**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:

>>
Huaneng Damao Maoming Phase I Wind Farm Project
PDD version 2.0
Completed on 25/08/2009

**PDD revision history**

| PDD version | Time | Note |
|---|---|---|
| Version 1.1 | 15/10/2008 | For GSP |
| Version 2.0 | 25/08/2009 | Revised following draft validation report |

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

>>
Huaneng Damao Maoming Phase I Wind Farm project (hereinafter referred to as the proposed project) is located in Damao County, Baotou City, Inner Mongolia Autonomous Region. The project is developed by Huaneng New Energy Industrial Co., Ltd. with the total installed capacity of 49.5MW. The expected net supplied power to the North China Power Grid (NCPG) is 121,852 MWh per year.

As NCPG is dominated by the thermal power generation, the operation of the proposed project will lead to emission reductions of $CO_2$, which is estimated to be approximately 128,535 tonnes of $CO_2$e per year. The proposed project will therefore help local government to promote the economy development and improve the air quality.

The project will assist China in stimulating and accelerating the commercialisation of grid-connected wind power technologies and markets which are an important objective of the Chinese government. The project will therefore help reduce GHG emissions versus the high-growth, coal-dominated business-as-usual scenario. Furthermore, the project will improve air quality and local livelihoods, promote sustainable renewable energy industry development.

The baseline scenario, therefore, is the same as the scenario existing prior to the implementation of the project activity, i.e. generation of electricity by grid connected power plants.

The proposed project promotes local sustainable development through the following aspects:
- reducing $CO_2$, $SO_2$ and NOx emissions;
- creating local employment opportunity during the assembly and installation of wind turbines, and for operation of the proposed project;
- reducing other particulate pollutants resulting from the fossil fuel fired power plants compared with a business-as-usual scenario.

### A.3. Project participants:

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| Name of Party involved | Private and/or public entity(ies) project participants (as applicable) | Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| P.R. China (host) | Huaneng New Energy Industrial Co., Ltd | No |
| United Kingdom of Great Britain and Northern Ireland | Carbon Resource Management Ltd. | 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):

>>
People's Republic of China

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

>>
Inner Mongolia Autonomous Region

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

>>
Baotou City/Damao Town

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

>>
The Huaneng Damao Maoming Phase I Wind Farm is located in the west of Damao County, 140km North of Baotou City. The centre of the proposed project is located at longitude 109°52′ East and latitude 41°34′ North. The average altitude of the project site is 1600m above sea level. Figure 1 shows the location of the proposed project in Inner Mongolia Autonomous Region.

**Figure 1 Map showing the location of the Project**


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

>>
Category: Renewable electricity in grid connected applications
Sector scope (1): Energy industries

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

>>
A total of 33 wind turbines of the 1500kW turbines (FD70B) will be supplied by Dongfang Electric. The turbine technology is introduced from Germany; and therefore, the establishment and operation of the proposed project activity will promote the technology transfer and utilization in China, and represents good practice[1].

The detailed parameters of the turbines are provided in Table 1. The turbine manufacturer will provide on-the-job-training for staff of the proposed wind farm before the start of operation.

**Table 1. Key Technology to be employed at the Project Wind Farm**

[1] http://www.gkong.com/html/news/2008/4/20473.html

| Key Technology Parameter | Value |
|---|---|
| Rotor diameter (m) | 70 |
| Swept area ($m^2$) | 3848 |
| Cut-in wind speed (m/s) | 3 |
| Rated wind speed (m/s) | 12 |
| Cut-out wind speed (m/s) | 25 |
| Hub height of the wind turbines (m) | 65 |
| Rated voltage (V) | 690 |
| Load factor | 0.28 |

The wind farm will be connected with an on-site 220kV transformer, and then connected with a 220kV Wanghai substation of NCPG via a 220kV transmission line. Each wind turbine will have a transformer from 690V to 35kV, and then connects with the 220kV transformer. The project will newly install a 220kV/35kV transformer.

The project scenario is the installation of 33 wind turbines with an aggregate capacity of 49.5MW. The wind turbines are estimated to generate on average 121,852MWh of electricity annually once fully operational, which is based on a detailed wind assessment leading to a load factor of 28% or 2462 hours per year. The power generation is monitored by the main electricity meter at the sub-station where the project is connected to the grid.

Prior to the implementation of the project activity, the electricity was generated by grid-connected power plants. Without the implementation of the project, this scenario would have continued and is considered the baseline scenario.

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

>>

The project participants chose renewable crediting period. The ex-ante estimated average annual emission reductions over the first seven-year crediting period of the project are as follows:

**Table 2. Estimated amount of emission reductions over the chosen crediting period**

| Years* | Annual estimation of emission reductions in tonnes of $CO_2$e |
|---|---|
| 2009 | 128,535 |
| 2010 | 128,535 |
| 2011 | 128,535 |
| 2012 | 128,535 |
| 2013 | 128,535 |
| 2014 | 128,535 |
| 2015 | 128,535 |
| **Total estimated reductions(tonnes of $CO_2$e)** | 899,745 |
| Total number of first crediting years | 7 years |
| **Annual average over the crediting period of estimated reductions (tonnes of $CO_2$e)** | 128,535 |

*Note: * Using 12-monthly periods, not calendar years, from the start of the crediting period.*

The baseline emissions factor has been fixed in the first 7-year crediting period. The amount of CERs actually generated by the project will vary based on the metered power supply of the project.

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

>>
There is no public funding from Annex I Parties for this 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:

>>
*ACM0002 Version 9 "Consolidated methodology for grid-connected electricity generation from renewable sources" (valid from 27 Feb 2009 to 10 Jun 09)*
*AM_Tool_01 Version 05.2 "Tool for the demonstration and assessment of additionality"*
*AM_Tool_07 Version 01.1 "Tool to calculate the emission factor for an electricity system"*

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

>>
The approved methodology ACM0002 is applicable to the proposed project activity, because:

- The proposed project involves electricity capacity addition from wind sources; and
- The project is connected to the grid; and
- The proposed project does not involve switching from fossil fuels to renewable energy at the site of the project activity; and
- The geographic and system boundaries for the North China Power Grid (NCPG) can be clearly identified and information on the characteristics of the grid is available.

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

>>
**Emission sources:**

For the baseline determination only $CO_2$ emissions from electricity generation by fossil fuel fired power plant that is displaced due to the project activity are taken into account.

According to the approved methodology ACM0002, the emission sources and GHGs in the project boundary are listed in Table 3.

**Table 3. Emission sources and GHG included in the project boundary**

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Minor emission source. |
| | | $N_2O$ | No | Minor emission source. |

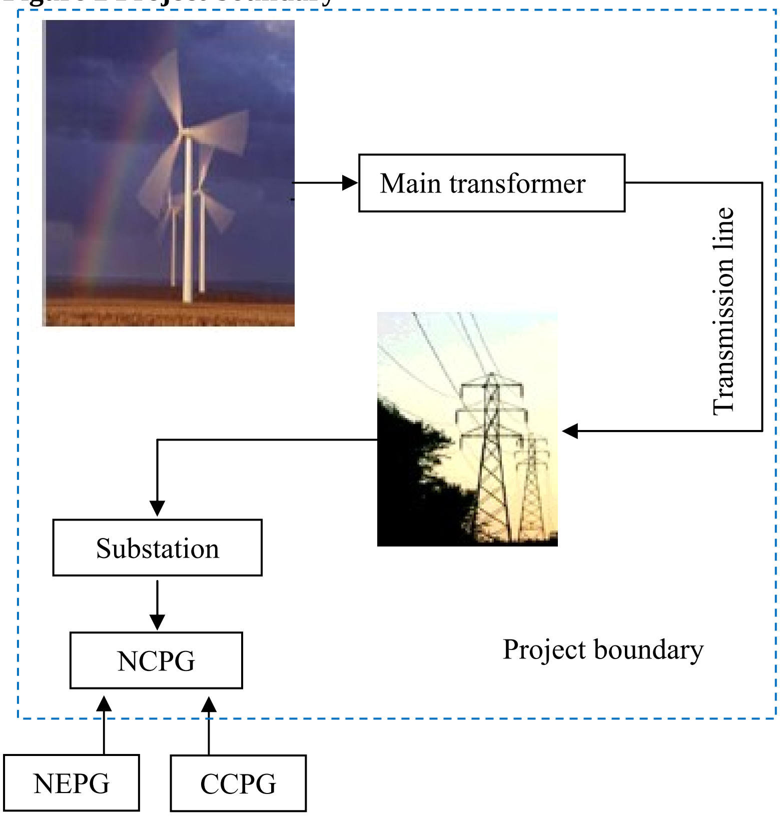
| | | | | |
|---|---|---|---|---|
| | to the project activity. | | | |
| **Project activity** | For all renewable energy plants, $CO_2$ emissions from backup power generation. | CO2 | Yes | Main emission source. |
| | | CH4 | No | Minor emission source. |
| | | N2O | No | Minor emission source. |

There is no backup power generation in the proposed project, so project emission is zero.

**Spatial boundary:**

The spatial extent of the proposed project boundary includes the proposed wind farm site and all power plants connected physically to the NCPG. NCPG is an electricity system which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains. The project boundary is illustrated in figure 2.

**Figure 2 Project boundary**




According to the delineation of grid boundaries as provided by the DNA of China, the NCPG, including Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong[2], is the project electricity system, which is

[2] Chinese DNA designates it at http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=3250.

defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains. The electricity transmission between different provinces in the NCPG is very large and it is unreasonable for the proposed project to regard the Provincial Power Grid as the project boundary.

The connected electricity system is the Northeast Power Grid (NEPG), consisting of three provincial grids: Jilin, Liaoning and Heilongjiang, and Central China Power Grid (CCPG), consisting of six provincial grids: Jiangxi, Henan, Hubei, Hunan, Chongqing and Sichuan.

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

>>

Because the project activity is the installation of a new grid-connected renewable power plant/unit, and is not a modification/retrofit of an existing plant/unit, the baseline scenario, according to methodology ACM0002, is the following:

*"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources in North China Power Grid, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

**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):**

>>

*CDM consideration*

The CDM was taken into account from the very beginning of the project. It was found in the feasibility study report (FSR), prepared by Shanghai Power Design Institute in March 2008, that the project was not financially attractive, with an IRR below the benchmark, without obtaining additional income from the sale of certified emission reductions, and therefore the CDM income was taken into account in the FSR to improve the IRR above benchmark. Therefore, the developer held a meeting in April 2008 after receiving the FSR, in which the decision of applying for CDM registration and seeking a CER buyer was made. On this basis, project owner started negotiation with Carbon Resource Management (CRM) regarding the CDM development and signed an Emission Reduction Purchase Agreement (ERPA) with CRM in May 2008. Following the above actions, the project owner applied for construction permission which was approved in June 2008 and defined as the project starting date. The incentive from the CDM, therefore, had been fully taken into account prior to the starting date of the project activity, aiming to obtain the additional funding to secure the project financially.

