Voluntary Carbon Standard
PROJECT DESCRIPTION (VCS PD)

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / Crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
CECIC HKE Zhangbei Lvnaobao Wind Power Project
PD version number: 02
Completed date: 14/06/2011

A.2. Description of the project activity:

>>
CECIC HKE Zhangbei Lvnaobao Wind Power Project (hereafter referred to as the Project) is located at Zhangbei County, northwest region of Hebei Province, China, which is a new-built project and operated by CECIC HKE Wind Power CO.,LTD.

The Project falls within sector scope 1: energy industries (Renewable electricity) from the perspective of proposed CDM activity. The total installed capacity of the Project is 100.5 MW equipped with 67 sets of wind turbine generators (briefly WTG henceforth) with a unit capacity of 1500 kW. And the estimated electricity delivered to the project electricity system, i.e. North China Power Grid (briefly NCPG henceforth) by the Project is 241.70GWh annually, equivalent to 2405 operating hours with full capacity.

Provision of an equivalent amount of annual power output by NCPG is the baseline for the Project, i.e. the scenario in the absence of the Project. Basically, NCPG is predominated by connected fossil fuel fired power plants, especially coal fired plants, so by replacing equal amount of electricity which is originally generated by the fossil fuel fired power plants within the grid system, the Project with almost zero emission would reduce GHG emission (only CO2 is considered) accrued from the saved fossil fuel combustion. It is estimated that the resulting CO2 emission reductions would be about 254, 960 tCO2 annually.

The Project has been registered as CDM project in EB successfully on 28/10/2010 with registration number of 3399. More details please refer to: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1265810041.21/view.

The Project promotes sustainable development through the following aspects:

- Reduce greenhouse gas emissions compared to the business-as-usual scenario;
- Help to stimulate the growth of the wind power industry in China;
- Reduce the emission of other pollutants resulting from the power generation industry in China, compared to a business-as-usual scenario;
- Create local employment opportunities during the construction and operation of the Project;
- Stimulate the development of local tourism industry.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (Host)	CECIC HKE Wind Power	No

	CO.,LTD	

The complete contact information on participants in the project activity is listed in Annex 1 of the PD.

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.:

>> Hebei Province

A.4.1.3. City/Town/Community etc:

>>Zhangbei County, Zhangjiakou City

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

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The Project is sited south to the Plateau of Inner Mongolia and within the geographic boundary of Zhangbei County, Zhangjiakou City, Hebei Province, P.R. China. The Project has geographical coordinates with east longitude of 114º32'30" and north latitude of 41º03'50". The altitude of the site ranges from 1450m to 1680m above mean sea level. The Project covers a wind farm area of about 48 km^2. Figure 1 shows the location of the Project in Hebei Province, China.

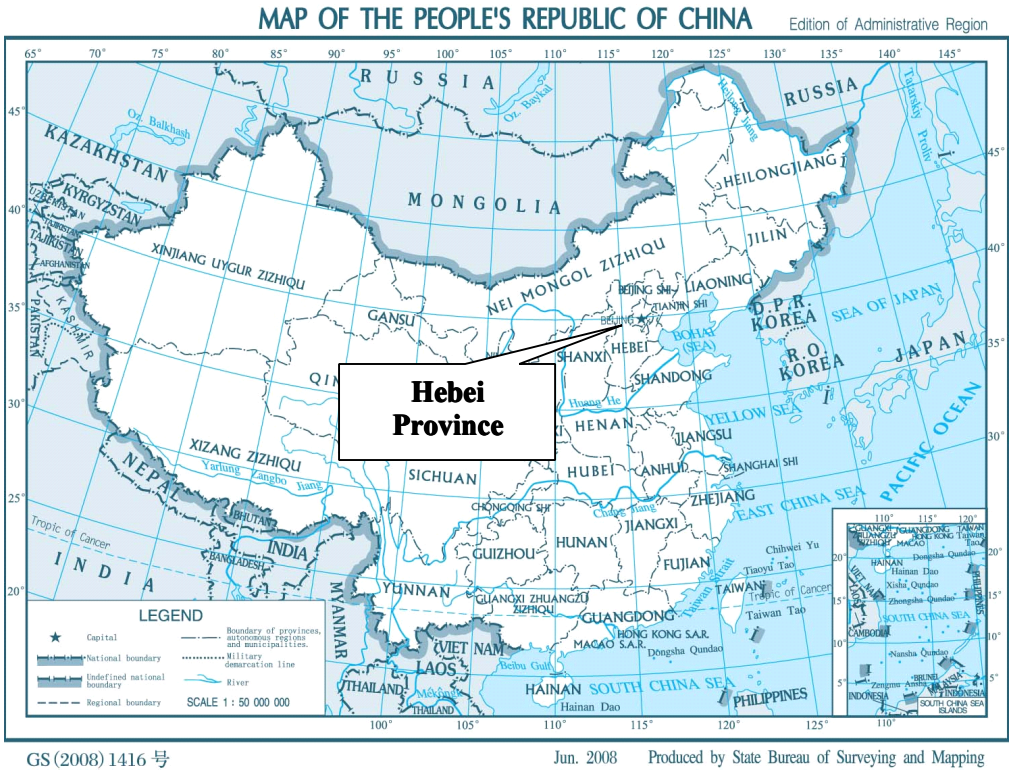

Figure 1 Map showing the location of the Project

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

>> The project activity category falls within sector scope 1: energy industries- renewable sources

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

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The Project adopts the domestically-made WTGs, and does not involve international technology transfer. Within the project electricity system NCPG, 67 units of WTG with 1.5MW unit capacity (Model type: FD77B) will be installed, forming 100.5MW of total capacity. These WTGs will be manufactured and assembled by Dongfang Steam Turbine Co. Limited.

The main technology parameter of this type of wind power turbine can be found at Table 1.

Table 1 Technology parameter of WTGs for the Project

Key Technology Parameter	FD77B
Rated power (kW)	1500
Number of Blades	3
Rotor diameter (m)	77
Swept area(m^2)	4657
Rated Rotational speed (rpm)	9.6-17.3
Cut-in wind speed (m/s)	3
Rated wind speed (m/s)	12.5
Cut-out wind speed (m/s)	20
Hub height of the wind turbines (m)	70
Capacity (kW)	1500
Rated Voltage (V)	690

According to the provisions specified in the equipment purchase contracts, the vendor of the wind turbine equipment will provide technical training for the operation technicians and manager staffs of the Project. The training courses have already been listed in the equipment purchasing contract signed on March 30, 2008. The engineers responsible for production and O & M has received the training on wind turbine installation, operation and safe production, and troubleshooting at the turbine production factory and construction site, and gotten the certificate of qualification.

The electricity delivered by the Project to the NCPG will be monitored through metering equipment at the substations (interconnection facility connecting the Project to the grid). Detailed, each wind turbine will have a transformer from 690V to 35KV. And the wind farm will be connected with one new-built 35KV/220KV substation located within the wind farm, and then to NCPG via a series of substations. There will be electric meters in the onsite substation to measure the electricity import/export.

Provision of an equivalent amount of annual power output by the NCPG is the reasonable baseline for the Project, details shown at Section B.4. The Project is expected to operate fully for 22 years from the beginning of 2011. According to the Feasibility Study Report (FSR) issued by China Power Construction Engineering Consulting Corporation on March, 2008, the Project can deliver 241, 700 MWh to the grid annually, about 2405 operation hours with full capacity and the calculated load factor is about 0.27. With this wind power electricity output, CO2 emission reduction can be achieved compared to the baseline, where the thermal power plant dominated grid will provide the same electricity service.

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

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Renewable crediting period (7yrs×3) is adopted by the Project. It is expected that the project activity will generate emission reductions of about 1, 650, 582 tCO2e over the first 7-year crediting period from 2010 to 2017.

Table 2 GHG Emission reduction estimation over the chosen crediting period

The chosen crediting period : The First Crediting Period: Year 2010-2017	
Years	Estimated Annual Emission Reductions in tCO_2e
01/06/2010-31/05/2011	120, 822
01/06/2011-31/05/2012	254, 960
01/06/2012-31/05/2013	254, 960
01/06/2013-31/05/2014	254, 960
01/06/2014-31/05/2015	254, 960
01/06/2015-31/05/2016	254, 960
01/06/2016-31/05/2017	254, 960
Total estimated reductions (t CO_2e)	1,650,582
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	235, 797

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 in the monitoring period.

A.4.5. Public funding of the project activity:

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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:

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Approved consolidated baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (Version 10)

In line with the requirements of application of ACM0002 agreed by the CDM Executive Board, the latest version of the “Tool for the demonstration and assessment of additionality” (Version 5.2), and “Tool to calculate the emission factor for an electricity system” (Version 02) are used also. “Combined tool to identify the baseline scenario and demonstrate additionality”, and “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion” will be not applied because the Project is a new-built wind power project, and one or more alternatives (see Section B.5 for these options) are not available options to project participants.
For more information please refer to
http://www.unfccc.int/methodologies/PAmethodologies/approved.html.

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

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The approved methodology ACM0002 is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

Further, the approved methodology ACM0002 is applicable under the following conditions:

- The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;
- In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;
- In case of hydro power plants, one of the following conditions must apply:
    - The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or
    - The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or
    - The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.

In addition, the applicability conditions included in the tools referred to above apply.

The Project is satisfied with the above conditions because:

• The Project involves electricity capacity installation from wind sources, not biomass and hydro, and without fuel switching; and
• The Project is connected to the grid and substitutes grid electricity, i.e. where the project activity supplies electricity to a grid; and
• The Project does not involve switching from fossil fuels to renewable energy at the site of the project activity; and
The "Tool for the demonstration and assessment of additionality" is applicable to the Project, because its application is indicated and mandatory in the approved methodology ACM0002.

The "Tool to calculate the emission factor for an electricity system" is applicable to the Project and used to estimate the OM, BM and CM for the purpose of calculating baseline emissions of the Project, also mentioned in the approved methodology ACM0002,

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

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For the baseline determination only CO2 emissions from electricity generation by fossil fuel fired power plant that is displaced due to the project activity are taken into account.

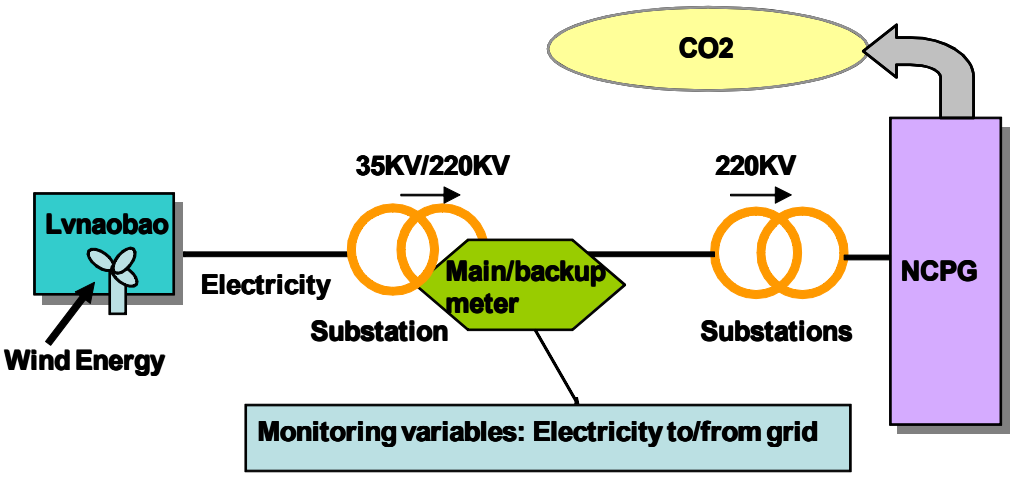
According to the approved methodology ACM0002, the emission sources and GHGs in the project boundary are listed in Table 3.

