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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Liaoning Changtu Quantou Wind Power Project

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A.2. Description of the project activity:

Liaoning Changtu Quantou Wind Power project (hereafter refers to the proposed project) is to build and operate a 49.3 MW grid connected wind farm, located in Quantou County, Changtu City, Liaoning Province, P.R.China. The proposed project installs totally 58 wind turbines with a nominal capacity of 850 KW. During the operation period, the proposed project will deliver about 100.751 GWh to the Liaoning Power Grid that is integral to and forms a part of the Northeast China Power Grid. The electricity generated by the proposed project is expected to displace grid electricity generated from fossil fuels and reduces GHG emissions by an amount of approximately 110,967 tCO_2e (tons of carbon dioxide equivalent) per year for the duration of the project activity. A reduction of approximately776,769tCO_2e is forecast for the first 7-year crediting period.

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Wind power is a priority development area as a green energy supply technology in China. The proposed project can improve air quality and local livelihoods and promote sustainable renewable energy industry development. The contributions to the sustainable development of the project are:

- Reduce greenhouse gas emissions and other pollutants (such as SO_2 and soot)resulting from the power industry in China compared to a business-as-usual approach;
- Help to simulate the growth of the wind power industry and the transfer of international technology in China;
- Promotes the local economy and create local employment opportunity during the installation and operation periods.

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A.3. Project participants:

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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)	Tieling Longyuan Wind Power Co., Ltd.	No
Austria	Kommunalkredit Public Consulting	No

	GmbH	
(*) 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 ofrequesting registration, the approval by the Party(ies) involved is required.		

Please see Annex 1 for detailed contact information

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A.4. Technical description of the project activity:

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A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

P.R.China

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

Liaoning Province

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A.4.1.3. City/Town/Community etc:

Quantou Town, Changtu County, Tieling City

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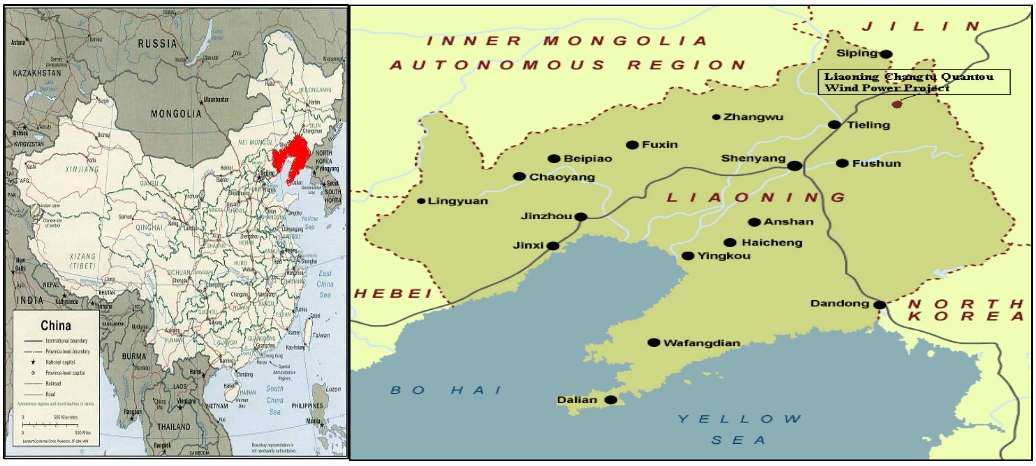
A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The proposed project is located in Quantou Town, Changtu County, Tieling City, Liaoning Province, P.R.China. The geographical co-ordinates of the proposed project are eastern longitude 124°13′and northern latitude 42°50′. Figure 1 illustrates the location of the proposed project.



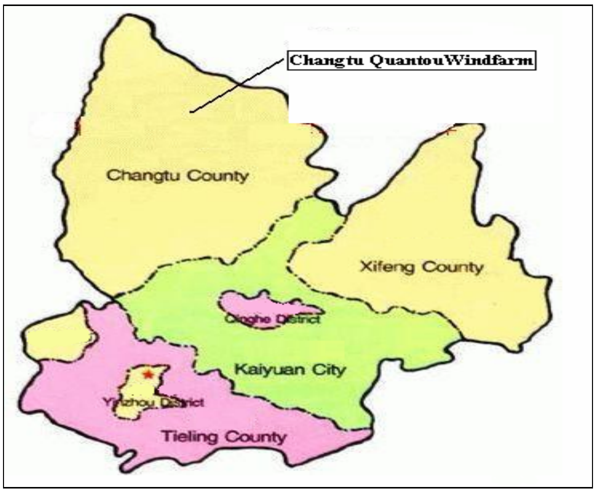


Figure 1 Location of Changtu Quantou Wind Power Project

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

Category: Renewable Energy in grid connected applications
Sectoral Scope 1: Energy Industries (renewable/non renewable).