The timeline of CDM development is shown below:

| **Date** | **Project activity timeline** |
|---|---|
| October, 2007 | Environmental Impact Assessment (EIA) completed |
| October 30th, 2007 | EIA approval |
| March, 2008 | Feasibility Study Report (FSR) for Huaneng Damao Maoming Phase I Wind Farm Project completed |
| April 8th, 2008 | Directorate Decision to apply CDM support |

| | |
|---|---|
| April 18th, 2008 | FSR approval |
| May 10th, 2008 | Emission Reduction Purchase Agreement (ERPA) signed |
| June 26th, 2008 | Construction permission (defined as the project starting date) |
| June 28th, 2008 | Construction contract signed |
| August, 2008 | Wind Turbine contract signed |
| October 24th, 2008 | Start GSP |
| January, 2009 | China LOA issued |
| February, 2009 | UK LOA issued |
| May 12th, 2009 | MoC signed |

From the description above, we can draw the conclusion that Huaneng New Energy Industrial Co. Ltd had decided to apply for CDM registration to overcome the financial barriers before the start date of the project.

*Additionality*

Approved methodology ACM0002 requires the use of the latest version of the “Tool for the demonstration and assessment of additionality” (version 05.2) agreed by the Executive Board to demonstrate and assess the additionality of the proposed project. The Tool consists of 4 steps as described below.

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

Realistic and credible alternatives to the project activity that can be part of the baseline scenario are defined through the following sub-steps:

***Sub-step1a. Define alternatives to the project activity:***

The demonstration about the alternative that provides outputs or services comparable with the proposed CDM project activity is as follows:

a) *The proposed project activity undertaken without being registered as a CDM project activity.*

- Alternative a) is in compliance with all applicable legal and regulatory requirements. But according to the detailed analysis in step 2, this scenario is less attractive with low IRR and is not realistic without CDM financing.

b) *A fossil fuel-fired power plant with the comparable capacity or electricity generation.*

- Taking into account the required capacity for the same annual generation, according to the current laws and regulations, it is not a realistic alternative (please refer to the analysis in sub-step 1b).

c) *A power plant using other source of renewable energy with the comparable capacity or electricity generation, such as PV, biomass and hydro, etc.*

- Besides wind energy, other kinds of renewable energy technologies, such as solar PV, geothermal, biomass and hydro are possible grid-connected sources that could be used in China. However, due to the technology development status and the high cost for power generation, solar PV, geothermal and biomass of similar installed capacity as the proposed project are not realistic alternatives in

China[3]. As for hydro power, due to dry climate and the lack of water resource recently years in project area, there is no commercially exploitable hydro power resource which can provide same electricity generation output of the proposed project activity[4]. Therefore, this alternative is not realistic.

d) *Continuation of the current situation: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.*

- To meet the increasing electricity demand, the power grid company can increase the generation from operating units as well as from new built (thermal) power plants connected to the grid. Indeed, this is the current route followed by the industry to meet demand, as reflected in the baseline calculations data presented: more than 95% of recently added capacity is thermal power. Therefore, continuation of the current situation, with the electricity generated by the operation of grid-connected power plants and by the addition of new generation sources on North China Power Grid (NCPG) can be taken as a realistic alternative for the project activity and comply with the applicable laws and regulations.

From the above mentioned, we know that the alternative (d) is the baseline scenario of the project, in line with the methodology.

***Sub-step 1b. Consistency with mandatory laws and regulations:***

For the alternative (b) described in sub-step1a, if taking the capacity that can generate the same annual electricity generation and estimating annual utilization hours as 5,612[5], which is the average utilization hours of the thermal units in China in 2006, the alternative baseline scenario for the proposed project should be a fuel-fired power plant with installed capacity of 21.7MW or lower. Further, as the proposed project is a grid-connected wind power generation project, the alternative baseline scenario must be a grid-connected fuel-fired power generation project. However, according to Chinese regulations, coal-fired power plants of less than 135MW are prohibited to be built in the areas covered by the large grids such as provincial grids[6]. For these reasons, the possible alternative baseline scenario of building a 21.7MW fuel-fired power plant conflicts with Chinese regulations. But the other scenarios are all compliant with the mandatory laws and regulations. So, scenario b) is not feasible as an alternative scenario, either.

According to the analysis in sub-step 1a and 1b, alternative (a) and alternative (d) are the realistic and feasible alternatives which comply with applicable laws and regulations.

**Step 2. Investment analysis**

The purpose of this step is to determine whether the proposed project activity is economically or financially less attractive than the alternatives, or economically or financially not feasible, without the

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[3] http://scitech.people.com.cn/GB/5347113.html, http://www.sdpc.gov.cn/zjgx/t20071123_174054.htm

[4] http://www.ecrcass.com/ecrcass/CTTB/2006/2006_28.htm, http://monitoring.chinaep-tech.com/channel/solidwaste/4536.shtml.

[5] *China Electric Power Yearbook* (2007 Edition), China Electric Power Press.

[6] Notice on Strictly Prohibiting the Installation of Fuel fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Decree No. 2002-6, http://www.gov.cn/gongbao/content/2002/content_61480.htm.

revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, the following sub-steps are used:

***Sub-step 2a. Determine appropriate analysis method***

This step determines whether to apply the simple cost analysis, investment comparison analysis or benchmark analysis (sub-step 2b):

The proposed project activity generates financial benefits by the sales of electricity, so the simple cost analysis can not be applied. The alternative to the project activity is the supply of electricity from a grid, which is not considered an investment, and a benchmark approach is considered appropriate, according to EB Guidance.[7] The investment comparison analysis (Option II), therefore, is not suitable, and the benchmark analysis (Option III) is adopted. The use of a benchmark analysis is also in line with Chinese practice and is followed in the FSR.

Therefore, the benchmark analysis (Option III) is adopted.

***Sub-step 2b – Option III. Apply benchmark analysis***

According to the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects* issued by former State Power Corporation of China in 2002, the benchmark of total investment financial internal rate of return (IRR) of electric power industry is 8%, and only if the project IRR of the project is higher than or equivalent to this benchmark, the proposed project is financially feasible. This benchmark is widely used in assessment and approval of Chinese electricity power industrial, especially new projects, and is applied by many Chinese projects under the CDM. Therefore, the project activity uses the benchmark of 8% in the financial analysis.

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

The investment estimation in the Feasibility Study Report (FSR) was carried out by an independent design institute regulated by national regulation. The relevant data involved in financial assessment is listed in Table 4.

**Table 4. Relevant indicators for financial assessment**

| Item | Value |
|---|---|
| **Supplied power to the grid** | 121,852MWh |
| **Static investment** | 527.64 million Yuan RMB |
| **On-grid tariff (including VAT)** | 0.51 Yuan RMB/kWh |
| **Annual O&M cost** | 9.75 million Yuan RMB |
| **Residue Value Ratio** | 5% |
| **Expected operational lifetime** | 20 years |
| **Additional tax rate** | 8% |
| **Value added tax rate** | 8.5% |
| **Income tax rate** | 25% |
| **Assumed CER price** | 9 €/t $CO_2$ |

[7] EB 41 Annex 45 (paragraph 15).

*Source: Feasibility Study Report (FSR), completed by Shanghai Power Design Institute*

It can be seen in the table 5 that the IRR without CER revenue is 6.1%, which is below the benchmark 8%. The proposed project activity without registration as a CDM project, therefore, is not financially attractive to the project developer. But the revenue from the sale of CERs will have a significant impact on the IRR. With revenue from CDM the proposed project would be financially attractive.

**Table 5. Total investment analysis of the proposed project**

| IRR | |
|---|---|
| **without CDM** | **with CDM revenue*** |
| **6.1%** | **8.7%** |

*with the assumed CER price in the FSR: 9 €/t $CO_2$

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

A sensitivity analysis is included to show that the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality as this sensitivity analysis consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be economically or financially attractive.

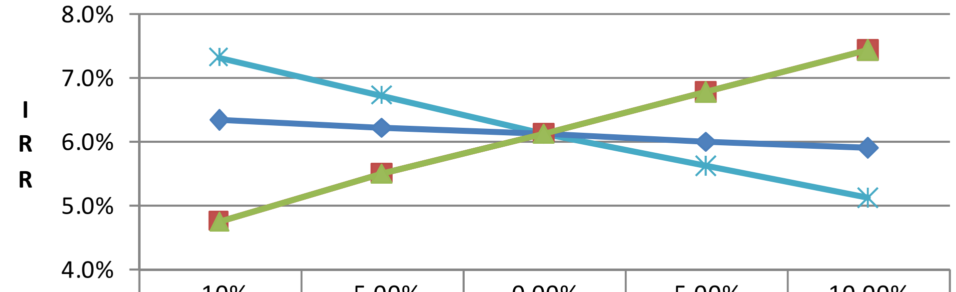
According to EB Guidance, only variables that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. The key variables in the sensitivity analysis are:

1) Investment;
2) Annual O&M cost;
3) On-grid tariff;
4) Supplied power.

In terms of the guidance on the assessment of investment analysis from EB41, Annex 45, paragraph 17, as a general point of departure variations in the sensitivity analysis should cover a range of +10% and -10%. Past trend may be a guide to determine the reasonable range.

In line with normal practice in China, a variation in the range of +10% to -10% is taken. Greater variations are unlikely, as discussed below, and it is not considered that the benchmark can be reached without CDM registration. The outcome of the sensitivity analysis is presented below.

**Figure 3 IRR sensitivity analysis for the proposed project**




| | -10% | -5.00% | 0.00% | 5.00% | 10.00% |
|---|---|---|---|---|---|
| Investment | 7.3% | 6.7% | 6.1% | 5.6% | 5.1% |
| Annual O&M cost | 6.3% | 6.2% | 6.1% | 6.0% | 5.9% |
| Tariff | 4.8% | 5.5% | 6.1% | 6.8% | 7.4% |
| supplied power | 4.8% | 5.5% | 6.1% | 6.8% | 7.4% |

The financial analysis shows that the project is not the most financially attractive alternative, and the sensitivity analysis shows that without CER revenue the IRR for the project will not reach the benchmark for any reasonable variation in the main parameters. This sensitivity analysis shows that the conclusion that the project is not financially attractive without CDM registration is robust to reasonable variations in the critical assumptions.

