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

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SECTION A. General description of project activity

A.1. Title of the project activity:

Heilongjiang Dabaishan Wind Power Project
PDD version : 2.0
Date of document: 20/06/ 2009

Revision version history

Version	Date	Comments
Version 1.0	17 July2008	First version of the PDD
Version 2.0	20 June 2009	Final completion version

A.2. Description of the project activity:

Heilongjiang Dabaishan Wind Power Project (hereinafter referred to as the proposed project) is a grid connected renewable energy project developed by Yichun Longyuan Hero Asia Wind Power Co., Ltd. The proposed project is to be located in Jinshantun District Yichun City, Heilongjiang Province, China. The purpose of the proposed project is to generate electricity using wind power resources in the project region and to sell into Northeast Power Grid (NEPG). The proposed project involves the installation of 33 sets of 1,500kW wind turbines, for a total installed capacity of 49.5 MW. It is estimated that the annual generated output will be 112,600 MWh.

The project is a new project, the situation prior to the project is the same as the baseline scenario, which is that the NEPG would provide the same amount of electricity. The electricity generated from the project can displace part of the power from the grid, and the expected annual GHG emission reductions are 128,442 tCO_2e.

The contributions of the proposed project to sustainable development goal are summarized as follows:

- Being located in a power grid dominated by fossil fuel fired power plants, development of the proposed project will not only reduce GHG emissions but also mitigate local environmental pollution caused by air emissions from fossil fuel fired power plants;
- New jobs will be generated;
- The implementation of the proposed project will be helpful to meet the energy demand, therefore, contribute to local economic development.

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)
China (host)	Yichun Longyuan Hero Asia Wind Power Co., Ltd	No
Austria	Kommunalkredit Public Consulting GmbH	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Heilongjiang Province

A.4.1.3. City/Town/Community etc:

Jinshantun District Yichun City

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

The proposed project is located in Jinshantun District Yichun City, Heilongjiang Province of China. The geographical coordinates of the proposed project are north latitude 47°43′50" and east longitude 129°48′40", its altitude is 1,039 m above sea level. The wind farm of the proposed project is on the Dabaishan Mountain. The detailed location of the proposed project is shown in figure 1.

font.

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

The project activity falls under the following scope and category.
Sectoral scope: 1. Energy industries
Category: Grid-connected electricity generation from renewable energy sources

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

The purpose of the proposed project is to generate zero-emission wind power and deliver it to NEPG. Considering wind condition, various technical and economic factors including generation, investment and installation, 65m was selected as installation height of wind turbine and totally 33 wind turbines with a nominal capacity of 1,500 kW (Goldwind 77/1500KW) will be installed, providing a total capacity of 49.5MW. All wind turbines are produced by Goldwind Science & Technology Co., LTD. of China. The main technical specifications are as follows (Shown in table1):

Table 1 Technical Parameters of Wind Turbines for the proposed project

Rotor	
• Number of blades	3
• Diameter	77 m
Operational data	
• Nominal output	1500 kW
• Cut-in wind speed	3 m/s
• Cut-out wind speed	22 m/s
• Nominal wind speed	11.8 m/s
• Survival wind speed	59.5m/s
• Rated power	1500KW
• Design life	20 Year
• Operating temperature	-30° C - +40° C
Blades	
• Material	Fiberglas
• Blades end speed	76.6m/s
Tower	
• Hub heights:	65 m

（Data sources: http://cn.goldwind.cn/cn/cp_77_1.asp）

Each turbine has a 690V-to-35kV transformer. All the wind turbines are divided into four groups. Every group has a 35kV line, which will link into 220kV Shaobaishan substations, and finally link into 220KV Jinshan substation.

The auxiliary electric system of the proposed project includes control, protection, measure, signalling and surveillance in central control room . The electricity generated by the wind farm will be dispatched by regional dispatch centre and wind turbines could be controlled and signalled remotely.

The wind turbine adopted by the proposed project is Goldwind 77/1500kW produced in China. This kind of wind turbines has been adopted by many wind farms in China in recent years. The development of the proposed project will contribute to promoting application of such type of

wind turbine, accelerating the accumulation of experiences of this kind of technology and advancement of domestic wind power technology.
The annual operation hours for the proposed project is about 2275 hours and the PLF for the proposed project is about 25.97%.

No technology from abroad is transferred for the CDM project activity.

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

The proposed project adopts renewable crediting periods of 7 years * 3. The total estimation of emission reductions in the first crediting period (01/09/2009-31/08/2016) is **899,094tCO_2e**, as shown in the following table.

Years	***Annual estimation of emission reductions in tons of CO_2e***
01/11/2009-31/10/2010	128,442
01/11/2010-31/10/2011	128,442
01/11/2011-31/10/2012	128,442
01/11/2012-31/10/2013	128,442
01/11/2013-31/10/2014	128,442
01/11/2014-31/10/2015	128,442
01/11/2015-31/10/2016	128,442
Total estimated reductions *(tons of CO_2e)*	899,094
Total number of crediting years	7
Annual average over the crediting period of estimated reductions *(tons of CO_2e)*	128,442

A.4.5. Public funding of the project activity:

No public funding from the Annex I parties is involved in the project activity

SECTION B. Application of a baseline and monitoring methodology:

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

Version 08 of ACM0002: Consolidated methodology for grid-connected electricity generation from renewable sources

The methodology also refers to the latest approved versions of the following tools:

◆Tool to calculate the emission factor for an electricity system(version01.1);
◆Tool for the demonstration and assessment of additionality (version05.2);

For more information regarding the methodology and the tools as well as their consideration by the Executive Board please refer to http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

The proposed project can meet the applicability criteria of the baseline methodology (ACM0002 version 8); therefore, the methodology is applicable to the proposed project.

- The proposed project is the installation of a grid-connected zero-emission renewable power generation activity from wind source;
- The proposed project is not an activity that involves switching from fossil fuels to renewable energy sources at the site of the project activity;
- The geographic and system boundaries for the relevant electricity grid (Northeast Power Grid) can be clearly identified and information on the characteristics of the grid is available;

Version05.2 of Tool for the demonstration and assessment of additionality is applied for the proposed project, because that the additionally tool is included in the approved methodology ACM0002 and its application is mandatory.

Version01.1 of Tool to calculate the emission factor for an electricity system is applied for the proposed project， because that the proposed project activity supplies electricity to the NEPG.

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

Spatial boundary:

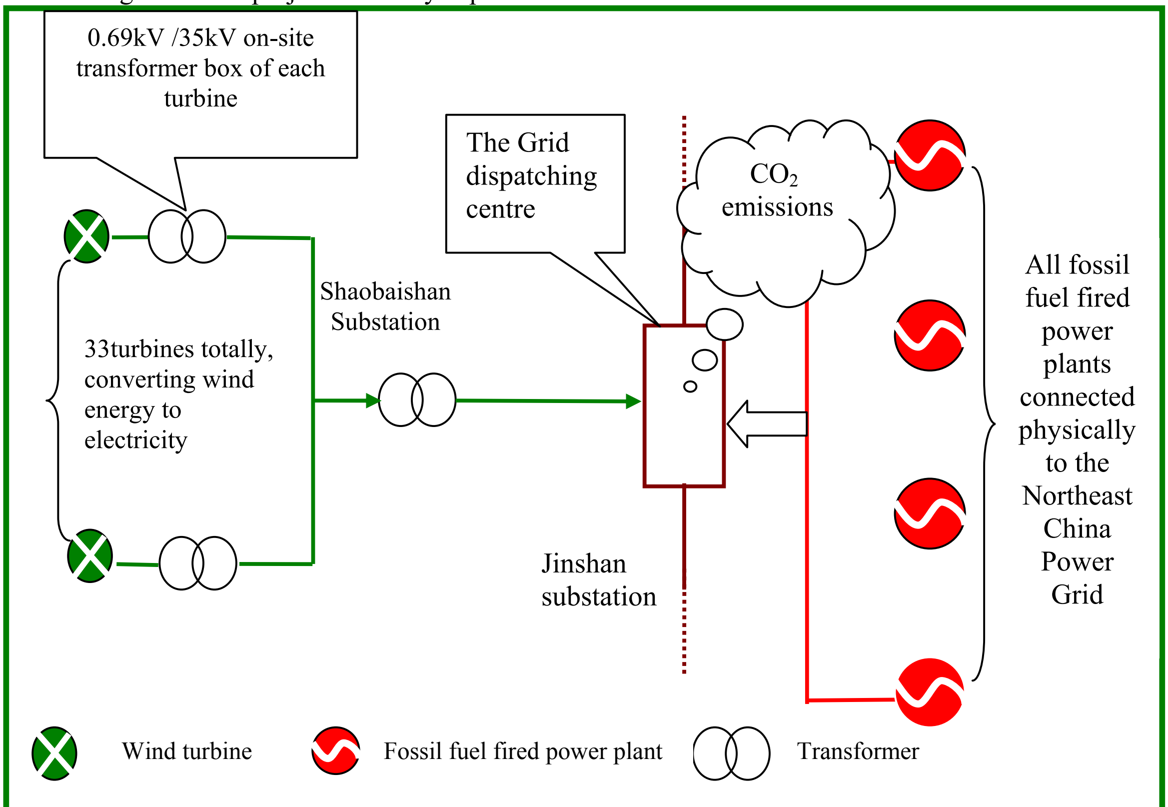
The spatial extent of the project boundary includes Heilongjiang Dabaishan Wind Power Project and all power plants connected physically to the Northeast Power Grid that the CDM project power plant is connected to. Northeast Power Grid is defined as the project electricity system, which consists of independent province-level electricity systems including Liaoning, Jilin and Heilongjiang province that can be dispatched without significant transmission constraints.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table:

	Source	Gas	Included?	Justification / Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project	CO_2	Yes	Major emission sources
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

	activity.			
Project Activity	The project is a zero-emissions renewable power source	CO2	No	According to ACM0002, the project emission of wind power project activity is not considered.
		CH4	No	According to ACM0002, the project emission of wind power project activity is not considered.
		N2O	No	According to ACM0002, the project emission of renewable wind power activity is not considered.

