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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

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Project title: Ningxia Yinchuan No. 1 Natural Gas Cogeneration Project

PDD version: 01

Date: Mar. 28, 2008

A.2. Description of the project activity:

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Ningxia Yinchuan No.1 Natural Gas Cogeneration Project (hereinafter referred to as the proposed project) is located in Jinfeng District, Yinchuan City, Ningxia, People's Republic of China. The project entity is Ningxia HANAS Natural Gas Thermal Power Co., Ltd.. Ningxia is a poverty-stricken and minority-residential region with a total population of 5.95 million in 2005[1]. 357,000 of the total population were living in poverty with an annual income below 944RMB and 75,000 under the absolute poverty line with an annual income below 683RMB. Among the population in poverty and under the absolute poverty line, respectively 74.5% and 77.3% live in Tongxin County, Haiyuan County and Xiji County where minority dominates the population[2].

A cogeneration system consisted of a 51MW gas turbine generating unit, a 70t/h waste heat boiler and a 13MW steam turbine generating unit will be installed. 64.76 million m^3 gas, which is from Shaanxi-Gansu-Ningxia gas field, will be consumed by the proposed project annually.

Electricity generated by the proposed project will be delivered to Northwest Power Grid (NWPG) via Ningxia Power Grid. The annual power delivered to the grid is 307,200MWh. It will take on the task of peak-load regulation. A part of the waste heat will be used for power generation by steam turbine generating unit, while the other part of the waste heat will be used for residential heating. Only the emission reduction by the electric power replacement is claimed. No other auxiliary fuel will be consumed by the proposed project. The proposed project will be put into operation in Oct. 2008.

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[1] http://www.stats.gov.cn/tjsj/ndsj/2006/indexch.htm

[2] http://www.nxso.gov.cn/news_display.asp?newsId=1364

http://www.nxso.gov.cn/news_display.asp?newsId=1363

The proposed project makes use of natural gas, a kind of clean and low-emission energy for power generation. The power generated by the proposed project will substitute a part of power would have been generated by NWPG which is dominated by coal-fired power plants and thus reduces GHG emission. The estimated annual emission reductions are 49,041tCO_2e.

The proposed project will contribute to local sustainable development mainly through the following aspects:

- The proposed project will promote the transfer of advanced technology from overseas;
- The proposed project uses combined-cycle gas turbine (CCGT) technology, which could improve energy efficiency and reduce GHG emission;
- The implementation of the proposed project will reduce other pollutants such as SO_2, NO_x and particulate matter to be produced by conventional power plants;
- The implementation of the proposed project will mitigate the poverty, which is very important to Ningxia, a poverty-stricken region. The proposed project is beneficial to economic promotion of minority residential region. This is in line with the UN Millennium Development Goal (MDG).

A.3. Project participants:

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The project participants are shown in Table A3-1:

Table A3-1 Project participants

Name of Party involved	Private and /or public entity (ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participants (Yes/No)
China (host)	Ningxia HANAS Natural Gas Thermal Power Co., Ltd.	No
Japan	Marubeni Corporation	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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The People's Republic of China

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

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Ningxia Hui Autonomous Region

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

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Jinfeng District, Yinchuan City

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

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The proposed project is located in Jinfeng District of Yinchuan City, Ningxia, People's Republic of China. The coordinates of the proposed project location are 106°16' east longitude, 38°27' north latitude. Figure A4.1 is the location of Ningxia and Figure A4.2 is the location of the proposed project.

Figure A4.1 Location of Ningxia

Figure A4.2 Location of the proposed project

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

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The proposed project activity category belongs to:

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

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

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The gas consumed by the proposed project is from Shaanxi-Gansu-Ningxia gas field. A booster and regulator station (secondary station) of natural gas will be built to further purify, supercharge, control, regulate and measure the natural gas imported.

The proposed project will use one imported gas turbine generating unit, one domestic waste heat boiler and one domestic steam turbine generating unit.

The flowchart of power generation is shown in Figure A4.3.

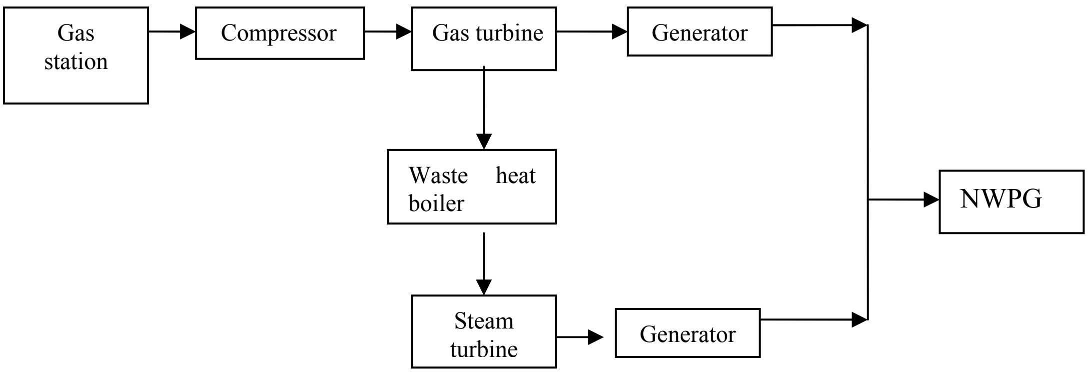

Figure A4.3 Flowchart of power generation

The key technology adopted by the proposed project will be imported from foreign countries, so the implementation of the proposed project will promote the technology transfer.

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

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Renewable crediting period (7*3 years) will be used by the proposed project. The estimation of the emission reductions during the first crediting period is presented in Table A4-1.

Table A4-1 The estimation of the emission reductions during the first crediting period

Year	The estimation of annual emission reductions (tCO_2e)
01/10/2008-31/12/2008	12,260
2009	49,041

2010	49,041
2011	49,041
2012	49,041
2013	49,041
2014	49,041
01/01/2015-30/09/2015	36,781
The estimation of total emission reductions in the first crediting period	**343,287**
Total number of the first crediting years	7
The estimation of annual average emission reductions in the first crediting period	49,041

A.4.5. Public funding of the project activity:

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No public funding from the Annex 1 countries is provided to the proposed project.

SECTION B. Application of a baseline and monitoring methodology

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

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Methodologies and tools applied to the proposed project are as follows:

Approved baseline methodology AM0029 – "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" (Version 02);

Approved monitoring methodology AM0029– "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel" (Version 02);

"Tool to calculate the emission factor for an electricity system" (version 01);

"Tool for demonstration and assessment of additionality" (Version 04).

More details can be referred to:

http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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The proposed project activity meets all the applicability conditions defined in the approved methodology AM0029 (Version 02) because of the following reasons:

- The proposed project is a new natural gas fired grid-connected electricity generation plant.
- The geographical/ physical boundaries of the baseline grid (the NWPG) can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available.
- The natural gas used by the proposed project is derived from Shaanxi-Gansu-Ningxia gas field. The exploitable reserve of Shaanxi-Gansu-Ningxia gas field exceeds 300 billion m^3 [3] and the design capacity of annual gas transmission is 12 billion m^3[4], while the expected natural gas consumption of the proposed project is about 64.76million m^3/year, accounting for only 0.54% of the total gas transportation capacity. Therefore, the natural gas supply for the proposed project is sufficient.

Meanwhile, the proposed project activity won't affect the gas utilization of the existing gas consumers. Furthermore, future natural gas based power capacity additions, comparable in size to the proposed project activity, will not constrained by the use of natural gas in the proposed project activity.

To conclude, the methodology AM0029 (version 02) is applicable to the proposed project.

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

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Power generated by the project will be connected to NWPG via Ningxia Power Grid. The spatial extent of the project boundary is the proposed project site and other power plants connected physically to the NWPG. According to *"China's Regional Grid Baseline Emission Factors Determined"* published by DNA[5], the areas covered by NWPG include Shaanxi Province, Gansu Province, Qinghai Province, Ningxia Hui Autonomous Region and Xinjiang Province.

The emission sources and gases included in the project boundary are listed in Table B3-1.

[3] Shaanxi-Gansu-Ningxia gas field is the biggest one in the mainland. The exploitable reserve of Shaanxi-Gansu-Ningxia gas field exceeds 300 billion m^3. At present, the natural gas is transmitted through three pipelines to Beijing, Xi'an and Yinchuan respectively and the transmission capacities are: Beijing 660mm*900km, 3 billion m^3/yr (supply for Beijing, Tianjin, Hebei); Xi'an 426mm*480km, 800-900 million m^3/yr; Yinchuan 426mm*300km, 300-400 million m^3/yr. http://news.163.com/06/0123/17/285UJKPD0001126S.html

[4] http://www.cpmec.com.cn/pub/syzbzx/yjdt/t20050922_37062.htm

[5] http://cdm.ccchina.gov.cn/web/index.asp

Table B3-1 The emission sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Power generation in NWPG	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.

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

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According to AM0029 (Version 02), the following steps are used to identify the baseline scenario:

Step 1: Identify plausible baseline scenarios

The identification of alternative baseline scenarios should include all possible, realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity.

Alternatives to be analyzed should include, inter alia:
- The proposed project activity not implemented as a CDM project;
- Power generation using natural gas, but technologies other than the proposed project activity;
- Power generation technologies using energy sources other than natural gas;
- Import of electricity from connected grids, including the possibility of new interconnections.

Alternatives should meet the following conditions:
a) Outputs or services provided should be comparable with the proposed CDM project activity (e.g. peak-load vs. base-load power);
b) They should include technologies adopted by existing, under-construction and to-be-constructed power plants;
c) They should be in compliance with all applicable legal and regulatory requirements.

Based on the conditions above and the characteristic of the proposed project, the plausible baseline scenarios are identified as follows:

Alternative 1, i.e. the proposed project activity not implemented as a CDM project, is a plausible baseline scenario and in line with current laws and regulations.

As to alternative 2, technologies for power generation using natural gas includes single cycle power generation technology and gas-steam combined cycle power generation technology. The thermal efficiency of single-cycle gas turbine is only 38%~39.5%[6] which is much lower than that of the combined cycle, i.e. 55%. Therefore, single cycle power generation is not economically attractive compared with combined cycle power generation. So, alternative 2 is not feasible.

As to alternative 3, there is no hydropower or wind power projects that can undertake the task of peak-load regulation in NWPG as the proposed project does and there is no nuclear power generation in NWPG, so the most possible power generation technologies using energy sources other than natural gas are coal-fired/oil-fired power generation technologies. According to the China energy statistical yearbook of recent years, however, there is no oil-fired power generation in NWPG. Besides, in the circumstance that oil price keeps increasing and China is comparatively short in oil, the construction of oil-fired power plant means a loss of money[7]. Therefore, oil-fired power generation is not a feasible alternative. According to the *Notice on Requirement of Planning and Construction of Coal Fired Power Plants* issued by National Development and Reform Commission (Document No. 2004.864), the unit capacity of the coal-fired power plant should be larger than 600MW (including 600MW). Thus subcritical or supercritical coal-fired power plant with a unit capacity of 600 MW could be the alternatives of the proposed project.