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

The proposed project is to install totally 58 wind turbines(Gamesa52－850kW of Spain) with a nominal capacity of 850 KW, providing a total capacity of 49.3 MW. Table 1 provides all technical information of wind Turbines in the project. Each turbine will have a 690V-to-10kV transformer, and every 7-9 transformers are parallel-connected with a 10kV line to a local transformer 10kV-to-66kV station, i.e., Changtu Transformer Station, where electricity generated by the project is delivered to the power grid through a 66kV line. The wind turbines and transmission facility could be monitored and controlled either by onsite central control room or remotely through Internet.

Gamesa Eólica is one of the biggest manufacturers and supplies of technologically advanced products installations and services in the renewable energy sectors. The main characteristics of Gamesa Eólica's wind turbines are their robustness, adaptability, reliability and maximum performance on all types of sites and in all types of winds. Due to its advantage on fully utilizing wind resources and improving efficiency, Gamesa52－850kW has been adopted worldwide. At the same time, Gamesa Eólica has a long experience in developing and operating wind farms. Hereby, the development of the project will contribute to promote the transfer of technology during the construction and training of technicians for manufacturing, operation and maintenance of the wind power technology.

Table 1 Technical Characteristics of Wind Turbines for the proposed project

	G52-850
Number	58
Rotor	
Type	3-bladed, horizontal axis, upwind
Rotor Diameter	52 m
Swept Area	2124 m^2
RPM	14.6-30.8 RPM
Cut in-cut-out wind	4 / 25 m/s
Nominal Output at velocity	14 m/s
Design conditions in terms of velocity	70 m/s (IEC)
Lifetime of turbine	20 years
Blades	
Blade Length	25.3 m
Material	Epoxy reinforced glass fibre
Generator	
Nominal Power	850 kW
Type	Doubly fed machine
Synchronous speed	1620 r.p.m
Towers	
Type	Tubular (cone-shaped)
Hub heights	65 m

Data sources from：http://www.gamesa.es/files/File/G52-ingles.pdf

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

The project applies a renewable crediting period. The first 7-year crediting period is expected to start on January 1st 2009 till December 31st 2015. Emission reductions to be achieved by the project during the first crediting period are shown in the table below.

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
2009	110,967
2010	110,967
2011	110,967
2012	110,967
2013	110,967
2014	110,967
2015	110,967
Total estimated reductions (tonnes of CO_2e)	776,769
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	110,967

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A.4.5. Public funding of the project activity:

No public funds from countries in Annex I is involved in the proposed project.

SECTION B. Application of a baseline and monitoring methodology:

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

Baseline methodology:

ACM0002(Version 6): Consolidated baseline methodology for grid-connected electricity generation from renewable sources.

“Tool for the Demonstration and Assessment of Additionality (version 04)”.

Monitoring methodology:

Approved consolidated monitoring methodology ACM0002 (Version 6): “Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources”.

Reference: UNFCCC website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
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B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The above methodologies are applicable to the project activities under the following conditions:

- The proposed project is a grid-connected zero-emission renewable electricity capacity additions from wind source;
- The proposed project is not an activity that involves switching from fossil fuels to renewable energy at the site of the project activity;
- The geographic and system boundaries for the Northeast China Power Grid can be clearly identified and information on the characteristics of the grid is publicly available.
- The methodology will be used in conjunction with the approved consolidated monitoring methodology ACM0002 (Consolidated monitoring methodology for grid-connected electricity generation from renewable sources).

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

Emission sources:

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

Spatial boundary:

The spatial extend of the project boundary includes the Liaoning Chuangtu Quantou Windfarm Project and all power plant connected to Northeast China Power Grid. The Northeast China Power Grid is the project electricity system, which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains.

Using the boundary definitions of the Chinese DNA1, the Northeast China Power Grid consists of

Liaoning, Heilongjiang and Jilin power grids.

	Source	Gas	Included?	Justification / Explanation
Baseline	Northeast China Power Grid	CO_2	Yes	Major emission sources
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	Wind power	CO_2	No	According to ACM0002, the project emission of renewable energy project activity is not considered.
		CH_4	No	According to ACM0002, the project emission of renewable energy project activity is not considered.
		N_2O	No	According to ACM0002, the project emission of renewable energy project activity is not considered.