A flow diagram of the project boundary is presented below:



The flow diagram of the project boundary

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

According to the description in the approved consolidated baseline and monitoring methodology ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

The proposed project is connected to the Heilongjiang Grid, an integrated part of the Northeast China Grid. So Northeast China Grid is considered as the "connected electricity system", which is defined as the "project boundary" of the proposed project. It includes the grids of Liaoning Grid, Jilin Grid, and Heilongjiang Grid. Therefore, being a project with the boundary of Northeast China Grid that does not modify or retrofit an existing electricity generation facility, the baseline scenario of the proposed project can be identified as the following:

Electricity delivered to the grid by the proposed project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources within the Northeast Power Grid, as reflected in the combined margin (CM) calculated described latter.

The analysis and description in B.5 and B.6 will support the baseline scenario shown above.

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):

Table 2 The implementation timeline of the proposed project activity

No	Date	Description
1	11/06/2007	The EIA of the proposed project has been finished.
2	November, 2007	Final FSR finished, in which the CDM incentive was seriously considered for the successfully implementation of the project. It clearly states in the FSR that: The proposed project is financially unattractive. To ensure a successful implementation of the proposed project, the project developer should apply the CDM according to the related regulation of the State, and improve the project return through GHG emission reduction trading.
3	06/12/2007	The stakeholders conference was hold by the project owner.
4	05/01/2008	The board meeting on CDM development.
5	15/03/2008	The Signing date of CDM Consultation contract
6	10/06/2008	Construction date.
7	12/06/2008	`the wind turbines purchasing contract was signed
8	21/06/2008	The construction engineering contract for wind turbines has been signed.
9	20/11/2008	ERPA was signed.
10	15/10/2008	The PDD was made publicly available directly on the UNFCCC CDM website.

In the feasibility study report (FSR), the IRR for the total investment is lower than the benchmark

8%. And at the same time, the FSR points out that, the project needs capital to overcome the financial barriers and advices PP to apply for the support of CDM. The project owner has paid a lot attention to the CDM applying since FSR finished. The project owner began to contact with the CDM consultation company and DOE. On 6 December 2007, with the help of consulting company, the project owner hold the stakeholder conference successfully. And the project owner signed the validation contract with Bureau Veritas Certification Holding S.A.S on 30 January 2008. On 5 January 2008, the board held a meeting discussing the CDM development for the project and reached the same result that the CDM revenue would help the project overcome financial barrier and the project should be applied for CDM registration after being approved by NDRC. On 15 March 2008, the CDM consultation contract for the proposed project was signed. The PDD was made publicly available directly on the UNFCCC CDM website on 15 October 2008.

The project activity is not the baseline scenario and possesses additionality, which is demonstrated below in a step-wise manner using the latest version05.2of "Tool for demonstration and assessment of additionality".

Step 1. Identification of alternatives to the project activity consistent with mandatory laws and Regulations

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

Sub-step 1a. 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 not undertaken as a CDM project activity
b) The thermal power plant with the same annual electricity output as the proposed project.
c) Other renewable energy project with the same annual electricity output as the proposed project.

d) To provide the same electricity output by Northeast Power Grid.

For the alternative c), besides wind energy, other kinds of energy like solar PV, geothermal, biomass and hydro are the possible grid-connected renewable energy technologies that could be applied in China. In the Northeast China Power Grid, other renewable energies including hydropower, solar PV, biomass and geothermal are the possible power generation technologies. Due to the technology development status and the high cost for power generation, solar PV, geothermal and biomass of the similar installed capacity as the proposed project are alternatives far from being attractive investment in the grid in China[1]. Only hydropower projects have the investment return rate that can compete over that of wind power projects in China. But Yichun City, where the proposed project is located in, is in the mountain area, there is no exploitable

[1] http://jjckb.xinhuanet.com/cjxw/2007-11/27/content_75467.htm;
http://finance.people.com.cn/GB/1038/59942/59949/6294546.html
http://news.163.com/07/0919/08/3OO8EQIR000120GU.html

hydro power resource in this area[2]. Furthermore, the hydro resources that can be utilized in Heilongjiang Province are not able to provide a comparable output or the same services as the proposed project given the fact that the installed hydro power capacities in Heilongjiang province are 844.6 MW in 2004 ,846.7 MW in 2005 and 853 MW in 2006 respectively[3], the installed hydro power capacity addition is less than 10 MW from the year 2004 to 2006. Therefore, though the alternative c) is in compliance with all mandatory laws and regulations, is not a realistic alternative.

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

The mandatory laws and regulations for the proposed project include laws, central government regulations, local regulations, departmental rules and disciplines related to electricity and environment protection.

The alternative b) should be eliminated from the following consideration because it does not comply with the national regulation for controlling small scale thermal power plant. The average generation hours for fossil fuel fired power plants are 5404 hours[4] in Heilongjiang Province in 2006 while the effective generation hours for proposed project are 2275 hours[5], to provide the same output as the proposed project, the alternative baseline scenario for the proposed project should be a grid-connected fossil fuel fired power plant with installed capacity of about21MW. However, according to Chinese regulations, thermal power plants of less than 135 MW are prohibited for construction within the grid connected area[6]. Therefore, alternative b) conflicts with Chinese regulations. In this sense, alternative b) cannot be a realistic alternative.

The other alternatives described in sub-step 1a are all in compliance with mandatory laws and regulations as required by the methodology used.

To summarize, the potential realistic and creditable alternatives that can provide the same output or services as the proposed project are a) and d). The investment analysis in Step 2 will show the proposed project not undertaken as a CDM project and without CERs income (alternative a)) is lack of the attraction for the potential investors.

Step 2. Investment analysis.

This step will determine whether the proposed project is the economically or financially less attractive than other alternatives without the revenue from the sale of CERs. The investment analysis is conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

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[2] Feasibility Study Report of the proposed project

[3] China Electric Power Yearbook 2005-2007

[4] China Electric Power Yearbook 2007, P626

[5] Feasibility Study of the proposed project

[6] Notice of the General Office of the State Council concerning the Strict Prohibition for Construction of Thermal Power Plants with the Capacity of less than 135 MW within the Grid Connected Area, GUOBANFAMINGDIAN〔2002〕Document No.6

Three options can be applied for the investment analysis: the simple cost analysis, the investment comparison analysis and the benchmark analysis.

The simple cost analysis is not applicable for the proposed project because the project activity will produce economic benefit (from electricity sale) other than CDM related income. The investment comparison analysis is also not applicable for the proposed project because the baseline scenario, as identified in step1, providing the same electricity output by the Northeast Power Grid, is not a new investment project.

To conclude, the benchmark analysis will be used to identify whether the financial indicators of the proposed project is better than relevant benchmark value.

Sub-step 2b. Apply benchmark analysis.

According to *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects* (version 1) issued by former State Power Corporation of China in 2003, the financial internal rate of return (IRR) on total investment as benchmark in China's power generation industry is 8%(after tax), considering economic assessments of hydropower projects, fossil fuel fired projects, transmission and substation projects, especially the interest rate of commercial loans over five years. Nowadays China's existing wind power projects have also applied it as the benchmark IRR.

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

(1) Basic parameters for calculation of financial indicators

Based on the Feasibility Study Report of the proposed project, basic parameters for calculation of financial indicators are as follows:

Item	Unit	Amount	Data source
Capacity	MW	49.5	FSR, P14-1
Static total investment	10000 Yuan	46,526	FSR, P14-1
Annual output	MWh/year	112,600	FSR, P14-1
Tariff (excluding VAT)	Yuan/kWh	0.5622 is implemented within 30000 operating hours，0.4147 is implemented in the rest of operating hours.	FSR, P14-2
Value Added Tax (VAT)	%	8.5	FSR, P14-3

Income Tax	%	25	FSR, P14-3
Project lifetime	Year	21	FSR, P14-1
Expected CERs price	EUR/tCO_2	12	Erpa
O&M cost	10000Yuan/Year	1250	FSR, P14-18
Residual value rate	%	4	FSR, P14-2

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

The financial indicators (PROJECT IRR) without income from selling CERs is listed in the following table. Without income from selling CERs, the IRR on total investment of the proposed project is lower than the benchmark IRR and the proposed project is financially unacceptable because of its low profitability.

Items	Without income from CERs	Benchmark	With income from CERs
PROJECT IRR	6.48%	8	9.87

Sub-step 2d. Sensitivity analysis

The objective of this sub step is to show the conclusion regarding the financial attractiveness is robust to reasonable variations of the critical assumptions.

Four factors are considered in following sensitivity analysis:

1) Static total investment.
2) Annual O & M costs
3) Tariff (excluding VAT)
4) Annual Output

What the project IRR (without income from selling CERs) varies with fluctuation of above factors is shown in below.