The IRR calculation spreadsheet shows the variations at which the benchmark would be reached: if the investment would need to decreases by about 15%; the tariff or supplied power would need to increase by 15%; the annual O&M costs would need to decrease by 88%. None of these scenarios are likely to happen.

***Investment***

For the wind farm projects, the cost of turbine, engineering construction and related accessories comprise the majority budget of the static investment. As the prices of raw materials and man power have been increasing over the years, which results in the price of industry equipments and construction rising.[8] Also the rise in price of the turbines and its accessories gives rise to investment cost of developing wind power project to go up. [9] Therefore, it was not credible to assume that the investment costs would decrease by about 15% to reach the benchmark.

***Tariff***

The tariff used in the investment analysis and PDD is taken from the FSR. The tariff assumed in the FSR referred to other approved tariff of nearby wind farms. On 9 June 2007 and 3 December 2007, National

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[8] http://www.stats.gov.cn/tjfx/jdfx/t20090122_402534140.htm

[9] http://www.newenergy.org.cn/Html/00811/11240823434.html

http://www.vvwind.com/html/wind_article/20080712/355.html

Development and Reform Committee (NDRC) issued two "Notification of electricity tariff for wind power projects" (Fa Gai Jia Ge [2007]1260 and (Fa Gai Jia Ge [2007]3303).[10] According to these two notifications, the tariff of wind power projects in western Inner Mongolia is 0.51 Yuan / kWh (incl. VAT). The FSR of the proposed project was completed in March 2008 and it can be concluded that these two notifications were the most recent official guiding tariff document public available at that time. Therefore, the tariff of 0.51 Yuan/kWh (incl. VAT) was used in the FSR (and thus also used in the PDD), which was the latest available on-grid tariff at the time of the preparation of the FSR. The tariff in western Inner Mongolia has been maintained at the 0.51 Yuan/kWh (incl. VAT) level in the subsequent tariff notification issued by NDRC on 23/07/2008 (Fa Gai Jia Ge [2008]1876).[11]

From above, it can be concluded that the tariff assumed in the FSR (and also used in the PDD) is suitable. Moreover, the tariff will be fixed once it is approved by government (as assumed in the FSR), and the owner of the project would not be able to make assumption of a tariff increase for investment decision making.

Therefore, it is not realistic to assume that the tariff would increase from the level quoted in the FSR, with an increase of 15% would be required to reach the benchmark.

***Supplied power***

The expected annual power output (supplied power) is determined by an independent qualified design institute with the highest grade (Grade A) using scientific methods as applied internationally. The approved feasibility study report determines the annual supplied power based on the calculated wind data for a representative average year, which is analyzed from 27 years of meteorological data of the wind resource in local area (1980 to 2006) and onsite measured wind data. The representative year data represents the annual average power supply during the lifetime of the wind farm, taking into account the yearly variations in power generation. It is highly unlikely that the wind data throughout the lifetime of the project would be significantly higher than the data used in the FSR.

As per the FSR, the estimated supplied power is calculated from the turbine availability and the wind resource. Regarding the turbine availability, the calculations for the proposed project are carried out using professional WASP software (www.wasp.dk) designed for wind energy. The output is maximised through selection of the most suitable turbines, optimal turbine distribution in the wind farm, and considering the specific turbine characteristics. The method of anticipating power generation is also approved by the government and is widely used in China for wind energy.

Therefore, it is not credible to assume that average annual generation from the proposed project would increase by at least 15% over the lifetime of the project in order to reach the benchmark 8%.

***O&M cost***

The O&M costs include the salary, materials fee and repair cost, etc. Past trends show that costs have been rising: as prices, including those of the salary and materials, have been increasing, a significant

[10] http://jgs.ndrc.gov.cn/zcfg/t20080218_193011.htm
http://law.laweach.com/rule_11607_1.html
[11] http://jgs.ndrc.gov.cn/zcfg/t20080813_230722.htm

reduction in the level of costs is particularly unlikely.[12] The impact of variations in O&M costs on the calculated IRR is not very significant, and the O&M costs would need to decrease by 88% before the project could reach the benchmark. This is not credible.

***Conclusion***

The financial analysis shows that the project is not the most financially attractive alternative, and the sensitivity analysis shows that it is unlikely to be financially attractive compared to the benchmark under any reasonable variations in the assumptions. However, the revenue from the CERs will greatly improve the financial feasibility of the proposed project, and it will also improve the ability to hedge risks caused by other factors. In conclusion, the proposed project is not financially feasible without the revenue of CERs and thus is additional.

***→ If after the sensitivity analysis it is concluded that (1) the proposed CDM project activity is unlikely to be the most financially/economically attractive (as per step 2c para 11a) or is unlikely to be financially/economically attractive (as per step 2c para 11b), then proceed to Step 4 (Common practice analysis).***

**Step 4. Common practice analysis**

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

In line with the EB guidance on the additionality tool, the common practice analysis is carried out on similar projects in the same region and taking place in a comparable environment with regards to regulatory framework, investment climate etc.

In China, the regulatory framework and investment climate for wind farm projects are only similar and comparable in the same Province/Autonomous Region. The common practice analysis of the proposed project activity, therefore, covers projects in the Inner Mongolia Autonomous Region.

In April 2002, China implemented power sector reform to establish a more commercialized power market in China[13]. Since market condition for wind power project development has changed significantly since April 2002, the common practice analysis starts from 2002.

The analysis is restricted to large scale project (using the CDM definition of large scale: >15MW) as small scale projects are not comparable in size to the 49.5MW installed by the proposed project activity.

Using the statistics of installed capacity of wind power in China in 2007, collated by Professor Shi Pengfei[14], the large scale wind farm projects commissioned and planned in the same region are listed in Table 6 below. Other CDM projects activities are excluded in line with the guidance of the additionality tool.

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[12] http://www.nmgtj.gov.cn/Html/jjshfztjgb/2009-7/0/2385.shtml

[13] Chinese National Development and Reform Commission, Separate Power Plants from Network and Compete in Price to Enter Network, April 11, 2002, http://www.ndrc.gov.cn/xwfb/t20050708_28096.htm.

[14] http://www.cwea.org.cn/download/display_info.asp?id=25

**Table 6 Similar projects in Inner Mongolia**

| Name | Commissioning date | Capacity (MW) | Note |
|---|---|---|---|
| Dali III | Mar, 2004 | 31.2 | Demonstration Project supported by national debt fund |
| Bailingmiao | Dec, 2007 | 35 | Facing financial barriers, applying for Voluntary Emission Reduction under Golden Standard Voluntary Carbon Standard |

*Source: http://www.cwea.org.cn/download/display_info.asp?id=2; http://cdm.unfccc.int/Projects/registered.html.*

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

From the table above it can be found that there are only two similar wind farms constructed which are not already (applying for) CDM financial support. Dali phase III wind project was Demonstration Project supported by national debt fund[15]. However, such support is no longer given in Inner Mongolia. As for Bailingmiao wind project, it is also facing financial barriers and applying for carbon financing support: Voluntary Emission Reduction under Golden Standard Voluntary Carbon Standard [16]. Under the current circumstances it is not feasible to develop wind farms in Inner Mongolia without the carbon revenue.

In addition to the two projects listed in Table 6, the other wind farms in Inner Mongolia are all applying for or have already received CDM registration, because they are financially unattractive without the additional income from CER sales.

As already described in the statement above, currently there are no wind farm projects with similar capacity in Inner Mongolia Autonomous Region. Therefore, the wind power projects similar with the proposed project activity are not common practice in Inner Mongolia.

***→ If Sub-steps 4a and 4b are satisfied, i.e. similar activities cannot be observed or similar activities are observed, but essential distinctions between the project activity and similar activities can reasonably be explained, then the proposed project activity is additional.***

In conclusion, all the steps above are satisfied, the proposed CDM project is not the baseline scenario, and the project activity is additional.

## B.6. Emission reductions:

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

>>

**1. Baseline Emission Calculation**

According to ACM0002**,** the baseline emissions include only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

[15] http://www.chifeng.gov.cn/html/2008-11/3130.shtml

[16] This project is applying for VER financial support: http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/project.php?id=423

$$BE_y = (EG_y - EG_{baseline})EF_{grid,CM,y} \quad (1)$$

Where:
$BE_y$ = Baseline emissions in year y ($tCO_2$/yr).
$EG_y$ = Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero. The proposed project is a new power plant, so this value is 0.
$EF_{grid,CM,y}$ = Combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

The baseline emission factor ($EF_y$) is calculated as a combined margin ($EF_{grid,CM,y}$), consisting of the combination of operating margin ($EF_{grid,OM,y}$) and build margin ($EF_{grid,BMy,}$) factors according to the following six steps defined in the "Tool to calculate the emission factor for an electricity system". The calculations follow the published data from the Chinese DNA, and data for the calculations are based on official national statistics books: *China Energy Statistical Yearbook* and *China Electric Power Yearbook*. (see Annex 3)

**Step 1. Identify the relevant electric power system**

The power generated from the proposed project activity will be supplied to the grid. As the DNA has published a delineation of the project electricity system and connected electricity systems, these delineations are used.

Following the DNA delineation, the project electricity system is the North China Power Grid (NCPG), consisting of six provincial grids: Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong.

The connected electricity system is the Northeast Power Grid (NEPG), consisting of three provincial grids: Jilin, Liaoning and Heilongjiang, and Central China Power Grid (CCPG), consisting of Jiangxi, Henan, Hubei, Hunan, Chongqing and Sichuan. There is electricity transferring from the connected electricity systems to the project electricity system, so the $CO_2$ emission factor for net electricity imports ($EF_{grid,import,y}$) from the connected electricity system should be determined using one of the following options for the purpose of determining the operating margin emission factor:

(a) 0 $tCO_2$/MWh, or
(b) The weighted average operating margin (OM) emission rate of the exporting grid; or
(c) The simple operating margin emission rate of the exporting grid; or
(d) The simple adjusted operating margin emission rate of the exporting grid.

The option (b) is selected to calculated the $CO_2$ emission factor(s) for net electricity imports ($EF_{grid,import,y}$) according to the delineation.

The electricity imports from the Northeast Power Grid to the North China Power Grid have not changed significantly from 2003 to 2006 (see Annex 3), and the electricity from Central China Power Grid to North China Power Grid just started from 2006 and the imported electricity is negligible compared to the power generated from NCPG (see Annex 3). So for the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system according to the tool.