Table 3 Emission sources of the Project

Source		GHG	Included?	Justification / Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main source of emissions
		CH_4	NO	Small source, excluded and is conservative
		N_2O	NO	Small source, excluded and is conservative
Project Activity	Project emissions	CO_2	NO	By ACM0002, emission from the project activity is ZERO
		CH_4	NO	Same as above
		N_2O	NO	Same as above

As per "Tool to calculate the emission factor for an electricity system" (Version 02), the delineation of grid boundaries as provided by the DNA (Contained in the file entitled "Notification on Determining Baseline Emission Factor of China's Grid" [1], Briefly Notification of NDRC hereafter) of the host country is used. NCPG, including Beijing Municipality, Tianjin Municipality, Hebei, Shanxi, Inner Mongolia and Shandong Provinces, is the project electricity system, which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains. The connected electricity systems are the Northeast Power Grid (NEPG), consisting of Jilin, Liaoning and Heilongjiang provincial grids, and the Central China Power Grid (CCPG), consisting of Chongqing Municipality, Jiangxi, Henan, Hubei, Hunan, and Sichuan provincial grids.

The spatial extent of the project boundary includes the project site and all power plants connected physically to the NCPG that the CDM project power plant is connected to. The project boundary, emission sources and monitoring variables and the energy flows are illustrated in Figure 2.



[1] It can be obtained from the official website of China' DNA at http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239

Figure 2 Illustration of the Lvnaobao wind power project

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

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Because the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario, according to latest methodology ACM0002, is the following:

"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of NCPG grid-connected power plants and by the addition of new generation sources, 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):

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According to the analysis in the FSR, the Project is not financially attractive because the IRR of this project (about 6.30%) was lower than the benchmark[2,3] (8%, total investment and after tax), so the CERs revenue was suggested in the FSR to improve the IRR above benchmark. The developer decided to develop the Project as a CDM project on March 3, 2008. 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 smoothly. Table 4 illustrated the key time schedule about the Project.

Table 4 Timeline of the implementation of the Project

Time	Milestone
June 13, 2007	Project tariff should be implemented as 0.5006 Yuan/kWh (with VAT), same to the project titling "CECIC HKC Danjinghe Wind Farm Project", regulated by the official document Fa Gai Neng Yuan [2007]1283
Mar., 2008	FSR finished, which is with a 6.30% IRR(project IRR with tax) and not economically feasible, and CDM already considered to make it feasible (the IRR benchmark, 8% can be achieved for the project with the CDM CERs revenue)
Mar. 5, 2008	Board Meeting – launch of CDM development
Mar.10, 2008	The stakeholder meeting and questionnaire survey given
Mar. 20, 2008	The CDM development contract signed with

[2] Interim Measures for Economic Evaluation on Electric Power Technical Reconstruction Project, issued by State Power Corporation, issued on Sept.10th, 2002, Document No. GuoDianFa [2002]623.

[3] "Measures for Feasibility Study Preparation of Wind Farm", issued by NDRC, China, Fagaibannengyuan [2005]899. http://www.cepee.com/news/text.php?NewsId=17479

	the consultancy company
Mar. 30, 2008	WTGs purchase contract signed (selected as project starting date)
July 17, 2008	FSR approval by NDRC
August, 2008	Civil construction start
Aug.22, 2008	Proposal for the Project submitted by ASIA PACIFIC CARBON FUND
Dec. 17, 2008	ERPA signed
Feb 24, 2009	Proposal for the Project issued by the DOE
Mar 10, 2009	GSP started

Approved methodology ACM0002 asks to use the latest version of the "Tool for the demonstration and assessment of additionality (Version 5.2)" agreed by the Executive Board to demonstrate and assess the additionality of the 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

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.
(b) A fossil fuel-fired power plant with the comparable capacity or electricity generation.
(c) A power plant using other source of renewable energy with the comparable capacity or electricity generation, such as PV, biomass and hydro, etc.
(d) Comparable capacity or electricity generation addition provided by the NCPG.

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 high cost for power generation, solar PV, geothermal and biomass of similar installed capacity as the proposed project are not realistic alternatives in China[4]. Only hydropower projects can have an investment return rate that competes with that of wind power projects in China. However, due to dry climate and the lack of water resource recently years in project site, there is no commercially exploitable hydro power resource which can provide same electricity generation output of the proposed project activity[5]. Therefore, alternative (c) is not realistic.

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

For (b), the installed capacity of the Project is 100.5 MW, considering the same annual electricity generation, the alternative baseline scenario of the Project should be a thermal power plant with an installed capacity not more than 50 MW. Moreover, the Project is a grid-connected wind farm, so the alternative baseline scenario must be a grid-connected thermal power generation project. However, according to China's regulations, construction of thermal power plants with the installed unit capacity of

4 http://scitech.people.com.cn/GB/5347113.html

5 http://www.shuidianzhan.net/snzy/267.html

135 MW or below is prohibited in areas where can be covered by large grids such as provincial grid[6]. Therefore, (b) is not feasible. And (a), (c) and (d) is consistency with laws and regulations, in particular, (a) is not the mandatory requirement of laws and regulations.

So with Step 1, only options (a) and (d) are feasible.

Step 2. Investment Analysis

The purpose of this step is to determine whether the project activity is economically or financially less attractive than (d) without an additional revenue/funding, possibly from the sales of certified emission reductions (CERs). The investment analysis is conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

The *Tool for the Demonstration and Assessment of Additionality* suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The potential alternative (d) of the Project is the NCPG rather than new investment projects. Therefore Option II is not appropriate. The Project will use benchmark analysis method (Option III) based on the consideration that the benchmark IRR of the power sector is available.

Sub-step 2b. Benchmark Analysis Method (Option III)

According to the *Interim Measures for Economic Evaluation on Electric Power Technical Reconstruction Project,* the financial benchmark IRR (after tax) for power industry is 8% for the IRR of total investment. If the IRR of a project is higher or equal to the benchmark, this project is financially feasible and reasonable."

Since the Project is a power generation project, 8% for the IRR of total investment is adopted by the Project as the financial benchmark. This benchmark IRR 8% is an industrial standard benchmark IRR recognized in the electric power industries and widely adopted for economic and financial evaluation for both electric power new construction projects and reconstruction projects in China[7,8]. On the basis of the above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

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

(1) Basic parameters for calculation of financial indicators

According to the FSR, with reference to the approval letter of the Project about electricity purchase price, the basic parameters for calculation of financial indicators of the Project are summarized in Table 5.

[6] Notice on Strictly Prohibiting the Violative Installation of Thermal Power Generation Units with the Capacity of 135 MW or below, issued by the General Office of the State Council, No. 2002-6.

[7] Interim Measures for Economic Evaluation on Electric Power Technical Reconstruction Project, issued by State Power Corporation, issued on Sept.10th, 2002, Document No. GuoDianFa [2002]623.

[8] "Measures for Feasibility Study Preparation of Wind Farm", issued by NDRC, China, Fagaibannengyuan [2005]899. http://www.cepee.com/news/text.php?NewsId=17479

Table 5 Financial parameters for calculation of the IRR of the Project

Key parameters	Unit	Value	Sources of data
Electricity delivered to power grid	MWh	241,700	FSR14-1 (Section 1, Chapter 14)
Construction period	Year	3	FSR14-1
Designed project life time	Year	22	FSR14-1
Total capital investment (static)	million Yuan	890.79	FSR14-1
Annual operation & maintenance cost (including salary & awards, materials, maintenance, heavy repair fund and insurance fee etc)	million Yuan	27.10*	FSR Appendix Form 14-3
Working capital	million Yuan	6	FSR14-1
Recovered fixed capital residual value	million Yuan	6	FSR Appendix Form 14-6
Income tax rate	%	25	FSR14-2
VAT rate	%	8.5	FSR14-2
Grid bus-bar tariff of the electricity (With VAT)	Yuan/kWh	0.5006 in the first 30 thousand operating hours, and after that, 0.4500 **	Official document Fa Gai Neng Yuan [2007]1283, approval letter of the Project and FSR
Grid bus-bar tariff of the electricity (W/T VAT)	Yuan/kWh	0.4614 in the first 30 thousand operating hours, and after that, 0.4147	FSR14-2
City Construction Tax Rate	%	0.43	FSR14-2
Education tax	%	0.26	FSR14-2
CERs price	€/tCO_2	12.00	Current reference price in CDM carbon market
Exchange rate	Yuan/€	8.9	

* These costs are average values calculated from the total life cost divided by the life time according to the FSR, given that the corresponding cost is slightly different across years because of the minor change of material and maintenance cost in different years.

** In the approval letter issued by NDRC, the electricity price after 30 thousand hours will be consistent with the benchmark price of local thermal power plants, which is less than 0.4 Yuan/kWh now. The assumed 0.45 Yuan/kWh is conservative enough to test the economic feasibility or not, also consistent with the setting of the FSR.

(2) Comparison of the financial benchmark of the IRR of total investment for the Project

In accordance with the benchmark analysis (Option III), if the financial indicators (such as IRR) of a project are lower than the benchmark, the Project is not considered as financially attractive. Based on the data above, without CERs sales revenues, the IRR of total investment of the Project is 6.30%, which is lower than the benchmark (8%). The Project is not financially attractive. With revenue from CDM at the assumed price level, the Project would be more financially attractive and the IRR is 10.05% assuming the

CERS price is 12€/tCO_2.

Sub-step 2d. Sensitivity analysis

For the Project, the financial parameters below were taken as uncertain factors for sensitive analysis of financial attractiveness:

(1) Static total investments
(2) Annual operational costs
(3) Annual electricity delivered to the grid
(4) Grid bus-bar tariff (W/T VAT)

Firstly, the effects of changes in the static total investments, annual operational costs and electricity delivered to the grid on the IRR are examined, assuming these parameters have reasonable variations within (-10%~10%). This optional variation range [-10%, 10%] is common practice in sensitivity assessment, especially often used for industrial projects, which is also adopted by Measures for Feasibility Study Preparation of Wind Farm issued by NDRC. All of the CDM projects registered in the EB website in the scope of China as we know also adopted this variation range. This approach is consistent with the Guidance on the Assessment of Investment Analysis issued by EB 41 meeting.

And the outcomes of IRR are presented in the Table 6 and Fig.3.

Table 6 IRR Sensitivity test (total investment)

Variation range Uncertain elements	-10%	-5%	0%	5%	10%
Static total investments	7.57%	6.91%	6.30%	5.73%	5.20%
Annual operational costs	6.69%	6.49%	6.30%	6.09%	5.89%
Annual electricity delivered to the grid	4.97%	5.64%	6.30%	6.94%	7.56%
Grid Bus-Bar Tariff (W/T VAT)	4.90%	5.61%	6.30%	6.97%	7.62%

It showed that within the range of change by -10%~+10% of those uncertain parameters the IRRs (for the total investment and after tax) of the Project could not reach or overcome 8%.