The impact of the static total investment on PROJECT IRR

Variation (%)	-10.35	-10	-7.5	-5	-2.5	0	+2.5	+5	+7.5	+10
PROJECT IRR(%)	8	7.94	7.55	7.18	6.82	6.48	6.15	5.83	5.52	5.23

The impact of the annual O & M costs on PROJECT IRR

Variation (%)	-52	-10	-7.5	-5	-2.5	0	+2.5	+5	+7.5	+10
PROJECT IRR(%)	8	6.78	6.7	6.63	6.55	6.48	6.4	6.33	6.25	6.18

The impact of annual generation output on PROJECT IRR

Variation (%)	-10	-7.5	-5	-2.5	0	+2.5	+5	+7.5	+10	+12.3

PROJECT IRR(%)	5.22	5.54	5.86	6.17	6.48	6.82	7.09	7.4	7.76	8

The impact of tariff on PROJECT IRR

Variation (%)	-10	-7.5	-5	-2.5	0	+2.5	+5	+7.5	+10	+10.8
PROJECT IRR(%)	5	5.38	5.75	6.12	6.48	6.84	7.19	7.54	7.89	8

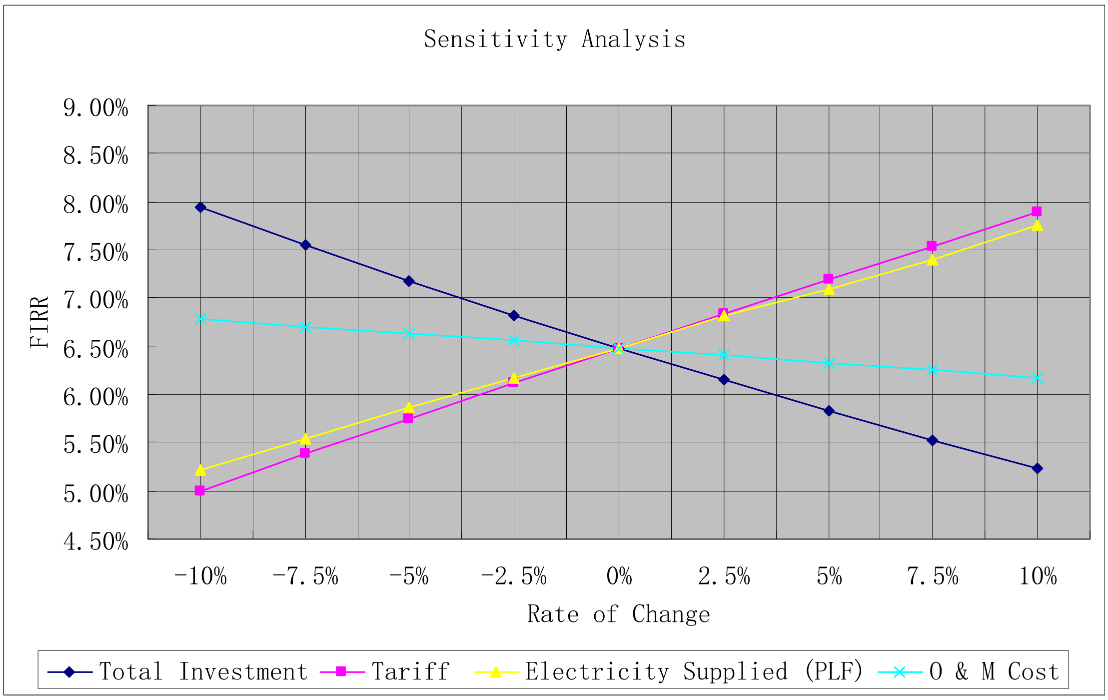

Figure2: Sensitivity Analysis of the Proposed Project

The change of total investment is an important factor affecting the financial attractiveness of the proposed project. In the case that the investment decreases by 10.35%, the Project IRR of the proposed project begins to exceed the benchmark, the conclusion of financial additionality begins to be in question. Considering the majority of total investment is used for purchasing wind turbines whose expenditure have been fixed under the equipment purchasing agreement[7]. The rest of the static investment, due to the increasing trend of construction material costs[8][9], is also unrealistic to be lowered down. Therefore, it is very unlikely for the static investment have a reduction of 10.35% on the value from the FSR.

[7] Equipment Purchasing Agreement of the project

[8] http://www.china.com.cn/chinese/EC-c/1246238.htm

[9] http://www.ca800.com/news/html/2007-6-27/n66164.html

The tariff is an important factor affecting the financial attractiveness of the proposed project. In the case that the tariff increases by 10.8%, the Project IRR of the proposed project begins to exceed the benchmark. On 23 July 2008, the guided tariff was issued by the National Development and Reform Commission before its implementation[10]. In China, the guided tariff is commonly implemented by the project owner and the grid company. In China, the guided tariff is commonly implemented by the project owner and the grid company. it is impossible that the tariff would increase by 10.8% higher than the tariff in the FSR.

According to the feasibility study report of the proposed project, the annual output is estimated basing on the long term (from 1985 to 2007) weather statistic data provided by local meteorological station and 1-year wind resources measurement, which at first using professional software WAsP to select the rich wind source area, then using software Wind Farmer to optimize the location of each turbine for maximizing power generation. The estimated annual output in FSR is a credible value, for it has been taken the average wind data over past 22 years into account. Therefore, the annual output in FSR is an average value. It is unreasonable to have an increase of 12.3% on this average value throughout the lifetime of the Project.

The impact of the annual O&M cost is the slightest, the project IRR of the proposed project begins to exceed the benchmark when the annual O&M cost decreases by 52%. However, according to the Feasibility Study Report of the proposed project, the detailed operation costs is composed of annual salaries and welfarism for the employees, maintenance costs and insurance premium of fixed assets, material costs and Miscellaneous account. The majority of the annual O&M cost is employee salaries, which are gradually increasing in China, leading to gradual increase in annual O&M cost[11]. Therefore, it is impossible that the annual O&M cost could decrease 52%, so the proposed project is always lack of financial attractiveness within the reasonable range of annual O&M cost.

Step 3. Barrier analysis.

Step 4. Common practice analysis

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

According to the definitions of other activities similar to the proposed project in "Tool for the Demonstration and Assessment of Additionality(version 05.2)", the similar projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.

In China, most of wind power projects are regulated by the provincial government. Investment climate, tariff, land policy, regulations etc. are usually similar for wind power projects in the same province. The location of the proposed project belongs to Heilongjiang province. Heilongjiang province is selected as the geographical scope for the common

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[10] http://www.sdpc.gov.cn/zfdj/jggg/dian/t20080813_230724.htm

[11] http://www.china.com.cn/chinese/EC-c/1246238.htm

http://www.chinadaily.com.cn/hqcj/2007-09/03/content_6075777.htm

practice analysis of the project.

The activities should be implemented after 2002. The wider power sector reforms happened in China after 2002 leaded to diversification in the ownership of generation capacity.[12] As a result, new generation, including wind power, was expected to compete under more commercial conditions.

Since 2002, all the similar wind projects (neither registered as CDM nor applying for CDM) in Heilongjiang province are listed in the following table.

Table3 all the similar projects in Heilongjiang province

project	Installed capacity(MW)	Status	Is it applying for CDM?
Huafu Mulan Wind Farm project	12	Operational (2003.12)	No. Demonstration Project
Huafu Fujin Wind Farm	24.3	Operational (2004.9)	No. Demonstration Project

Data source: Shi Pengfei (Deputy Director, Chinese Wind Energy Association), Statistics on China Wind Farm Cumulative Installed Capacity in 2005, 2006 and 2007[13]

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

Two identified projects listed above are demonstration projects, which were funded by international low interest loan[14] [15]. The proposed project does not enjoy these favourable policies, and takes place in a different environment with respect to regulatory framework, investment climate, access to financing.
To conclude, there are essential distinctions between the proposed project and existing similar projects.
The existence of the project mentioned above does not contradict the claim that the proposed project activity is financially unattractive.
In conclusion, the proposed project activity meets all criteria of “Tool for the demonstration and assessment of additionality”. The proposed project is additional.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

The proposed project is the installation of a new grid-connected renewable power plant, and the

[12] http://www.chinanews.com.cn/2002-12-30/26/258825.html

[13] Statistics on China Wind Farm Cumulative Installed Capacity in 2005, 2006 and 2007 (The evidences are available for DOE validation)

[14] http://www.sxcoal.com/news/2008/11/29/227059/Article.html

[15] http://www.chinapower.com.cn/newsarticle/1005/new1005504.asp

baseline scenario is the following:

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

Baseline emissions

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:

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

Where:
BE_y = Baseline emissions in year y (tCO2/yr).
EG_y = Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.
$EF_{grid,CM,y}$ = Combined margin CO2 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” (version 1.1).

The methodological tool “Tool to calculate the emission factor for an electricity system” (version 01) determines the CO2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the “operating margin” (OM) and “build margin” (BM) as well as the “combined margin” (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity.

The methodological tool “Tool to calculate the emission factor for an electricity system” (version 01) provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,BM,y}$	tCO2/MWh	Build margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,OM,y}$	tCO2/MWh	Operating margin CO_2 emission factor for grid connected power generation in year y

The following six steps are applied to calculate the emission factor for an electricity system:

STEP 1: Identify the relevant electric power system.
STEP 2: Select an operating margin (OM) method.

STEP 3: Calculate the operating margin emission factor according to the selected method.
STEP 4: Identify the cohort of power units to be included in the build margin (BM).
STEP 5: Calculate the build margin emission factor.
STEP 6: Calculate the combined margin (CM) emissions factor.

Step1: Identify the relevant electric power system.