As to alternative 4, according to the China Electric Power Yearbook, in the past years, the NWPG has no electricity import from other grids. Therefore, importing electricity from connected grids is unrealistic. So, alternative 4 is not feasible.

To sum up, the possible baseline scenarios include:
Alternative scenario 1: The proposed project activity not implemented as a CDM project;
Alternative scenario 3-1: Subcritical coal-fired power plant with a unit capacity of 600 MW;
Alternative scenario 3-2: Supercritical coal-fired power plant with a unit capacity of 600MW.

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6 http://www.chinapower.com.cn/article/1025/art1025680.asp

7 http://finance.sina.com.cn/chanjing/b/20071123/12291812019.shtml

Step 2: Identify the economically most attractive baseline scenario alternative

According to AM0029 (Version 02), the economically most attractive baseline scenario alternative is identified from all alternatives remaining after step 1 by using investment analysis. The levelized cost of electricity production should be used as financial indicator for investment analysis.

The levelized cost formula used is as follows[8]:

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

Where:
EGC=levelized EGC per *kWh*;
I_t=investment 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.

Relevant assumptions and parameters for calculating levelized costs of various generation technologies are listed in Table B4-1:

Table B4-1 Relevant assumptions and parameters of levelized costs of various generation technologies

Generation technology	Alternative scenario 1	Alternative scenario 3-1	Alternative scenario 3-2
Investment (RMB/kW)	4656	3623	4235
Construction Period (year)	2	3	3
Lifetime (year)	20	30	30
Material expenditure (RMB/MWh)	12.06	7	7.49
Other expenditure (RMB/MWh)	13.7	15	13.59
Water expenditure	2.17	1	0.24

[8] IEA：Appendix 10, Projected Costs of Generation Electricity

(RMB/MWh)			
Desulfuration expenditure (RMB/MWh)	0	1.5	1.53
Employee expenditure (RMB/MWh)	3.83	0.38	0.3
Power generation energy consumption	0.203 m^3/kWh	320 gce/kWh	299 gce/kWh
Fuel expenditure	RMB 1.18/Nm^3	RMB 260/t	RMB 260/t
Levelized cost (RMB/kWh)	0.3773	0.1841	0.1914
Data source	Preliminary Design Report of the proposed project	Feasibility Study Report of typical power plant	Feasibility Study Report of typical power plant

Based on the above parameters and levelized cost calculation formula, the levelized EGC and sensitive analysis of the alternatives are listed in Table B4-2.

Table B4-2 Sensitive analysis of levelized cost

Generation technology	**Levelized cost (RMB/kWh)**	**Load factor**		**Fuel cost**	
		+10%	**-10%**	**+10%**	**-10%**
Alternative scenario 1: The proposed project activity	0.3773	0.3674	0.3895	0.4014	0.3533
Alternative scenario 3-1: 600MW subcritical	0.1841	0.1769	0.1928	0.1921	0.1760
Alternative scenario 3-2: 600MW supercritical	0.1914	0.1831	0.2015	0.1992	0.1836

Table B4-1 shows that the 600MW subcritical coal-fired power generation technology has the lowest levelized cost. The sensitive analysis in Table B4-2 confirms and supports that the levelized cost of the 600MW subcritical coal-fired power generation technology remains the least when the critical assumptions fluctuate within reasonable variations. According to AM0029 (Version 02), the baseline alternative with the best financial indicator, i.e. the lowest levelized cost, can be pre-selected as the most plausible scenario. Therefore, without the proposed project activity, the relevant output and service will be provided by 600MW subcritical coal-fired power plants which are being built or to be built.

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):

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According to AM0029 (Version 02) and "Tool for demonstration and assessment of additionality" (Version 04), the additionality of the proposed project is demonstrated and assessed through the following steps:

Step 1: Benchmark investment analysis

Sub-step 1a. Apply benchmark analysis

The Interim Measures for Economical Assessment of Electrical Technological Transformation Project is the most important reference for power generation project investment assessment in China. According to it, the sectoral benchmark IRR on total investment for power industry is 8% (after tax). The proposed project adopts this benchmark.

Sub-step 1b. Calculation and comparison of financial indicators

(1) Basic parameters for calculation of financial indicators

The basic parameters for calculation of financial indicators are shown in the following Table:

Table B5-1: Basic parameters for calculation of financial indicators

No.	Items	Parameters
1	Installed capacity	64MW
2	Static total investment	298.01 million RMB
3	Project lifetime	20 years
4	Annual operation hours	5,500h
5	Annual power delivered to the grid	307,200MWh
6	Prospective on-rid power price (after tax)	0.402RMB/kWh
7	Tax	
8	VAT	17%
9	Income tax	25%
	City Preservation and Development Tax	7%
	Education surcharges	3%

	Annual average O&M cost	91.23 million RMB
	Depreciation period	15 years
10	Crediting period	7*3 yrs (Renewable)
11	Expected CERs price	8 Euro/tCO_2e

(2) Comparison of the financial indicators of the proposed project and the benchmark *IRR*

In accordance with benchmark analysis (Option III), if the financial indicator (*IRR*) of the proposed project is lower than the benchmark, the proposed project is not considered financially attractive.

Table B5-2: Financial indicators of the proposed project

	IRR (%)
Without CDM income	6.66
With CDM income	8.09

Table B5-2 shows that without CDM income, the *IRR* of total investment is 6.66%, which is lower than the benchmark *IRR*, i.e. 8%. With CDM income (CERs price is 8 Euro/tCO_2e and crediting period is 7*3 yrs), the *IRR* of total investment increases to 8.09%, thus the financial condition is improved considerably.

Sub-step 1c. Sensitivity analysis

For the proposed project, the following financial parameters are taken as uncertain factors for sensitive analysis of financial attractiveness:

· Static total investment;
· Power delivered to the grid;
· Annual O&M cost.
· Power price

When the above financial parameters fluctuate within the range of -10% to +10%, the IRR of total investment of the proposed project varies to different extent. The impacts on IRR of total investment due to the parameters' fluctuation (not considering CDM income) are shown in Table B5-3 and Figure B5.1:

Table B5-3 Sensitivity analysis of the proposed project IRR (total investment)

Fluctuation range of indicator	-10%	-5%	0	5%	10%

Static total investment	7.99%	7.30%	6.66%	6.07%	5.52%
Power delivered to the grid	1.84%	4.46%	6.66%	8.60%	10.18%
Annual O&M cost	10.40%	8.59%	6.66%	4.55%	2.20%
Power price	1.84%	4.46%	6.66%	8.60%	10.18%

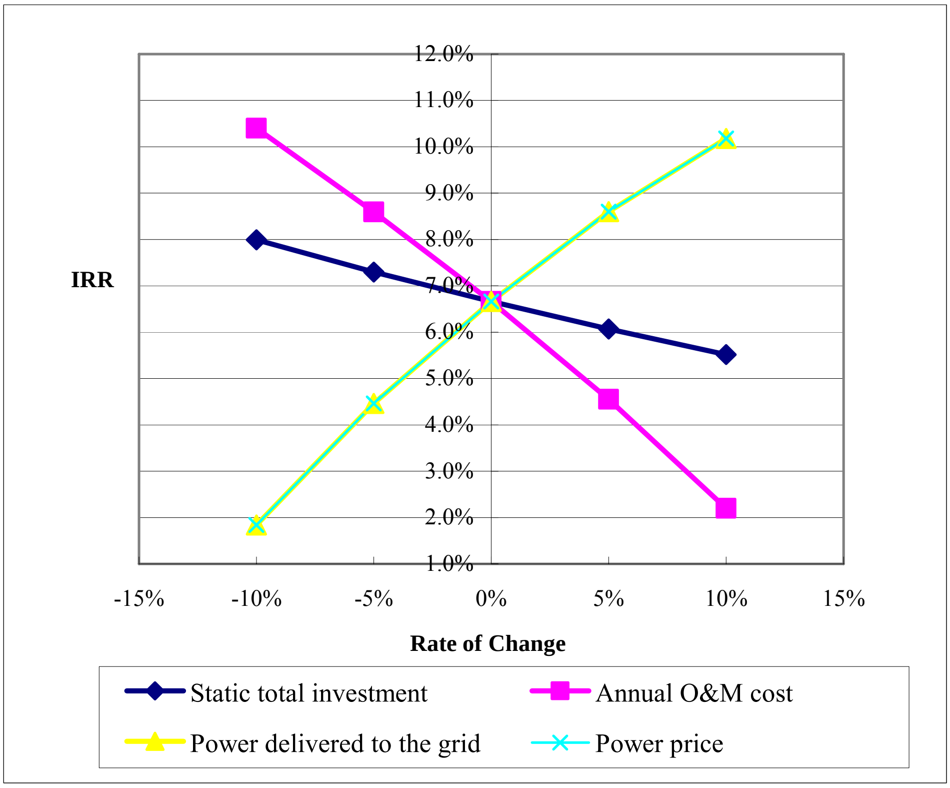

Figure B5.1 The impacts on IRR (total investment) by uncertain factors fluctuation (without CDM income)

When the power delivered to the grid increases 3.3%, the IRR will reach to the benchmark. Power delivered to the grid is determined by the installed capacity and annual operation hours of the project. The installed capacity of the proposed project has been approved by local government and is fixed. Only the variation of operation hours could influence the power delivered to the grid. As for a power plant, peak-load task undertaking results in frequent start-up and power-off of the generating units, which shortens interval period of maintenance and increases O&M cost. According to the statistic rule on beneficial result and reliability of gas turbine, a cycle of start-up and power-off equals to 10~20 operation hours equivalent. Generally Annual frequency of gas turbine generation unit undertaking peak-load task is more than 300 times, which equals to increase 3000~6000 operation hours.[9] The operation hours equivalent of generating unit of the proposed project will reach 8500~11500 as the actual operation hours are 5500, while there are 8760 hours in a year. It is hard to increase the operation hours of the proposed project on the basis of such operation intensity. Therefore, the power delivered to the grid is unlikely to increase 3.3%.

When the power price increases 3.3%, the IRR will reach to the benchmark. The power price of the proposed project has been approved by the local government. Thus there is no room for the power price to increase.

