209.34**	**1432.11**	**1995.02**
Generation		P667	P617	P585	P709	P474	P568
Thermal	100GWh	432.751	458.21	513.82	651.06	804.27	0
Hydro	100GWh	5.5939	6.2	6.74	6.97	8.13	0
Nuclear	100GWh	0	0	0	0	0	0
Other	100GWh	0	0	1.34	1.44	2.18	0
Total	**100GWh**	**438.3449**	**464.41**	**521.9**	**659.47**	**814.58**	**0**

Efficiency Factor		P671	P624	P592	P670	P472	P559
Coal(power generation)	gCoal/kWh	363	362	360	352	336	319
Coal(power supply)	gCoal/kWh	433	395	391	381	369	366

Shandong

Capacity		P666	P616	P584	P709	P473	P571
Thermal	10MW	1992.6	2095.77	2510.24	3049.44	3286.04	3733.2
Hydro	10MW	8.41	5.62	5.08	5.08	5.08	5.08
Nuclear	10MW	0	0	0	0	0	0
Other	10MW	0	0	0	0	1.23	3.06
Total	**10MW**	**2001.01**	**2101.39**	**2515.32**	**3054.52**	**3292.35**	**3741.34**

Generation		P667	P617	P585	P709	P474	P568
Thermal	100GWh	1000.541	1104.04	1241.62	1395.47	1639.18	1898.8
Hydro	100GWh	0.3042	0.31	0.15	0.19	0.41	0
Nuclear	100GWh	0	0	0	0	0	0
Other	100GWh	0	0	0	0	0.16	1.2
Total	**100GWh**	**1000.8452**	**1104.35**	**1241.77**	**1395.66**	**1639.75**	**1900**

Efficiency Factor		P671	P624	P592	P670	P472	P559
Coal(power generation)	gCoal/kWh	356	355	361	361	337	338
Coal(power supply)	gCoal/kWh	382	380	387	387	364	364

Total Thermal Capacity	*10MW*	*6371.49*	*6879.13*	*7560.76*	*8400.96*	*9359.49*	*11106.87*
Total Hydro Capacity	10MW	*326.27*	*322.40*	*325.76*	*326.60*	*325.07*	*321.63*
Total Nuclear Capacity	10MW	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Other Capacity	10MW	*0.00*	*0.00*	*9.01*	*9.01*	*13.75*	*31.15*
Total Capacity	**10MW**	**6697.76**	**7201.53**	**7895.53**	**8736.57**	**9698.31**	**11459.65**

Capacity Additions (2001)	%	7.00%	-	-	-	-	-
Capacity Additions (2002)	%	15.17%	8.79%	-	-	-	-
Capacity Additions (2003)	%	**23.34%**	17.57%	9.63%	-	-	-
Capacity Additions (2004)	%	30.94%	**25.74%**	18.59%	9.92%	-	-
Capacity Additions (2004)	%	41.55%	37.16%	31.10%	**23.76%**	15.37%	-

Total Thermal Generation	*100GWh*	*3273.00*	*3580.66*	*4039.19*	*4576.75*	*5267.72*	*5108.86*
Total Hydro Generation	100GWh	*36.33*	*29.27*	*34.55*	*37.98*	*37.58*	*29.12*
Total Nuclear Generation	100GWh	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Total Other Generation	100GWh	*0.00*	*0.00*	*1.70*	*1.81*	*2.74*	*3.01*
Total Generation	100GWh	**3309.32**	**3609.93**	**4075.44**	**4616.54**	**5308.04**	**5140.99**

Weighted Coal Efficiency Factor

Coal (power generation)	gCoal/kWh	**351**	**348**	**350**	**351**	**343**	**342**
Coal (power supply)	gCoal/kWh	**384**	**376**	**377**	**378**	**371**	**368**

Total Thermal Capacity	*MW*	*63714.90*	*68791.30*	*75607.60*	*84009.60*	*93594.90*	*111068.70*
Total Hydro Capacity	MW	3262.70	3224.00	3257.60	3266.00	3250.70	3216.30
Total Nuclear Capacity	MW	0.00	0.00	0.00	0.00	0.00	0.00
Total Other Capacity	MW	0.00	0.00	90.10	90.10	137.50	311.50
Total Capacity	**MW**	**66977.60**	**72015.30**	**78955.30**	**87365.70**	**96983.10**	**114596.50**