**Step 2. Select an operating margin (OM) method**

According to the tool, four various methods are provided for calculating the operating margin emission factor ($EF_{grid,OM,y}$), including:

a) Simple OM;
b) Simple Adjusted OM;
c) Dispatch data analysis OM;
d) Average OM

According to the tool, the Simple OM method (a) is applicable to the project if the low-cost/must-run[17] resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

Since generation from all sources (including hydro power) other than thermal plants were less than 1% of total generation in the North China Power Grid and this percentage has not changed significantly in recent years (see Annex 3), the Simple OM method is applicable to the proposed project.

The Simple OM emissions factor can be calculated using either ex-ante or ex-post data vintages. The project proponents have chosen to use the ex-ante option, and $EF_{grid,OM,y}$ is fixed for the duration of the first crediting period.

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

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

The Simple Operating Margin emission factor $EF_{\text{grid},OM,y}$ is defined as the generation-weighted average emissions per unit net electricity generation ($tCO_2$/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. Three options can be selected to calculate the simple OM:

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

Option C can be used if the necessary data for using options A and B is not available, and if only nuclear and renewable power generation are considered low-cost/must-run sources. Data for using options A and

[17] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

B is not available. And nuclear and renewables are considered the only low-cost/must-run power generation sources. Therefore, option C is chosen to calculate the OM emission factor.

For Option C, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{co_2,i,y}}{EG_y} \qquad (2)$$

Where

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

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

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

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

$EG_y$ is the 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* is all fossil fuel types combusted in power sources in the project electricity system in year y

*y*, when using the ex-ante option, is the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

On the basis of the data available, the three-year average operating margin emission factor is calculated by the DNA as a full-generation-weighted average of the emission factors[18]:

$EF_{grid,OMsimlpe,y}$ = 1.1169 $tCO_2/MWh$

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

The sample group of power units m used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.[19] This option is chosen as it comprises larger annual generation than the five units built most recently.

However, due to the limited publicly available data, it is not possible to identify the exact new-built plants which comprise the 20% of the system generation. Therefore, the project participants follow the method of calculations of the Chinese DNA, which uses the deviation accepted by EB to calculate $EF_{BM}$[20]: using the latest statistical data available (from the China Power Yearbook), the most recent year from which the added generation capacity is equal to or just exceeds 20% of the latest statistic year 2006 is determined. The added generation capacity is the sample group of power units *m* used to calculate the build margin.

[18] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239

[19] If 20% falls on part capacity of a unit, that unit is fully included in the calculation.

[20] http://cdm.unfccc.int/Projects/Deviations: Application of approved methodology AM0005 (DNV, 07 Oct 05).

In terms of vintage of data, project participants can choose between option 1 ex-ante, and option 2 ex-post data vintages. The project proponents have chosen to use the ex-ante option, and $EF_{grid,BM,y}$ is fixed for the duration of the first crediting period.

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

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

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

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad (3)$$

$EF_{grid,BM,y}$ is the Build margin CO2 emission factor in year $y$($t\ CO_2/MWh$);
$EG_{m,y}$ is the Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh);
$EF_{EL,m,y}$ is the CO2 emission factor of power unit *m* in year y ($tCO_2/MWh$);
*m* is the power units included in the build margin;
*y* is the most recent historical year for which power generation data is available.

The $CO_2$ emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in step 3 (a) for the Simple OM, using for *y*, the most recent historical year for which power generation data is available, and using for *m*, the power units included in the build margin. However, data on fuel consumption, fuel types and electricity generation from each of the units *m* is not available. Therefore, following the calculations of the Chinese DNA, the deviation mentioned above is used, using the following sub-steps:

*Sub-step 1: Calculate the $CO_2$ emission share of thermal generation by fuel type*

- Using the latest statistical data available from the China Energy Statistical Yearbook calculate the $CO_2$ emission percentages ($\lambda_i$) of solid, liquid and gas fossil fuels in the total emissions from thermal power generation in the project electricity system.

*Sub-step 2: Calculate the weighted emission factor of thermal power*

- Based the fuel shares ($\lambda_i$) and the corresponding emission factor ($EF_i$) according to the best technology commercially available in the China, calculate the weighted emission factor of thermal power ($EF_{thermal}$).

*Sub-step 3: Calculate the build margin emission factor*

- Using the identified cohort of power units (step 4) and the emission factor of thermal power, calculate the build margin emission factor.

On the basis of the data available, the build margin emission factor is calculated by the DNA (see Annex 3) as: 0.8687 $tCO_2/MWh$[21].

**Step 6. Calculation of the combined margin emission factor**

The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \bullet EF_{grid,OM,y} + w_{BM} \bullet EF_{grid,BM,y} \quad (4)$$

Where
$EF_{grid,BM,y}$ is the build margin $CO_2$ emission factor in year y ($tCO_2/MWh$)
$EF_{grid,OM,y}$ is the operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$)
$w_{OM}$ is the weighting of operating margin emissions factor (%)
$w_{BM}$ is the weighting of build margin emissions factor (%).

The default weights are used, i.e. for the wind farm projects in the first crediting period and the subsequent crediting period, $w_{OM} = 0.75$ and $w_{BM} = 0.25$.

On the basis of these weights for the first crediting period, the combined margin emission factor is calculated, and fixed ex-ante:

$EF_{grid,CM,y}$ = 1.05485 $tCO_2/MWh$

Using Operating Margin and Build Margin emission factors that are fixed for the duration of the first crediting period, the baseline emissions factor is also fixed for the first crediting period. These parameters will be recalculated at any renewal of the crediting period using the same steps 1-6 in the tool and the latest data available at that time.

**Table 7 Values obtained when calculating the baseline emission factor using ACM0002**

| **Variable** | **Value** |
|---|---|
| Operating Margin Emissions Factor ($EF_{grid,OM,y}$ )in $tCO_2/MWh$) | 1.1169 |
| Build Margin Emissions Factor ($EF_{grid, BM,y}$ in $tCO_2/MWh$) | 0.8687 |
| Baseline Emissions Factor ($EF_{grid,CM,y}$ in $tCO_2/MWh$) | 1.05485 |

Baseline emissions ($BE_y$) now can be calculated as the combined margin $CO_2$ emission factor ($EF_{grid,CM,y}$)multiplied by the annual net generation of the Proposed Project ($EG_y$).

## 2. Project emission

According to ACM0002, the proposed wind farm belongs to renewable energy activity, and there is no backup power generation in the proposed project, so $PE_y$ of the proposed project is zero.

## 3. Leakage

[21] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239

According to ACM0002, no leakage is considered for the proposed project.

**4. Calculate Emission Reduction**

The emission reduction $ER_y$ by the project activity during a given year *y* is the difference between baseline emission ($BE_y$), project emissions ($PE_y$) and emission due to leakage ($LE_y$), as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (5)$$

Where the baseline emissions ($BE_y$ in $tCO_2$) are the product of the baseline emissions factor ($EF_y$ in $tCO_2$/MWh) times the electricity supplied by the project activity to the grid ($EG_y$ in MWh). The calculation formula is as follows:

$$BE_y = EG_y \times EF_{grid,CM,y} = (EG_{export,y} - EG_{import,y}) \times EF_{grid,CM,y} \quad (6)$$

With:
$EG_{export,y}$ is the quantity of annual electricity delivered to the grid by the proposed project(MWh);
$EG_{import,y}$ is the quantity of annual electricity purchased from the grid by the proposed project(MWh).

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

| **Data / Parameter:** | $FC_{i,y}$ |
|---|---|
| Data unit: | Mass or volume |
| Description: | the amount of the fossil fuel *i* consumed in the project electricity system in year *y* |
| 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 : | The aggregate amount of each fuel is applied because the amount of a fuel of each plant cannot be acquired. |
| Any comment: | |

| **Data / Parameter:** | $EG_{grid,y}$ *and* $EG_{m,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied to power grid by included sources in year y |
| Source of data used: | China Electric Power Yearbook |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The aggregate amount of electricity is applied because the amount of each plant cannot be obtained. |

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

| | |
|---|---|
| **Data / Parameter:** | $NCV_i$ |
| Data unit: | GJ/mass or volume unit |
| Description: | Net caloric value of fossil fuel type i consumed in the project electricity system in year y |
| Source of data used: | China Energy Statistic Yearbook |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Best data available published by the Chinese authorities, and officially accepted by the Chinese DNA in their emission factor calculations. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $EF_{CO2,i,y}$ and $EF_{CO2,m,y}$ |
| Data unit: | $tCO_2/GJ$ |
| Description: | $CO_2$ emission factor of fossil fuel type *i* in year *y* |
| Source of data used: | Chinese DNA: officially accepted values used in their emission factor calculations |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | The Chinese DNA has officially adopted, for their emission factor calculations, the IPCC default values: Table 1.4 of Chapter 1, Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories) |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | Efficiency of the best technology commercially |
| Data unit: | % |
| Description: | Best commercial available efficiency of coal, gas, oil fuel power plant |
| Source of data used: | http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239 |
| Value applied: | Best efficiency for coal plant is 37.28%;<br>Best efficiency for oil plant is 48.81%;<br>Best efficiency for gas plant is 48.81% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | Installed Capacity |
| Data unit: | MW |

| | |
|---|---|
| Description: | Installed capacity of the NCPG in year *y* |
| Source of data used: | China Electric Power Yearbook (2005, 2006, 2007) |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | Import Electricity |
|---|---|
| Data unit: | MWh |
| Description: | Net import electricity from NEPG to the NCPG |
| Source of data used: | China Electric Power Yearbook |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | Import Electricity |
|---|---|
| Data unit: | MWh |
| Description: | Net import electricity from CCPG to the NCPG |
| Source of data used: | China Electric Power Yearbook |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | |

| **Data / Parameter:** | $EF_{CM}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | Combined margin emission factor of the grid |
| Source of data used: | Calculated & Chinese DNA |
| Value applied: | 1.05485 |
| Justification of the choice of data or description of measurement methods and procedures actually | Data used from Chinese DNA, http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239 |

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

| | |
|---|---|
| **Data / Parameter:** | $EF_{OM}$ (also $EF_{grid,OMsimple,y}$) |
| Data unit: | $tCO_2/MWh$ |
| Description: | Operating Margin Emission Factor |
| Source of data used: | Calculated |
| Value applied: | 1.1169 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used from Chinese DNA, http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239 |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $EF_{BM}$ |
| Data unit: | $tCO_2/MWh$ |
| Description: | Build Margin Emission Factor |
| Source of data used: | Calculated |
| Value applied: | 0.8687 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used from Chinese DNA, http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239 |
| Any comment: | |

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

>>

Based on the Feasible Study Report, the proposed project will generate 121,852MWh electricity to the NCPG annually. The emission reduction $ER_y$ by the project activity during a giving year y is calculated as follows:

$$BE_y = EG_y \times EF_{grid,CM,y} = 121{,}852\text{MWh} \times 1.05485\ tCO_2/MWh = 128{,}535\ tCO_2$$

$$ER_y = BE_y - PE_y - LE_y = 128{,}535 - 0 - 0 = 128{,}535\ tCO_2$$

The emission reduction $ER_y$ by the project activity during a giving year $y$ is 128,535 $tCO_2$ and the total emission reduction in the first crediting period is 899,745 $tCO_2$.