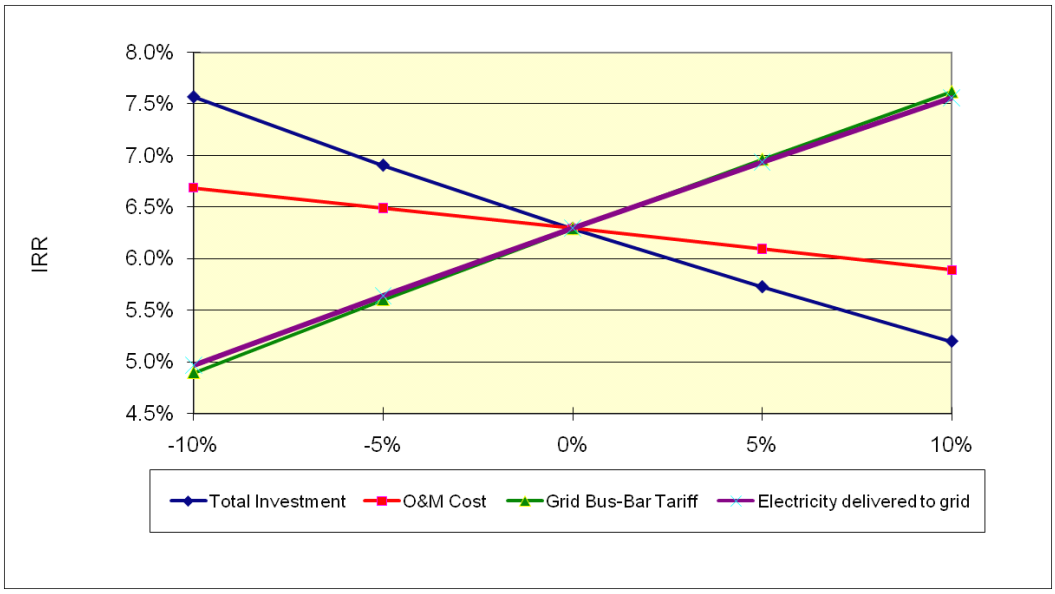

Figure 3 Sensitivity Analysis regarding the impact of three key elements' variation on IRR

Further sensitivity analysis was given and it showed that without CER revenue, the IRR of the Project reaches the benchmark 8% only if the investment decreases by at least 13%, or either the power delivered to the grid increases by at least 13.3%, or the Grid Bus-Bar Tariff increases by 10.3% based on 0.5006 Yuan/kWh for the whole project life, or the annual O&M cost decreases by at least 45%. However, none of these conditions can be achieved due to the following reasons:

Regarding the electricity grid bus-bar tariff

At the time that FSR was being written, the proposed project had received the notification on the tariff from NDRC (Fa Gai Neng Yuan [2007]1283) in Jun 2007. It said that the proposed project should be constructed and managed according to the tariff and related conditions of Zhangbei Danjinghe project (0.5006 Yuan/kWh with VAT) in the same region. So the authorized third party used 0.5006Yuan/kWh (including VAT) as the tariff applied in FSR in March, 2008. This tariff level was confirmed finally in the approval letter (Fa Gai Neng Yuan [2008]1815) specifically for the Project to complete the official tariff determining procedure.

Furthermore, the suitability of the applied electricity tariff can be justified as following, structured in two parts. Firstly, it should be noted that this project to be different to many other registered CDM projects in the region because it is large (greater than 50MW). Thus comparison with smaller scale projects less than 50MW is inappropriate. More information on this argument is under "Part 1". Secondly, even if we examine smaller scale projects (less than 50MW) in Hebei province listed in Appendix Table 8 below, and use their average financial parameters to arrive at the reference tariffs, we find that the project has an IRR below the 8% benchmark. This is further explained in Part 2 of this section.

Part 1

In China, wind projects with a capacity of less than 50MW are submitted for approval to the provincial Development and Reform Commission, and wind projects with a capacity greater than 50MW are submitted for approval to the National Development and Reform Commission (NDRC). As the proposed project has an installed capacity of 100.5MW, it was approved by the Chinese National Development and

Reform Commission and this is not comparable to the wind projects less than 50 MW in Hebei province[9].

There are marked differences between large and ordinary projects in terms of basic input values in investment analysis. Appendix Table 1 illustrates the difference. The large difference of main input values between the proposed project and average value of ordinary projects, especially the unit investment and load factor. As the installed capacity of the proposed projects is much larger, it benefits from economies of scale and hence generally receives lower tariffs than relatively ordinary projects (less than 50MW). The unit investment of the proposed project is 15.8% lower than the average unit investment of small wind power projects.

Furthermore, the proposed project is located in areas with more favorable wind resources. Thus, the project load factor of is 7.6% higher than that of the average projects.

Appendix Table 1: Comparison of basic input values for the proposed project and ordinary projects in Hebei province

	The proposed project	Small projects (Average project)	Comparison
	A	B	C=(B-A) /A
Capacity (MW)	100.5 MW	46 MW	-54.3%
Unit investment (RMB/kW)	8864	10269	15.8%
O & M Cost (RMB/kWh)	0.112	0.107	-4.2%
Project load factor	27.5%	25.4%	-7.6%
Tariff (RMB/kWh, including VAT)	0.5006	0.5605	12.0%

Appendix Table 2 below shows the CDM projects in Hebei Province with an installed capacity greater than 50MW. The table shows that all other projects in Hebei Province greater than 50MW have the same tariff as the proposed project (0.5006 RMB/kWh), apart from the "Hebei Chengde Weichang Yudaokou Pasture 150MW Wind Farm Project (150MW)", which uses a two phase tariff approach for different periods of operation (0.551 RMB/kWh for the first 3000 hours of operation and 0.3664 after this). Applying the highest tariff of 0.551 RMB/kWh for the proposed project in the first phase and 0.3664 RMB/kWh in the second phase, the IRR is 6.76%. Conservatively, if 0.551 RMB/kWh applied for the whole life of the proposed project, the IRR is 7.98% which is still below the benchmark (8%).

Thus it can be seen that the CDM EB has approved several projects in this province of a similar size using the tariff of 0.5006 RMB/kWh and this is appropriate for the proposed project.

Appendix Table 2: Projects with an installed capacity greater than 50MW in Hebei Province

[9] As per the regulation large projects are defined as those with a capacity above 50MW; however in practice those projects have a minimum size of 100MW capacity.

No.	Project	Tariff (including VAT) RMB/kWh	Reference	CDM status	IRR in PDD
1	CECIC HKC Danjinghe Wind Farm (200MW)	0.5006	Fa Gai Neng Yuan [2007] 654 by NDRC in Mar 2007	Registered CDM Ref No.2170	6.99%
2	CECIC HKE Zhangbei Lvnaobao Wind Power Project (100.5MW)	0.5006	Fa Gai Neng Yuan [2008] 1815 issued by NDRC in Jul 17,2008	(The proposed project)	6.3%
3	Hebei Shangyi Qijiashan Wind farm (199.5MW)	0.5006	Fa Gai Neng Yuan [2008] 1812 issued by NDRC in Jul 2008	Registered CDM Ref No.1854	6.71%
4	SDIC Hebei Zhangjiakou Kangbao Pasture Wind Farm Project (100.5MW)	0.5006	Fa Gai Neng Yuan [2007] 1283	CDM under validation	6.2%
5	Hebei Chengde Weichang Yudaokou Pasture 150MW Wind Farm Project (150MW)	0.551 within 30000 hours, after that, 0.3664	Fa Gai Neng Yuan [2008] 386 issued by NDRC in Feb 2008	CDM under validation	5.26%

Part 2

Appendix Table 8 shows 47 wind projects in Hebei province. These projects have 5 different tariffs. Projects with a capacity of greater than 50MW have been discussed in part 1. The other projects have received tariffs of 0.65, 0.61, 0.60 or 0.54 RMB/kWh over time. Most of the new CDM projects (30/47) in Hebei province receive a tariff of 0.54 RMB/kWh. Comparisons with these projects are made in the following sections.

As an aside, it should be noted that the proposed project falls within wind resource area II under the 2009 Information on the Policy of Wind Farm On-Grid Tariff, which area is prescribed a tariff of 0.54 (the project is located in Zhangbei County, Zhangjiakou City, Hebei Province). However, the "Information on the policy of wind farm on-grid tariff" (Fa Gai Jia Ge 2009(1906) is only applicable for projects approved after August, 2009 and is thus not applicable to the proposed project (the tariff is determined in Fa Gai Neng Yuan [2007]1283 and finally confirmed by Fa Gai Neng Yuan [2008]1815a.

0.65 RMB/kWh early stage development projects

Before the Chinese Electric Power Sector Reform Programme in March 2002, two small experimental wind farms were constructed in 2001 in Hebei Province using small turbines. The tariffs for these projects (0.65 RMB/kWh) are not suitable for comparison with the proposed project because they were early stage, non-commercial demonstration projects. Information on these projects can be found below in Appendix Table 3.

The objective of these two projects was to stimulate wind power development in China and to stimulate the local manufacture of components, so these projects received a high tariff of 0.65 RMB/kWh, (approved in February 2002 prior to reform). The Chengde Hongsong 3.6MW wind farm project introduced experimental 600kW wind turbines which were produced by Goldwind Science & Technology Ltd - the first domestic wind turbine supplier, and is belonging to the "Cheng Feng Plan".

To further emphasize the "developmental" nature of these projects, we can see that the Zhangbei Changcheng 9MW wind farm phase I (4.5MW) actually received foreign aid from the Danish government, and phase II was a "Double Increase" project which was supported by a grant from the Chinese Government.

Both projects were implemented before the Power Sector Reform when the electricity market was not competitive and wind technology not mature in China. Therefore, the tariffs awarded to these two projects should not be compared to the tariff awarded to the proposed project.

Appendix Table 3: The attributes of the projects with the highest 0.65 RMB/kWh tariff level

No.	Project	Year of commissioning	Capacity (MW)	Tariff (including VAT) (Yuan/kWh)
1	Zhangbei Changcheng wind farm	1996.2	9	0.65 (Ji Jia Ge [2002]242 issued by NDRC in Feb, 2002) (http://www.fjjg.gov.cn/fjwjj/jgfw/gjjgzc/webinfo/2002/02/1187774415686122.htm)
2	Chende Hongsong wind farm phase I	2001.11	3.6	

0.61 RMB/kWh another wind resource area projects

Among these 47 projects in the Appendix Table 8, there are four in this category. The projects with 0.61RMB/kWh are located in Wind Resource Area IV of Hebei province, which has a worse wind resource, and therefore receives higher tariffs to compensate. It was stated in the "Notice on improving policies for on-grid wind power prices issued by NDRC" (Fa Gai Jia Ge 2009 (1906) that four wind resource regions are to be determined over the whole country and a guiding tariff for each region is to be determined as 0.51, 0.54, 0.58 and 0.61RMB/kWh (VAT incl.) for wind recourse area I/II/III/IV, respectively. Therefore, the tariffs awarded to the projects in Wind Resource Area IV of Hebei are not comparable to the proposed project.

Reference Tariff Comparison

In order to compare the proposed project with wind projects in Hebei Province receiving tariffs of 0.65, 0.61, 0.60 RMB/kWh, we have used a process where the average financial parameters (investment cost per kWh, O&M costs, load factor (operating hours) and income tax rate) were substituted, for these projects into our project, and keeping all other assumptions the same, arrive at an IRR. This IRR is then used to determine an equivalent or "reference tariff". This process allows us to compare projects using the same base financial parameters, and thus gives us a fairer way of comparing projects.

0.60 RMB/kWh projects

The average financial parameters for the 0.60 RMB/kWh projects can be seen in the table below.

Appendix Table 4: The attributes of the projects with the tariff level of 0.60 RMB/kWh[10]

CDM Ref No.	Project title	Approved tariff (RMB/kWh, incl VAT)	Investment costs (RMB/kW)	O&M costs (Million RMB/MWh)	Operating hours	Income tax	IRR in PDD
VER	Chengde Hongsong wind farm project	0.6	N/A	N/A	N/A	N/A	N/A
VER	Guohua Shangyi Manjing wind farm	0.6	N/A	N/A	N/A	N/A	N/A
0842	Hebei Shangyi Manjing East Wind Farm	0.6	9468	197	2360	33%	7.04%
0233	Zhangbei Manjing Wind Farm	0.6	N/A	N/A	2400	33%	7.39%
0845	Zhangbei Mijiagou 49.5 MW Wind Farm	0.6	9726	95	2137	33%	6.80%
0878	Hebei Kangbao Wolongtushan 30 MW Wind farm	0.6	9170	97	1992	33%	7.47%
	Average	0.6	9454	130	2222	33%	7.18%

By using the tariff of 0.60 RMB/kWh for the proposed project, and considering the average financial parameters of the projects with the tariff of 0.6 RMB/kWh, we arrive at a hypothetical IRR of 6.75%, and a reference tariff of 0.5225 RMB/kWh for the project. Thus at this reference tariff, the project does not cross the benchmark of 8%.

0.61 RMB/kWh projects

The average financial parameters for the 0.61 RMB/kWh projects can be seen in the table below.