Capacity Additions (2001)	%	7.00%	-	-	-	-	-
Capacity Additions (2002)	%	15.17%	8.79%	-	-	-	-
Capacity Additions (2003)	%	**23.34%**	17.57%	9.63%	-	-	-
Capacity Additions (2004)	%	30.94%	**25.74%**	18.59%	9.92%	-	-
Capacity Additions (2005)	%	41.55%	37.16%	31.10%	**23.76%**	15.37%	-

Total Thermal Generation	*GWh*	*327299.84*	*358066.00*	*403919.00*	*457675.00*	*526772.00*	*510886.00*
Total Hydro Generation	GWh	3632.63	2927.00	3455.00	3798.00	3758.00	2912.00
Total Nuclear Generation	GWh	0.00	0.00	0.00	0.00	0.00	0.00
Total Other Generation	GWh	0.00	0.00	170.00	181.00	274.00	301.00
	GWh	**330932.47**	**360993.00**	**407544.00**	**461654.00**	**530804.00**	**514099.00**

	A	B	C	D	E	F	G	H	I	J
	Installed Capacity 2003	Installed Capacity 2005	New Capacity Additions	Split of New Capacity	Fuel Consumption	Fuel Calorific Value	CO_2 Emission Factor	CO_2 Emission Factor	Emissions Factor	Weighted Average Build Margin Emissions Factor
	MW	MW	MW	%	t_{SCE}*/GWh	GJ/t_{SCE}	tCO_2/GJ	tCO2/t_{SCE}	tCO_2/MWh	tCO_2/MWh
	China Electric Power Yearbook 2004, page 709	*China Electric Power Yearbook 2006, page 571 and "2005 Power Generation Yearbook for China Electricity Industry"*	*= B - A*		*BAT (http://www.ccchina.gov.cn/source/fa/fa2002082803)*	*The General Code for Comprehensive Energy Consumption Calculation (Chinese National Standard GB2589-90)*	*2006 IPCC Data*	*= F * G*	*= E * H/1000*	*= D * I*
Hydro	3,266.00	3,216.30	N/A	0.00%						0.000
Coal	84,009.60	111,068.70	27,059.1	99.19%	320	29.3	0.0946	2.7718	0.887	0.880
Nuclear	0.00	0.00	0.0	0.00%						0.000
Other (wind)	90.10	311.50	221.4	0.81%						0.000
Total / % Change	**87,365.7**	**114,596.5**	**27,280.5**	**23.8%**						**0.880**

Table A4: Combined Margin

		Units	Equation or Source	
A	Operating Margin emissions factor	tCO_2/MWh	Table A1	1.0255
B	Build Margin emissions factor	tCO_2/MWh	Table A3	0.8798
C	Baseline emissions factor	tCO_2/MWh	(=(A * 0.5 + B * 0.5)	**0.9526**

Table A5: Emission factor of baseline technology

	ID number	Value	Unit	Source
Fuel emission co-efficient		25.8	tC/ TJ	2006 IPPC Guidelines for National GHG Inventories (Chapter 1)
Fuel emission co-efficient	$COEF_{BL}$	0.0946	tCO_2/GJ	
Fuel Consumption	t_{SCE}/ GWh	315	t_{SCE}/GWh	China Power Engineering Consulting Group Corporation, Thermal Power Engineering Design Reference Cost Index, 2005 edition
Fuel Calorific Value		29.3	GJ/t_{SCE}	The General Code for Comprehensive Energy Consumption Calculation (Chinese National Standard GB2589-90)
Oxidation factor		1		2006 IPPC Guidelines for National GHG Inventories (Chapter 1)
Efficiency of plant		2.7718	tCO_2/ t_{SCE}	Calculated
Energy efficiency of plant	η_{BL}	0.3901		Calculated
Baseline scenario emission factor	$EF_{BL,CO2}$	0.8731	tCO_2/ MWh	Calculated according to AM0029

Table A6: Baseline emissions

	ID number	Value	Unit	Source
Net electricty generated pa	EG_{PJ}	3,266,032	MWh	Estimated in Taiyanggong Feasibility Study Report
Baseline emissions	BE	2,851,607	tCO2	Calculated