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

>>

**Table 8. Emission reduction of the proposed project in the first crediting period**

| Year* | Estimated value of | Estimated value | Estimated value | Estimated value of |
|---|---|---|---|---|

| | emission of the proposed project activity ($tCO_2e$) | of emission of the baseline ($tCO_2e$) | of emission of leakage ($tCO_2e$) | total emission reductions ($tCO_2e$) |
|---|---|---|---|---|
| 2009 | 0 | 128,535 | 0 | 128,535 |
| 2010 | 0 | 128,535 | 0 | 128,535 |
| 2011 | 0 | 128,535 | 0 | 128,535 |
| 2012 | 0 | 128,535 | 0 | 128,535 |
| 2013 | 0 | 128,535 | 0 | 128,535 |
| 2014 | 0 | 128,535 | 0 | 128,535 |
| 2015 | 0 | 128,535 | 0 | 128,535 |
| Total ($tCO_2e$) | 0 | 899,745 | 0 | 899,745 |

*Note: * Using 12-monthly periods, not calendar years.*

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

>>

Following approved methodology ACM0002, the data that is required to be monitored to establish the emission reductions, is the net electricity generation ($EG_y$).

### B.7.1 Data and parameters monitored:

| **Data / Parameter:** | ***$EG_y$*** |
|---|---|
| Data unit: | MWh |
| Description: | Net electricity supplied to the grid by the project in period y |
| Source of data to be used: | Electricity meter, monitoring supply to the grid ($EG_{export, y}$) and imports from the grid ($EG_{import, y}$) (bi-directional, i.e. recording generation and consumption). The net electricity supplied by the proposed project activity to the grid ($EG_y$) is the difference of exports to the grid and imports from the grid ($EG_{export,y}$ - $EG_{import,y}$). |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 121,852 MWh/year once fully operational. |
| Description of measurement methods and procedures to be applied: | Grid-connected electricity generated by the proposed project will be monitored through main metering equipment at the substation of the grid. The electricity meters (main and back-up) measure continuously and accumulatively. The data is recorded monthly. A back-up meter is also installed at the grid substation. When the main meter fails to work normally, the readings of the back-up meter will be adopted. |
| QA/QC procedures to be applied: | The metering equipments will be calibrated and checked yearly by qualified third party for accuracy according to the appropriate industry standards.<br><br>The quantity of annual net electricity delivered to the grid by the proposed project is cross-checked against sales receipts.<br><br>The accuracy of the meters meets the national standard (0.5s), which means that the metering equipments shall have sufficient accuracy so that any error resulting from such equipment shall not exceed 0.5%. |

| | |
|---|---|
| | Monthly supplied generation data will be approved and signed off by CDM manager before it is accepted and stored. This audit will check compliance with operational procedures in this monitoring plan (for details, see Section B.7.2).<br><br>This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years. If such improvements are proposed these will be reported to the DOE and only operated after approval from the DOE. |
| Any comment: | |

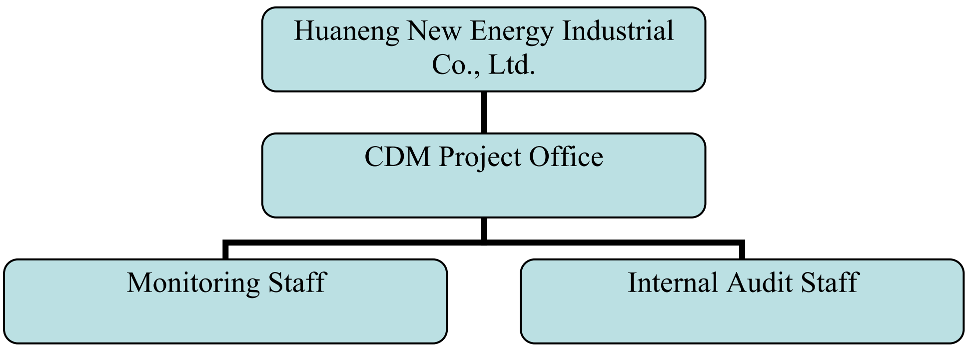
**B.7.2 Description of the monitoring plan:**

>>

Overall responsibility for monitoring and carrying out the monitoring following this monitoring plan lies with Huaneng New Energy Industrial Co., Ltd. The company will establish a CDM project management office and assign dedicated people responsible for the monitoring and reporting of the generation and emission reductions of the project activity.

The operating and management structure is illustrated as followed:

The detailed information about the monitoring plan is presented in Annex 4.




**1. Introduction**

Huaneng Damao Maoming Phase I Wind Farm project adopts the Revision to the approved consolidated monitoring methodology ACM0002 “Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources” (version 09) to determine the emission reductions from the net electricity generation from the wind farm. This plan describes in more detail the process.

**2. Responsibility**

Overall responsibility for monitoring and carrying out the monitoring following this monitoring plan lies with Huaneng New Energy Industrial Co., Ltd.

CDM manager of Huaneng New Energy Industrial Co., Ltd is responsible for the monitoring and reporting of the wind farm.

Huaneng New Energy Industrial Co., Ltd, in co-operation with the existing wind farm experienced experts will train the staff carrying out the monitoring work.

**3. Training**

The CDM project management office will assign and train the dedicated people carrying out the monitoring work. The CDM project manager will complete the monitoring personnel training before the registration, further training work will be completed with the preliminary verification.

**4. The monitored data**

The net electricity supplied by the proposed project activity to the grid ($EG_{,y}$) will be monitored through the main meter installed in the substation of the grid, recording exports to the grid ($EG_{export,y}$) and imports from the grid ($EG_{import,y}$). The net electricity supplied by the proposed project activity to the grid ($EG_{,y}$) is the difference of exports to the grid and imports from the grid ($EG_{export,y}$ - $EG_{import,y}$). The electricity meters (main and back-up) measure continuously and accumulatively. The data is recorded monthly. A back-up meter is also installed at the grid substation. When the main meter fails to work normally, the readings of the back-up meter will be adopted.

**5. Installation of meters**

The net electricity supplied by the proposed project activity to the grid will be monitored through the main meter installed in the substation of the grid, recording exports to the grid ($EG_{export,y}$) and imports from the grid ($EG_{import,y}$). Net electricity supplied to the grid by the project is calculated as exports minus imports ($EG_{export,y}$ - $EG_{import,y}$). The backup meters will also be installed at the grid substation. The accuracy of the meters is 0.5. The electricity meters monitor the flow continuously and are reported monthly.

The net supplied power monitored by these meters will suffice for the purpose of billing and emission reductions, as long as the error in the meters is within the agreed limits. The main meter used for billing (at the substation of the grid) will also be the primary meter used for emission reduction calculations.

If in the future, some other wind farms share the transmission and transformer facilities as well as the metering equipments at the substation with the proposed project activity, the appropriate separate meters installed in the project site will be used in order that the electricity generation can be monitored respectively to calculate the share of this wind farm of the net supply to the grid.

The net electricity supplied by the project activity to the grid ($EG_y$) is calculated as follows:

$$EG_{export,\ y} = EG_{export,\ total} * EG_{project} / (EG_{project} + EG_{others})$$

$$EG_{import,\ y} = EG_{import,\ total}$$

$$EG_y = EG_{export,\ y} - EG_{import,\ y}$$

$EG_{export,\ total}$ is total exported electricity to the grid based on the data metered by the main meter at the grid substation;

$EG_{import,\ total}$ is total imported electricity from the grid based on the data metered by the main meter at the

grid substation;
$EG_{project}$ is the electricity generation of the proposed project based on the data metered by separate meters at the project site;
$EG_{others}$ is the electricity generation of the other wind farm projects based on the data metered by other separate meters;
$EG_y$ is the net electricity supplied to the grid by the proposed project.

The $EG_{export, total}$ and $EG_{import, total}$ can be cross-checked by sale receipt. The readings of those separate meters can be cross-checked by the confirmation letter of generation from the grid.

**6. Calibration**

The metering equipments are calibrated and checked for accuracy in accordance with industry standards (Chinese electric industry regulation DL/T448). The metering equipments shall have sufficient accuracy so that any error resulting from such equipment shall not exceed 0.5%. The net generation output registered by the meters alone will suffice for the purpose of billing and emission reduction verification as long as the error in the meters is within the agreed limits.

Both meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

Calibration is carried out by the qualified entity, and these records will be maintained by the grid company.

All the meters installed shall be tested by qualified entity after: the detection of a difference larger than the allowable error in the readings of both meters; the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications.

If any errors are detected the party owning the meter shall repair, recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.

Should any previous months reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the net generation output shall be determined by:
(a) first, by reading backup meter, unless a test by either party reveals it is inaccurate;
(b) if the backup system is not within acceptable limits of accuracy or operation is performed improperly Huaneng New Energy Industrial Co., Ltd and the North China Power Grid shall jointly prepare an reasonable and conservative estimate of the correct reading, and provide sufficient evidence that this estimation is reasonable and conservative when DOE undertakes verification; and
(c) if the North China Power Grid and Huaneng New Energy Industrial Co., Ltd fail to agree then the matter will be referred for arbitration according to agreed procedures.

**7. Quality control**

Monthly net generation data will be approved and signed off by CDM manager before it is accepted and stored.

This audit will check compliance with operational procedures in this monitoring plan.

This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years.

**8. Data management system**

Physical document such as paper-based maps, diagrams and environmental assessments will be collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the Huaneng Damao Maoming Phase I Wind Farm project, the project material and monitoring results will be indexed. All paper-based information will be stored by the technology department of Huaneng New Energy Industrial Co., Ltd and all the material will have a copy for backup.

And all data including calibration records is kept until 2 years after the end of the total crediting period of the CDM project.

**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 is 25/08/2009, and the individuals/entities involved in the study are as follows:


- Mr. Xu Chao, Dr. Zhong Yong, Ms. Qian Yiwen, cx@carbonresource.com, Carbon Resource Management China Representative Office, Suite 806, Hyundai Motor Tower, No. 38 Xiaoyun Road, Chaoyang District, Beijing, 100027, China, Tel: +86 10 8447 5246/8.
- Mr. Christiaan Vrolijk, cv@carbonresource.com, Carbon Resource Management Ltd, 49 St James's Street, London SW1A 1JT, UK, Tel: +44 20 7016 1426.