When the annual O&M cost reduces 3.5%, the IRR will reach to the benchmark. The annual O&M cost composes of the fuel fee, material fee, repairing fee and the payment for the workers etc.. All these elements are the basic expenditure for operation and maintain of the project activity. If the fuel fee, which accounted for 83.4% of the annual O&M cost, could be reduced, the annual O&M cost would decreased significantly. However, the natural gas price keeps increasing[10], which means that the fuel fee of the proposed project is unlikely to be reduced. Meanwhile, the material price in Ningxia has been keeping increasing[11]. Therefore, the annual O&M cost is unlikely to fall by 3.5%.

When the total investment reduces 10.1%, the IRR will reach to the benchmark. However, the investment estimation has been made in the Preliminary Design Report (PDR) in terms of conservative manner. The key technical equipment of the proposed project is imported from overseas, which holds a great weight in the total investment. Besides, the construction cost has been keeping increasing due to the increase of industrial material[12]. The construction and operation of the proposed project will be influenced if the total investment is deducted intentionally. Therefore, the total investment is unlikely to fall by 10.1%.

Based on the above analysis, without the support of CDM income, the proposed project is not financially attractive.

Step 2: Common practice analysis

Sub-step 2a. Analyze other activities similar to the proposed project activity

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[9] http://www.chinapower.com.cn/article/1046/art1046081.asp

[10] http://www.bhtz.com/SPECIAL/SPECIAL.ASP?ID=720863

[11] http://www.mofcom.gov.cn/aarticle/difang/ningxia/200507/20050700197684.html

[12] http://www.mofcom.gov.cn/aarticle/difang/ningxia/200507/20050700197684.html

Ningxia Power Grid is dominated by fossil-fired power generation. According to the BM emission factor calculation issued by Chinese DNA[13], the fuel consumed by fossil-fired power in Ningxia Power Grid is predominantly coal and no natural gas. The project is the "first of its kind" in Ningxia, so natural gas power generation is not common practice in Ningxia Power Grid.

Sub-step 2b. Discuss any similar options that are occurring

After the completion of construction, the proposed project will become the first natural gas based gas-steam combined cycle power project in Ningxia Power Grid. Therefore, the proposed project is not a common practice.

In conclusion, without CDM support, the proposed project would unlikely occur. The proposed project is additional, not (part of) the baseline scenario. If the proposed project fails to be registered as a CDM project, the emission reduction can not be realized.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Step 1 Calculate Baseline Emission (BE_y)

Sub-step 1a Calculate Baseline Emission Factor ($EF_{BL,CO2}$)

Baseline emissions are calculated by multiplying the electricity generated by the proposed project with a baseline CO_2 emission factor, as follows:

$$BE_y = EG_{pj,y} \times EF_{BL,CO2,y} \qquad (2)$$

According to AM0029 (version 02), for the first crediting period, the baseline emission factor should be the lowest of the following three options:

Option 1: The build margin, calculated according to "Tool to calculate emission factor for an electricity system";

Option 2: The combined margin, calculated according to "Tool to calculate emission factor for an

[13] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf

electricity system", 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:

$$EF_{BL,CO2}(tCO_2/MWh)=\frac{COEF_{BL}}{\eta_{BL}}*3.6GJ/MWh \qquad (3)$$

Sub-step 1a.1 Calculate the build margin and the combined margin according to "Tool to calculate the emission factor for an electricity system"

The calculation steps are as follows:

① Identify the relevant electric power system.

② Select an operating margin (OM) method.

③ Calculate the operating margin emission factor according to the selected method.

④ Identify the cohort of power units to be included in the build margin (BM).

⑤ Calculate the build margin emission factor.

⑥ Calculate the combined margin (CM) emissions factor.

The detailed calculated processes are as follows:

① Identify the relevant electric power system.

According to "Tool to calculate the emission factor for an electricity system" and the delineation of electricity system given by Chinese DNA, the proposed project belongs to NWPG. Areas covered by NWPG includes Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.

② Select an operating margin (OM) method.

Based on one of the four following methods:

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

Method (a) can only be used where low-cost/must run resources[14] constitute less than 50% of total grid

[14] The low-cost/must run resources include hydro power, geothermal sources, wind power, solar sources etc.

generation in: 1) average of the five most recent years, or 2) based on long-term norms for hydroelectricity production. Among the total electricity generations during 2001-2005 of the NWPG where the proposed project connected, the low-cost/must run resources constitute less than 50% of total amount grid generating output, which is in compliance with the applicability of Method (a). The detailed information could be seen in Table B6-1.

Table B6-1 Annual electricity generation of NWPG during 2001-2005

No.	Year	Electricity generation （10^8kWh）			Proportion of wind power, etc.
		Total generation	Fuel-fired power	Wind power, etc	
1	2001[15]	1,088.28	811.48	276.8	25.43%
2	2002[16]	1210.52	934.28	276.24	22.82%
3	2003[17]	1392.34	1130.93	261.41	18.77%
4	2004[18]	1674.57	1319.39	355.18	21.21%
5	2005[19]	1845.62	1339.09	506.53	27.44%

So, method (a) is selected.

③ **Calculate the operating margin emission factor according to the selected method.**

The Simple OM emission factor is calculated ex-ante, and it uses the available data in NWPG for the most recent 3 years (2003-2005).

The Simple *OM* emission factor is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, excluding those low-operating cost and must-run power plants. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant/unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or

[15] China Electric Power Yearbook 2002 p. 617

[16] China Electric Power Yearbook 2003 p. 585

[17] China Electric Power Yearbook 2004 p. 709

[18] China Electric Power Yearbook 2005 p. 474

[19] China Electric Power Yearbook 2006 p. 568

- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C).

Option A should be preferred and must be used if fuel consumption data is available for each power plant / unit. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost / must-run power sources and if the quantity of electricity supplied to the grid by these sources is available.

The data of each power plant /unit in NWPG where the proposed project connected to is not available publicly, thus Option A and Option B is not applicable. The low-cost/must run power resources in NWPG include only nuclear and renewable power generation, and the quantity of electricity supplied to the grid by these sources is available. Therefore, Option C is selected for calculating the Simple *OM* emission factor.

The calculation is as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad (4)$$

Where:

$EF_{grid,OMsimple,y}$ =Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$FC_{i,y}$=Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)

$NCV_{i,y}$=Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

$EF_{CO2,i,y}$=CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)

EG_y=Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)

i=All fossil fuel types combusted in power sources in the project electricity system in year y

y=The three most recent years which data is available

According to the *Bulletin on Determination of Baseline Emission Factor of Chinese Power Grid*

[20]published by China DNA, the simple *OM* emission factor of NWPG calculated ex-ante is:
$EF_{grid,OM,y}$ = 1.1257 tCO_2/MWh.

④ **Identify the cohort of power units to be included in the build margin (BM).**

The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Sample group that comprises the larger annual generation from these two options should be used. However, it is very difficult to obtain the data of the five power plants built most recently because these data are considered confidential business matter in China. So, option 2 is selected.

The Build Margin emission factor $EF_{BM,y}$ is calculated ex-ante based on the most recent information available on plants already built for sample group *m* at the time of PDD submission.

⑤ **Calculate the build margin emission factor.**

The Build Margin Emission Factor ($EF_{grid, BM, y}$) is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (5)$$

Where:
$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$ =Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ =CO2 emission factor of power unit m in year y (tCO2/MWh)
m =Power units included in the build margin
y =Most recent historical year for which power generation data is available

Due to the data's unavailability, the BM calculation in this PDD follows the guidance provided by the EB in the deviation. Calculate first the newly installed capacity and its power generation technology mix, then the weights of different power technologies in the newly installed capacity, and finally the BM emission factor based on the emissions factors of different types of most advanced commercial generation technologies.

[20]http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

Because the capacity of the coal-fired, oil-fired and gas fired power plants can not be separated in the publicly available statistical data, the BM calculation in this PDD adopts the following method. Firstly, use the available data in the energy balance sheets of the most recent year to calculate the proportions of the CO_2 emission from solid, liquid and gaseous fuels in the total CO_2 emissions related to power generation. Secondly, calculate the emissions factor of the fossil fuel-fired power generation in NWPG using the above proportions as the weights and the emission factors of the most advanced commercial generation technologies as the reference. Finally, the BM emission factor is the product of this emission factor of fossil fuel-fired power generation and the proportion of fossil fuel-fired power plants in the newly installed 20% capacity. The detailed steps and the related formulas are as follows:

Sub-step 5a. **Calculating the share of CO_2 emissions of different fuel-fired power plants in the total CO_2 emissions**

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \tag{6}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \tag{7}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} * COEF_{i,j}}{\sum_{i,j} F_{i,j,y} * COEF_{i,j}} \tag{8}$$

Where:

$F_{i,j,y}$ is the amount of fuel i consumed (in a mass or volume unit) by relevant provincial sub-grids j in year y;

$COEF_{i,j}$ is the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant provincial sub-grids j and the percent oxidation of fuel in year y;

*COAL,OIL,*and *GAS* refers to all forms of coal, oil and gas.

Sub-step 5b. **Calculating the Emission Factor of fuel-fired power technology**

$$EF_{Fuel-fired} = \lambda_{Coal} * EF_{Coal,Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas,Adv} \tag{9}$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ represent the related Emission Factor of the commercially available most advanced coal, oil and gas fired power technology, please refer to Annex 3 for more details.

Sub-step 5c. **Calculating the $EF_{grid, BM, y}$ of NWPG**

$$EF_{BM} = \frac{CAP_{Fuel-fired}}{CAP_{Total}} * EF_{Fuel-fired} \qquad (10)$$

Where:

CAP_{Total} is the newly increment of total installed capacity;

$CAP_{Fuel\text{-}fired}$ is the newly increment of fuel-fired installed capacity.

According to the *Bulletin on Determination of Baseline Emission Factor of Chinese Power Grid*[21] published by China DNA, the *BM* emission factor of NWPG calculated ex-ante is:

EF_{BM} = 0.5739tCO_2 /MWh.

⑥ **Calculate the combined margin (CM) emissions factor.**

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \qquad (11)$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

According to AM0029 (version 02), $w_{OM} = w_{BM}$ =0.5. Hence:

$EF_{grid, CM, y}$=0.5*$EF_{grid, OM, y}$+0.5*$EF_{grid, BM, y}$

=0.5*1.1258+0.5*0.5739

=0.8498 tCO_2/MWh

Sub-step 1a2: Calculate the Emission Factor of the Baseline Technology and Fuel

The emission factor of the baseline technology and fuel is calculated as per formula (3) as follows:

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

[21] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

Where:

$COEF_{BL}$: is the fuel emission coefficient (tCO_2e/GJ), based on national average fuel data, if available, otherwise IPCC defaults can be used.

η_{BL} is the energy efficiency of the technology, as estimated in the baseline scenario analysis above.