Using the boundary definitions of the Chinese DNA[16], the spatial extent of the project boundary includes Heilongjiang Dabaishan Wind Power Project and all power plants connected physically to the Northeast Power Grid that the CDM project power plant is connected to. Northeast Power Grid is defined as the **project electricity system**, which consists of independent province-level electricity systems including Liaoning, Jilin and Heilongjiang province that can be dispatched without significant transmission constraints. The **connected electricity system** is North China Power Grid, which is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

Electricity transfers from connected electricity systems to the project electricity system are defined as **electricity imports** and electricity transfers to connected electricity systems are defined as **electricity exports**.

Since the Northeast Power Grid has the electricity exports to the North China Power Grid, the spatial extent is limited to the project electricity system (Northeast Power Grid).

Step2: Select an operating margin (OM) method

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

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

The simple OM method (option a) can only be used if low-cost/must-run resources[17] 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.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

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

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

For the dispatch data analysis OM, use the year in which the project activity displaces grid electricity and update the emission factor annually during monitoring.

The data vintage chosen should be documented in the CDM-PDD and not be changed during the crediting periods.

Power plants registered as CDM project activities should be included in the sample group that is used to calculate the operating margin if the criteria for including the power source in the sample group apply.

The justifications of the choice of method to calculate OM emission factor are as follows.

Method (c): The dispatch data analysis OM emission factor is determined based on the power units that are actually dispatched at the margin during each hour h where the project is displacing electricity. This method requires the dispatch order of each power plant and the dispatched electricity generation of all the power plants in the power grid during each hour. Since the dispatch data, power plants operation data are considered as confidential materials and only for internal usage and are not available publicly. Thus, method (c) is not applicable for the proposed project.

Method (b): Method (b) requires the annual load duration curve of the power grid and the load data of every hour data during the whole year on the basis of the time order. As mentioned above, the dispatch data and detailed load curve data are not available publicly. Therefore, method (b) is not applicable for the proposed project as well.

In terms of Method (d) and Method (a): The average OM emission factor (option d) is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) above for the simple OM, but including in all equations also low-cost/must-run power plants. The simple OM method (option a) can only be used if low-cost/must-run 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. Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants. Considering the low-cost/ must run resources only constitute 5.44%, 4.72%, 6.45% ,7.98% and 5.25%of total generation of Northeast Power Grid from the year 2002 to 2006, respectively (China Electric Power Yearbooks 2003-2007). Therefore, method

(a) is chosen to calculate OM emission factor for the proposed project.

In conclusion, the Ex ante option of the data vintages is chosen to calculate the emission factor of the Northeast Power Grid by using the simple OM method (option a) for the proposed project.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

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

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

For the proposed project, the data on fuel consumption, net electricity generation and the average efficiency of each power unit are unavailable, thus option A and option B cannot be used. Nevertheless, the data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system are available, and, nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known, therefore, Option C can be used.

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

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad (2)$$

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 generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year y
y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

For this approach (simple OM) to calculate the operating margin, 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 including electricity imports to the grid[18]. Electricity imports should be treated as one power plant source.

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. The Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2007. Emission factors ($EF_{CO2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

As chosen in step 2, the simple OM emission factor is calculated by using Ex-ante option of data vintages, i.e. 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.

The data of installed capacity, electricity generation and fuel consumptions are all from China Energy Statistical Yearbooks 2005-2007 and China Electric Power Yearbooks 2005-2007.

Given the above, the simple operating margin CO2 emission factor ($EF_{grid,OMsimple,y}$) of Northeast Power Grid is **1.256099tCO2/MWh.** The detailed calculations and data are listed in the annex 3 (The baseline emission factor OM is same as that provided by Chinese DNA, the website is http://cdm.ccchina.gov.cn/web/index.asp).

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

[18] An import from a connected electricity system should be considered as one power source.

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

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

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[19].

The set of power units that comprises the larger annual generation should be used.

A power unit is considered to have been built at the date when it started to supply electricity to the grid.

Power plant registered as CDM project activities should be excluded from the sample group m. However, if group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power unit(s) that is (are) built more than 10 years ago then:

(i) Exclude power unit(s) that is (are) built more than 10 years ago from the group; and

(ii) Include grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

In terms of vintage of data, one of the following two options can be chosen:

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

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

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

For the proposed project, option 1 is chosen to calculate Build Margin emission factor.

Step 5: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor ($tCO2/MWh$) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

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

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

No matter which options for calculating BM factor mentioned in step 4 was adopted for the proposed project; the same issue on data availability must be addressed. Currently, it is very difficulty to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity generated and delivered to the grid and fuel consumption data in power unit m are regarded as commercial secrets or only for internal usage. Then the following deviation was adopted to calculate the Build Margin emission factor.

1. The breakdown data by power plants are not while the aggregate data by different types of fuels are available. Considering this situation, the m sample group will consist of capacity addition by power sources with same fuel instead of by power plants. For the proposed project the m sample group will consist of fossil fuel fired capacity addition, hydropower capacity addition and other capacity addition;
2. Assuming that all the power plants with same fuel type have equal annual operation hours, the starting year t_0 could be identified which fulfil the following constraint:

$$\sum_i CAP_{i,t-t_0} \geq 20\% \times \sum_i CAP_{i,t} \qquad (4)$$

Where,
t is the recent year of which the latest data is available;
$CAP_{i,t-t0}$ is the capacity addition of type i from year t_0 to year t;
$CAP_{i,t}$ is the installed capacity of type i in year t;

The capacity addition belonging to m sample group thus could be identified. For the proposed project, the most recent year of which data is available is 2006, while t_0=2000, the total capacity addition during 2000 to 2006 consisting of 7283.5MW of fossil fuel fired capacity,526MW of hydropower capacity and 0MW of nuclear power capacity, and 508.1MW of other capacity[20].

3. To be conservative, zero emission factors were selected for hydropower capacity and other capacity. Moreover, since specific data on coal fired capacity, oil fired capacity, and gas fired capacity could not be separated from current statistical data on fossil fuel fired capacity, the following approach was adopted for calculating the emission factor of fossil fuel fired capacity addition:

(1) With the energy balance sheet in China Energy Statistical Yearbook for the most recent year, calculating the respective percentages of CO2 emissions from coal fired power generation, oil fired power generation, and gas fired power generation against total CO2 emissions from fossil fuel fired power generation:

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}} \qquad (5)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}} \qquad (6)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}} \qquad (7)$$

Where:

$F_{i,j,y}$ = The amount of fuel i (in a mass or volume unit) consumed by province j in year y;

$COEF_{i,j,y}$ = the CO_2 emission coefficient of fuel i (tCO_2/ mass or volume unit of the fuel), taking into account the carbon content of the fuels consumed by province j and the percent oxidation of the fuel in year(s) y,

$$COEF_{i,j,y} = NCV_i \times EF_{CO2,i,j,y} \qquad (7)$$

Where:

NCV_i =Net calorific value (energy content) of fossil fuel type i (GJ/ mass or volume unit）;

[20] China Electric Power Yearbook 2005-2007

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

$COAL, OIL, and\ GAS$ = The aggregation of various kinds of coal, oil, and gas as fossil fuels.

(2) Calculating the corresponding emission factor for fossil fuel fired power generation:

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

Where:

$EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$ and $EF_{Gas,Adv,y}$ are the emission factors for the best commercially available technology of coal fired power generation, oil fired power generation, and gas fired power generation, respectively (See Annex 3 for detailed calculation).

4. Using the share of different type of capacity in total capacity addition as weight, the weighted average of emission factors of different type capacity is calculated as the Build Margin emission factor $EF_{grid,BM,y}$ of Northeast Power Grid (See Annex 3 for detailed calculation):

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

Where:

CAP_{Total} = The total capacity addition

$CAP_{Thermal}$ =The fossil fuel fired capacity addition

Following the four steps above, the build margin emission factor $EF_{grid,BM,y}$ of the Northeast Power Grid is calculated to be **0.7946tCO2/MWh.** The detailed calculations and data are listed in the annex 3 (The build margin emission factor BM is same as that provided by Chinese DNA, the website is http://cdm.ccchina.gov.cn/web/index.asp).

Step 6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

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

Where:

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

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

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

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

Wind project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non dispatchable nature) for the first crediting period and for subsequent crediting periods.

The default weights are adopted for the proposed project, the baseline emission factor is:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} = \mathbf{1.1407\ tCO2/MWh}$$

Project emissions

For wind power project activities, $PE_y = 0$

Leakage

For wind power project activities, $LE_y = 0$

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad (12)$$

Where:

ER_y = Emission reductions in year y (t CO2e/yr).

BE_y = Baseline emissions in year y (t CO2e/yr).

PE_y = Project emissions in year y (t CO2/yr).

LE_y = Leakage emissions in year y (t CO2/yr).