Carbon Resource Management is a project participant.

## 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:

>>

26/06/2008 (construction permission date)

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

>>

20 years, 0 month.

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

#### C.2.1. Renewable crediting period

A renewable crediting period is chosen.

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

>>
01/12/2009 (or the date of registration, whichever is later)

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

>>
7y-0m

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

>>
Not applicable.

**C.2.2.2. Length:**

>>
Not applicable.

## SECTION D. Environmental impacts

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

>>
Environmental Impact Assessment (EIA) for the Huaneng Damao Maoming Phase I Wind Farm project has been completed by of Inner Mongolia Power Exploration & Design Institute in October 2007, and has been approved by the Environmental Protection Bureau of Inner Mongolia Autonomous Region in the end of October 2007. Here is a summary of the EIA.

**1. The analysis of the environment impact in the construction period**

- Construction machinery and construction activity will generate noise. However, since the nearest local residential area is far away from the wind farm site and local atmosphere environment capacity is very large, the impact of construction noise to the local region is minimal.
- The waste water from construction is mainly sewage from construction workers. This small quantity of waste water will be treated by deposition in a septic tank near the wind farm, and therefore it will not have a significant impact on the environment. A new sewage system will be built for long term use during operations. All the waste water from construction work is used for eliminating dust. So the water during construction period will have no impact on the local environment.
- The solid waste during construction period is mainly the soil and garbage. The soil will be used to backfill the road and the surrounding area of the wind farm. Therefore, the solid waste will do no harm to the local environment.
- The air pollution from the proposed project is mainly dust emitted by the construction activity with emission source in a low position and the diameter of the particulate is relative large, so the impact by the dust emitted is limited within the construction site. Major measures for dust control are spreading water on the construction site and setting temporary covering on the construction materials.
- The project temporarily disturbs some grass cover for construction use. The occupied land will be restored after construction. Overall, land use impact on the local residents arising from the project is

considered to be insignificant.

**2. The analysis of the environment impact in operation period**

- The noise from blades of wind power machine rotating during project construction is avoided mainly by selecting low noise equipment. Furthermore the residential regions are far away from the wind farm, so the noise does not influence the residential districts nearest to the site.
- Solid waste and liquid waste will be produced by operation staff during operation period. The emitted waste quantity is very small and will have no significant impact on the environment after treatment.
- The major concern of the impact to the ecological environment by the operation of the wind farm is the potential impact to birds, especially to the birds migrating during night time. From the research focused on this issue, it is stated that the chance of crashing by birds with wind generating sets are relative low. Moreover, the places with large number of night-migrating birds are excluded during project site selection process, which indicates minimal chance of collision between the birds and generators. The impact to local birds by the operation of the proposed project is very small.

**3. Conclusion**

The wind farm does not put much pressure on the local environment when generating renewable power. However it will bring great environmental benefit as well as the social benefit.

**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:**

>>

Environmental impacts are not considered significant. The Environmental Protection Bureau of Inner Mongolia Autonomous Region has approved the EIA.

## SECTION E. Stakeholders' comments

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

>>

In September of 2007, the staff from Huaneng New Energy Industrial Co., Ltd carried out a survey of the local villagers and residents in the area. A 1 page questionnaire was sent to 50 households and the survey had a 100% response rate. The result of the survey indicated the support to the project. The survey is summarized in Section E.2 below.

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

>>

Following is a summary of the local survey. The survey forms are available from the project owner.

A one-page questionnaire was designed to be easy to fill in and has the following sections:

I. Project introduction
II. Respondent's basic information and education level
III. Specific questions:

1. Will the Project raise effects on your environment of living, studying and working?
2. Will construction, operation or decommissioning of the Project affect natural resources or ecosystems, such as water, habitats, etc?
3. Will the Project cause noise, vibration or release of electromagnetic radiation that could adversely affect your health?
4. Do you think the proposed project will have promotion in local economic development?
5. Do you agree with the development of the Project?
6. Do you have any suggestion about the project?

The questionnaires were sent to 50 households, all of whom replied.

The results are summarised as follows:

**The people being surveyed**

| Item | Content | Vote | Proportion |
|---|---|---|---|
| Gender | Male | 18 | 36% |
| | Female | 32 | 64% |
| Education | Elementary school | 5 | 10% |
| | Junior high school | 13 | 26% |
| | Senior high school | 21 | 42% |
| | University or above | 11 | 22% |

**Their opinions**

| | | | |
|---|---|---|---|
| 1. Will the Project raise effects on your environment of living, studying and working? | Yes | No | Not Sure |
| | 0 | 100% | 0% |
| 2. Will construction, operation or decommissioning of the Project affect natural resources or ecosystems, such as water, habitats, etc? | Yes | No | Not Sure |
| | 0 | 98% | 2% |
| 3. Will the Project cause noise, vibration or release of electromagnetic radiation that could adversely affect your health? | Yes | No | Not Sure |
| | 0 | 100% | 0% |
| 4. Do you think the proposed project will have promotion in local economic development? | Yes | No | Unclear |
| | 100% | 0 | 0 |
| 5. Do you agree with the development of the Project? | Yes | No | No Concern |
| | 100% | 0 | 0 |

**Conclusions from the survey**

The survey shows that the proposed project has strong local support among the local people. They all believe the proposed project will promote the local economic development and agree the project construction.

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

>>

The villagers are all supportive of the proposed project and to date there has been no need to modify the project design according to the comments received.

The project owner has an overall environment-friendly plan to guarantee that the project has the minimum negative impact on the environment during the project construction and operation.

# Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
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**Annex 2**

## INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the proposed project.

## Annex 3

## BASELINE INFORMATION

### Step 1. Identify the relevant electric power system

Following the DNA delineation, the project electricity system is the North China Power Grid (NCPG), consisting of six provincial grids: Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong.

The connected electricity systems are the Northeast Power Grid (NEPG), consisting of three provincial grids: Jilin, Liaoning and Heilongjiang, and Central China Power Grid (CCPG), consisting of six provincial grids: Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan.

### Step 2. Select an operating margin (OM) method

According to Tool to calculate the emission factor for an electricity system, the Simple OM method is applicable to the project if the low-cost resources constitute less than 50% of total grid generation on average in the five most recent years or based on long-term average hydroelectric production. The Simple OM method, therefore, is applicable to the proposed project as the share of low-cost/must-run generation does not exceed 1% in the most recent last 5 years, with the average being 0.8% as presented below.

The most recent year for which data is available in the yearbook is the year 2006. Table A1 presents the shares of generation from all sources including hydro power, other than thermal plants. The table shows that over the last five years generation from these sources has been consistently less than 1%.

**Table A1 Power generation in the North China Power Grid from 2002 to 2006**

| Year | Low-cost/must-run generation ($10^8$ kWh) | Total Generation ($10^8$ kWh) | Share | Source* (edition/page) |
|---|---|---|---|---|
| 2002 | 36.25 | 4,075.45 | 0.89% | 2003/p585 |
| 2003 | 39.79 | 4,616.53 | 0.86% | 2004/p709 |
| 2004 | 40.32 | 5,308.04 | 0.76% | 2005/p474 |
| 2005 | 45.51 | 6,077.82 | 0.75% | 2006/p568 |
| 2006 | 48.04 | 6,099.11 | 0.75% | 2007/p638 |
| Total | 209.91 | 26,177.55 | | |
| Average | 41.982 | 5235.51 | 0.80% | |

*Source: * China Electric Power Yearbook (2003, 2004,2005,2006,2007).*

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

$EF_{CO2,i,y}$, the $CO_2$ emission factor of fossil fuel type i in year y ,is calculated as follows:

$EF_{CO2,i,y}= EF_{CO2,i,y} * 44/12$

**Table A2 Emission Factors of Fuels**

| Fuel types | Carbon Emission Factor |
|---|---|

| | (tC/TJ) |
|---|---|
| Coal | 25.8 |
| Cleaned Coal | 25.8 |
| Other washed coal | 25.8 |
| Coke | 29.2 |
| Shaped Coal | 26.6 |
| Crude Oil | 20.0 |
| Gasoline | 18.9 |
| Diesel | 20.2 |
| Fuel Oil | 21.1 |
| Other Petro Product | 20.0 |
| Natural Gas | 15.3 |
| Coke Oven Gas | 12.1 |
| Other Coal Gas | 12.1 |
| LPG | 17.2 |
| Refinery Gas | 15.7 |
| Other Coking Products | 25.8 |
| Other Energy | 0 |

*Source: 1) 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy;* 2) China Power Year Book (2007), p287.

*Fossil fuel consumption*

Fuel consumption is taken from the latest China Energy Statistical Yearbook editions. The yearbooks present a range of more than 10 fuels for each province. Data is presented in Table A3 below. The share of emissions from coal consumption is also given in the table.

**Table A3 Energy consumption and $CO_2$ emissions of NCPG in 2004-2006**

*2004*

| Fuel Type | Beijing | Tianjing | Hebei | Shanxi | Neimeng | Shandong | Fuel Consumption ($Mt,Mm^3$) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|---|---|---|
| Coal | 8.9775 | 16.752 | 67.265 | 61.7645 | 62.7723 | 104.054 | 321.5853 | 636.0625 |
| Cleaned coal | | | | | | 0.4218 | 0.4218 | 1.0512 |
| Other washed coal | 0.0657 | | 1.6745 | 3.7365 | | 1.0869 | 6.5636 | 5.1927 |
| Coke | | | | | 0.0021 | 0.0011 | 0.0032 | 0.0097 |
| Coke oven gas | 64 | 75 | 62 | 2108 | 39 | | 2348 | 1.7424 |
| Other coal gas | 1609 | 786 | 3883 | | 1837 | | 9103 | 2.1110 |
| Crude oil | | | | | 0.0073 | | 0.0073 | 0.0224 |
| Gasoline | | | 0.0001 | | | | 0.0001 | 0.0003 |
| Diesel | 0.0048 | | 0.0354 | | 0.0012 | | 0.0414 | 0.1308 |
| Fuel oil | 0.1225 | | 0.0023 | | 0.0006 | | 0.1254 | 0.4057 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LPG | | | | | | | 0 | 0 |
| Refinery gas | | | 0.0902 | | | | 0.0902 | 0.2391 |
| Natural gas | 28 | 8 | | 276 | | | 312 | 0.6814 |
| Other petro products | | | | | | | 0 | 0 |
| Other coke products | | | | | | | 0 | 0 |
| Other energy | 0.0858 | | 0.3235 | 0.6931 | 0.0727 | | 2.3641 | 0 |
| **$CO_2$ Emission 549.0240 $MtCO_2$** | | | | | | | | |