As identified and described in Section B4, the 600MW subcritical coal-fired power generation technology has been identified as the most likely baseline scenario. The calculation of emission coefficient of coal is as follows:

$$COEF_{Coal}=NCV_{Coal}\times EF_{CO2,Coal}\times OXID_{Coal} \qquad (12)$$

Where:

NCV_{Coal} is the net calorific value of coal, the country-specific value has been adopted in PDD: NCV_{Coal} = 29.27GJ/tce;

$EF_{CO2,Coal}$ is the CO_2 emission factor per unit of energy of coal in year y, IPCC 2006 default value is used in PDD:

$EF_{CO2\ Coal}$ =0.0258 tc/GJ*44CO_2/12C*100%=0.0946tCO_2/GJ;

$OXID_{Coal}$ is the oxidation factor of coal, the IPCC 2006 default value will be used in PDD: $OXID_{Coal}$ =100%.

Then the formula (3) could be expressed as follows:

$$EF_{BL,CO2}(tCO_2/MWh)= COEF_{Coal}\times PSCC_{BL} \qquad (13)$$

Where:

$COEF_{Coal}$ is the emission coefficient of coal (tCO_2/tce);

$PSCC_{BL}$ is the unit coal consumption of power supply (tce/MWh) of the baseline power generation technology. According to data published by Chinese DNA, the value for subcritical coal-fired power plant with a unit capacity of 600 MW is 343.33 gce/kWh[22].

Therefore, the emission factor of the baseline technology and fuel is:

$EF_{BL,CO2}$ = 0.9507tCO_2/MWh

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[22] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf

Sub-step 1a3: Choice of Baseline Emission Factor ($EF_{BL,CO2}$)

In summary, the choice of the Baseline Emission Factor ($EF_{BL,CO2}$) is shown in Table B6-2:

Table B6-2 The choice of the Baseline Emission Factor

Options	Emission Factor (tCO_2/MWh)
Option 1：Build Margin *BM*	0.5739
Option 2：Combine Margin *CM*	0.8498
Option 3：Generation technology of the baseline scenario ($EF_{BL,CO2}$)	0.9507

According to AM0029 (Version 02), the baseline emission factor ($EF_{BL,CO2}$) should be the lowest emission factor among the above three options, so the baseline emission factor of the proposed project is identified as:

$EF_{BL,CO2,y}$ =0.5739 tCO_2/MWh

According to AM0029 (version 02), since $EF_{grid,BM,y}$ is selected, it will be estimated *ex post.*

Sub-step 1b Calculate Baseline Emission (BE_y)

The baseline emission is calculated as per formula (2) as follows:

$BE_y=EG_{pj,y}\times EF_{BL,CO2,y}$

Then:

$$BE_y = EG_{pj,y}\times EF_{BL,CO2,y}$$
$$=0.5739\, EG_{pj,y}\ (tCO_2) \qquad (14)$$

Step 2 Calculate Project Emission (*PE_y*)

The project activity is on-site combustion of natural gas to generate electricity. According to AM0029 (Version 02), the CO_2 emissions from electricity generation are calculated as follows:

$$PE_y=\sum_f FC_{f,y}\times COEF_{f,y} \qquad (15)$$

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 unit) 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 the proposed project activity doesn't use other fuel or other startup fuel, so only the CO_2 emission coefficient of natural gas need to be calculated. According to AM0029 (version 02), it is obtained as:

$COEF_{CO2,NG} = NCV_{NG} \times EF_{CO2,NG} \times OXID_{NG}$ (16)

Where:

NCV_{NG} is the net calorific value (energy content) per volume unit of natural gas in year 'y', the NCV of natural gas from the proposed project feasibility study is used in PDD: $0.035028GJ/Nm^3$ (46.559GJ/t);

$EF_{CO2,NG}$ is the CO_2 emission factor per unit of energy of natural gas in year 'y' (tCO_2/GJ), IPCC 2006 default value is used in PDD: $0.0153tc/GJ*44CO_2/12C*100\%=0.0561tCO_2/GJ$;

$OXID_{NG}$ is the oxidation factor of natural gas. The IPCC 2006 default value is used: 100%.

Thus the CO_2 emission coefficient of natural gas is calculated as:

$COEF_{CO2,NG} = 0.001965\ tCO_2/m^3$

The project emission is:

$PE_y = 0.001965\ FC_y\ tCO_2$ (17)

Where

FC_y is the total volume of natural gas combusted in the project plant (m^3) in year(s) y.

Step 3 Calculate Leakage (*LE_y*)

According to AM0029 (Version 02), the following leakage emission sources are considered:

- Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, regasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity;
- In the case LNG is used in the project plant: CO_2 emissions from fuel combustion/electricity consumption associated with the liquefaction, transportation, regasification and compression into a natural gas transmission or distribution system.

As only the natural gas is used in the proposed project activity and LNG is not involved, only the fugitive methane emissions are considered.

Based on AM0029 (Version 02), fugitive methane emissions are calculated as:

$$LE_{CH4,y}=(FC_y \times NCV_{NG} \times EF_{NG,upstream,CH4} - EG_{pj,y} \times EF_{BL,upstream,CH4}) \times GWP_{CH4} \quad (18)$$

Where:
$LE_{CH4,y}$ are leakage emissions due to fugitive upstream CH_4 emissions in the year y in t CO_2e;
FC_y is quantity of natural gas combusted in the project plant during the year y in m³;
NCV_{NG} is average net calorific value of the natural gas combusted during the year y in GJ/m³;
$EF_{NG,upstream,CH4}$ is emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, in t CH_4/GJ;
$EG_{pj.,y}$ is the annual net power delivered to the grid during the year in MWh;
$EF_{BL,upstream,CH4}$ is emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH_4 per MWh electricity generation in the project plant;
GWP_{CH4} is global warming potential of methane valid for the relevant commitment period.

Sub step 3a Calculate the upstream fugitive CH_4 emission factor ($EF_{BL,upstream,CH4}$)

According to AM0029 (Version 02), the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the proposed project activity should be calculated consistent with the baseline emission factor ($EF_{BL,CO2}$). As described above, the BM is selected as the baseline emission factor, and then the corresponding upstream fugitive CH_4 emission factor can be calculated as follows:

Option 1: Build Margin

$$EF_{BL,upstream,CH4} = \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream.CH4}}{\sum_j EG_j}$$

$$= \frac{FF_{coal} \times EF_{coal,upatream,ch4} + FF_{gas} \times EF_{gas,upatream,ch4} + FF_{oil} \times EF_{oil,upatream,ch4}}{GENy} \quad (19)$$

Where:
$EF_{BL,upstream,CH4}$ =The emission factor for upstream fugitive methane emissions occurring in the absence of

the project activity in tCH_4/MWh.

FF_{Coal} =Total quantity of coal combusted (tons coal equivalent) in power plants included in the build margin.

$EF_{Coal,upstream,CH4}$ =Emission factor for upstream fugitive methane emissions from production of coal. AM0029 (Version 02) suggested two default values associated with different source: underground mining and surface mining. Because 95% of the coal production in China are produced by underground mining[23], so the default value for underground mining (13.4 tCH_4/kt coal) is used in this PDD.

FF_{Gas} =Total quantity of gas combusted (GJ) in power plants included in the build margin.

$EF_{Gas,upstream,CH4}$ =Emission factor for upstream fugitive methane emissions from production of gas in tCH_4/GJ. AM0029 (Version 02) suggested several default values associated with different regions. In this PDD, the default value for USA and Canada is adopted, i.e. 160tCH_4/PJ, because the new transmission and distribution network and gas terminal of the proposed project is constructed and operated by advanced technology.

FF_{oil} =Total quantity of oil combusted (GJ) in power plants included in the build margin.

$EF_{Oil,upstream,CH4}$ =Emission factor for upstream fugitive methane emissions from production of oil in tCH_4/GJ. The default value, i.e. 4.1tCH_4/PJ, suggested in AM0029 (Version 02) is used in this PDD.

GEN_y =Electricity generation in the plants included in the build margin in MWh.

As oil-fired and gas-fired power generation in NWPG is little and on the principle of conservativeness, formula (19) is rewritten as:

$$EF_{Bl,upstream,CH4} = \lambda_{Coal} \times PGCC_{Adv} \times EF_{Coal,\ upstream,CH4} \times \frac{NCV_{Coal}}{NCV_{Rawcoal}} < \frac{FF_{coal} \times EF_{coal,upstream,CH4} + FF_{Gas} \times EF_{Gas,upstream,CH4} + FF_{Oil} \times EF_{Oil,upstream,CH4}}{GEN_y} \qquad (20)$$

Where:

λ_{Coal} is the share of coal-fired generation in BM generation. According to the published *Bulletin of Determination of Baseline Emission Factor of Chinese Power Grid* by Chinese DNA, the λ_{Coal} of NWPG is 98.1%[24].

$PGCC_{Adv}$ is the unit coal consumption of power supply of the most advanced coal-fired generation technology within the grid boundary. The value for calculating *BM* emission factor by Chinese DNA is

[23] http://www.china.com.cn/aboutchina/zhuanti/nywt/2007-08/09/content_8653127.htm

[24] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf

used for the proposed project, i.e.343.33 gce/kWh.

$EF_{Coal,upstream,CH4}$ is the emission factor for upstream fugitive methane emissions from production of coal: 13.4 tCH_4/kt coal.

NCV_{Coal} is the net caloric value of standard coal equivalent, the country-specific value has been adopted, i.e. 29.27GJ/tce.

$NCV_{Rawcoal}$ is the net caloric value of raw coal which is used for power generation, the country-specific value has been adopted, i.e. 20.908GJ/t[25].

The above data will be put into formula (20) and calculated as:

$EF_{Bl,upstream,CH4}$ =98.10%*343.33g/kWh*13.4tCH_4/kt*29.27/20.908 =0.006318 tCH_4/MWh

Sub step 3b Calculate Fugitive Methane Emissions ($LE_{CH4,y}$)

As described above, the formula of fugitive methane emissions is as follows:

$$LE_{CH4,y}=(FC_y*NCV_{NG}*EF_{NG,upstream,CH4}-EG_{pj,y}*EF_{BL,upstream,CH4})*GWP_{CH4} \qquad (21)$$

Where:

$LE_{CH4,y}$: Leakage emissions due to fugitive upstream CH_4 emissions in the year y (tCO_2).

FC_y: Total volume of NG combusted in the project plant (m^3) in year y.

NCV_{NG}: Net calorific value of NG (GJ/ton) combusted by plants, which is determined from the NG supplier, i.e. 0.035028GJ/Nm^3 (46.559GJ/t).

$EF_{Gas,upstream,CH4}$: Emission factor for upstream fugitive methane emissions from production of gas in tCH_4/GJ. As described above, in this PDD, the default value for USA and Canada is adopted, i.e. 160tCH_4/PJ.