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

Data / Parameter:	$FC_{i,y}$, $F_{i,j,y}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type i (in a mass or volume unit) consumed by power plant/unit (or in the project electricity system in case of $FC_{i,y}$) in year y, or the amount of fuel type i (in a mass or volume unit) consumed by province j
Source of data used:	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 :	Official statistical data
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$NCV_{i,y}$
Data unit:	kJ/kg or kJ/m3
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	China Energy Statistical Yearbook 2007
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of fossil fuel type i in year y
Source of data used:	2006 IPCC default values
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$\eta_{coal,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for coal fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	37.28
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value
Any comment:	Applied for calculating BM

Data / Parameter:	$\eta_{oil,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for oil fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	48.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value

Any comment:	Applied for calculating BM

Data / Parameter:	$\eta_{gas,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for gas fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	48.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value
Any comment:	Applied for calculating BM

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO2/MWh
Description:	Combined margin CO2 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”
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	1.1407(Chinese DNA)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the “Tool to calculate the emission factor for an electricity system” (version01.1)
Any comment:	

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

According to the calculation results in B6.1, the emission reductions of the proposed project are calculated as follows:

Baseline emissions

Operating Margin emission factor（$EF_{OM,y}$）（tCO_2/MWh）：1.256099

Build Margin emission factor（$EF_{BM,y}$） （tCO_2/MWh）：0.7946

Baseline Emission factor（EF_y） （tCO_2/MWh）：1.1407

Project emissions

According to the baseline methodology ACM0002, the GHG emission of the proposed project within the project boundary is zero, i.e.

$$PE_y = 0$$

Leakage

According to the baseline methodology ACM0002, the leakage of the proposed project is not considered,

$$L_y = 0$$

Project Emission Reductions

The emission reduction (*ERy)* by the project activity during a given year y is the difference between baseline emissions (*BEy*), project emissions (*PEy*) and emissions due to leakage (*Ly*), as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where: according to the baseline methodology ACM0002, PE_y=0 and L_y=0. Therefore, the annual emission reductions of the project during the first crediting period are estimated to be:

$$ER_y = BE_y = EG_y \times EF_y$$

Annual generation (net of auxiliary power i.e. the on site electricity usage for the operation of the hydro station) is estimated as 112,600MWh. Using the approach above, the annual emission reductions are estimated to be 128,442tCO2 .the proposed project activity is expected to achieve 899,094 tCO2 of net emission reductions during the first 7-year crediting period. (details in Annex3).

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

Summary of the ex ante estimation of emission reductions are listed below.

Year	*Estimation of project activity emissions (tons of CO2e)*	*Estimation of baseline emissions (tons of CO_2e)*	*Estimation of leakage (tons of CO_2e)*	*Estimation of overall emission reductions (tons of CO_2e)*
01/11/2009-31/10/2010	***0***	***128,442***	***0***	***128,442***
01/11/2010-31/10/2011	***0***	***128,442***	***0***	***128,442***
01/11/2011-31/10/2012	***0***	***128,442***	***0***	***128,442***
01/11/2012-31/10/2013	***0***	***128,442***	***0***	***128,442***
01/11/2013-31/10/2014	***0***	***128,442***	***0***	***128,442***
01/11/2014-31/10/2015	***0***	***128,442***	***0***	***128,442***
01/11/2015-31/10/2016	***0***	***128,442***	***0***	***128,442***
Total (tons of CO_2e)	***0***	***899,094***	***0***	***899,094***

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

B.7.1. Data and parameters monitored:

Data / Parameter:	$\mathbf{EG_y}$

Data unit:	MWh
Description:	The net quantity of power electricity supplied to NEPG in year y
Source of data to be used:	Calculated from the onsite meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	112,600
Description of measurement methods and procedures to be applied:	Continuously measurement and monthly recording
QA/QC procedures to be applied:	All the meters are the multifunctional electricity meters (accuracy degree is no less than 0.5S, bidirectional). All the meters will be calibrated as per China electric industry regulation DL/T448-2000. The electricity supplied by the project activity to the grid should be double checked by sales receipts.
Any comment:	

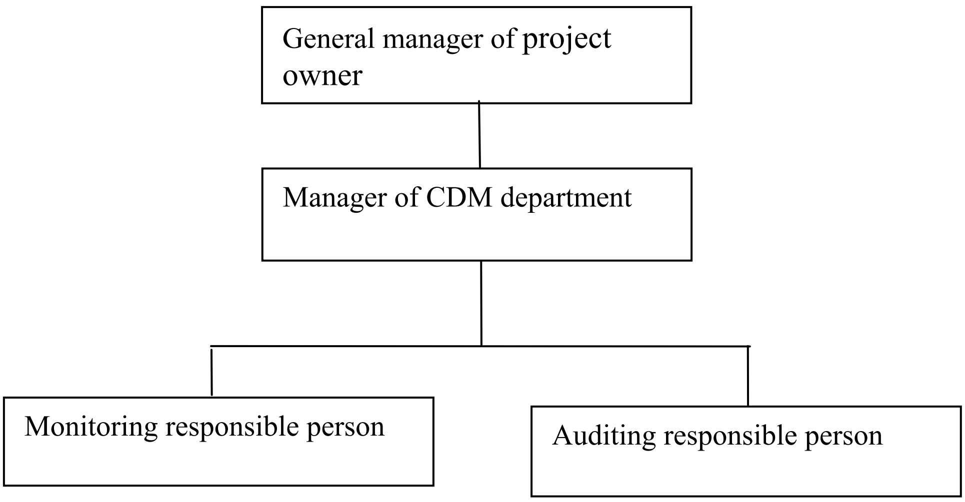
B.7.2. Description of the monitoring plan:

1. Introduction

The project adopts the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources" (Version 08) to determine the emission reductions from the net electricity generation from the wind farm. This plan describes the process in more detail.

2. Responsibility

Yichun Longyuan Hero Asia Wind Power Co., Ltd is overall responsible for monitoring and carrying out this monitoring plan. The management structure is illustrated as follows:



Title	Responsibility
general manager of project owner	Appoint persons according to the management structure chart
manager of CDM department	1. Cooperate with the DOE and the consultancy company to complete validation and verification; 2. Collect the project completion report, power purchase agreement, calibration organization qualification and meter calibration report; 3. Communicate and coordinate with the meter calibration organization when the meter is out of order 4. Organize the training of the relative persons.
Auditing responsible person	1. Collect the copy of Sales Receipts for each month; 2. Check the records provided by the grid monthly with the records from the wind farm. If any data errors are detected, inform the monitoring responsible person and correct the data immediately.
Monitoring responsible person	1. Carry out operational rules and regulations made for the wind farm; 2. Organize and dispatch workers 3. Ensure the equipment run normally. Report the abnormal to the CDM manager. 4. Input the daily reading of the meter in the wind farm into Excel spreadsheet. Be responsible for the monthly electricity statistics. And send the result to the auditing responsible person. 5. Record the readings of the meters 6. Check the records with the readings recorded by the wind turbine system. If any data errors are detected, correct the data immediately.

3. Training

The monitoring staff should be trained by professional CDM consulting company before the registration. Daily training will be arranged according to the requirements by operation and management in different phase of wind farm construction. During construction period, engineering management training should be planned. The workers should be trained by the wind turbine manufacturer. Before the project putting into operation, the workers should be trained on dispatching knowledge by the local grid company.

4. Calibration

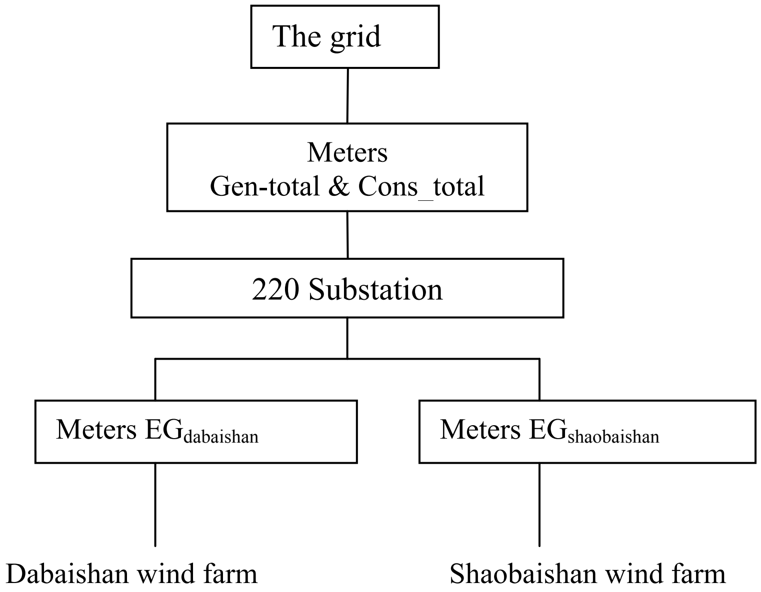
The monitoring meters should be tested before installation by a qualified third party. During the operation period, the metering equipments are calibrated once a year by a qualified third party for accuracy according to the requirements from Technical Administrative code of Electric Energy Metering (DL/T448－2000). The 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.

5. Monitoring system

All the meters are the multifunctional electricity meters (accuracy degree is no less than 0.5S, bidirectional). Heilongjiang Shaobaishan Wind Power Project and Heilongjiang Dabaishan Wind Power Project are owned by the same project owner. The two wind farms are sharing one power line. Total net electricity delivered to the grid by the two wind farms can be measured by one shared meter. This shared meter has bidirectional metering, recording both export to the grid (Gen_total) and import from the grid (Cons_total); net electricity supply (EG_{total}), therefore, is calculated as exports minus imports.

Separate meters are installed at each of the project sites, which can also record bidirectional metering, and can be used as back-up for the main meter. The project-wise metering equipment at the project site are owned, operated and maintained by Yichun Longyuan Hero Asia Wind Power Co., Ltd.

A metering diagram is presented below, giving an overview of these meters.



The net electricity delivered to the grid from each of wind farms can be calculated by the readings of the shared meter and the project-wise meters at the substation. The project-wise metering equipment are used to calculate the share of each of the projects of the net supply to the grid. The project activity's share in exports to the grid and imports from the grid is not separately calculated, as only net supply is required for the emission reduction calculations.