Appendix Table 5: The attributes of the projects with the tariff level of 0.61 RMB/kWh

CDM Ref No.	Project title	Approved tariff (RMB/kWh, incl VAT)	Investment costs (RMB/kW)	O&M costs (RMB/MWh)	Operating hours	Income tax	IRR in PDD
2007	Hebei Haixing 49.5MW Wind Farm	0.61	11171	80	2323	33.00%	6.38%
3160	Huaneng Leting	0.61	11247	102	2050	25.00%	6.03%
2125	Guohua Huahua phase I	0.61	9938	128	2003	33.00%	6.24%
3021	Guohua Huahua phase II	0.61	10082	115	1956	25.00%	6.30%
	Average	**0.61**	**10610**	**106**	**2083**	**29.00%**	**6.24%**

Using the tariff of 0.61 RMB/kWh for the proposed project, and considering the average financial parameters of the projects with the tariff of 0.61 RMB/kWh, we arrive at a hypothetical IRR of 5.67%,

[10] The financial parameters of all of the projects successfully registered or in the pipeline of CDM at EB were obtained from the EB database at http://cdm.unfccc.int/Projects/index.html. For the projects rather than CDM projects, N/A will be given if data is unavailable.

and a reference tariff of 0.4700 RMB/kWh. At this tariff, the project does not cross the benchmark of 8% and can be considered additional.

0.65 RMB/kWh Projects

The average financial parameters for the 0.65 RMB/kWh projects can be seen in the table below.

Appendix Table 6: The attributes of the projects with the tariff level of 0.65 RMB/kWh

Project title	Approved tariff (RMB/kWh, incl VAT)	Investment costs (RMB/kW)	O&M costs (mRMB/MWh)	Operating hours	Income tax
Zhangbei Changcheng 9MW	0.65	11261	N/A	N/A	33%
Chengde Hongsong phase I 3.6MW	0.65	12342	N/A	N/A	33%
Average	**0.65**	**11802**	**N/A**	**N/A**	**33%**

Even using the average financial parameters of the projects receiving the highest tariff 0.65 RMB/kWh) the reference tariff is calculated as 0.4994 RMB/kWh. By application of this reference tariff, the proposed project activity results in a hypothetical IRR of 6.27% which is still below the benchmark 8%. O&M costs were not available for these comparison projects, so the value for the proposed project was used in this case.

Thus it can be seen that at the highest tariffs level of 0.65, 0.61, and 0.60 RMB/kWh, the corresponding reference tariffs all result in project IRRs less than the 8% benchmark and can be considered additional. A summary of the reference tariffs can be seen in the table below.

Appendix Table 7: Summary of the calculated reference tariff under different highest tariff options

Options as the highest tariff (RMB/kWh, with VAT)	0.60	0.61	0.65
Reference tariff (RMB/kWh, with VAT)	0.5225	0.4700	0.4994
Corresponding IRR (%)	6.75	5.67	6.27

Appendix Table 8: Registered wind power CDM projects in Hebei Province

No	Time	Project	Feed-in tariff (RM	Reference	CDM	capacity (MW)	Generation (MWh)	Annual operating hours	investment(million Yuan)	Investment Yuan per kW (Yuan)	OM cost(Million Yuan)	OM cost/MWh(Yuan)	IRR in PDD
Prior to the Power Sector Reform (March 2002)													
	Construction finis	Zhangbei Changcheng 9MW wind farm	0.65	JiJiaGe [2002]242 iss	No carbon fund.	9	N/A	N/A	101	11261	N/A	N/A	N/A
	construction finish	Chengde Hongsong 3.6MW wind farm	0.65			3.6	N/A	N/A	44	12342	N/A	N/A	N/A
After the Electric Power Sector Reform Programme (March 2002): the projects in north of Hebei (Wind Resource Area II)													
1	2005.11	Chengde Hongsong wind farm	0.6		VER	49.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	2005.7	Guohua Shangyi Manjing wind farm	0.6		VER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	2006.11	Hebei Shangyi Manjing East Wind Farm	0.6	Ji Jia Guan Zi [2006]	Ref No.0842	49.5	116820	2360	469	9468	23.00	197	7.04%
4	2006.5	Zhangbei Manjing Wind Farm	0.6		Ref No.0233	45	108000	2400	N/A	N/A	N/A	N/A	7.39%
5	2006.12	Zhangbei Mijiagou 49.5 MW Wind Farm	0.6		Ref No.0845	49.5	105800	2137	481	9726	10.10	95	6.75%
6	2006.1	Hebei Kangbao Wolongtushan 30 MW Wind farm	0.6		Ref No.0878	30	59746	1992	275	9170	5.62	94	7.47%
7	2007.8	Guyuan 30.6MW Wind farm	0.54		Ref No.0873	30.6	67320	2200	326	10654	N/A	N/A	7.01%
8	2005.11	Hebei Chengde Songshan Wind farm	0.54		Ref No.0877	49.5	103000	2081	411	8303	17.00	165	6.68%
9	2007.12	Hebei Chongli Qingsanying 49.3MW Wind Farm	0.54		Ref No.2140	49.3	113042	2293	510	10336	11.36	100	6.12%
10		Hebei Shirenshan Wind farm	0.54	Fa Gai Jia Ge [2007]	Ref No.2067	49.5	113850	2300	490	9908	12.76	112	4.97%
11	after 2007.12.31	Hebei Wanquan Yulong Wind	0.54		Ref No.2205	36	80641	2240	337	9351	8.09	100	5.66%
12		Hebei Yuxian Kongzhongcaoyuan 49.5MW Wind Farm Pro	0.54		Ref No.2088	49.5	111610	2255	534	10797	10.75	96	5.85%
13	2007.1	Hebei Shangyi Manjing West Wind Farm	0.54		Ref No.2040	49.5	103000	2081	456	9205	12.43	121	6.36%
14	after 2007.12.31	Hebei Weichang Zhangjiawan Wind farm	0.54	Fa Gai Jia Ge [2007]	under validation	49.5	123,310	2491	524	10595	N/A	N/A	5.42%
15		Hebei Weichang Longyuan Construction Investment Shanwa	0.54		Ref No.2870	49.5	127990	2586	530	10708	10.28	80	5.77%
16	2007 2007.12	CECIC Zhangbei Dayangzhuang Wind Farm	0.54	NDRC Fa Gai Jia Ge	Ref No.1855	49.5	96530	1950	378	7640	13.82	143	6.11%
17		Hebei Huifeng	0.54		Ref No. 1873	49.5	106859	2159	535	10798	12.40	116	5.35%
18		Hebei Fengze	0.54		Ref No. 1715	49.5	119037	2405	503	10162	N/A	N/A	5.90%
19		Hebei Chongli Qingsanying Phase II	0.54		under validation	49.3	109,002	2211	505	10247	11.61	107	4.79%
20		Hebei Yuxian Kongzhongcaoyuan phase II	0.54		under validation	49.5	110,400	2230	499	10087	N/A	N/A	6.23%
21		Hebei Kangbao Sanxiatian	0.54		under validation	49.5	118,355	2391	629	12701	2.77(1st-2	N/A	5.35%
22		Hebei Guyuan Wuhuaping	0.54		under validation	49.5	117216	2368	640	12935	7.80	67	4.90%
23		CECIC Zhangbei phase IIII	0.54		Ref No. 1895,reject	49.5	94050	1900	438	8846	N/A	N/A	5.47%
24		Longyuan Baimiaotan	0.54		under validation	49.5	109612	2214	460	9283	N/A	N/A	5.92%
25	after 2007.12.31	Longyuan Shangyi Shirenfeng	0.54	Ji Jia Guan [2009]69	under validation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
26		Guohua Hebei Chicheng	0.54		under validation	49.5	110,385	2230	487	9831	N/A	N/A	6.09%
27		Zhangbei Bode Longxiaoertai wind farm	0.54		applying CDM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
28		Guohua Shangyi Manjing North	0.54		Ref 1792	49.5	105090	2123	437	8832	N/A	N/A	6.50%
29		Huarun Weichang Yudaokou	0.54		Ref 2865	48	98400	2050	428	8917	7.51	76	6.18%
30		Huarun Yueliangshan	0.54		Ref No 1464	49.5	111733	2257	474	9577	14.87	133	5.73%
31		Huarun Dongbaliang	0.54		Ref No 1423	49.5	112115	2265	490	9900	14.34	128	5.78%
32		Hebei Zhuzixia	0.54		under validation	49.5	117,980	2383	425	8577	N/A	N/A	7.19%
33		Hebei Guangfayong	0.54		under validation	49.5	118,690	2398	403	8143	N/A	N/A	7.17%
34		Hebei Dehe Zhangbei phase 1	0.54	Ji Jia Guan [2009]98	under validation	49.5	109,148	2205	452	9124	N/A	N/A	6.09%
35		Hebei Chengde Peifeng	0.54	Ji Jia Guan [2009]10	Ref No.3079	49.5	115560	2335	490	9890	12.21	106	6.10%
36		Hebei Chengde Runfeng	0.54		under validation	49.5	115,551	2334	491	9928	12.96	112	6.00%
37	2007	CECIC HKC Danjinghe Wind Farm	0.5006	Fa Gai neng yuan[200	Ref No.2170	200	438550	2193	1547	7737	45.60	104	6.99%
38	2007	Hebei Shangyi Qijiashan Wind Farm	0.5006	Fa Gai neng yuan [20	Ref No.1854	199.5	462060	2316	1838	9212	N/A	N/A	6.71%
39	after 2007.12.31	**CECIC HKE Zhangbei Lvnaobao Wind Power Project**	0.5006	Fa Gai Neng Yuan [2	Ref No. 3399	100.5	241700	2405	891	8864	27.10	112	6.30%
40	2007	Hebei Chengde Yudaokou	0.551	NDRC Fa Gai Jia Ge	Ref No.3467	150	312700	2085	1339	8928	33.59	107	5.26%
41	after 2007.12.31	SDIC Hebei Zhangjiakou Kangbao Pasture Wind Farm Proje	0.5006	N/A	under validation	100.5	248600	2474	959	9540	19.90	80	6.20%
After the Electric Power Sector Reform Programme (March 2002): the projects in north of Hebei (Wind Resource Area IV)													
42	after 2007.12.31	Hebei Haixing 49.5MW Wind Farm	0.61	Fa Gai Jia Ge[2007]	Ref No.2007	49.5	114999	2323	553	11171	9.24	80	6.38%
43	after 2007.12.31	Huaneng Leting	0.61	Ji Jia Guan [2009]69	Ref 3160	49.5	101470	2050	557	11247	10.39	102.4	6.03%
44		Guohua Huahua phase I	0.61		Ref 2125	49.5	99160	2003	492	9938	12.70	128.0	6.24%
45		Guohua Huahua phase II	0.61	Ji Jia Guan [2010]4 issued by Price	Ref No.3021	49.5	96822	1956	499	10082	11.15	115.1	6.30%

Source: http://cdm.unfccc.int/Projects/index.html

Conclusions for the tariff issue:

To sum up, our findings are as follows:

- The project parameters for the proposed project (investment cost, O&M cost, electricity delivered to the grid and operating hours, and the electricity tariff) are appropriate and comparable to projects in the same province (Hebei).

- The proposed project is a large project with capacity over 50 MW approved by the National Development and Reform Commission (NDRC), which is different in many aspects (especially the approval authority, unit investment, and load factor) to the small projects (<50MW). It is deemed appropriate to be compared to the project above 50MW in the Hebei province.

- The highest tariff for large project (above 50MW) in Hebei is 0.551 Yuan/kWh. By application of this highest tariff for the whole life of the proposed project, the IRR of the project increases to (7.98%) and still remains below the benchmark.

- Even if the proposed project is set to compare with projects less than 50MW, using a method of **reference tariff** derived from average financial parameters from other CDM projects in Hebei at tariffs of 0.65, 0.61, and 0.60 RMB/kWh, it can be seen that the proposed project IRR remains below the 8% benchmark with the level of reference tariff and thus remains additional.

Therefore, the proposed project activity is financially unattractive without CDM revenues. There is furthermore no basis and not any justification or a simply application of the highest tariff of ordinary wind power projects.