$EG_{pj,y}$: the annual net power delivered to the grid during year y in MWh.

$EF_{BL,upstream,CH4}$: The emission factor determined in sub step 3a for upstream fugitive methane emissions in tCH_4/MWh.

GWP_{CH4}: Global warming potential of methane valid for the relevant commitment period, the IPCC 2006 default value will be used, i.e. 21tCO_2e/tCH_4.

Sub step 3c Calculate Leakage (LE_y)

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[25] China energy statistical yearbook 2005 p.365

According to AM0029 (Version 02), the leakage can be calculated as follows:

$LE_y = LE_{CH4,y} + LE_{LNG,CO2,y}$ (22)

Where:
LE_y: leakage emission during the year y in tCO_2e.
$LE_{CH4,y}$: leakage emission due to fugitive upstream CH_4 emissions in year y in tCO_2e.
$LE_{LNG,CO2,y}$: leakage emission due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in tCO_2e.

LNG is not involved in the proposed project activity, so:
$LE_{LNG,CO2,y} = 0$

So the leakage of the proposed project is:
$LE_y = LE_{CH4,y}$ (23)

Step 4 Calculate Emission Reduction (ER_y)

According to AM0029 (Version 02), the emission reduction of the proposed project can be calculated as follows:

$ER_y=BE_y-PE_y-LE_y$ (24)

Where:
ER_y: emission reduction in year y in tCO_2e.
BE_y: emission in the baseline scenario in year y in tCO_2e.
PE_y: emission in the project scenario in year y in tCO_2e.
LE_y: emission due to leakage in the year y in tCO_2e.

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

Data / Parameter:	$G_{j,y}$
Data unit:	MWh
Description:	Power generation in each province of NWPG

Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics.
Any comment:	Low uncertainty

Data / Parameter:	$e_{i,y}$
Data unit:	%
Description:	Self- consumption rate of electricity in each province of NWPG
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics.
Any comment:	Low uncertainty

Data / Parameter:	$CAP_{i,j,y}$
Data unit:	MW
Description:	Installed capacity in each province of NWPG
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics.
Any comment:	Low uncertainty

Data / Parameter:	$FC_{Adv,\ coal}$
Data unit:	gce/kWh
Description:	The coal consumption of power supply with the best thermal power technology commercially available.
Source of data used:	Bulletin about determining the Emission factors of Chinese Power Grids http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf
Value applied:	343.33
Justification of the choice of data or description of measurement methods and procedures actually applied :	Authoritative government bulletin
Any comment:	Uncertainty level of data is low.

Data / Parameter:	$FC_{Adv,\ Oil}$, $FC_{Adv,\ Gas}$
Data unit:	gce/kWh
Description:	The coal consumption of power supply with the best oil and gas fired power plant technology commercially available.
Source of data used:	Bulletin about determining the Emission factors of Chinese Power Grids http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf
Value applied:	258
Justification of the choice of data or description of measurement methods and procedures actually applied :	Authoritative government bulletin
Any comment:	Uncertainty level of data is low.

Data / Parameter:	$FC_{i,y}$ or $F_{i,j,y}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed in the project electricity system in year

	y
Source of data used:	*China energy statistical yearbook 2004-2006*
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics.
Any comment:	Uncertainty level of data is low.

Data / Parameter:	NCV_i
Data unit:	GJ/tce or m^3
Description:	The net calorific value of the fuel i
Source of data used:	*China energy statistical yearbook*
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics.
Any comment:	Low uncertainty

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tC/tJ
Description:	The Carbon Emission Factor of fuel i
Source of data used:	2006 IPCC Guidelines
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value of IPCC.

Any comment:	Low uncertainty

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of fuel i
Source of data used:	2006 IPCC Guidelines
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value of IPCC
Any comment:	Low uncertainty

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane
Source of data used:	2006 IPCC Guidelines
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	Low uncertainty

Data / Parameter:	$EF_{Coal,upstream,CH4}$
Data unit:	tCH_4/kt coal
Description:	Fugitive CH_4 upstream emission of coal mining
Source of data used:	Default value suggested by the methodology AM0029 (Version 02)
Value applied:	13.4
Justification of the	Since 95% of the coal production in China are produced by underground

choice of data or description of measurement methods and procedures actually applied :	mining[26], the default value for underground mining 13.4tCH_4/kt coal is used
Any comment:	Low uncertainty

Data / Parameter:	$EF_{Gas,upstream,CH4}$
Data unit:	tCH_4 /PJ
Description:	Fugitive CH_4 upstream emission of natural gas production
Source of data used:	Default value suggested by the methodology AM0029 (Version 02)
Value applied:	160
Justification of the choice of data or description of measurement methods and procedures actually applied :	Because the new transmission and distribution network and gas terminal of the proposed project is construed and operated by advance technology, the default value for USA and Canada is adopted
Any comment:	Low uncertainty

Data / Parameter:	$EF_{Coal,\ surfacing\ mining,\ ,upstream.CH4}$
Data unit:	tCH_4/PJ
Description:	Emission factor for upstream fugitive methane emissions from production, transportation, etc. of coal by surfacing mining
Source of data used:	2006 IPCC Guidelines
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value

[26] http://www.china.com.cn/aboutchina/zhuanti/nywt/2007-08/09/content_8653127.htm

Any comment:	Low uncertainty

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

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According to AM0029 (Version 02) and the explanation of methodology choice in section B6.1, the emission reductions can be ex-ante calculated as follows:

Step 1 Calculate baseline emission (BE_y)

According to the calculation of section B.6.1, the baseline emission factor is:
$EF_{BL,CO2}$ = 0.5739 tCO_2/MWh

According to the PDR of the proposed project, the amount of power delivered to the grid is:
$EG_{pj,y} = EG_{ou,yt}$=307,200 MWh

According to formula 14, the baseline emission (BE_y) is calculated as:

$BE_y = EG_y \times EF_{BL,CO2}$
= 307,200MWh*0.5739 tCO_2/MWh
=176,302.1 tCO_2

Step 2 Calculate project emission (PE_y)

According to the section B.6.1, CO_2 emission coefficient of natural gas is calculated as:
$COEF_{CO2,NG}$ = 0.001965tCO_2/Nm^3

According to the PDR of the proposed project, annual volume of natural gas combusted by the proposed project activity is:
$FC_{NG,y} = 6476.4*10^4Nm^3$

According to the formula 17, the project emission (PE_y) is calculated as:
$PE_y = FC_{NG,y} \times COEF_{NG,y}$
= $6476.4*10^4Nm^3$ *0.001965 tCO_2/Nm^3
= 127,261.3 tCO_2

Step 3 Calculate leakage (*LE_y*)

Sub step 3a: the upstream fugitive CH_4 emission factor is calculated as:
$EF_{Bl,upstream,CH4}$=0.006318tCH_4/MWh

Sub step 3b: according to the formula 21, the upstream fugitive CH_4 emission is calculated as:

$$LE_{CH4,y}= (FC_{NG,y}\times NCV_{NG,y}\times EF_{Gas,\ upstream,CH4}-EGy\times EF_{BL,\ upstream,CH4})\times GWP_{CH4}$$

$$= (6476.4*10^4\ Nm^3*0.035028GJ/Nm^3*160tCH_4/PJ-307200MWh*0.006318tCH_4/MWh)*21tCO_2/tCH_4$$

$$= -33136tCO_2$$

Sub step 3c: according to the formula 23, the amount of leakage is:
$LE_y=LE_{CH4,y}= -33136tCO_2$

According to the methodology AM0029 (Version 02), since the leakage is negative, the leakage of the proposed project is considered to be zero, i.e. LE_y=0.

Step 4 Calculate Emission Reduction (*ER_y*)

According to the formula 24 of section B.6.1, the emission reduction is calculated as:

$$ER_y = BE_y - PE_y - LE_y$$

$$= 176,302.1-127,261.3-0$$

$$= 49,041tCO_2$$

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

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Table B6-5 Estimation of emission reductions due to the proposed project activity

No.	Year	Estimation of project emission (tCO_2e)	Estimation of baseline emission (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of emission reductions (tCO_2e)
1	01/10/2008-31/12/2008	31,815	44,075	0	12,260
2	2009	127,261	176,302	0	49,041
3	2010	127,261	176,302	0	49,041
4	2011	127,261	176,302	0	49,041
5	2012	127,261	176,302	0	49,041

6	2013	127,261	176,302	0	49,041
7	2014	127,261	176,302	0	49,041
8	01/01/2015-30/09/2015	95,446	132,227	0	36,781
Total		**890,827**	**1,234,114**	**0**	**343,287**

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

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	$EG_{pj,y}$
Data unit:	MWh
Description:	Power delivered to the grid
Source of data to be used:	Direct reading
Value of data applied for the purpose of calculating expected emission reductions in section B.5	307,200
Description of measurement methods and procedures to be applied:	The data will be measured hourly, recorded monthly, and archived in electronic version for crediting period+2yrs.
QA/QC procedures to be applied:	According to the national standard, the ammeters will be calibrated periodically. The data will be read together by the project owner and the local Power Grid Company and be cross-checked by the invoice of electricity sale.
Any comment:	Low uncertainty

Data / Parameter:	$FC_{NG,y}$
Data unit:	Nm^3
Description:	Annual quantity of natural gas consumed in proposed project activity
Source of data to be used:	Reading of natural gas flow meter installed by the proposed project or invoice of gas purchase
Value of data applied for the purpose of calculating expected emission reductions in section B.5	64,764,000
Description of measurement methods and procedures to be applied:	The natural gas flow will be monitored by gas supplier continuously. The daily gas consumption amount will be aggregated automatically and recorded.
QA/QC procedures to be applied:	The natural gas flow meter will be checked according to the relevant rules. Besides, the natural gas consumption amount could be monitored both by the gas supplier and project owner for cross-verification.
Any comment:	Uncertainty level of the data is low

Data /parameter：	NCV_{NG}
Data unit：	GJ/Nm^3
Description：	Net Calorific Value of natural gas consumed by the proposed project. The value will be measured fortnightly.
Source of data：	Supplied by the gas supplier.
Data used for expected emission reduction calculation in B.5：	0.035028
Description of measurement methods and procedures applied：	Measure Report of Net Calorific Value of natural gas as determined from the gas supplier.
QA/QC procedures:	Qualified authoritative organization or official statistics
Any comments：	Low uncertainty

Data /parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build margin emission factor of the project electricity system in year y.
Source of data:	The website of Chinese DNA: http://cdm.ccchina.gov.cn/web/index.asp
Data used for expected emission reduction calculation in B.5:	The value issued by Chinese DNA.
Description of measurement methods and procedures applied:	In line with AM0029 (version 02), the calculation is carried out by Chinese DNA, according to the "Tool to calculate the emission factor for an electricity system" approved by EB and statistics of electric power issued by Chinese authority.
QA/QC procedures:	Official statistics
Any comments:	Low uncertainty