*Source: China Energy Statistical Year Book (2005);*

*2005*

| Fuel Type | Beijing | Tianjing | Hebei | Shanxi | Neimeng | Shandong | Fuel Consumption (Mt,Mm3) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|---|---|---|
| Coal | 8.9775 | 16.752 | 67.265 | 61.7645 | 62.7723 | 104.054 | 321.5853 | 636.0625 |
| Cleaned coal | | | | | | 0.4218 | 0.4218 | 1.0512 |
| Other washed coal | 0.0657 | | 1.6745 | 3.7365 | | 1.0869 | 6.5636 | 5.1927 |
| Coke | | | | | 0.0021 | 0.0011 | 0.0032 | 0.0097 |
| Coke oven gas | 64 | 75 | 62 | 2108 | 39 | | 2348 | 1.7424 |
| Other coal gas | 1609 | 786 | 3883 | | 1837 | | 9103 | 2.1110 |
| Crude oil | | | | | 0.0073 | | 0.0073 | 0.0224 |
| Gasoline | | | 0.0001 | | | | 0.0001 | 0.0003 |
| Diesel | 0.0048 | | 0.0354 | | 0.0012 | | 0.0414 | 0.1308 |
| Fuel oil | 0.1225 | | 0.0023 | | 0.0006 | | 0.1254 | 0.4057 |
| LPG | | | | | | | 0 | 0 |
| Refinery gas | | | 0.0902 | | | | 0.0902 | 0.2391 |
| Natural gas | 28 | 8 | | 276 | | | 312 | 0.6814 |
| Other petro products | | | | | | | 0 | 0 |
| Other coke products | | | | | | | 0 | 0 |
| Other energy | 0.0858 | | 0.3235 | 0.6931 | 0.0727 | | 2.3641 | 0 |
| **$CO_2$ Emission 647.6493 $MtCO_2$** | | | | | | | | |

*Source: China Energy Statistical Year Book (2006);*

*2006*

| Fuel Type | Beijing | Tianjing | Hebei | Shanxi | Neimeng | Shandong | Fuel Consumption (Mt,Mm3) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|---|---|---|
| Coal | 7.9663 | 16.392 | 68.6799 | 69.6888 | 84.0405 | 109.3066 | 356.0741 | 704.2778 |
| Cleaned coal | | | | | | 0.3977 | 0.3977 | 0.9911 |
| Other washed coal | 0.0636 | | 2.1413 | 3.7114 | 0.6177 | 5.446 | 11.98 | 9.4779 |
| Shape coal | 0.0797 | | | | 0.2777 | | 0.3574 | 0.7288 |
| Coke | | | | | | 0.0323 | 0.0323 | 0.0983 |
| Coke oven gas | 38 | 63 | 580 | 2232 | 64 | 579 | 3556 | 2.6388 |
| Other coal gas | 2066 | 658 | 6972 | 1379 | 2276 | 722 | 14073 | 3.2636 |
| Crude oil | | | | | 0.0074 | | 0.0074 | 0.0227 |
| Gasoline | | | 0.0001 | | | | 0.0001 | 0.0003 |
| Diesel | 0.0021 | | 0.0301 | | 0.0007 | 0.0632 | 0.0961 | 0.3036 |
| Fuel oil | 0.0638 | | 0.0008 | | | 0.041 | 0.1056 | 0.3416 |
| LPG | | | | | | 0.0001 | 0.0001 | 0.0003 |
| Refinery gas | | | 0.0243 | | | 0.0232 | 0.0475 | 0.1259 |
| Natural gas | 341 | 73 | | 53 | | | 467 | 1.0199 |
| Other petro products | | | | | | 0.0028 | 0.0028 | 0.00788 |
| Other coke products | | | | | | | 0 | 0 |
| Other energy | 0.0683 | | 0.4711 | 2.3076 | 0.1251 | 1.3229 | 4.295 | 0 |
| **$CO_2$ Emission 723.2987 $MtCO_2$** | | | | | | | | |

*Source: China Energy Statistical Year Book (2007).*

*Calculation of net generation from included sources*

Gross generation for each province is presented in the yearbooks. The data is also broken down into three categories: thermal, hydro and other sources. For the OM calculations, only thermal generation is included. Gross generation and own consumption are used to calculate net generation from included sources. The calculations are presented in Table A4 below.

**Table A4 Thermal generation, own consumption rate, and net supply in NCPG**

| Provincial Grid | 2004 | | | 2005 | | | 2006 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Generation (MWh) | Self use rate (%) | On-grid generation (MWh) | Generation (MWh) | Self use rate (%) | On-grid generation (MWh) | Generation (MWh) | Self use rate (%) | On-grid generation (MWh) |
| Beijing | 18579000 | 7.94 | 17103827 | 20880000 | 7.73 | 19265976 | 20705000 | 7.51 | 19150055 |
| Tianjing | 33952000 | 6.35 | 31796048 | 36993000 | 6.63 | 34540364 | 35924000 | 6.86 | 33459614 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Hebei | 124970000 | 6.5 | 116846950 | 134348000 | 6.57 | 125521336 | 143888000 | 6.63 | 134348226 |
| Shanxi | 104926000 | 7.7 | 96846698 | 128785000 | 7.42 | 119229153 | 150250000 | 7.45 | 139056375 |
| Neimeng | 80427000 | 7.17 | 74660384 | 92345000 | 7.01 | 85871616 | 139593000 | 7.58 | 129011851 |
| Shandong | 163918000 | 7.32 | 151919202 | 189880000 | 7.14 | 176322568 | 230922000 | 7.12 | 214480354 |
| **Total** | | | 489173110 | | | 560751013 | | | 669506473 |

*Source: China Power Year Book ( 2005, 2006, 2007).*

*Imports*

The connected electricity systems are the Northeast Power Grid (NEPG), consisting of three provincial grids: Jilin, Liaoning and Heilongjiang and the Central China Power Grid (CCPG), consisting of six provincial grids: Jiangxi, Henan, Hubei, Hunan, Chongqing and Sichuan. According to the tool, there is electricity transferring from the connected electricity systems to the project electricity system, so the $CO_2$ emission factor for net electricity imports ($EF_{grid,import,y}$) from the connected electricity systems should be determined to use "The weighted average operating margin (OM) emission rate of the exporting grid".

The average emission rate is calculated using the same steps as above for NCPG, namely fuel consumption and net generation as indicated in Table A5 – A8 below.

Fuel consumption in NEPG and CCPG is taken from the latest China Energy Statistical Yearbook editions. The yearbooks present a range of more than 10 fuels for each province.

**Table A5 Fuel consumption and $CO_2$ emissions of NEPG in 2004-2006(connected system)**

*2004*

| Fuel type | Liaoning | Jinlin | Heilongjiang | Fuel Consumption (Mt,Mm$^3$) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|
| Coal | 41.442 | 23.109 | 30.848 | 95.399 | 188.6894 |
| Cleaned coal | 0.8475 | 0.0109 | 0.0488 | 0.9072 | 2.2609 |
| Other washed coal | 5.7767 | 0.1426 | 0.61 | 6.5293 | 5.1656 |
| Coke | | | | 0 | 0 |
| Coke oven gas | 483 | 291 | | 774 | 0.5744 |
| Other coal gas | 5733 | 419 | | 6152 | 1.4267 |
| Crude oil | | | | 0 | 0 |
| Gasoline | | | | 0 | 0 |
| Diesel | 0.0204 | 0.0116 | 0.0024 | 0.0344 | 0.1087 |
| Fuel oil | 0.1281 | 0.0178 | 0.0286 | 0.1745 | 0.5645 |
| LPG | 0.0219 | | | 0.0219 | 0.0693 |
| Refinery gas | 0.0979 | | 0.0114 | 0.1093 | 0.2898 |
| Natural gas | | 3 | 253 | 256 | 0.5591 |
| Other petro products | | | | 0 | 0 |
| Other coke products | | | | 0 | 0 |
| Other energy | 0.2697 | 0.0507 | | 0.3204 | 0 |
| **$CO_2$ Emission 199.7083 $MtCO_2$** | | | | | |

*Source: China Energy Statistical Year Book (2005);*

*2005*

| Fuel type | Liaoning | Jinlin | Heilongjiang | Fuel Consumption ($Mt,Mm^3$) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|
| Coal | 43.0541 | 24.4613 | 33.8321 | 101.3475 | 200.4549 |
| Cleaned coal | | | | 0 | 0 |
| Other washed coal | 5.2474 | 0.1926 | 0.2416 | 5.6816 | 4.4949 |
| Coke | | | | 0 | 0 |
| Coke oven gas | 103 | 357 | 68 | 528 | 0.3918 |
| Other coal gas | 1262 | 837 | | 2099 | 0.4868 |
| Crude oil | 0.0116 | | | 0.0116 | 0.0356 |
| Gasoline | | | | 0 | 0 |
| Diesel | 0.0118 | 0.0148 | 0.0057 | 0.0323 | 0.1020 |
| Fuel oil | 0.0932 | 0.0246 | 0.0155 | 0.1333 | 0.4312 |
| LPG | 0.0012 | | | 0.0012 | 0.0038 |
| Refinery gas | 0.0548 | | 0.0132 | 0.068 | 0.1803 |
| Natural gas | | 84 | 224 | 308 | 0.6727 |
| Other petro products | | | | 0 | 0 |
| Other coke products | | | | 0 | 0 |
| Other energy | 0.1618 | | | 0.1618 | 0 |
| **$CO_2$ Emissions 207.2540 $MtCO_2$** | | | | | |

*Source: China Energy Statistical Year Book (2006);*

*2006*

| Fuel type | Liaoning | Jinlin | Heilongjiang | Fuel Consumption ($Mt,Mm^3$) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|
| Coal | 46.8199 | 27.3824 | 36.9829 | 111.1852 | 200.4548959 |
| Cleaned coal | 0.0003 | | | 0.0003 | 0.000748 |
| Other washed coal | 6.7474 | 0.1783 | 0.96 | 7.8857 | 6.2387 |
| Coke | 0.00332 | | | 0.00332 | 0.1011 |
| Coke oven gas | 268 | 16 | 144 | 428 | 0.3176 |
| Other coal gas | 5526 | 143 | | 5669 | 1.3147 |
| Crude oil | 0.0049 | | | 0.0049 | 0.015 |
| Gasoline | | | | 0 | 0 |
| Diesel | 0.0075 | 0.0039 | 0.003 | 0.0144 | 0.0455 |
| Fuel oil | 0.1173 | 0.0045 | 0.0144 | 0.1362 | 0.4406 |
| LPG | | | | 0 | 0.003797547 |
| Refinery gas | 0.0855 | | 0.0427 | 0.1282 | 0.3399 |

| | | | | | |
|---|---|---|---|---|---|
| Natural gas | | 19 | 210 | 229 | 0.5001 |
| Other petro products | | | | 0 | 0 |
| Other coke products | | | | 0 | 0 |
| Other energy | 0.1216 | 0.176 | 0.8277 | 1.1253 | 0 |
| **$CO_2$ Emissions 229.2268 $MtCO_2$** | | | | | |

*Source: China Energy Statistical Year Book (2007).*

Net generation is calculated from gross generation and self consumption data presented.