Regarding the electricity delivered to the grid

The electricity delivered to the grid by the project activity would fluctuate annually along with the seasonal changes in wind power resource availability. . The estimated power supplied to grid in the FSR is 241,700MWh. This is based on an annual operation time of 2405 hours, resulting in a load factor of 27.45%, which was derived from the Feasibility Study Report (FSR) prepared by a third party design institute "China Power Construction Engineering Consultant Company" in March 2008, and officially approved by National Development and Reform Committee in July 2008. So the plant load factor (PLF) for CECIC HKE Zhangbei Lvnaobao Wind Power Project is in line with EB guidelines (EB 48, Annex 11 option b).This estimation was based on long term data measured at the site, and long term wind energy estimates derived from data records at the local weather station in Hebei Province. A detailed wind power generation estimate was made using the exact specifications of the wind turbines being used and calculated using the professional wind energy resource analysis and electricity calculation software[11]. And the chosen wind turbine is the one that could best fit local wind resource. While in addition, along with the age increase in project operation, the time needed for regular maintenance of wind equipment would also increase, which would tend to decrease the annual electricity generation. So it is unlikely to have giant increase in the annual electricity delivered by the Project by 13.3%.

According to "New and renewable sources of energy in China - technologies and products issued in 2001 by Chinese renewable energy industries association, the average operational hours for wind turbines in China is about 2300 hours per year. This figure is similar to the estimated operational hours of the

[11] See P81-86 of FSR for the whole detailed calculation process.

proposed project in the FSR and PDD.

Furthermore, it is also similar to projects located near the proposed project in Hebei province listed in Appendix Table 8 above. Appendix Table 8 shows that the proposed project has a similar average number of operating hours compared to other projects - ranging from 1950-2586 hours. So the estimation of electricity delivered to the grid annually in the FSR & PDD is reasonable and conservative.

Regarding total investment

For the wind farm project, the cost of turbine, engineering construction and related accessories consist main budget of the investment. In order to save capital, domestically-manufactured turbines with smaller investment per unit installed capacity are employed by the project owner, and 3 options in terms of per kWh equipment investment have been compared at length in the FSR (Chapter 5) and the project option is finally determined. The total investment cost of the proposed project is 890.79 Million RMB. These values for these calculations were derived from the Feasibility Study Report (FSR) prepared by a third party design institute "China Power Construction Engineering Consultant Company" in March 2008, and officially approved by National Development and Reform Committee in July 2008. Physical equipment investment is the main part of the total investment. It is impossible to largely decrease the total investment by 13%, given that the purchase contract of WTGs and most key equipments had been signed.

Moreover, the installation of the wind turbines is nearly complete and full commissioning is expected at the end of 2010. The investment cost per kW of the proposed project is 8864 RMB/kW in FSR. This figure is less than the investment cost of the wind farms in China, which is approximately 10,000RMB/kW. The approved FSR contains the estimated value of total investment which can be cross checked with already occurred expenditure (shown from the signed contract lists). The values of the signed contracts including the purchase of wind turbine generators, main transformer and other main components is 912.38 million RMB, which is 2.4% larger than the total estimated investment in the FSR. Thus, the estimated investment costs in the FSR are conservative. From the comparison of the proposed project with CDM registered projects in Hebei province provided in Appendix Table 8 above, it can be seen that the investment costs for this project are well within the range of 7640-11171 RMB/kW.

Regarding the O&M cost

Annual O&M cost comprises maintenance cost, salary & awards, materials, heavy repair and other costs. All of these costs are determined by long term operation experience. Values for the O&M cost calculation have come from the FSR, which was prepared by an independent third party. The annual O&M costs are estimated in the FSR as 27.10 Million RMB per year, which is 3% of the total investment cost in the full operating period. This is approximately 0.112 RMB/kWh, which is small compared to other projects in Hebei province. It is not realistic to reduce the salary & awards of the employees, which is related to the daily life standard. In term of maintenance and heavy repair, which are basically consigned to the professional entities and it is impossible for the contract price to change much. As O&M costs would need to drop by at least 45% in order to reach the benchmark rate of 8%, this possibility can be ruled out.

Appendix Table 8 shows that the O&M costs for this project are well within the typical range of 0.08 RMB/kWh to 0.197 RMB/kWh. During the early stage of the project when the equipment is new, the maintenance costs are generally low but costs increase as the equipment ages. So the actual O & M cost of the proposed project is likely to increase over time. Thus, the actual O & M cost of the proposed project as stated in the FSR is conservative.

It can be demon strated that, the sensitivity analysis always support the conclusion that the Project is not financially attractive. However, the revenues from the CERs will greatly improve the IRR to reach the

benchmark of the financial feasibility for the Project. This is an effective evidence for demonstration of additionality.

Step 3 Barrier analysis

Barrier analysis is not employed by the Project which can satisfy the requirement of the *Tool for the Demonstration and Assessment of Additionality*.

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, access to technology, and access to financing, 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 Hebei province.

To analyze the common practice, the statistics of wind power installed capacity in China 2007 by Shi Pengfei is adopted as the data source[12]. Taking note of that the proposed project is a large scale project, the small scale projects, less than 15MW, and CDM projects[13] are excluded as per the EB guidance for common practice, only two projects, Shangyi Manjing and Chengde Hongsong can be the similar projects to the Project. Table 7 illustrates the detailed information.

Table 7 Wind farm projects similar to the Project

Name	Project Owner	Commissioning Date	Capacity (MW)	Notes
Shangyi Manjing Wind Farm Project in Hebei Province China	Guohua (Hebei) Renewable Energy Co. Ltd	Jul, 2005	34.5	Facing financial barriers, receiving direct carbon funding as VCS (Voluntary Carbon Standard) standard project
Chengde Hongsong Wind Farm Project in Chengde City, Hebei Province, China	Hebei HongSong Wind Power Share Holding Ltd	Dec, 2005	51.3	Facing financial barriers, receiving direct carbon funding as VCS standard project

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

Both Chengde Hongsong wind farm and Shangyi Manjing were facing serious financial barriers. Both

[12] Shi Pengfei. Statistics of wind power installed capacity in China in 2007. China Wind Energy. 2008,1. http://www.cwea.org.cn/upload/20080324.pdf

[13] See: http://cdm.unfccc.int/Projects/registered.html, and http://cdm.unfccc.int/Projects/Validation/index.html.

projects overcome this serious barrier with the help of carbon funding[14]. Therefore, the wind power projects similar with the Project without carbon income are not the common practice in Hebei Province.

To summarize, if the Project fails to be registered as a CDM project, without CERs sales revenues, the high cost of the Project can not be compensated and the loan payback can not be guaranteed. Under such circumstances, the implementation of the Project is facing prohibitive barriers as mentioned above. Being registered as a CDM project, CERs sales revenues can alleviate the identified barriers, therefore the Project is additional.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

According to ACM0002, the baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows in four steps:

·First, calculate the project GHG emissions;
·Second, calculate the baseline GHG emissions;
·Third, calculate the project leakage;
·Fourth, calculate the emission reductions.

1. Calculate the project GHG emissions

According to ACM0002, for wind energy project activities, it can be treated as ZERO.

2. Calculate the baseline GHG emissions

According to latest ACM0002 (Version 10), the baseline emissions calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad \textbf{(1)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$ = 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" (tCO_2/MWh)

Furthermore,

[14] See the information about Shangyi Manjing VCS project at VCU Verification and Certification Report for this project issued by DOE, also VCS attribute of this project can be known from the report of other CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1213672838.89/view; https://vcsregistry1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=61 for Chengdong Hongsong VCS project.

$$EG_{PJ,y} = EG_{togrid,y} - EG_{fromgrid,y} \quad (2)$$

So,

$$BE_y = (EG_{togrid,y} - EG_{fromgrid,y}) \times EF_{grid,CM,y} \quad (3)$$

Where,

$EG_{togrid,y}$: The electricity delivered to the grid by the proposed project activity in y year

$EG_{fromgrid,y}$: The electricity purchased by the proposed project activity from the grid in *y* year, when wind resources not sufficient or wind turbine might shut down for regular mainte nance.

The baseline emission factor (EFy) is calculated as a combined margin ($EF_{grid,CM,y}$), consisting of the combination of operating margin ($EF_{grid,OM,y}$) and build margin ($EF_{grid,BM,y}$) factors according to the following six steps defined in the "Tool to calculate the emission factor for an electricity system(Ver 02)" (Briefly the Tool hereafter). Data for the calculations are based on official national statistics books: *China Energy Statistical Yearbook* and *China Electric Power Yearbook*.

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 calculate 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 has not increased from 2004 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 - 497,060MWh / 669,506,473MWh, 0.072%). 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. Choose whether to include off-grid power plants in the project electricity system (optional).

As per the tool to calculate the emission factor for an electricity system, project participants may choose

between the following two options to calculate the operating margin and build margin emission factor:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

Here, Option I was chose given off-grid power generation is not significant in NCPG and it is impossible to be partially displaced by the project activities as an intermittent wind power generation source, also consistent with the approach in the Notification of NDRC.

STEP 3. Select an operating margin (OM) method

According to the Tool mentioned above, the calculation of the OM emission factor of the identified grid is based on one of the four following methods:

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

According to the Tool, the Simple OM method (a) is applicable to the project if the low-cost 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 NCPG is thermal plants dominated grid and the generation from all the other sources (including hydro power) were less than 1% of total generation and this percentage has not changed significantly in recent years, shown from the statistic data from China Electric Power Yearbook 2003-2007 listed in the table below, the Simple OM method is applicable to the proposed project.

Table 8 Power generation in the North China Power Grid from 2002 to 2006

Year	Thermal Generation	Low-cost/must-run generation (10^8kWh)	Total Generation (10^8 kWh)	Share	Source* (edition/page)
2002	4,039.2	36.25	4,075.45	0.89%	2003/p585
2003	4,576.7	39.79	4,616.53	0.86%	2004/p709
2004	5,267.7	40.32	5,308.04	0.76%	2005/p474
2005	6,032.3	45.51	6,077.82	0.75%	2006/p568
2006	6,033.2	45.89	6,079.11	0.75%	2007/p638
Total	25,949.2	207.76	26,156.95		

Source: China Electric Power Yearbook, 2003-2007

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

The Simple Operating Margin emission factor $EF_{grid,OM,y}$ 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. Two options can be selected to calculate the simple OM:

Option A: Based on the net electricity generation and a CO2 emission factor of each power unit;3 or
Option B: Based 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.

As data for options A are not available, the Notification of NDRC uses option B for the calculation of the operating margin emission factor.

For Option B, 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:

$$EF_{grid,OMsimple,y} = \frac{\sum FC_{i,y} \times NCV_{i,y} \times EF_{co2,i,y}}{\sum EG_y} \quad (4)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year y (tCO2/MWh)

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

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

$EF_{CO2,i,}y$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)

EG_y = Net electricity delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh) , which can be calculated from the product of net electricity generation (*GENy)* by all power sources, not including low-cost / must-run power plants / units, in year y (MWh) and (1-*AERy*), where, AERy is the average auxiliary electricity consumption rate(%) of all power sources serving the North China Power Grid, not including low-cost/must-run power plants/units, in year y.

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

y = Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2.

For this approach (simple OM) to calculate the operating margin (OM), the subscript m refers to the power plants / units delivering electricity to the grid, not including low-cost/must-run power plants / units, and including electricity imports to the grid (ZERO in this project case). Electricity imports should be treated as one power plant m.

Finally, the weighted average $EF_{OM,y}$ of the NCPG based on the latest 3 years data (2004-2006) is 1.1169

tCO_2e/MWh[15]. For more details please refer to Annex 3 Table A3-1 to A3-6.

STEP 5. Identify the cohort of power units to be included in the build margin (BM)

The sample group of power units *m* used to calculate the build margin consists of 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 (NDRC of China) 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.