Table A7: Leakage

Data type	ID number	Value	Unit	Source
Annual gas consumption	FC_{gas}	727,445,800	m^3	Taiyanggong Feasibility Study Report
Net Calorific Value	NCV_{gas}	0.03272	GJ/m^3	Taiyanggong Feasibility Study Report
Emission factor for upstream fugitive methane emissions of natural gas from production, transportation and distribution	$EF_{NGupstream,CH}$	0.000296	tCH_4/ GJ	AM0029
Net annual electricity generation	$EG_{PJ,y}$	3,266,032	MWh	Taiyanggong Feasibility Study Report
Global Warming Potential of methane	GWP_{CH4}	21	tCO_2e/tCH_4	UNFCCC
Emission factor for upstream fugitive methane emissions from production of coal	$EF_{k,upstream,CH4}$	0.0134	tCH_4/tcoal	AM0029, underground mining
Net Calorific Value of coal	NCV_{coal}	29.3	GJ/ t_{SCE}	The General Code for Comprehensive Energy Consumption Calculation (Chinese National Standard GB2589-90)
Emission factor for upstream fugitive methane emissions from production of coal	$EF_{k,upstream,CH4}$	0.0005	tCH_4/GJ	
Emission factor for upstream fugitive methane emissions occuring in the absence of the project activity	$EF_{BL,upstreamCH}$	0.0042	tCH_4/ MWh	
Total leakage	**LE_{CH4}**	**-141,551**	**tCO_2e**	

Table A8: Emission Reductions

Data type	ID number	Value	Unit
Project emissions	PE_Y	1,335,318	tCO2e
Baseline emissions	BE_Y	2,851,607	tCO2e
Leakage	BE_Y	0	tCO2e
Emission Reductions	ER_Y	1,516,289	tCO2e

Annex 4

MONITORING INFORMATION

- ----

1. Introduction

This document outlines the procedures that Beijing Taiyanggong Gas-fired Thermal Power Co. Ltd. proposes to follow to ensure that the operation of the project complies with the CDM requirements.

2. Overall Project Management

Ultimate responsibility for the project rests with the General Manager of Taiyanggong Gas-Fired Combined Cycle Power Plant Company.

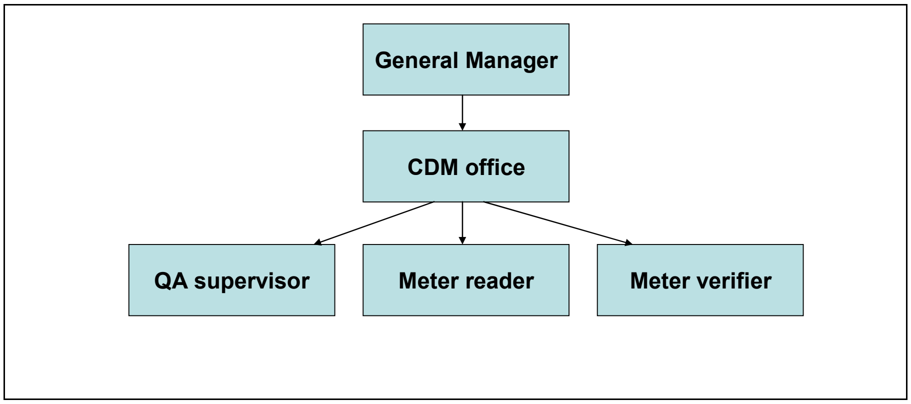
3. CDM Project Management and Calculations

The project sponsor will establish a CDM office which will be responsible for monitoring project emissions and other CDM related activities. An organisation chart is illustrated below. The meter reader will be responsible for compiling meter readings regularly and ensuring that the parameters identified in B7.1 are monitored. The meter reader will then send these records to the auditor who will ensure that they correspond to third party records (e.g. meter readings by the grid company or gas supply company). Any discrepancies will be reported to the office head and general manager. Following this cross-checking procedure, the readings will be stored electronically in the CDM information management system.

The supervision of the calibration and maintenance of the meters will be the responsibility of the quality supervisor. The quality supervisor will supervise meter maintenance and manage the calibration process according to the company's quality control programme.

To ensure that this monitoring plan is fully implemented, a CDM manual will be prepared giving full instructions for implementation. In addition, responsibility will be assigned to an individual (the CDM project officer) in the CDM office to prepare the monitoring report for verification by the DoE and issuance of CERs.