**Table A6 Power generation, own consumption and net supply in NEPG (2004-2006)**

| Province | 2004 | | | 2005 | | | 2006 | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Generation (MWh)** | **Self use rate (%)** | **On-grid generation (MWh)** | **Generation (MWh)** | **Self use rate (%)** | **On-grid generation (MWh)** | **Generation (MWh)** | **Self use rate (%)** | **On-grid generation (MWh)** |
| Liaoning | 84543000 | 7.21 | 78447450 | 89668000 | 7.03 | 83364340 | 101100000 | 6.62 | 94407180 |
| Jinlin | 33242000 | 7.68 | 30689014 | 43395000 | 6.59 | 40535270 | 45600000 | 6.78 | 42508320 |
| Heilongjiang | 53482000 | 7.84 | 49289011 | 59900000 | 7.96 | 55131960 | 64600000 | 7.85 | 59528900 |
| **Total** | | | 158425475 | | | 179031569 | | | 196444400 |

*Source: China Power Year Book (2005 - 2007).*

**Table A7 Fuel consumption and $CO_2$ emissions of CCPG in 2006(connected system)**

| Fuel type | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Fuel Consumption ($Mt,Mm^3$) | $CO_2$ Emission ($MtCO_2$) |
|---|---|---|---|---|---|---|---|---|
| Coal | 19.2602 | 80.9801 | 31.7979 | 24.5448 | 11.843 | 32.8522 | 201.2782 | 398.1075 |
| Cleaned coal | | | | | 0.0579 | | 0.0579 | 0.1443 |
| Other washed coal | 0.0451 | 1.0412 | | 0.0859 | 0.7921 | | 1.9643 | 1.5540 |
| Shape coal | | | | | 0.0001 | | 0.0001 | 0.00002 |
| Coke | | 0.1723 | | 0.0032 | | | 0.1755 | 0.5343 |
| Coke oven gas | | 52 | 107 | 424 | 38 | 1 | 622 | 0.4616 |
| Other coal gas | 1269 | 395 | | 170 | 436 | 1 | 2271 | 0.5267 |
| Crude oil | | 0.0049 | | | | | 0.0049 | 0.0150 |
| Gasoline | | 0.0001 | | | | | 0.0001 | 0.00003 |
| Diesel | 0.0091 | 0.0223 | 0.0141 | 0.0178 | 0.0096 | | 0.0729 | 0.2303 |
| Fuel oil | 0.0051 | 0.0126 | 0.0131 | 0.008 | 0.0057 | 0.0349 | 0.0794 | 0.2569 |
| LPG | | | | | | | 0 | 0.0003 |
| Refinery gas | 0.0086 | 0.081 | 0.01 | 0.0097 | | | 0.1093 | 0.2898 |
| Natural gas | | | 28 | | 16 | 1863 | 1907 | 4.1649 |
| Other petro products | | | | | | | 0 | 0.00788 |
| Other coke products | | | | | | 0.0001 | 0.0001 | 0.00003 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Other energy | 0.1745 | 0.3736 | 0.3155 | 0.1829 | 0.2935 | | 1.34 | 0 |
| **$CO_2$ Emissions 406.2861 $MtCO_2$** | | | | | | | | |

*Source: China Energy Statistical Year Book (2007)*

**Table A8 Power generation, own consumption and net supply in CCPG (2006)**

| Provincial grids | Generation (MWh) | Self use rate (%) | On-grid generation (MWh) |
|---|---|---|---|
| Jiangxi | 34449000 | 6.17 | 32323497 |
| Henan | 151235000 | 7.06 | 140557809 |
| Hubei | 54841000 | 2.75 | 53332873 |
| Hunan | 46408000 | 4.95 | 44110804 |
| Chongqing | 23487000 | 8.45 | 21502349 |
| Sichuan | 44193000 | 4.51 | 42199896 |
| **Total** | | | 334027226 |

*Source: China Power Year Book (2007)*

*Operating Margin Emission Factor calculations*

The Operating Margin Emissions Factor is now calculated from the data presented above using the formula below, including adjustment for imports from NEPG and CCPG. The calculation is shown in Table A9.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{co_2,i,y}}{EG_y}$$

**Table A9 Operating margin emission factor calculation**

| | Unit | 2004 | 2005 | 2006 | 3-year total/average |
|---|---|---|---|---|---|
| **NCPG** | | | | | |
| Emission | $MtCO_2$ | 549.02 | 647.65 | 723.3 | 1919.97 |
| Generation | TWh | 489.17 | 560.75 | 669.51 | 1719.43 |
| Import from NEPG | TWh | 4.51 | 3.93 | 2.618 | 11.06155 |
| EF NEPG | $tCO_2$/MWh | 1.17384 | 1.15764 | 1.16688 | |
| Emissions from imports | $MtCO_2$ | 5.30 | 4.55 | 3.05 | 12.90261877 |
| Import from CCPG | TWh | - | - | 0.497 | 0.497 |
| EF CCPG | $tCO_2$/MWh | - | - | 0.87599 | |
| Emission from imports | $MtCO_2$ | - | - | 0.43536703 | 0.43536703 |
| **Total** | | | | | |
| Emissions | $MtCO_2$ | 554.32 | 652.20 | 726.79 | 1933.31 |
| Generation supply | TWh | 493.68 | 564.68 | 672.63 | 1730.99 |

| Operating margin Emission Factor | 1.1169 $tCO_2$/MWh |
|---|---|

Based on above data, the simple OM emission factor of NCPG is calculated ex-ante using a 3-year generation-weighed average is 1.1169 $tCO_2e$/MWh.

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

The sample group of power units m used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. This option is chosen as it comprises larger annual generation than the five units built most recently. Following the deviation, the latest statistical data available (from the China Power Yearbook 2007) is used by the DNA to determine the most recent year from which the added generation capacity is equal to or just exceeds 20% of the latest statistic year 2006. The added generation capacity is the sample group of power units *m* used to calculate the build margin.

Using the latest statistical data available (from the China Electric Power Yearbook, as used in the DNA calculations) the year from which the added generation capacity is equal to or just exceeds 20% of the capacity of the latest statistic year 2006 is determined. The year selected is 2005, since which about 21.75% of generating capacity has been added. See Table below.

**Table A10 Identify the year from which the added generation capacity is equal to or just exceeds 20% of the latest statistic year 2006**

| Power plant type | Capacity 2004<br>A | Capacity 2005<br>B | Capacity 2006<br>C | Added Capacity 2005-2006<br>D=C-B | Share |
|---|---|---|---|---|---|
| Thermal (MW) | 93594.9 | 111068.7 | 141538 | 30469.3 | 95.64% |
| Hydro (MW) | 3250.7 | 3216.2 | 4004 | 787.8 | 2.47% |
| Nuclear (MW) | 0 | 0 | 0 | 0 | 0.00% |
| Wind (MW) | 137.5 | 335.5 | 937 | 601.5 | 1.89% |
| **Total (MW)** | 96983.1 | 114620.4 | 146479 | 31858.6 | 100% |
| **The ratio to C** | 66.21% | 78.25% | 100% | | |

*Source: China Power Year Book (2005, 2006, 2007).*

The newly installed capacity from 2005 to 2006, therefore, is 95.64% thermal power units, which is to be included in the build margin.

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

As described in step 4, because of the limited availability of publicly available data, this proposed project uses a substitute method accepted by EB to calculate $EF_{BM,y}$

*Sub-step 1:*

Calculate the different $CO_2$ emission percentage of solid, liquid and gas fuel in the total emission of North China Power Grid in 2006 using new latest statistical data available from China Energy Statistical Year Book 2007.

**Table A11 Calculation of $CO_2$ Emission of North China Power Grid in 2006**

| Fuel type | $CO_2$ Emission ($tCO_2$) | Share ($\lambda_i$) |
|---|---|---|
| Coal | 715573958 | 98.932% |
| Oil | 676091 | 0.093% |
| Gas | 7048610 | 0.975% |
| **Total** | **723298659** | **100%** |

*Source: China Energy Statistical Year Book (2007).*

*Sub-step 2:*

Based the emission percentage ($\lambda_i$) of different kind fossil fuels and the corresponding emission factor ($EF_i$) according to the best technology commercially available in the China, the weighted emission factor of thermal power ($EF_{thermal}$) is calculated.

**Table A12 Calculation of $CO_2$ Emission Factor of Coal, Oil and Gas Fuel Power Plant with the Best Commercial Efficiency in China**

| Power plant type | Parameter | Best efficiency | Carbon factor (tC/TJ) | Oxidizing rate | $CO_2$ emission factor ($tCO_2$/MWh) |
|---|---|---|---|---|---|
| | | A | B | C | D=3.6/A/1000*B*C*44/12 |
| **Coal** | $EF_{Coal,Adv}$ | 37.28% | 25.8 | 100% | 0.9135 |
| **Gas** | $EF_{Gas,Adv}$ | 48.81% | 15.3 | 100% | 0.4138 |
| **Oil** | $EF_{Oil,Adv}$ | 48.81% | 21.1 | 100% | 0.5706 |

*Source: http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239*

So, emission factor of thermal plant is:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9083 tCO_2/MWh$$

*Sub-step3:*

Now using the share of thermal generation in the added capacity calculated in Step 4 above (95.64%) and the effective emissions factor for the added (advanced) thermal power generation (0.9083 tCO2/MWh), the Build Margin emission factor is calculated.

$EF_{BM}$= 0.9083×95.64% = 0.8687 $tCO_2$/MWh

**Step 6. Calculation of the combined margin emission factor**

The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \bullet EF_{grid,OM,y} + w_{BM} \bullet EF_{grid,BM,y} = 0.75 \times 1.1169 + 0.25 \times 0.8687 = 1.05485 tCO_2/MWh$$

## Annex 4

## MONITORING INFORMATION

No additional information.