The grid company provides the electricity amount to the project owner monthly and the project owner checks the results against the readings from the project-wise meters.

According to the method determining the electricity imported and exported by the two projects between the project owner and the grid company, readings of the shared meter and the project-wise meters are used to calculate the share of net electricity delivered to the grid by each project. The calculation formula shows as follows:

$EG_y = EG_{total} * EG_{dabaishan} / (EG_{dabaishan} + EG_{shaobaishan}) - E_{10kv}$
Where:
EG_y is the calculated net electricity supplied from the project activity;
EG_{total} is the total net electricity supplied to the grid, i.e. exports minus imports, this data is provided by the grid company and used in the sales receipts, and it is checked by the meter reading from the substation (which is for the two wind farms combined);
$EG_{shaobaishan}$ is the electricity generation metered by the onsite meters of Heilongjiang Shaobaishan Wind Power Project;

$EG_{dabaishan}$ is the electricity generation metered by the onsite meters of Heilongjiang Dabaishan Wind Power Project;
E_{10kv} is the electricity consumption through the 10kV back-up power line by the project activity, which is also confirmed by the grid company. Jinshan substation is the local dispatching centre of NEPG.

6. Monitoring data

According to the meters system mentioned above, the net electricity supplied by the proposed project activity is calculated based on the recording measured by the meters. The recording frequency will be continuously measured and monthly recorded.

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1.EG_y	Net Electricity supplied to the grid by the project	calculated from the on-site monitoring meters	MWh	*m*	continuously measured and monthly recorded	100%	Electronic and paper	During the crediting period and two years after	Rechecked by sales receipts

The meter reading will be readily available for DOE. Calibration records will be maintained for verification.

Overall responsibility for monitoring greenhouse gas emissions reductions will rest with the CDM monitoring staff of the proposed project. Monitoring responsible person will record the readings of the meters and check the recorded data with the data from the wind turbine system. Auditing responsible person will check the records with Electricity transaction Receipts issued by the grid company. If any data errors are detected, the monitoring responsible person should be informed and the data should be corrected immediately. All paper-based information will be stored by auditing responsible person of Yichun Longyuan Hero Asia Wind Power Co.,Ltd and the electronic copy will be kept by manager of CDM department and auditing responsible person. And all data including calibration records are kept until 2 years after the end of the total crediting period of the CDM project.

The table below outlines the key documents relevant to monitoring and verification of the emission reductions from the proposed project.

Table9 List of the key documents relevant to monitoring and verification

ID No.	Document Title	Main Content	Source
F-1	PDD, including the electronic spreadsheets and supporting documentation(assumptions, estimations, measurement, etc)	Calculation procedure of emission reduction and monitoring items	Proposed project owner or UNFCC website
F-2	Report on monitoring and checking of electricity supplied to the grid	Record based on monthly meter reading and electricity sale receipts	Proposed project owner
F-3	Report on maintenance and calibration of metering equipment	Reasons for maintenance and calibration and the precision after maintenance and calibration	Proposed project owner
F-4	the project management record (including date collection and management system)	Comprehensively and truly reflect the management and the operation of the proposed project	Proposed project owner

7. Error disposal

● If any errors are detected, the project owner owning the meter should organize repairing, recalibration or replacement the meter, and all these activities should be done in the presence of the representative of the local grid company.

● Should reading of any meters be inaccurate by more than the allowable error, or otherwise functioned improperly, the electricity supplied to the grid by the proposed project shall be determined by:

a) First, by reading the self-carried meters of wind turbines should be accepted, unless a test by either party reveals they are inaccurate;

b) if the self-carried meters of wind turbines are not with acceptable limits of accuracy or are otherwise performing improperly, the project owner and the local grid shall jointly prepare an estimate of the correct reading; and

c) If the project owner and the local grid fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to No. 19 in the Relevant Regulation on Renewable Energy made by NDRC.[21]

8. Quality assurance and Quality control

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity. This is an on-going process that will be ensured through the CDM in terms of the need for verification of the emissions.

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)

[21] http://www.cwea.org.cn/upload/可再生能源发电有关管理规定.pdf page 4

The date of completion of the baseline study and monitoring methodology is 20 June 2009.

Name of the responsible person/entity:

Feng Tianfeng, Longyuan(Beijing) carbon asset management technology Co.,ltd.
Address: Part C Floor 7, International Investment Building, No.6-9 Fuchengmen North Street, Xicheng District, Beijing 100034
Telephone: +8610-66091327
Email: tffeng@163.com

(Not the project participants listed in Annex 1)

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:

10/06/2008 (Construction Starting Date)

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

20 years 0 month

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

C.2.1. Renewable crediting period

Renewable crediting period is chosen

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

01/11/2009 or the date of registration whichever is later.

C.2.1.2. Length of the first crediting period:

7 years 0 month

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

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

The Environmental Impact Assessment Report was approved in August 22th, 2007 by the Heilongjiang Environmental Protection Bureau.

The analysis of environmental impacts in construction phase and operation phase for the proposed project are as following:

Air

The major air pollution sources in construction phase are dust generated from constructing building foundations, tower foundations, exhaust gas from vehicles and other emissions from ordinary workers' activities. Although the construction area is dispersed, the pollution sources are intermittent, mobile and small in intensity, several measures will still be taken in order to control and reduce the air pollution. Construction management should be tightened up and construction at strong windy days should be forbidden; Water should be sprinkled on the mounds of soil exposed in the air to prevent the dust blowing. The soil dug from groundwork should be transported without delay. The velocity of vehicles should be restricted and no overloading of the vehicles should be permitted to avoid any material falling down along the way. The impact on the air quality caused by dust from use and movement of construction equipment during the construction period will be eliminated after completing the construction.

There are no air pollution sources in operation phase for the proposed project.

Water

The major wastewater emissions are mainly from domestic sewage. The domestic sewage both in construction phase and operation phase will be treated in a septic tank in the project site. The treated water can be discharged or recycled for watering the vegetation in project district.

Solid Waste

The main solid waste generated by the proposed project will be the construction waste and domestic waste. The construction waste will be use for backfilling tower and road foundations. The domestic wastes will, after collection, be transported to the designated waste disposal sites for centralized disposal. It is estimated that no adverse impact will be caused by the solid waste on the surrounding environment.

Noise

Noise will be generated by vehicles and machine equipment during construction. Measures will be taken to reduce the environmental impacts of noise to the maximum extent: choosing low-noise machines and vehicles, strengthening the maintenance of equipment, and enhancing construction management. Wind turbine units will produce noise of about 95-100dB(A) in operation phase, Noise attenuation calculation

shows that at a distance of 250m from the sound source, noise decreases to 45dB(A), which satisfies well the Class 1 requirement of Standard of Environmental Noise of Industrial Enterprises (GB 12348-90). In addition, there are no residents within 500 meters around the wind farm, and the background noise in the proposed plant site is high. So, the noise of the project will have no impact on nearby residents. For the operation members on the wind farm, some noise partition measures will be taken to reduce the noise impacts.

Birds and endangered species

The operation of the project may have a certain degree of influence on the migratory birds, so the attention on the flight route of migratory birds should be taken, and the operation of the wind turbines should be stopped when it is necessary in order to avoid the influence on the migratory birds.

There are no endangered species in the project region.

The proposed project activity has no significant negative influence on birds and endangered species.

Ecological aspects

The implementation of the proposed project will occupy some land and spoil some of the vegetation which will cause the soil erosion and have negative influence on ecological environment. A series of soil and water conservation measures will be taken to control this influence: ensuring the right placement of the machinery and other facilities, big machinery are used as little as possible during the construction period, the vehicles can only go along exclusive ways, the surface soil will be preserved for backfilling during cable burying, green belt development will be undertaken all-round the project site, the temporary requisitioned land will be restored after the completion of construction by taking corresponding vegetation restoration measures, therefore, the construction of the project will put little impact on variety of local vegetation.

In conclusion, being as a typical type of clean renewable energy, the proposed project has no significant impacts on local environment and will greatly contribute to achievement of sustainable development objective and promote local environmental 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:

>>

Not applicable, since, no negative environmental impacts are anticipated due to the project activity.

SECTION E. Stakeholders' comments

>>

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

The comments on the project activity by the local stakeholders have been invited and complied in two ways:

1) Symposium

On 6 Dec. 2007, under the support of the local government, the project participants successfully held a stakeholder symposium in Yichun City. Stakeholder representatives participated the symposium, respectively from the local Environmental Protection Bureau, Local Development and Reform Commission, local Electricity Supply Company and several villages influenced by and around the proposed project. The project participants informed them about the project, asked for their comments on the project concerning socio-economic and environmental aspects, namely as follows,

1) Impact on the economic aspect, including the local economy, income and employment, etc;
2) Impact on the environmental aspect, including the ecological environment, air, noise and the impact of soil erosion, etc;
3) Impact on sustainable development;
4) Suggestions and recommendations on the proposed project;
5) Attitude to the implementation of the proposed project, whether or not to support.

2) Questionnaire

The project participants have also carried out a public survey on the project in the format of questionnaires from Dec. 2007 to Feb. 2008. To make sure the results more representative, all these informants came from nearby areas and covered different ages and occupations. The questionnaire was designed as following table.