Data /parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2e/MWh
Description:	Combined margin emission factor of the project electricity system in year y.
Source of data:	The website of Chinese DNA: http://cdm.ccchina.gov.cn/web/index.asp
Data used for expected emission reduction calculation in B.5:	The value issued by Chinese DNA.
Description of measurement methods and procedures applied:	In line with AM0029 (version 02), the calculation is carried out by Chinese DNA, according to the "Tool to calculate the emission factor for an electricity system" approved by EB and statistics of electric power issued by Chinese authority.
QA/QC procedures:	Official statistics
Any comments:	Low uncertainty

B.7.2. Description of the monitoring plan:

>>

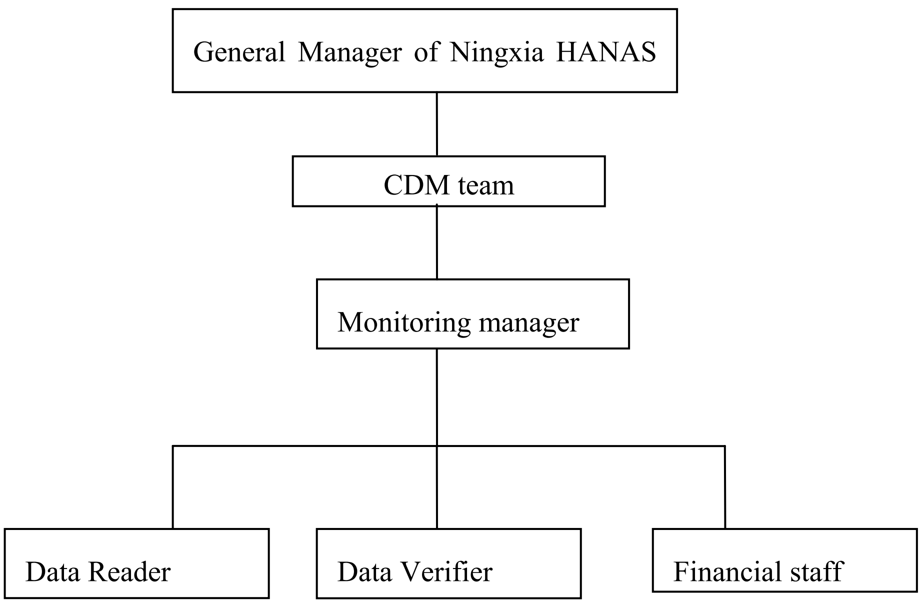
The monitoring plan of the proposed project is made in accordance with ACM0029 and the purpose of the monitoring plan is to ensure the completeness, consistency, accuracy of the monitoring and calculation for the emission reduction. The personnel appointed by the project owner will be in charge of the monitoring plan.

1. Monitoring objects

The data to be monitored are the electricity delivered to the grid, the electricity consumed by the proposed project which is imported from NWPG, quantity of natural gas consumed in the proposed project activity and its Net Calorific Value, the build margin emission factor and combined margin emission factor of the project electricity system. The Net Calorific Value of natural gas consumed by the proposed project comes from the fuel supplier and will be measured periodically. Meanwhile, the build margin emission factor and combined margin emission factor of the project electricity system derive from official statistics. Thus, the electricity delivered to the grid, the electricity consumed by the proposed project which is imported from the NWPG, quantity of natural gas consumed in the proposed project activity are the key data to be monitored.

2. Monitoring organization

The project owner will appoint a monitoring manager who will take charge of implementation and management of the monitoring plan, and ensure the completeness, consistency, accuracy of the data. Besides, 6 nominated team members responsible for data collecting and reviewing, emission reduction calculation and preparation of periodical monitoring sum-up report will be appointed.



3. Monitoring equipment and installation

3.1 The installation of electricity meter

An electricity meter will be installed at the substation (Gateway Meter) measuring the net electricity delivered to the grid. The electricity meter will be jointly checked by the project owner and the Power Grid Company before installation in accordance with the procedure.

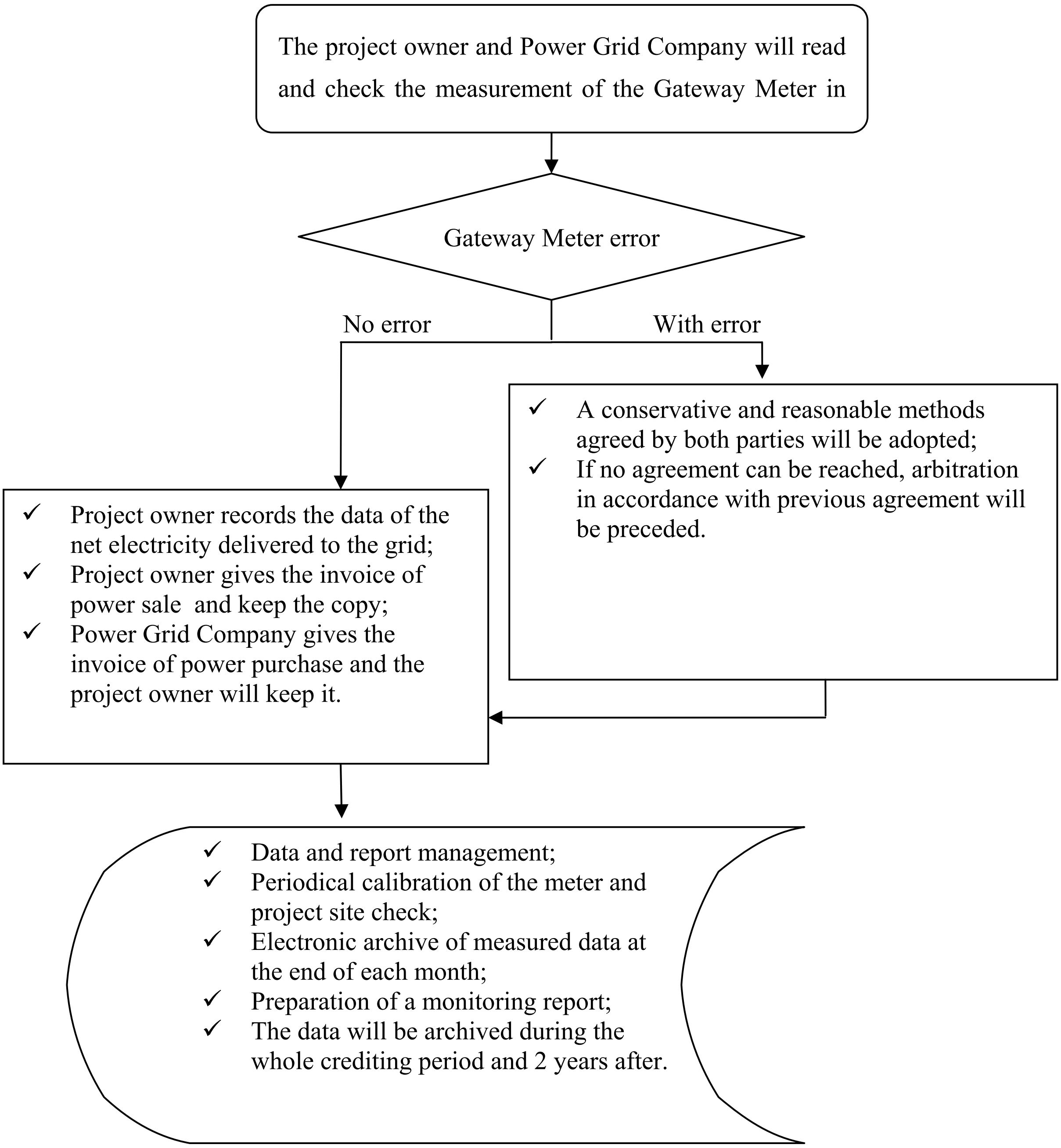
3.2 The installation of gas meter

A set of gas metering devices will be installed at the fan-out of the gas supply station (Main Metering Device) measuring the net quantity of gas consumed in the proposed project activity. The gas metering devices will be jointly checked by the project owner and the gas supplier before installation in accordance with the procedure.

4. Data collection

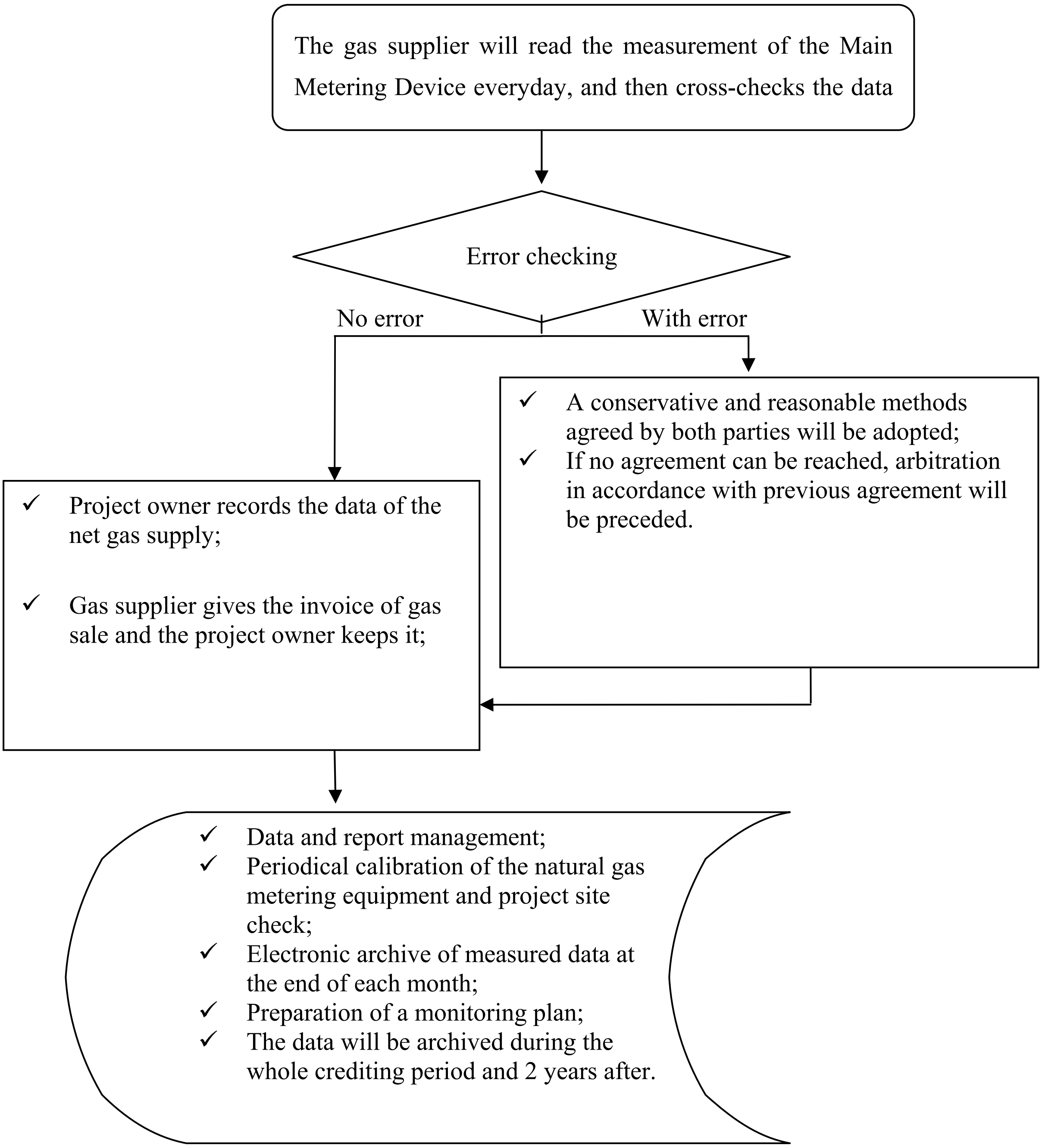
4.1 Data collection of the electricity meter

The procedure for data collection is as follow:



4.2 Data collection of the gas meter

The procedure for data collection is as follow:



It should be ensured that the auditors can get reliable meter records, calibration and maintenance record.