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

According to the status of power industries in China, to provide the same output or services comparable with the proposed CDM project activity, these scenarios are to include:

a) The proposed project not undertaken as a CDM project activity but as a commercial project;

b) The fossil fuel power plant with the same annual electricity output as the proposed project;

c) Other power plants using other sources of renewable energy with the same annual electricity output as the proposed project;

d) The Northeast China Power Grid as the provider for the same capacity and electricity output as the proposed project.

Specific analysis on the four alternative scenarios in absence of the proposed project is as follows：

a) The financial internal rate of return (IRR) of total investment of this project activity is 7.17%, lower than the benchmark IRR (8%)[1] without the income from CERs and thus the project not undertaken as CDM project is not financially feasible. Therefore, the scenario a) couldn't be considered as an alternative scenario.

b) According to the applicable laws and regulations, the alternative b) should be eliminated from the following consideration because it does not comply with the national regulation for controlling small scale coal-fired power plant. To provide the same output as the proposed project, the alternative coal

[1] Appendix C10, Article 19, Development Method of Feasibility Study Report for Wind Power Projects, by China Hydropower Engineering Consultation Co. under organization of NDRC；

power plant will has the capacity less than 20 MW then will be categorized as the small scale coal power plant and should be forbidden to construct according to the regulations from NDRC(*No. 50 NDRC Bulletin of P.R.C*)[2].;

c) Besides wind power, other renewable energies including hydropower, solar PV, biomass and geothermal are the possible grid-connected technologies in the Northeast China Power Grid. However, there exists no river nearby or at the proposed project site that it isn't suit for development of hydropower projects in Changtu County[3]. In China, solar PV, biomass and geothermal generation technology is still in the demonstration phase and can bring only poor economic benefits, which can not be operated without support from the national policies[4]. So the scenario c) couldn't be considered as an alternative scenario

d) The installed capacity of Northeast China Power Grid keeps increasing for many years. Hence, the scenario d) is the only realistic and credible alternative scenario.

As a result, the Northeast China Power Grid is selected as the baseline scenario for the proposed project.

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B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The feasibility study report of the proposed project was approved by Liaoning province DNA on 5th Sep.2006, in which the IRR of the project was 8.44% with the expected tariff of 0.5998 RMB/kWh (Excluding VAT). Based on the expected IRR of the proposed project, the project owner started to perform the exploration plan and prepare to construct after they received the approval of the project. During this period, the local NDRC provided the propositional letter on the expected tariff on 8th*Jan*.2007, by which the IRR of the project was only 7.17 %(the benchmark of 8%) with the propositional tariff of 0.5714 RMB/kWh (Excluding VAT). Because of the lack of the guarantee of investment security, the project owner didn't gain the commercial loan from the banks. When the project owner was about to give up, the local NDRC recommended the CDM to the project owner and provided the governmental web site about CDM[5]. With those, the project owner particularly invited the CDM consulting company to identify the proposed project .The CDM consulting company advised the project owner to apply for the support from CDM business. Moreover, the project owner applied for the loans from the bank by the CDM support and finally obtained it on 14 th Jan.2007. After the project owner obtain the support from CDM consulting company, the proposed project began to perform the construction *On 8th Feb.2007.*

The project uses the *Tool for the Demonstration and Assessment of Additionality (version 04)* to

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[2] *On Prohibition of 135MW and Smaller-scale Coal-fired Power Plants, General Office of State Council*

3 *http://www.kftour.com/Map/18-27973-1/*

4 *http://www.chinaenergy.gov.cn/news.php?id=15688*

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

demonstrate the additionality .It is including the steps as follows:

Step1. Identification of alternatives to the project activity consistent with current laws and regulations.

The objective of this step is to identify realistic and credible alternatives to the project that can be the baseline scenario through the following sub-steps:

Sub-step 1a. Define alternatives to the project activity

To provide the same output or services comparable with the proposed CDM project activity, these alternatives are to include:

a) The proposed project not undertaken as a CDM project activity but as a commercial project;
b) The fossil fuel power plant with the same annual electricity output as the proposed project;
c) Other power plants using other sources of renewable energy with the same annual electricity output as the proposed project;
d) The Northeast China Power Grid as the provider for the same capacity and electricity output as the proposed project.