CDM Responsibility table



4. Procedures to be followed

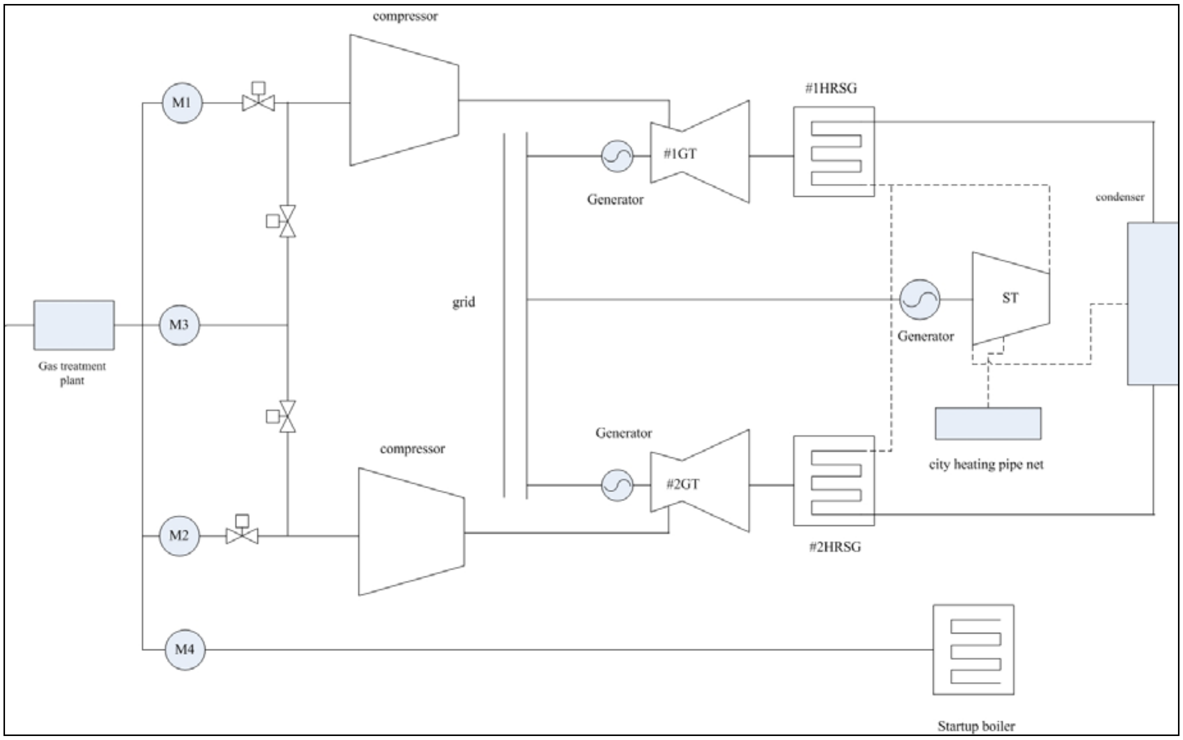
A detailed monitoring plan will be developed in accordance with the company's management system.

4.1 Gas consumption monitoring

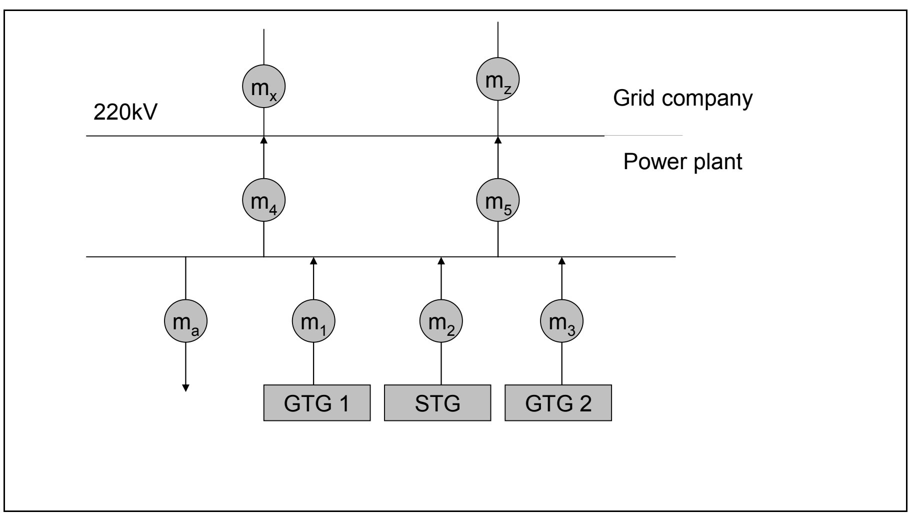
- There are four meters monitoring gas consumption: meters 1 and 2 measuring gas to each compressor and a meter 3 as a back-up. Meter 4 measures gas sent to the start-up boiler.
- Gas consumption will therefore be calculated by:

$$\mathbf{FC_{Gas} = M1 + M2 + M4}$$

- M3 will act as a back-up in case of failure of M1 or M2.
- The gas meters will automatically compensate for changes in temperature and pressure of the natural gas so that FCgas is given at normal temperature and pressure.
- As a further back-up, receipts of gas supplied by the gas company will be used.