5. Meters maintenance and calibration

The periodical calibration and maintenance of the meters should comply with the related standards and regulations of national power sector, so as to ensure the precision of the meters. The meters must be sealed after calibration. Neither party could unseal or change the meters without the presence of the other party.

The monitoring manager of the proposed project will be in charge of the data recording. The invoice can be used as the reference for the second check.

Ten days after the occurrence of the conditions below, the Meters shall be tested by the designated institute commissioned by both parties:

a. the error of the meters is out of the permissible limits;

b. maintenance of the meters due to the faults of the meters' components.

6. Data management System

The data management system describes how the collected data are recorded and kept, which is also the core of the monitoring plan.

At the end of every month, the monitored data should be archived in the computer and backup in disk, at the same time the paper document should be archived. The project owner should keep the invoice of power sales and gas purchase.

The monitoring and data management will be carried out mainly by the CDM team and conducted by the appointed personnel. Documents such as paper map, diagram, Environment Impact Assessment Report and the monitoring plan will be kept collectively. For convenience of auditing, the project owner should provide the index of project document and monitoring report.

The project owner will have a copy of all the paper documents. The monitored data will be kept during the whole crediting period and 2 years after.

7. Periodical Monitoring Sum-up Report

In the end of each monitoring period, the CDM team will prepare a periodical monitoring sum-up report which covers power delivered monitoring and auditing report, gas supply monitoring and auditing report, emission reduction calculation report, meters maintenance and calibration records. It will be an important reference for DOE's verification.

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 application of the baseline study and monitoring methodology:

01/03/2008

Name of personnel determining the baseline and monitoring methodology:

Shi Chongqi / Beijing Keji Consulting Ltd. (CDM project developer)

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Contributors:

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Yun Fu	Beijing Keji Consulting Ltd.
Jin Xiaodong	Ningxia HANAS Natural Gas Thermal Power Co., Ltd.

Ningxia HANAS Natural Gas Thermal Power Co., Ltd. is a project participant, while Beijing Keji Consulting Ltd. is not a participant of the proposed project.

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:

>>

08/10/2007

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

>>

The lifetime of the proposed project is 20y-0m.

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

C.2.1. Renewable crediting period:

>>

The renewable crediting period (7*3) will be used.

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

>>

01/10/2008

C.2.1.2. Length of the first crediting period:

>>

7y-0m

C.2.2. Fixed crediting period:

>>

Not applicable.

C.2.2.1. Starting date:

>>

Not applicable.

C.2.2.2. Length:

>>

Not applicable.

SECTION D. Environmental impacts

>>

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

>>

In accordance with relevant environmental law and regulations, an Appraisal of Environmental Impacts of Project Construction has been prepared. The approval for implementation of the proposed project has been issued by Ningxia Environmental Protection Bureau on July 6, 2003.

The proposed project is likely to cause the following environmental impacts:

Construction period:

The environmental problem during the construction period is of short duration. During the construction period, atmosphere, soil and vegetation around the construction site may be influenced to some extent, and these impacts will disappear due to the restoration measures when the construction period is over. So, if active restoration measures are taken, negative impact to the environment during and after the construction period will not come into being.

1. Noise
The construction noise pollution mainly comes from various construction machineries. The project entity will control the time of using the machines with loud noise and taking noise reducing measures. The workers working on the site will be equipped with noise reducing facilities.

2. Dust
As the dust caused by the proposed project construction will influence the surrounding environmental quality of construction site, during the construction period, the construction site should be watered in time, and the management of material yards should be strengthened so as to reduce the occurrence of dust pollution.

3. Construction wastes
The construction wastes left in the construction locale should be cleared and transported in time. When the transportation vehicles leave the construction site, the dirt tracked in by the vehicles should be cleared in time and the wastes should be transported to specified place.

4. Waste water
The sewage will be collectively treated before discharge, so as to meet the related standards.

Operation period:

The main environmental pollutants emitted after the proposed project operation are NO_2 and SO_2, basically no particulate matter. The surrounding environment of the proposed project plant could meet the requirement of Grade Ⅱ of *Environmental Atmosphere Quality Standards* (GB3095-1996).

The waste water mainly involves sewage. It will be discharged to sewage pipe network after treated, and won’t cause environmental impact.

Another pollutant of the proposed project operation is noise from gas turbine, air compressor of step-up station for cycle water pump etc.. Various measures have been considered when the proposed project is constructed, for example, the muffler is installed at the intake and exhaust ports in the combustion engine, and sound insulation enclosure is adopted in the combustion engine and sound absorption materials are used when the plant is built so as to satisfy Grade Ⅱ of *Plant Noise Standards for Industrial Enterprise* (GB12348-90).

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

>>

According to the Appraisal of Environmental Impacts and the approval for implementation of the proposed project issued by Ningxia Environmental Protection Bureau, impacts are considered insignificant.

SECTION E. Stakeholders' comments

>>

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

>>

In order to invite stakeholders' comments, the project owner together with Yinchuan Environmental Protection Research Institute conducted a survey by ways of sending questionnaires. Respondents included stakeholders such as residents around, officials, and workers. 65 questionnaires were sent out and all of them were collected back. Table E-1 is the statistics for people who have been invited for the survey.

Table E-1 The detailed respondents' information

Total respondents	65
Gender	Male: 49
	Female: 16
Occupation	Officials: 11
	Workers: 29
	Residents: 16
	Others: 9
Education	Junior College and above: 26
	Senior high school or technical secondary school: 37

	Junior high school and below: 2

E.2. Summary of the comments received:

>>

According to the survey on 65 surrounding stakeholders, all of them support the implementation of the proposed project. Meanwhile, some comments without counterview have be collected and the result is shown as follows:

Table E-2 Summary of the comments received

NO.	Questions	Options	Ratio (%)	Notes
1	How do you feel about the current environment of the proposed project area?	Satisfied	63.1	
		Unsatisfied	4.6	
		Acceptable	32.3	
2	How do you think about the current local power supply?	Tense	7.7	
		Not tense	16.9	
		OK	75.4	
3	How much do you know about natural gas co-generation project?	A lot	27.7	
		Nothing	10.8	
		A little	61.5	
4	What is your attitude towards the construction of natural gas co-generation project?	Supportive	96.9	
		Not supportive	0	
		Do not care	3.1	
5	What are the impacts of the proposed project construction on your life quality?	Improve	18.5	
		Decline	0	
		No impact	81.5	
6	What are the impacts of the proposed project construction on the current environment?	Significant	1.5	
		Minor	6.2	
		No impact	92.3	

7	What are the impacts of the proposed project construction on the local economic development?	Promote	100	
		Hamper	0	
		No impact	0	
8	Other suggestions and requirements to the project construction:			No other comments

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

>>

In conclusion, the local residents, enterprises and government are supportive to the proposed project. According to the comments received from the stakeholders, it is not necessary now to adjust the design, construction and operation of the proposed project.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from *UNFCCC* Annex 1 countries for the proposed project.

Annex 3

BASELINE INFORMATION

1. Calculation of Operating Margin (*OM*) Emission Factor

Table 3-1 CO_2 Emissions from Fuel-fired Power Plants of NWPG in 2003

Fuel types	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Emission factor	Oxidation factor	NCV	CO_2 emission (tCO_2e)
								tc/TJ	%	MJ/t,m^3	*J=G*H*I*F*44/12/10000 (Mass unit)*
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	*J=G*H*I*F*44/12/1000 (Volume unit)*
Raw coal	10^4t	2002.26	1479.62	330.67	682	1065.75	**5560.3**	25.8	100	20908	109976995.8
Cleaned coal	10^4t						**0**	25.8	100	26344	0
Other washed coal	10^4t				27	3.64	**30.64**	25.8	100	8363	242405.2347
Coke	10^4t						**0**	29.2	100	28435	0
Coke oven gas	10^8m^3		1.54				**1.54**	12.1	100	16726	114279.8375
Other coal gas	10^8m^3		0.12				**0.12**	12.1	100	5227	2782.8548
Crude oil	10^4t						**0**	20	100	41816	0
Gasoline	10^4t						**0**	18.9	100	43070	0
Diesel	10^4t	3.12			0.04	0.4	**3.56**	20.2	100	42652	112463.6562
Fuel oil	10^4t		1.19			1.02	**2.21**	21.1	100	41816	71497.13619
LPG	10^4t						**0**	17.2	100	50179	0
Refinery gas	10^4t					3.48	**3.48**	15.7	100	46055	92262.9026
Natural gas	10^8m^3	0.1	0.54			5.95	**6.59**	15.3	100	38931	1439275.177
Other oil products	10^4t						**0**	20	100	38369	0

Other coal chemicals	10^4t						**0**	25.8	100	28435	0
Other energy	10^4tce		5.86			2.3	**8.16**	0	100	0	0
										Subtotal	112051962.6

Data sources: China energy statistical yearbook 2004

Table 3-2 Fuel-fired Electricity Generation in NWPG 2003

Name of the province	Generation	Generation	Rate of electricity used by factory	Power supply
	10^8kWh	MWh	%	MWh
Shaanxi	381.44	38,144,000	6.94	35,496,806
Gansu	294.94	29,494,000	6.35	27,621,131
Qinghai	64.46	6,446,000	4.50	6,155,930
Ningxia	191.75	19,175,000	5.25	18,168,313
Xinjiang	198.34	19,834,000	8.19	18,209,595
Total				105,651,775