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 6. Calculate the build margin emission factor

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

Where,

$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year y (tCO2/MWh)

$EG_{m,y}$ =Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ =CO2 emission factor of power unit m in year y (tCO2/MWh)

m =Power units included in the build margin

y =Most recent historical year for which power generation data is available

The CO_2 emission factor $EF_{grid,BM,y}$, should be determined as per step 3 (a) for the simple OM in the "Tool to calculate the emission factor for an electricity system". However, due to the limited availability of publicly available data, the Notification of DNA uses the accepted deviation mentioned in Step 4 to calculate $EF_{grid,BM,y}$, as follows:

• Using the latest statistical data available from China Energy Statistical Yearbook 2007 to calculate the

[15] Notification on Determining Baseline Emission Factor of China's Grid for the North China Power Grid (NCPG) issued by NDRC, China's DNA on Dec. 30, 2008

different CO_2 emission percentage (λ_i) of solid, liquid and gas fuel in the total emission from thermal generation in the North China Power Grid in 2006.
• Based the emission percentage (λ_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.
• Using the latest statistical data available (from the China Electric Power Yearbook) determine the year from which the added generation capacity is equal to or just exceeds 20% of the capacity of the latest statistic year 2006. Regarding the added generation capacity above 20%, calculate the BM through multiply the weighted emission factor of thermal power ($EF_{thermal}$) by the capacity percentage of the thermal power among the about 20% new capacity of 2006.

The detailed steps and formulas are as follows:

Step a: calculate the proportion λ_i of the CO_2 emission of solid, liquid and gas fuel type consumed for power generation to the total CO_2 emission from the total thermal power generation.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (6)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (7)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (8)$$

Where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources in province j in year y,

$NCV_{i,y}$ is the net calorific value (energy content) per mass or volume unit of a fuel i (GJ/t for solid and liquid fuel and GJ/m^3 for gas fuel)

$EF_{CO2,i,j,y}$ is CO2 emission factor of fuel i (tCO2/GJ)

COAL, OIL and *GAS* is the footnote set of the solid fuel, liquid fuel and gas fuel.

For more details please refer to Table A3-7 in Annex 3. The result is:

λ_{Coal}=98.93%, λ_{Oil}=0.09%, λ_{Gas}=0.98%.

Step b: calculate the emission factor of the corresponding thermal power.

$$EF_{Thermal} = \lambda_{Coal} * EF_{Coal,Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas,Adv} \quad (9)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are the emission factors in line with the efficiency level of the best technology commercially available in China's power grid for each fuel type respectively.

Step c: calculate the $EF_{grid,BM,y}$ of the grid:

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} * EF_{Thermal} \quad (10)$$

Where:

CAP_{Total} is the total newly capacity addition, $CAP_{Thermal}$ is the newly capacity addition of thermal power plants.

With these procedures indicated in the Notification of NDRC, the $EF_{grid,BM,y}$ of NCPG is 0.8687 tCO2/MWh[16] (details can be found at Annex 3).

STEP 7. Calculate the combined margin (CM) emissions factor.

The baseline combined emission factor ($EF_{grid,CM,y}$) is the weighted average value of the $EF_{grid,OMsimple,y}$ and $EF_{grid,BM,y}$:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OMsimple,y} + w_{BM} * EF_{grid,BM,y} \quad (11)$$

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 $w_{BM} = 0.25$.

3. Calculate the project leakage

According to ACM0002, for wind energy project activities, it can be treated as ZERO.

4. Calculate the emission reductions

The emission reductions for a given year are calculated as baseline emissions minus the project emissions and leakage:

$$ER_y = BE_y - PE_y = BE_y \quad (12)$$

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

Data / Parameter:	$FC_{i,y}$
Data unit:	ton or m^3

[16] Notification on Determining Baseline Emission Factor of China's Grid for the North China Power Grid (NCPG) issued by NDRC, China's DNA on Dec. 30, 2008

Description:	Amount of fuel *i* consumed within the project electricity system, in years *y*, not including low operating cost/must run power sources.
Source of data used:	China's Energy Statistical Yearbook
Value applied:	see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on official national statistics
Any comment:	

Data / Parameter:	GEN_y
Data unit:	MWh
Description:	electricity generated by all power sources serving the North China Grid, Northeast China Grid and Central China Grid, not including low-cost/must-run power plants/units, 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 choice of data satisfies the guidance in the methodology ACM0002 and its deviation approach. The data is used to calculate OM emission factor.
Any comment:	

Data / Parameter:	AER_y
Data unit:	%
Description:	the auxiliary electricity consumption rate of all power sources serving the North China Grid, the Northeast China Grid and the Central China Grid.
Source of data used:	China Power Electric Yearbook
Value applied:	see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on official national statistics
Any comment:	

Data / Parameter:	NCV_i
Data unit:	GJ/ton or GJ/km^3
Description:	Net calorific value (energy content) per mass or volume unit of a fuel *i*.
Source of data used:	China Energy Statistical Yearbook, 2006 Edition, p 287
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology ACM0002. The data is used to calculate the emission coefficient of the fuel.
Any comment:	

Data / Parameter:	$EF_{CO2,i,j,y,}$
Data unit:	tCO2/GJ
Description:	CO_2 emission factor per unit of energy of the fuel *i*.
Source of data used:	"2006 IPCC Guidelines for National Greenhouse Gas Invento ries ", Volume 2
Value applied:	Varies for each type of fuel, 25.8 for coal, 21.1 for oil, 15.3 for gas
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology ACM0002. The data is used to calculate the emission coefficient of the fuel
Any comment:	

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	The total installed capacity of province j in year y
Source of data used:	China Electric Power Yearbook, 2005-2007
Value applied:	see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology ACM0002. The data is used to calculate the BM emission factor
Any comment:	

Data / Parameter:	$EF_{i,Adv}$
Data unit:	%
Description:	The efficiency level of the best technology commercially available in China's power grid for each fuel type.
Source of data used:	Notification of NDRC, China
Value applied:	The supply efficiency for coal is 37.28%; for oil and gas is 48.81%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The choice of data satisfies the guidance in the methodology ACM0002. The data is used to calculate the BM emission factor.
Any comment:	

Data / Parameter:	$F_{i,j,y}$
Data unit:	tce
Description:	the consumption of fuel i in province j in year y.
Source of data used:	*China Energy Statistical Yearbook*
Value applied:	see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on official national statistics
Any comment:	

Data / Parameter:	Import Electricity from NEPG

Data unit:	MWh
Description:	The net imported electricity from NEPG, which should be considered as one power source *j, j = imports.*
Source of data used:	China Electric Power Yearbook, 2005-2007
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on official national statistics
Any comment:	

Data / Parameter:	Import Electricity from CCPG
Data unit:	MWh
Description:	The net imported electricity from CCPG, which should be considered as one power source *j, j = imports.*
Source of data used:	China Electric Power Yearbook, 2005-2007
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on official national statistics
Any comment:	

Data / Parameter:	EF_{OM}
Data unit:	tCO_2/MWh
Description:	Operating margin emission factor of the project grid system
Source of data used:	China Electric Power Yearbook, 2005-2007; China Energy Statistical Yearbook, 2005-2007
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated based on official national statistics
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	tCO_2/MWh
Description:	Building margin emission factor of the project grid system
Source of data used:	China Electric Power Yearbook, 2005-2007; China Energy Statistical Yearbook, 2005-2007
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated based on official national statistics
Any comment:	

Data / Parameter:	EF_{CM}

Data unit:	tCO_2/MWh
Description:	Combined emission factor of the project grid system
Source of data used:	China Electric Power Yearbook, 2005-2007; China Energy Statistical Yearbook, 2005-2007
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated based on official national statistics
Any comment:	

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

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According to the Tool, The weight of w_{OM} and w_{BM} is set: w_{OM} = 0.75, w_{BM} = 0.25. So the ex-ante calculation of CM is

$$EF_{grid,CM,y} = 1.1169*0.75 + 0.8687*0.25 = 1.05485 (tCO_2/MWh)$$

According to the ACM0002 methodology, the project emissions (PE_y) as well as the leakage (L_y) are zero for wind power projects, and therefore the emission reductions are equal to the baseline emissions:

$$ER_y = BE_y = EF_{grid,CM,y} * EG_y = 1.05485 (tCO_2e/MWh) * 241{,}700 (MWh) = 254{,}960\ tCO_2e/y$$

The proposed power plants will sell approx. 241, 700MWh of power to the grid. Annual GHG emissions reduction based on the above methodology and data sources are estimated at 254,960 tCO_2/y.

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

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Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
01/06/2010-31/05/2011	0	120, 822	0	120, 822
01/06/2011-31/05/2012	0	254, 960	0	254, 960
01/06/2012-31/05/2013	0	254, 960	0	254, 960
01/06/2013-31/05/2014	0	254, 960	0	254, 960
01/06/2014-31/05/2015	0	254, 960	0	254, 960
01/06/2015-31/05/2016	0	254, 960	0	254, 960
01/06/2016-31/05/2017	0	254, 960	0	254, 960

Total (tonnes of CO_2e)	0	1,650,582	0	1,650,582

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

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B.7.1. Data and parameters monitored:

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Following approved methodology ACM0002, the data that is required to be monitored to establish the emission reductions, is the net electricity supplied by the project activity to the grid (EG_y).

Data / Parameter:	$EG_{togrid,y}$
Data unit:	MWh
Description:	Quantity of annual electricity exported to the grid by the Project
Source of data to be used:	Monitored from electricity meters within the wind farm
Value of data applied for the purpose of calculating expected emission reductions in section B.6	241,700
Description of measurement methods and procedures to be applied:	Two bi-direction meters are employed at the newly-built 220kV substation by the Project, one is for main meter and the other is for backup. The electricity delivered to the grid will be monitored through the bi-direction metering equipments. Monthly power exported to NCPG will be approved and signed off by monitoring and auditing staff before it is accepted and stored.
QA/QC procedures to be applied:	Monthly power exported to the NCPG is cross-checked against invoices. The metering equipments are calibrated and checked for accuracy according to the industry standards so that the metering equipment shall have sufficient accuracy.
Any comment:	

Data / Parameter:	$EG_{fromgrid,y}$
Data unit:	MWh
Description:	Quantity of annual electricity imported from the grid by the Project
Source of data to be used:	Monitored from electricity meters within the wind farm
Value of data applied for the purpose of calculating expected emission reductions in section B.6	Zero
Description of measurement methods and procedures to be applied:	Two bi-direction meters are employed at the newly-built 220kV substation by the Project, one is main meter and the other is for backup. The electricity imported from the grid will be monitored through the bi-direction metering equipments. Monthly power imported from NCPG will be approved and signed off by monitoring and auditing staff before it is accepted and stored.
QA/QC procedures to be applied:	Monthly power imported from NCPG is cross-checked against invoices. The metering equipments are calibrated and checked for accuracy according to the industry standards so that the metering equipment shall have sufficient accuracy.

Any comment:	
Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity supplied to the grid by the Project
Source of data to be used:	Monitored from electricity meters within the wind farm and calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.6	241,700
Description of measurement methods and procedures to be applied:	Result of $EG_{togrid,y}$ minus $EG_{fromgrid,y}$
QA/QC procedures to be applied:	Monthly power exported and imported to the NCPG are cross-checked against invoices. The metering equipments are calibrated and checked for accuracy according to the industry standards so that the metering equipment shall have sufficient accuracy.
Any comment:	

B.7.2. Description of the monitoring plan:

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1. Monitoring system organization

Overall responsibility for monitoring and carrying out the monitoring following this monitoring plan lies with CECIC HKE WIND POWER CO., LTD. The company will 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:

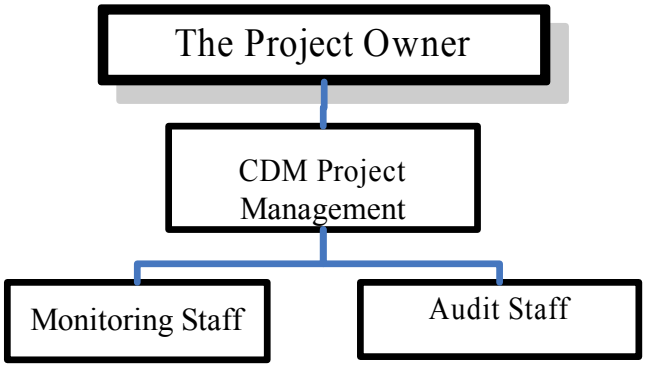

Figure 4 Monitoring system organizations

2. Installation of meters

Two bi-direction meters in the newly-built 220KV substation within the wind farm are employed by the Project, one is main meter and the other is for backup. Every month the 220kV substation in the wind farm will report the electricity exchanged between the Project and NCPG.