Your sex: ☐Male ☐Female
Your age: ☐30 and below ☐30-40 ☐40-50 ☐50 and above
Your educational level: ☐Junior middle school and below ☐High school ☐College and above
What type of organization you work for? ☐Government ☐Enterprise ☐Agriculture ☐Others
Do you know CDM before? ☐Yes ☐No
To which extent you know the proposed project? ☐Know ☐Not know
The distance from your residence or working unit to the project site: ☐100m below ☐100-500m ☐500-1000m ☐1000m and above
Do you satisfied with the local environment? ☐Yes ☐No
What positive impacts on local region are there for the construction of the proposed project? ☐Economy ☐Environment ☐Social ☐Others

Do you think whether the proposed project will generally help develop local economy and create new job opportunity? ☐Yes ☐No
Do you think whether it's beneficial to local residents' income consequently? ☐Yes ☐No
What special environmental issues should be considered in the construction of the proposed project? ☐Ecological environment ☐Waste water ☐Waste air ☐Noise ☐Solid waste ☐Soil erosion
To which extent the proposed project will result in nature environmental pollution? ☐Nothing ☐Nearly nothing ☐Slightly ☐Seriously
To which extent the proposed project has negative impact on visual environment, animals and plants? ☐Nothing ☐Nearly nothing ☐Slightly ☐Seriously
To which extent the proposed project has negative impact on soil erosion? ☐Nothing ☐Nearly nothing ☐Slightly ☐Seriously
Do you think whether the proposed project will help to develop local tourism? ☐Yes ☐No
Do you satisfied with the method and amount of compensation for the occupied land? ☐Yes ☐No
Do you think whether the proposed project will contribute to the mitigation of the GHG emissions? ☐Yes ☐No
Do you support the proposed project? ☐Yes ☐No
Your other comments:
Your signature: Date:

E.2. Summary of the comments received:

1) Summary of the comments received in the symposium:

- The proposed project has been approved by the Development and Reform Commission and Environmental Protection Bureau of Heilongjiang Province, which shows that the construction and operation of the proposed project will have little impacts on the local environment.

- All the stakeholder representatives believe that the proposed project will achieve CO_2 emission reduction by replacing electricity generated by fossil fuel fired power plants connected into Northeast Power Grid, and the proposed project will contribute to the mitigation of the GHG emissions.

- All the stakeholder representatives believe that the proposed project will have positive impacts on economy, environment and social in local region.

- The local government highly supports the proposed project, and expects the increase of local financial incoming, which can provide more public health services and rebuild schools, etc.

- All stakeholders think that the proposed project will improve the life quality of local residents, such as, providing more employment opportunities for local residents, increasing incomes of the local residents, increasing revenues from tourism with the wind farm as a beautiful landscape, accelerate the development of local service industry, and tourism.

- All stakeholders think that the proposed project activity has no significant negative influence on local environment.

- All the stakeholder representatives support and welcome the proposed project.

2) Public survey results:

Totally 30 questionnaires returned out of 30 with a 100% response rate. Of the 30 respondents, 21 persons are male and 9 persons are female; 10 persons are younger than 30, 20 persons are older than 30; 3 persons are of primary school, 15 persons are of high school, 12 persons are of college and above.

Summary views on the questionnaires:

- 60% of the informants have not known CDM.
- 40% of the informants have known the proposed project.
- 100% of the informants live or work far away from the proposed project.
- 100% of the informants are satisfied with the local environment.
- 100% of the informants believe that the proposed project will have positive impacts on economy, environment and social in local region.
- 100% of the informants believe that the implementation of the proposed project will improve the life quality of local residents, by providing more employment opportunities for local residents, increasing incomes of the local residents, etc.
- 10% of the informants think that the project participants should pay attention to the problem of soil erosion, and other 16% of the informants think that the project participants should pay attention to ecological problems in the implementation of the proposed project. In this regard, the project participants will be in strict accordance with the environmental impact assessment and take environmental protection measures to ease the impact of the environment.
- 100% of the informants believe that the proposed project has no significant impacts on local environment and will contribute to achievement of sustainable development objective.
- 100% of the informants believe that the proposed project will help to develop local tourism.
- 100% of the informants are satisfied with the method and amount of compensation for the occupied land.
- 100% of the informants believe that the proposed project will contribute to the mitigation of the GHG emissions.
- 100% of the informants support and welcome the proposed project, no negative comments were received.

In conclusion, being as a typical type of clean renewable energy, the proposed project has no significant impacts on local environment and will greatly contribute to achievement of sustainable development objective, thus all the stakeholder representatives give no negative comments and support and welcome the proposed project.

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

Since there is no negative comment received, it's no need to make adjustment on design, construction and operation of the project. However, to reduce the impacts on the local environment produced from the construction of the project, the project stakeholders should guarantee and suitably add the investment of environmental protection. At the same time, the construction processes should be strictly implemented according to the national environment criterions.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project activity.

Annex 3

BASELINE INFORMATION

1. OM emission factor calculation of NEPG (Northeast Power Grid)

Table A-1, A-2, and A-3 provide annual thermal power electricity generation in NEPG from 2004 to 2006. The main data sources come from China Electric Power Yearbook 2005, 2006 and 2007.

Table A- 1 Annual thermal power electricity generation in NEPG in 2004

Province	Electricity generation （MWh)	Self usage rate （%）	Electricity delivered to the grid （MWh)
Liaoning	84,543,000.0	7.21	78,447,450.0
Jilin	33,242,000.0	7.68	30,689,014.0
Heilongjiang	53,482,000.0	7.84	49,289,011.0
Total			**158,425,475.0**

Data source：China Electric Power Yearbook 2005.

Table A- 2 Annual thermal power electricity generation in NEPG in 2005

Province	Electricity generation （MWh)	Self usage rate （%）	Electricity delivered to the grid （MWh)
Liaoning	83,697,000.0	7.03	77,813,101.0
Jilin	35,294,000.0	6.59	32,968,125.0
Heilongjiang	58,000,000.0	7.96	53,383,200.0
Total			**164,164,426.0**

Data source：China Electric Power Yearbook 2006.

Table A- 3 Annual thermal power electricity generation in NEPG in 2006

Province	Electricity generation （MWh)	Self usage rate （%）	Electricity delivered to the grid （MWh)
Liaoning	96,282,000.0	6.62	89,908,132.0
Jilin	38,576,000.0	6.78	35,960,547.0
Heilongjiang	62,964,000.0	7.85	58,021,326.0
Total			**183,890,005**

Data source：China Electric Power Yearbook 2007.

The key parameters in OM and BM calculation include the net caloric values (NCV_s) and CO2 emission factor per unit of energy (EF_{CO2s}) of various types of fuels, which are shown in the table below:

Table A-4: NCV_s and EF_{CO2s} of various types of fuels

Fuel	NCV_s	EF_{CO2s} (tc/TJ)
Coal	20,908 kJ/kg	25.80
Washed coal	26,344 kJ/kg	25.80
Other Washed Coal[22]	8,363 kJ/kg	25.80
Coke	28,435 kJ/kg	29.20
Crude oil	41,816 kJ/kg	20.00
Gasoline	43,070 kJ/kg	18.90
Kerosene	43,070 kJ/kg	19.60
Diesel	42,652 kJ/kg	20.20
Fuel oil	41,816 kJ/kg	21.10
Other petroleum products[23]	38,369 kJ/kg	20.00
Other coked products	28,435 kJ/kg	25.80
Natural gas	38,931 kJ/m3	15.30
Coke oven gas[24]	16,726 kJ/m3	12.10
Other gas[25]	5,227 kJ/m3	12.10
LPG	50,179 kJ/kg	17.20
Refinery gas	46,055 kJ/kg	15.70

Data sources:
NCV_s are from China Energy Statistical Yearbook 2007, p287

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[22] Other washed coal includes middlings and slimes. The NCV value of middlings is adopted here, which is conservative because the NCV value of slimes is higher than that of middlings.

[23] The NCV value of other petroleum products are not provided in China Energy Statistical Yearbooks. This Annex calculates it as 38369 kJ/kg, i.e., 1.3108 tce/t, on the basis of Energy Balance Sheets (physical quantity) and conversion factor against SCE.

[24] The NCV value here adopts the lower limit of the NCV value range, i.e., 16726-17981 kJ/m^3, for coke oven gas provided in China Energy Statistical Yearbook 2007, P 287.

[25] The NCV value here adopts the lowest NCV value among those for gas by furnace, gas by heavy oil catalytic cracking, gas by heavy oil catalytic thermal cracking, gas by pressure gasification, and water coal gas, which are provided in China Energy Statistical Yearbook 2007, P 287.

EF_{CO2s} are from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, table 1-3.