Data sources: China Electric Power Yearbook 2004

Table 3-3 Calculation on Simple OM Emission Factor of NWPG in 2003

Total emission amount in NWPG	112,051,963 tCO_2
Total power supply in NWPG	105,651,775.3 MWh
Emission factor in NWPG	1.060578 tCO_2/MWh

Table 3-4 CO_2 Emissions from Fuel-fired Power Plants of NWPG in 2004

Fuel types	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Emission factor	Oxidation factor	NCV	CO_2 emission (tCO_2e)
								tc/TJ	%	MJ/t,m^3	*J=G*H*I*F*44/12 /10000 (Mass unit)*
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	*J=G*H**F*44/12/ 1000 (Volume unit)*
Raw coal	10^4t	2,428.7	1,595.9	322.8	1,270	1,240.9	6,858.4	25.8	100	20,908	135652074.1
Cleaned coal	10^4t		0.91				0	25.8	100	26,344	0
Other washed coal	10^4t				102	10.5	113.14	25.8	100	8,363	895095.5697
Coke	10^4t	0.78					0.78	29.2	100	28,438	23746.6372
Coke oven gas	10^8m^3		0.3				0.3	12.1	100	16,726	22262.306
Other coal gas	10^8m^3	0.74	1.26				2	12.1	100	5,227	46380.91333
Crude oil	10^4t	0.01				0.06	0.07	20	100	41,816	2146.554667
Gasoline	10^4t	0.02					0.02	18.9	100	43,070	596.9502
Diesel	10^4t	2.16	0.36		0.05	0.41	2.98	21.1	100	42,652	94140.92571
Fuel oil	10^4t	0.01	0.69			0.3	1	17.2	100	41,816	32351.64533
LPG	10^4t						0	15.7	100	50,179	0
Refinery gas	10^4t					3.26	3.26	15.3	100	46,055	86430.19037
Natural gas	10^8m^3	1.61	0.59			6.27	8.47	20	100	38,931	1849872.648
Other oil products	10^4t						0	25.8	100	38,369	0
Other coal chemicals	10^4t						0	0	100	28,435	0

Other energy	10^4tce		6.17			3.46	9.63	0	100	0	0
										Total	138705098.5

Data sources: China energy statistical yearbook 2005

Table 3-5 Fuel-fired Electricity Generation of NWPG 2004

Name of the province	Generation	Generation	Rate of electricity used by factory	Power supply
	10^8kWh	MWh	%	MWh
Shaanxi	444.39	44,439,000	7.50	41,106,075
Gansu	332.42	33,242,000	6.21	31,177,672
Qinghai	62.08	6,208,000	7.96	5,713,843.2
Ningxia	252.98	25,298,000	5.45	23,919,259
Xinjiang	227.52	22,752,000	9.07	20,688,394
Total				122,605,243

Data sources: China Electric Power Yearbook 2005

Table 3-6 Calculation on Simple OM Emission Factor of NWPG in 2004

Total emission amount in NWPG	138,705,098 tCO_2
Total power supply in NWPG	122,605,243 MWh
Emission factor in NWPG	1.131315 tCO_2/MWh

Table 3-7 CO_2 Emissions from Fuel-fired Power Plants of NWPG in 2005

Fuel types	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Emission factor	Oxidation factor	NCV	CO_2 emission (tCO_2e)
								tc/TJ	%	MJ/t,m^3	*J=G*H*I*F*44/12/10000 (Mass unit)*
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	*J=G*H*I*F*44/12/1000 (Volume unit)*
Raw coal	10^4t	2461.28	1597	345.1	1467.7	1358.09	7229.17	25.8	100	20,908	142985522.1
Cleaned coal	10^4t	16.22					16.22	25.8	100	26,344	404225.4973
Other washed coal	10^4t	35.56			101.2	102.	147.71	25.8	100	8,363	1168592.599
Coke	10^4t	3.23					3.23	29.2	100	28,438	98335.43353
Coke oven gas	10^8m^3						0	12.1	100	16,726	0
Other coal gas	10^8m^3						0	12.1	100	5,227	0
Crude oil	10^4t					0.18	0.18	20	100	41,816	5519.712
Gasoline	10^4t	0.02				0.01	0.03	18.9	100	43070	895.4253
Diesel	10^4t	2.24	0.46	0.06		0.5	3.26	20.2	100	42,652	102986.3818
Fuel oil	10^4t	0.01	0.57			0.25	0.83	21.1	100	41,816	26851.86563
LPG	10^4t						0	17.2	100	50,179	0
Refinery gas	10^4t					7.71	7.71	15.7	100	46,055	204410.0515
Natural gas	10^8m^3	1.46	0.52	1.33		7.81	11.12	15.3	100	38,931	2428640.359
Other oil products	10^4t						0	20	100	38,369	0
Other coal chemicals	10^4t						0	25.8	100	28,435	0

Other energy	10^4t ce	8.24	1.3				9.54	0	100	0	0
										Total	147425979.4

Data sources: China energy statistical yearbook 2006

Table 3-8 Fuel-fired Electricity Generation of NWPG 2005

Name of the province	Generation	Generation	Rate of electricity used by factory	Power Supply
	10^8kWh	MWh	%	MWh
Shaanxi	411	41,100,000	7.16	38,157,240
Gansu	331.06	33,106,000	4.23	31,705,616
Qinghai	55	5,500,000	2.69	5,352,050
Ningxia	276.43	27,643,000	5.73	26,059,056
Xinjiang	265.6	26,560,000	8.8	24,222,720
Total				125,496,682

Data sources: China Electric Power Yearbook 2006

Table 3-9 Calculation on Simple OM Emission Factor of NWPG in 2005

Total emission amount in NWPG	147,425,979 tCO_2
Total power supply in NWPG	125,496,682 MWh
Emission factor in NWPG	1.174740 CO_2/MWh

Weighted Average Emission Factor of 3 years: 1. 125809 tCO_2/MWh

2. Calculation of Build Margin (*BM*) Emission Factor

Table 3-10 The proportion of CO_2 emission of solid, liquid and gas in total emission

Fuel types	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	NCV	Emission factor (tc/TJ)	Oxidation factor	CO_2 emission (tCO_2e)
		A	B	C	D	E	F=A+…+E	G	H	I	*J=F*G*H*I*44/12/100*
Raw coal	10^4t	2461.28	1597	345.1	1467.7	1358.09	7229.17	20908	25.8	1	142,985,522
Cleaned coal	10^4t	16.22	0	0	0	0	16.22	26344	25.8	1	404,225
Other washed coal	10^4t	35.56	0	0	101.95	10.2	147.71	8363	25.8	1	1,168,593
Coke	10^4t	3.23	0	0	0	0	3.23	28435	29.2	1	98,335
Subtotal											**144,656,675**
Crude oil	10^4t	0	0	0	0	0.18	0.18	41816	20	I	5,520
Gasoline	10^4t	0.02	0	0	0	0.01	0.03	43070	18.9	1	895
Coal oil	10^4t	0	0	0	0	0	0	43070	19.6	1	0
Diesel	10^4t	2.24	0.46	0.06	0	0.5	3.26	42652	20.2	1	102,986
Fuel oil	10^4t	0.01	0.57	0	0	0.25	0.83	41816	21.1	1	26,852
Other oil products	10^4t	0	0	0	0	0	0	38369	20	1	0
Subtotal											**136,253**
Natural gas	10^7m^3	14.6	5.2	13.3	0	78.1	111.2	38931	15.3	I	2,428,640
Coke oven gas	10^7m^3	0	0	0	0	0	0	16726	12.1	1	0
Other coal gas	10^7m^3	0	0	0	0	0	0	5227	12.1	1	0
LPG	10^4t	0	0	0	0	0	0	50179	17.2	1	0
Refinery gas	10^4t	0	0	0	0	7.71	7.71	46055	15.7	1	204,410
Subtotal											**2,633,050**

Total											**147,425,978**

Data sources: China Energy StatisticsYearbook 2006

According to above calculation, λ_{Coal} =98.1%, λ_{Oil} =0.1%, λ_{Gas} =1.8%.

$$EF_{Thermal} = \lambda_{Coal} * EF_{Coal,Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas,Adv}$$
$$= 0.9410$$

Table 3-11 Installed capacity of the NWPG 2005

Installed capacity	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Total
Fire power	MW	9132.1	5715	886.8	4577	5051.7	25362.6
Hydro power	MW	1578	4036.2	4825	428.5	1352.1	12219.8
Nuclear power	MW	0	0	0	0	0	0
Wind power and other	MW	46	109.1	0	112.2	132.2	399.5
Total	MW	10756.1	9860.3	5711.8	5117.7	6536	37981.9

Data sources: China Electric Power Yearbook 2006

Table 3-12 Installed capacity of the NWPG 2004

Installed capacity	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Total
Fire power	MW	7640.4	4975.6	889.8	3782	4959.7	22247.5
Hydro power	MW	1876.5	3566.1	4053.4	366.2	973	10835.2
Nuclear power	MW	0	0	0	0	0	0
Wind power and other	MW	0	138.2	0	42.5	95.3	276
Total	MW	9516.9	8679.9	4943.2	4190.7	6028	33358.7

Data sources: China Electric Power Yearbook 2005

Table 3-13 Installed capacity of the NWPG 2003

Installed capacity	Unit	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Total
Fire power	MW	7326.4	4745	905.8	3102	4413.5	20492.7
Hydro power	MW	1462.3	3280.6	3341.1	308.2	989.8	9382
Nuclear power	MW	0	0	0	0	0	0
Wind power and other	MW	0	21.6	0	10	91.3	122.9
Total	MW	8788.7	8047.2	4246.9	3420.2	5494.6	29997.6

Data sources: China Electric Power Yearbook 2004

Table 3-14 *BM* calculation of the NWPG

	Installed capacity 2003	Installed capacity 2004	Installed capacity 2005	New added installed capacity 2003-2005	The fraction of newly added installed capacity
	A	B	C	D=C-A	
Fire power	20,492.7	22,247.5	25,362.6	4,869.9	60.99%
Hydro power	9,382	10,835.2	12,219.8	2,837.8	35.54%
Nuclear power	0	0	0	0	0.00%
Wind power	122.9	276	399.5	276.6	3.46%
Total	29,997.6	33,358.7	37,981.9	7,984.3	100.00%
The fraction of installed capacity 2004	78.98%	87.83%	100%		

Thus: $EF_{BM,y}$ =0.9410*60.99% ＝0.5739 tCO_2/MWh

Annex 4

MONITORING INFORMATION

There is no additional information.