3. Calibration of meters & metering

The metering equipments will be calibrated and checked by qualified third party for accuracy according to local industry standards so that the metering equipments shall have accuracy of no less than 0.5s. 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.

All the meters installed shall be tested by the NCPG within 10 days 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 month's 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 with acceptable limits of accuracy or operation is performed improperly the project owner and the grid company shall jointly prepare a 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 two parties fail to agree then the matter will be referred for arbitration according to agreed procedures.

4. Data collection and management system

• The proposed wind farm records readings monthly from the meter equipment within the farm, and other relevant separated meters if needed.
•The proposed wind farm supplies reading to Zhangjiakou Electric Power Company monthly.
• Zhangjiakou Electric Power Company records readings of meters within the wind farm via remote data transfer equipment.
• The Zhangjiakou Electric Power Company reports the confirmed readings result to NCPG Company monthly and to the wind farm in some forms, e.g. Electricity Transaction Notes or sale receipts.
• The proposed wind farm carries out an internal audit on the readings and calculations and prepare for the verification by DOE.

Relevant physical document will be collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the proposed Wind farm project, the project material and monitoring results will be indexed. All paper-based information will be stored by the technology department of the proposed Wind farm 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.

5. Quality control

Monthly net generation data will be approved and signed off by monitoring and auditing staff 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. If such improvements are proposed these will be reported to the DOE and only

operated after approval from the DOE.

6. Reporting

CECIC HKE WIND POWER CO., LTD will complete the monitoring report and provide it to a DOE for verification

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

>> **Date of completion:** 23/09/2010.

The application of the baseline study and monitoring methodology of the Project was completed by:

Name/Origination	**Project participate Yes/No**
Dr. Shuwei ZHANG Gold China Consultancy International Room 10-D, Building C, Huating Park, No.6 Middle Road of the 4th North Ring, Chaoyang District, Beijing, P.R.China (100029) Tel: (8610) 8285 8669 Fax: (8610) 8284 7322 Email: zhangshuwei09@gmail.com	No

SECTION C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 26/07/2010 (The date when the Project wind turbines commissoning activity started)

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

>>22 years

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

>>

C.2.1. Renewable crediting period

>>

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

>>01/06/2010 (or the date of registration, whichever is later)

C.2.1.2. Length of the first crediting period:

>>7 years

C.2.2. Fixed crediting period:

>> N/A

C.2.2.1. Starting date:

>> N/A

C.2.2.2. Length:

>> N/A

SECTION D. Environmental impacts

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

>>

On Nov.19, 2007, the Environmental Protection Bureau of Hebei Province approved the Environmental Impact Assessment (EIA) of the Project. Here is a summary of the EIA with analysis of the environmental impacts of the Project, during the construction and the operation period, respectively.

1. The analysis of the environment impact during the construction period

• Dust: Since the local residential area is at least 500m away from the wind farm site, the impact of construction dust to the local region is limited. Several measures will be implemented to reduce the impact of dust on local residents and the construction staff, including watering and earthwork covering.
• Noise: Construction machines, transportation vehicles and construction work will generate noise. However, the noise levels are within acceptable levels at the nearest habitation, which is 500m away from the project site. Furthermore, using machinery and equipments with low noise levels, and arranging the construction times during day time, reduces the impact to the environment significantly.
• Solid waste: The solid wastes from the construction include waste soil and stone and construction wastes, as well as some waste from human life. All these wastes are collected and disposed properly to the landfill site of Zhangbei County.
• Waste water: The waste water will be generated from construction work and the project office. The total volume is small and it can be treated and re-used as watering or sprinkler.
• Ecosystem: After construction, the land temporally occupied by the Project will be recovered by grass, so as to recreate the original ecosystem. So the Project has little impact to the ecosystem.

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

• Noise: The operating noise of these turbines ranges from 101 dB to 105dB. With at least 500 meters far from the turbines, where residential areas are located, the noise has been greatly weakened to about 37 db, dropping down below the national standard (No. GB 3096-93) of 45dB in night and 55 db in daytime. There are no effects on the local residential life from the operational noise.
• Waste: Solid waste and waste water will be produced by operation staff during operation period. The emitted waste quantity is very small and will cause no interference with the environment after proper treatment or integrated utilization.
• Impact on birds: The site of the Project is not the main habitat of migratory bird, and also not on the main line of bird migratory. Also the often-seen birds in this region are commonly with a small size and flexible in flying. They are easy to find the huge wind blades and avoid the hitting. So the Project will not bring obvious effects on birds.

3. Conclusion

Wind power is green power and the impact caused by wind farm on the surrounding ecosystem and residents, water, and atmosphere etc is very little. Therefore, the Project is feasible from aspect of environment protection.

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

>>

The implementation of the Project is without obviously adverse and transboundary impacts. The Environmental Protection Bureau of Hebei Province has approved the EIA of the Project.

SECTION E. Stakeholders' comments

>>

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

>>

In March 10, 2008, consultations were carried out in the Zhangbei County by CECIC HKE Wind Power CO., LTD. The consultations, which included two parts, one is the discussions among local people with the developer and another, a questionnaire survey.

The developer introduced the background of the Project firstly according to the meeting schedule and respondents filled in a questionnaire, and then a discussion meeting is raised to get the comments and suggestions from local people.

- Project brief introduction
- Respondents' information on name, gender, education level etc.
- Questions on:

1. Is the environment quiet where you are living, working and studying?
2. Do you feel any impact on surrounding environment (air, noise & water) by the project construction?
3. Are there any adverse impacts on your and your family's life, work and study by the project construction? (if yes, please explain in the attached pages.)
4. Whether the completion of the Project will bring about positive impacts to you?
5. What is the issue that you are most concerned with during the construction and operation period of the Project? (Options: Noise, air pollution, equipment safety, waste water, electromagnetic interference, or landscape destroy)
6. Do you agree with the development & construction of the Project?
7. Do you think which environmental protection measures should be undertaken during the construction and operation period of the Project?
8. Do you have any further comment and suggestion about the Project?

E.2. Summary of the comments received:

>>

The questionnaires were sent to 35 respondents and the survey had a 100% response rate. The statistical results of the questionnaire survey to the stakeholders are summarised as following:

Indicator	Total	Male	Female	Young (10-35)	Middle (35-55)	Elder (55-70)
Number of Respondents	35	26	9	11	18	6

Indicator	Below junior	Junior high	Above junior	Student	Farmer	Worker	Officials

	high school	school	high school				
Number of Respondents	12	20	3	1	30	3	1

Questionnaire	Yes (Num.)	No (Num.)	Not clear (Num.))
1. Is the environment quiet where you are living, working and studying?	33	1	1
2. Do you feel any impact on surrounding environment (air, noise & water) by the project construction?	7	23	5
3. Are there any adverse impacts on your whole family's life, work and study by the project constru ction?	1	29	5
4.Whether the completion of the project will bring about positive impacts to you?	24	1	10
5. Which issue you are most concerned with during the construction and operation period of the project?	(Multi options)		

Noise	Air Pollution	Equipment safety	Waste water discharge	Elec-magnetic wave disturb	Sight damage
16	7	18	0	4	16

6. Do you agree with the development & construction of the project?	31	0	4

Most respondents (31/35) agree and support the development of the Project. Some respondents provide their concern in the section of Question 5 and descriptive questions on the possible negative impacts possible caused by the Project, including land occupation, grass and road destroy, noise of truck at night etc, which possibly occur at the period of construction and all of these were mentioned and designed to be solved in EIA report.

Conclusions of the meeting discussions:

With respect to local economic development, this wind farm project is expected to greatly promote the development of wind power in Hebei. Hopefully this project could also help drive the local economic growth and contribute much to local fiscal revenues. Wind electricity can provide "green energy" for the Hebei power grid and boost local sustainable development.

With respect to environmental protection, the environmental impact analysis (EIA) for this project shows that noise level associated with the operation of this wind-turbine can meet the permitted range of China's national standard. As is known this project is geographically located far from the downtown of Zhangbei, apparently without the possibility of telecommunication signal jamming. In addition, no migratory bird is flying over this region.

With respect to local people's life and employment, the project is basically without negative impact on the people's daily life, but can be possible to employ some local farmers or herdsmen nearby. During the construction and operation of this project, the related purchases and consumptions could promote local business and trade, thus increasing local farmer's income.

To sum up, the stakeholders are very supportive of this project and looking forward to the operation of the Project as early as possible. And the project owner will strengthen the communication with the stakeholders, and confirm the measurements given in the EIA report will be implemented totally to solve the issues the local people concern mostly, including land occupation, grass and road destroy, noise of truck

at night etc at the construction period.

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

>>

The project owner has given full consideration to the comments and suggestions from stakeholders, and has an overall environment-friendly plan (partially included in the EIA report) to guarantee that the Project has the minimum negative impact on the environment during the project construction and operation. Local residents and government are all supportive to the implementation of the Project. There has been no need to modify the project design according to the comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	Li Shusheng
Title:	Head of the project participant
Salutation:	Mr.
Last Name:	Li
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

>>

The Project receives no public funding from Annex 1 countries. The funding of this project is from the Asia Pacific Carbon Fund (not public funding), managed by Asian Development Bank on behalf of fund participants including Sweden and Spain. The Fund and its projects do not result in a diversion of official development assistance.

Annex 3

BASELINE INFORMATION

>>

To determine the simple OM emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$) of the Project, data and formula recommended in the latest *Notification on Determining Baseline Emission Factor of China's Grid* for the North China Power Grid (NCPG) issued by NDRC, China's DNA on Dec. 30, 2008, are adopted.

The following tables summarized the numerical results from the equations listed in the approved methodology ACM0002 (version 10) and Notification of NDRC. The information provided by the tables includes data, data sources and the underlying calculations.

Table A3-1 Simplified Operation Margin Emission Factor Calculation for North China Power Grid in 2004

Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Neimeng	Shandong	Total	Emission factor (tc/TJ)	OXID (%)	NCV (MJ/t,km^3)	CO2 emission(tCO2e)
Raw coal	10^4t	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	25.8	100	20908	538,547,477
Clean coal	10^4t						40	40	25.8	100	26344	996,857
Other washed coal	10^4t	6.48		101.04	354.17		284.22	745.91	25.8	100	8363	5,901,191
Coke	10^4t					0.22		0.22	29.2	100	28435	6,698
Coke Oven Gas	10^8m^3	0.55		0.54	5.32	0.4	8.73	15.54	12.1	100	16726	1,153,187
Other coal gas	10^8m^3	17.74		24.25	8.2	16.47	1.41	68.07	12.1	100	5227	1,578,574
Crude oil	10^4t							0	20	100	41816	0
Gasoline	10^4t								18.9	100	43070	0
Diesel	10^4t	0.39	0.84	4.66				5.89	20.2	100	42652	186,070
Fuel oil	10^4t	14.66		0.16				14.82	21.1	100	41816	479,451
LPG	10^4t							0	17.2	100	50179	0
Refinery gas	10^4t		0.55	1.42				1.97	15.7	100	46055	52,229
Natural gas	10^8m^3		0.37		0.19			0.56	15.3	100	38931	122,306
Other petro. product	10^4t							0	20	100	38369	0
Other coking product	10^4t							0	25.8	100	28435	0
Other energy	10^4tce	9.41		34.64	109.73	4.48		158.26	0	100	0	0
											Total	549,024,041

Source: China Energy Statistical Power Yearbook 2005

Table A3-2 Thermal Generation and OM of North China Power Grid in 2004

Province	**Generation**	**Self service rate**	**Electricity supply**
	(MWh)	(%)	(MWh)
Beijing	18579000	7.94	171,038,27
Tianjin	33952000	6.35	31,796,048
Hebei	124970000	6.5	116,846,950
Shanxi	104926000	7.7	96,846,698
Neimeng	80427000	7.17	74,660,384
Shandong	163918000	7.32	151,919,202
Total	603231000		560,751,013

Source: China Electric Power Yearbook 2005

Imports from Northeast Power Grid (MWh)	4,514,550
OM of Northeast Power Grid (tCO2/MWh)*	1.1738371
Total emission(tCO_2)	493,687,660
Total electricity supply (MWh)	554,323,387
OM(tCO_2/ MWh)	1.12282

* As mentioned in the text of the PDD, the electricity imported from NEPG will be considered as one source for OM calculation of NCPG. The OM of NEPG was calculated from the corresponding energy balance of NEPG, which can be obtained from the Notification of NDRC, China's DNA. To be concise, the calculated process will not be repeated here, as well as the OM of CCPG, because it is not the direct-related part in term of the final emission calculation of the Project within the NCPG.