Table A-5: The fuel consumption and total emissions of Northeast Power Grid in 2004

Fuel types	unit	Liaoning	Jilin	Heilongjiang	Sub-Total	EF_{co2}	Net caloric value	CO_2 emission（tCO_2e）
						（tc/TJ）	（MJ/t,km3）	G=D*E*F*44/12/100(quantity)
		A	B	C	D=A+B+C	E	F	G=D*E*F*44/12/10(volume)
Coal	10^4t	4,144.20	2,310.90	3,084.80	9,539.90	25.80	20,908.00	188,689,377.00
Washed coal	10^4t	84.75	1.09	4.88	90.72	25.80	26,344.00	2,260,872.00
Other Washed Coal	10^4t	577.67	14.26	61.00	652.93	25.80	8,363.00	5,165,589.00
Coke	10^4t				0.00	29.20	28,435.00	0.00
Coke oven gas	10^8M^3	4.83	2.91		7.74	12.10	16,726.00	574,367.00
Other gas	10^8M^3	57.33	4.19		61.52	12.10	5,227.00	1,426,677.00
Crude oil	10^4t				0.00	20.00	41,816.00	0.00
Gasoline	10^4t				0.00	18.90	43,070.00	0.00
Diesel	10^4t	2.04	1.16	0.24	3.44	20.20	42,652.00	108,673.00
Fuel oil	10^4t	12.81	1.78	2.86	17.45	21.10	41,816.00	564,536.00
LPG	10^4t	2.19			2.19	17.20	50,179.00	69,305.00
Refinery gas	10^4t	9.79		1.14	10.93	15.70	46,055.00	289,780.00
Natural gas	10^8M^3		0.03	2.53	2.56	15.30	38,931.00	559,111.00
Other oil product	10^4t				0.00	20.00	38,369.00	0.00
Other coked product	10^4t				0.00	25.80	28,435.00	0.00
Other energy	10^4t	26.97	5.07		32.04	0.00	0.00	0.00
Total								199,708,287.00

China Energy Statistical Yearbook 2005

Table A-6: The fuel consumption and total emissions of Northeast Power Grid in 2005

Fuel types	unit	Liaoning	Jilin	Heilongjiang	Sub-Total	EF_{co2}	Net caloric value	CO_2 emission（tCO_2e）
						（tc/TJ）	（MJ/t,km3）	G=D*E*F*44/12/100(quantity)
		A	B	C	D=A+B+C	E	F	G=D*E*F*44/12/10(volume)
Coal	10^4t	4,305.41	2,446.13	3,383.21	10,134.75	25.80	20,908.00	200,454,896.00
Washed coal	10^4t				0.00	25.80	26,344.00	0.00
Other Washed Coal	10^4t	524.74	19.26	24.16	568.16	25.80	8,363.00	4,494,940.00
Coke	10^4t				0.00	29.20	28,435.00	0.00
Coke oven gas	10^8M^3	1.03	3.57	0.68	5.28	12.10	16,726.00	391,817.00
Other gas	10^8M^3	12.62	8.37		20.99	12.10	5,227.00	486,768.00
Crude oil	10^4t	1.16			1.16	20.00	41,816.00	35,571.00
Gasoline	10^4t				0.00	18.90	43,070.00	0.00
Diesel	10^4t	1.18	1.48	0.57	3.23	20.20	42,652.00	102,039.00
Fuel oil	10^4t	9.32	2.46	1.55	13.33	21.10	41,816.00	431,247.00
LPG	10^4t	0.12			0.12	17.20	50,179.00	3,798.00
Refinery gas	10^4t	5.48		1.32	6.80	15.70	46,055.00	180,284.00
Natural gas	10^8M^3		0.84	2.24	3.08	15.30	38,931.00	672,681.00
Other oil product	10^4t				0.00	20.00	38,369.00	0.00
Other coked product	10^4t				0.00	25.80	28,435.00	0.00
Other energy	10^4t	16.18			16.18	0.00	0.00	0.00
Total								207,254,040.00

China Energy Statistical Yearbook 2006

Table A-7: The fuel consumption and total emissions of Northeast Power Grid in 2006

Fuel types	unit	Liaoning	Jilin	Heilongjiang	Sub-Total	EF_{co2}	Net caloric value	CO_2 emission（tCO_2e）
						（tc/TJ）	（MJ/t,km3）	G=D*E*F*44/12/100(quantity)
		A	B	C	D=A+B+C	E	F	G=D*E*F*44/12/10(volume)
Coal	10^4t	4,681.99	2,738.24	3,698.29	11,118.52	25.80	20,908.00	219,912,851.00
Washed coal	10^4t	0.03			0.30	25.80	26,344.00	748.00
Other Washed Coal	10^4t	674.74	17.83	96.00	788.57	25.80	8,363.00	6,238,691.00
Coke	10^4t	3.32			3.32	29.20	28,435.00	101,075.00
Coke oven gas	10^8M^3	2.68	0.16	1.44	4.28	12.10	16,726.00	317,609.00
Other gas	10^8M^3	55.26	1.43		56.69	12.10	5,227.00	1,314,667.00
Crude oil	10^4t	0.49			0.49	20.00	41,816.00	15,026.00
Gasoline	10^4t				0.00	18.90	43,070.00	0.00
Diesel	10^4t	0.75	0.39	0.30	1.44	20.20	42,652.00	45,491.00
Fuel oil	10^4t	11.73	0.45	1.44	13.62	21.10	41,816.00	440,629.00
LPG	10^4t				0.00	17.20	50,179.00	0.00
Refinery gas	10^4t	8.55		4.27	12.82	15.70	46,055.00	339,888.00
Natural gas	10^8M^3		0.19	2.10	2.29	15.30	38,931.00	500,143.00
Other oil product	10^4t				0.00	20.00	38,369.00	0.00
Other coked product	10^4t				0.00	25.80	28,435.00	0.00
Other energy	10^4t	12.16	17.60	82.77	112.53	0.00	0.00	0.00
Total								229,226,818.00

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Table A-8: OM factor of Northeast Power Grid

Years	Thermal generation delivered to NEPG (MWh)	The emissions from NEPG (tCO2)	OM (tCO2/MWh)
	A	**B**	**C=B/A**
2004	158,425,475.00	199,708,287.00	1.260582
2005	164,164,426.00	207,254,040.00	1.262478
2006	183,890,005.00	229,226,818.00	1.246543
Average OM	506,479,906.00	636,189,145.00	**1.256099**

2. BM emission factor calculation of NEPG.

Table A-9 Emission factor of the unit applying best commercially available technology

Technology	Electricity supply efficiency	EF_{co2} (tc/TJ)	Emission factor (tCO2/MWh)
	A	**B**	**C=3.6/A/1000*B*44/12**
Coal fired plant	37.28%	25.8	$EF_{Coal,Adv}$ =**0.9135**
Gas fired plant	48.81%	15.3	$EF_{Gas,Adv}$ =**0.4138**
Oil fired plant	48.81%	21.1	$EF_{Oil,Adv}$ =**0.5706**

Table A-10 Calculation of the respective percentages of CO2 emissions from coal fired power generation, oil fired power generation, and gas fired power generation against total CO2 emissions from fossil fuel fired power generation

Fuel types	unit	Liaoning	Jilin	Heilongjiang	Sub-Total	EF_{co2}	Net caloric value	CO_2 emission（tCO_2e）
						（tc/TJ）	（MJ/t,km3）	G=D*E*F*44/12/100(quantity)
		A	B	C	D=A+B+C	E	F	G=D*E*F*44/12/10(volume)
Coal	10^4t	4,681.99	2,738.24	3,698.29	11,118.52	25.80	20,908.00	219,912,851.00
Washed coal	10^4t	0.03			0.03	25.80	26,344.00	748.00
Other Washed Coal	10^4t	674.74	17.83	96.00	788.57	25.80	8,363.00	6,238,691.00
Coke	10^4t	3.32			3.32	29.20	28,435.00	101,075.00
Sub-total								**226,253,365.00**
Crude oil	10^4t	0.49			0.49	20.00	41,816.00	15,026.00
Diesel	10^4t	0.75	0.39	0.30	1.44	20.20	42,652.00	45,491.00
Fuel oil	10^4t	11.73	0.45	1.44	13.62	21.10	41,816.00	440,629.00
Other oil product	10^4t					20.00	38,369.00	0.00
Sub-total								**501,146.00**
Natural gas	10^8M^3		1.90	21.00	22.90	15.30	38,931.00	500,143.00
Coke oven gas	10^8M^3	26.80	1.60	14.40	42.80	12.10	16,726.00	317,609.00
Other gas	10^8M^3	552.60	14.30		566.90	12.10	5,227.00	1,314,667.00
LPG	10^4t					17.20	50,179.00	0.00
Refinery gas	10^4t	8.55		4.27	12.82	15.70	46,055.00	339,888.00
Sub-total								**2,472,307.00**
Total								**229,226,818.00**

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With the above table and formula (5), (6), and (7), the following results are achieved:

λ_{coal} =98.70% λ_{oil} =0.22% λ_{gas} =1.08%

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =**0.9074 tCO2/MWh**

Table A-11: Capacity addition in the Northeast Power Grid

	Installed capacity in 1999（MW）	Installed capacity in 2000（MW）	Installed capacity in 2006（MW）	Addition capacity（MW）	Addition share（%）
	A	**B**	**C**	**C-B**	
Thermal	27,136.90	28,932.50	36,216.00	7,283.50	87.57%
Hydro	5,522.70	5,600.00	6,126.00	526.00	6.32%
Other	22.90	43.90	552.00	508.10	6.11%
Total	32,682.50	34,576.40	42,894.00	8,317.60	100%
Share of 2006 installed capacity	76.19%	80.61%	100%		

Data sources: China Electric Power Yearbook 2000-2007

$EF_{grid,BM,y} = EF_{Thermal,Adv} \times CAP_{Thermal,addition} / CAP_{Total,,addition}$ = 0.9074×87.57%=**0.7946 tCO2/MWh**

3. The combined emission factor calculation of the Northeast Power Grid

Table A-12: Combined emission factor of Northeast Power Grid

OM factor (tCO2/MWh)	1.256099
BM factor (tCO2/MWh)	0.7946
CM factor (tCO2/MWh) **CM**=0.75***OM**+0.25***BM**	**1.1407**

4. Emission reduction calculation of the proposed project

$ER_y = BE_y - PE_y - LE_y =$ **112600**MWh × 1.1407 tCO2/MWh = **128,442** $\mathbf{tCO_2}$

Annex 4

MONITORING PLAN

No appended information.