4.2 Net Electricity Generation monitoring



- There are 2 connections to the 220kV Beijing Power Grid, each with a meter (m_4 and m_5). These meters will measure total electricity sent to the grid.
- Each of the 3 electricity producing generators has a meter to monitor the electricity produced and sent to the main internal line (m_1, m_2 and m_3). On-site, auxiliary use of power generated is measures by a separate meter (m_a). Back up readings will be taken from these meters

- Finally, there are two meters (m_x and m_z) owned by the Beijing Power grid company measuring the electricity supplied to the grid from the project. Readings from these will be used as a further back-up, if necessary.

In summary,

$$\text{Net electricity generated} = m_4 + m_5 = (m_1 + m_2 + m_3) - m_a$$

4.3 Monitoring of diesel consumption

- The diesel generators will be used in an emergency only to supply electricity to shutdown turbines smoothly and safely. They will also be tested once a week.
- A volume flow meter will be used to measure diesel consumption. The volume flow meter will be installed on the main fuel supply line and will measure the volume of diesel consumed in litres by the diesel gensets. This will be converted to the mass of diesel consumed using the standard density of diesel (0.85 kg/litre), giving FC_{diesel}.
- As a back-up, receipts will be used to monitor diesel consumption.

5. Training, Record Keeping, Error handling and Reporting Procedures

5.1 Training

Members of staff who are part of the CDM office will be given training on the CDM and reporting requirements, prior to registration of the project. New members of staff joining the CDM office will also be given training in relation to their responsibilities. Full training procedures and a training plan will be detailed in the CDM Manual.

5.2 Record Keeping and Internal Reporting Procedure

This will be developed in accordance with the company's management procedures.

5.2 Error Handling Procedure

In the event that a meter has lost calibration over the allowable error limit then this shall be corrected at the earliest opportunity and re-calibrated and the data recorded from this meter since the last successful calibration shall be ignored.

In the event that there is uncertainty over the accuracy of the data set for net electricity generated from the main meters (e.g. the meter has lost calibration over the acceptable error limit) then the data from the back-up meters shall be used. In the event that there is uncertainty over the accuracy of the data set from the main and from the back-up meters, then power generated and delivered to the grid as evidenced by invoices and/or sales receipts shall then be used to evaluate the power generation.

Similarly for gas consumption, if there is uncertainty over the accuracy of the data set for gas consumed from the main meter, then data from the back-up meters will be used. If there is uncertainty over the accuracy of both data sets, then invoices and/ or sales receipts shall be used.

The check of the CDM Project Officer and then the third party verifier prior to issuance of the CERs is considered adequate for errors in the calculations. Where errors in the calculations are discovered by either of these Parties, the monitoring report shall be modified and the corrected version shall be resubmitted to the verifier.

5.3 External Reporting Procedure

After signing by the CDM Project Officer, the report is sent to the 3rd party verifier who is contracted to verify the emissions reductions during the crediting period of the project.

5.4 Procedure for corrective actions arising

The CDM Project Officer is responsible for identifying corrective actions arising from the above procedures and for liaising with the purchaser, the 3rd party verifiers and other stakeholders to take necessary steps to implement the corrective actions.

6. Emergency procedures

In the unlikely event of an emergency, set procedures will be followed to prevent unintended emissions of methane. Details of the procedures to be followed are described in the relevant Operation Manuals. The key points include:

- The Distributed Control System (DCS) will automatically shut off gas supply to areas where a leak could occur upon detecting an emergency.
- The operators can also remotely shut off the gas supply if they find an emergency situation has occurred.

7. Standard Template for Reporting of Data for Verification of CERs

Name of Project: Taiyanggong Natural Gas-Fired Combined Cycle Power Plant Project

Crediting Period for which CERs are claimed:

From [---Insert Date---] **to** [---Insert Date---]

Author of this Report: [Insert Name]

Date of Issuance of this Report to Verifier: [---Insert Date---]

Name and contact details of Verifier: [Insert]

Number of ER's claimed during period: [Insert Number] t CO_2e

Baseline emissions Factor: 0.8731 tCO_2e per MWh

Generated Electricity (net of auxiliary power): [insert number] MWh

Gas consumed: [insert number] m^3

Diesel consumed: [insert number] tonnes

Calculation and Data:

Month	Generation Period (Start Date/End Date)	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 emissions reductions (tonnes of CO_2e)
Total					

Comments:

Signed: ________________________ (CDM Officer) Date:__________