Table A3-3 Simplified Operation Margin Emission Factor Calculation for North China Power Grid in 2005

Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Neimeng	Shandong	Total	Emission factor (tc/TJ)	OXID (%)	NCV (MJ/t,km^3)	CO2 emission(tCO2e)
Raw coal	10^4t	897.75	1675.2	6726.5	6176.45	6277.23	10405.4	32158.53	25.8	100	20908	636,062,536
Clean coal	10^4t						42.18	42.18	25.8	100	26344	1,051,186
Other washed coal	10^4t	6.57		167.45	373.65		108.69	656.36	25.8	100	8363	5,192,725
Coke	10^4t					0.21	0.11	0.32	29.2	100	28435	9,742
Coke Oven Gas	10^8m^3	0.64	0.75	0.62	21.08	0.39		23.48	12.1	100	16726	1,742,396
Other coal gas	10^8m^3	16.09	7.86	38.83	9.88	18.37		91.03	12.1	100	5227	2,111,027
Crude oil	10^4t					0.73		0.73	20	100	41816	22,385
Gasoline	10^4t			0.01				0.01	18.9	100	43070	298
Diesel	10^4t	0.48		3.54		0.12		4.14	20.2	100	42652	130,786
Fuel oil	10^4t	12.25		0.23		0.06		12.54	21.1	100	41816	405,690
LPG	10^4t							0	17.2	100	50179	0
Refinery gas	10^4t			9.02				9.02	15.7	100	46055	239,141
Natural gas	10^8m^3	0.28	0.08		2.76			3.12	15.3	100	38931	681,417
Other petro. product	10^4t							0	20	100	38369	0
Other coking product	10^4t							0	25.8	100	28435	0
Other energy	10^4tce	8.58		32.35	69.31	7.27	118.9	236.41	0	100	0	0
											Total	647,649,331

Source: China Energy Statistical Power Yearbook 2006

Table A3-4 Thermal Generation and OM of North China Power Grid in 2005

Province	Generation	Self service rate	Electricity supply
	(MWh)	(%)	(MWh)
Beijing	20880000	7.73	19,265,976
Tianjin	36993000	6.63	34,540,364
Hebei	134348000	6.57	125,521,336
Shanxi	128785000	7.42	119,229,153
Neimeng	92345000	7.01	85,871,616
Shandong	189880000	7.14	176,322,568
Total	603231000		560,751,013

Source: China Electric Power Yearbook 2006

Imports from Northeast Power Grid (MWh)	3,929,000
OM of Northeast Power Grid (tCO2/MWh)	1.15763963
Total emission(tCO_2)	564,680,013
Total electricity supply (MWh)	652,197,697
OM(tCO_2/ MWh)	1.15499

Table A3-5 Simplified Operation Margin Emission Factor Calculation for North China Power Grid in 2006

Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Neimeng	Shandong	Total	Emission factor (tc/TJ)	OXID (%)	NCV (MJ/t,km^3)	CO2 emission(tCO2e)
Raw coal	10^4t	796.63	1639.2	6867.99	6968.88	8404.05	10930.66	35607.41	25.8	100	20908	704,277,823
Clean coal	10^4t						39.77	39.77	25.8	100	26344	991,125
Other washed coal	10^4t	6.36		214.13	371.14	61.77	544.6	1198	25.8	100	8363	9,477,855
Briquette		7.97					27.77	35.74	26.6	100	20908	728,820
Coke	10^4t						3.23	3.23	29.2	100	28435	98,335
Coke Oven Gas	10^8m^3	0.38	0.63	5.8	22.32	0.64	5.79	35.56	12.1	100	16726	2,638,825
Other coal gas	10^8m^3	20.66	6.58	69.72	13.79	22.76	7.22	140.73	12.1	100	5227	3,263,593
Crude oil	10^4t					0.74		0.74	20	100	41816	22,692
Gasoline	10^4t			0.01				0.01	18.9	100	43070	298
Diesel	10^4t	0.21		3.01		0.07	6.32	9.61	20.2	100	42652	303,589
Fuel oil	10^4t	6.38		0.08			4.1	10.56	21.1	100	41816	341,633
LPG	10^4t						0.01	0.01	17.2	100	50179	316
Refinery gas	10^4t			2.43			2.32	4.75	15.7	100	46055	125,934
Natural gas	10^8m^3	3.41	0.73		0.53			4.67	15.3	100	38931	1,019,942
Other petro. product	10^4t						0.28	0.28	20	100	38369	7,878
Other coking product	10^4t							0	25.8	100	28435	0
Other energy	10^4tce	6.83		47.11	230.76	12.51	132.29	429.5	0	100	0	0
												723,298,659

Source: China Energy Statistical Power Yearbook 2007

Table A3-6 Thermal Generation and OM of North China Power Grid in 2006

Province	Generation	Self service rate	Electricity supply
	(MWh)	(%)	(MWh)
Beijing	20705000	7.51	
Tianjin	35924000	6.86	33,459,614
Hebei	143888000	6.63	134,348,226
Shanxi	150250000	7.45	139,056,375
Neimeng	139593000	7.58	129,011,851
Shandong	230922000	7.12	214,480,354
Total	721282000		669,506,473

Source: China Electric Power Yearbook 2007

Imports from Northeast Power Grid (MWh)	2,618,060
OM of Northeast Power Grid (tCO2/kWh)	1.16687886
Imports from Central China Power Grid (MWh)	497,060
OM of Central China Power Grid	0.87599
Total emission(tCO_2)	672,621,593
Total electricity supply (MWh)	726,789,038
OM(tCO_2/ MWh)	1.08053

The average OM is**: 1.1169** tCO_2/ MWh

Table A3-7 Proportion of the solid, liquid, gas fuel emission out of the total emission in North China Power Grid

		Beijing	Tianjin	Hebei	Shanxi	Neimeng	Shandong	Total	Emission factor (tc/TJ)	OXID (%)	NCV (MJ/t,km^3)	CO2 emission(tCO2e)
Raw coal	10^4t	796.63	1639.2	6867.99	6968.88	10930.66	8404.05	35607.41	20908	25.8	1	704,277,823
Clean coal	10^4t	0	0	0	0	39.77	0	39.77	26344	25.8	1	991,125
Other washed coal	10^4t	6.36	0	214.13	371.14	544.6	61.77	1198	8363	25.8	1	9,477,855
Briquette	10^4t	7.97	0	0	0	27.77	0	35.74	20908	26.6	1	728,820
Coke	10^4t	0	0	0	0	3.23	0	3.23	28435	29.2	1	98,335
Sum												**715,573,958**
Crude oil	10^4t	0	0	0	0	0	0.74	0.74	41816	20	1	22,692
Gasoline	10^4t	0	0	0.01	0	0	0	0.01	43070	18.9	1	298
Coal oil	10^4t	0	0	0	0	0	0	0	43070	19.6	1	0
Diesel	10^4t	0.21	0	3.01	0	6.32	0.07	9.61	42652	20.2	1	303,589
Fuel oil	10^4t	6.38	0	0.08	0	4.1	0	10.56	41816	21.1	1	341,633
Other petro. product	10^4t	0	0	0	0	0.28	0	0.28	38369	20	1	7,878
Other coking product	10^4t	0	0	0	0	0	0	0	28435	25.8	1	0
Sum												**676,091**
Natural gas	10^7m^3	34.1	7.3	0	5.3	0	0	46.7	38931	15.3	1	1,019,942
Coke Oven Gas	10^7m^3	3.8	6.3	58	223.2	57.9	6.4	355.6	16726	12.1	1	2,638,825
Other coal gas	10^7m^3	206.6	65.8	697.2	137.9	72.2	227.6	1407.3	5227	12.1	1	3,263,593
LPG	10^4t	0	0	0	0	0.01	0	0.01	50179	17.2	1	316
Refinery gas	10^4t	0	0	2.43	0	2.32	0	4.75	46055	15.7	1	125,934
Sum												**7,048,610**
Sum together												**723,298,659**

Source：China Energy Statistical Yearbook 2007;

From the table and the formula of λ,

λ_{Coal}=98.93%, λ_{Oil}=0.09%, λ_{Gas}=0.98%

Table A3-8 Emission factor and the efficiency level of the best technology commercially available in China's power grid for each fuel type coal, oil and gas

	Variable	Fuel intensity per unit elec. supply (gce/kWh)	Elec. supply efficiency (%)	Emission factor (tC/TJ)	OXID	Emission factor (tCO_2e/MWh)
Coal power	$EF_{Coal,Adv}$	329.94	37.28%	25.8	1	0.9135
Oil power	$EF_{Oil,Adv}$	252	48.81%	21.1	1	0.5706
Gas power	$EF_{Gas,Adv}$	252	48.81%	15.3	1	0.4138

Source: Baseline emission factor of China grid determined by the Notification of NDRC.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9083 \text{ tCO2e/MWh.}$$

Table A3-9 Installed Capacity of the North China Power Grid in 2006

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Neimeng	Shandong	Total
Thermal	MW	3984	6512	26087	26661	28899	49395	141538
Hydro	MW	1053	5	785	790	818	553	4004
Nuclear	MW	0	0	0	0	0	0	0
Wind & others	MW	24	24	218	0	565	106	937
Total	MW	5061	6541	27090	27451	30282	50054	146479

Source: China Electric Power Yearbook, 2007

Table A3-10 Installed Capacity of the North China Power Grid in 2005

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

Source: China Electric Power Yearbook, 2006

Table A3-11 Installed Capacity of the North China Power Grid in 2004

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Neimeng	Shandong	Total
Thermal	MW	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro	MW	1055.9	5	783.8	787.3	567.9	50.8	3250.7
Nuclear	MW	0	0	0	0	0	0	0
Wind & others	MW	0	0	13.5	0	111.7	12.3	137.5
Total	MW	4514.4	6013.5	20730	18480.6	14321.2	32923.5	96983.2

Source: China Electric Power Yearbook, 2005

Table A3-12 BM calculation for the NCPG

Unit (MW)	Installed Capacity in 2004	Installed Capacity in 2005	Installed Capacity in 2006	Newly added capacity from 2005-2006	Share in the newly added capacity %
	A	B	C	D=C-B	
Thermal	93594.9	111068.7	141538	30469.3	95.64%
Hydro	3250.7	3216.2	4004	787.8	2.47%
Nuclear	0	0	0	0	0.00%
Wind etc	137.5	335.5	937	601.5	1.89%
Total	96983.1	114620.4	146479	31858.6	100.00%
% of the capacity of 2006	66.21%	78.25%	100%		
In the sample group m consisting of newly added capa city in 2005-2006, the ratio of newly built thermal capacity to the total capacity in group m = $CAP_{thermal}/CAP_{total}$				95.64%	

Data source: China Electric Power Yearbook 2005-2007

$$EF_{BM,y} = (Cap_{Thermal}/Cap_{Total}) \times EF_{Thermal} = 95.64\% \times 0.9083 = 0.8687\ tCO_2/MWh.$$

Annex 4

MONITORING PLAN

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