In the Northeast China Power Grid, other renewable energies including hydropower, solar PV, biomass and geothermal are the possible grid-connected technologies However, there exists no river nearby or at the proposed project site that it isn't suit for development of hydropower projects in Changtu County[6]. In China, solar PV, biomass and geothermal generation technology is still in the demonstration phase and can bring only poor economic benefits, which can not be operated without support from the national policies[7].Moreover, the proposed project owner is only dedicated to wind power development in Liaoning Province, and has no experience and ability to develop other renewable energy power plants. So the scenario c) couldn't be considered as an alternative scenario.

Sub-step1b. Consistency of mandatory laws and regulations

Based on the latest national power statistic, the operational hour of a fossil fuel plan t (5865 hours) is about 2.8 times more than that of the proposed project (2044 hours) with the same capacity[8]. Therefore, to provide the same output as the proposed project, the alternative coal power plant will has the capacity less than 20 MW then will be categorized as the small scale coal power plant and should be forbidden to construct according to the regulations from NDRC(*No. 50 NDRC Bulletin of P.R.C*)[9]. Consequently, the scenario b) is not a feasible alternative scenario.

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6 *http://www.kftour.com/Map/18-27973-1/*
7 *http://www.chinaenergy.gov.cn/news.php?id=15688*
8 *China Electric Power Yearbook2006, page559*
9 *On Prohibition of 135MW and Smaller-scale Coal-fired Power Plants, General Office of State Council*

The applicable legal and regulatory requirement from the website of State Electricity Regulatory Commission (SERC) and National Development and Reform Commission (NDRC): http://www.serc.gov.cn/opencms/export/serc/laws/index.html and http://nyj.ndrc.gov.cn .

Outcome of Step 1: as illustrated above, the proposed project activity doesn't belong to baseline scenario and therefore it is additional. The baseline scenario of the proposed project activity is alternative4, i.e. provision of equivalent amount of annual power output by the grid (Northeast China Power Grid) where the proposed project is connected into.

Step2. Investment analysis

This step will determine whether the project is the economically or financially less attractive than other alternatives without the revenue from the sale of CERs.

Sub-step 2a. Determine appropriate analysis method

Tool for the Demonstration and Assessment of Additionality (version 04) provides three analysis methods to apply for the investment analysis: the simple cost analysis (option I), the investment comparison analysis (option II) and the benchmark analysis (option III).

For the proposed project, the simple cost analysis method is not applicable because the project activity will produce economic benefit (from electricity sale) other than CDM related income. The investment comparison analysis method is also not applicable because the baseline scenario is the Northeast China Power Grid rather than a new investment project.

To conclude, the proposed project will use the benchmark analysis method based on total investment IRR to identify whether the financial indicators of the proposed project is better than relevant benchmark value.

Sub-step 2b. —Option III. Apply benchmark analysis

According to the "Economical assessment and parameters for construction project, 2nd edition", a project will be financially acceptable when the Financial Internal Return Rate (FIRR) is better than the sectoral benchmark FIRR.

In according with *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects* issued by former State Power Corporation of China, there is not yet such a financial internal rate of return (IRR) as benchmark in China's power generation industry to date. However, the project IRR shall not be lower than 8 percent 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 many of China's existing wind power projects have applied it as the benchmark IRR. ***Sub-step 2c. Calculation and comparison of financial indicators***

(1) Basic parameters for calculation of financial indicators

According to the feasibility study report of the proposed project, the parameters for calculation of financial indicators are shown in Table 2.

Table 2 Main parameters for calculation of financial indicators

Items	Unit	Amount	Data source
Capacity	MW	49.3	FS
Total Investment	Million RMB	416.54	FS
Annually output	GWh/year	100.751	FS
Operation cost	Million RMB	270.03	FS
Electricity Tariff (Excluding VAT)	RMB/kWh	0.5714	Propositional letter from local NDRC
Value Added Tax (VAT)	%	8.5	FS
Income tax	%	33	FS
Expected CERs Price	EUR/tCO_2	9.0	Market anticipation
Project life time	Year	21	FS
CERs crediting time	Year	7×3	Section C

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

In according with the benchmark analysis method, the proposed project will not be considered as financially attractive if its financial indicators (such as IRR) are lower than the benchmark rate.

Table 3 shows the IRR of the proposed project with and without CERs revenues. Without CERs revenues, the IRR on the total investment is 7.17%, lower than the benchmark rate 8%. Thus the proposed project is not considered as financially attractive. However, taking into account the CERs revenues, the IRR on the total investment is 9.67%, which is significantly improved and higher than the financial benchmark rate. Therefore, the proposed project with CERs revenues can be considered as financially attractive to the investors.

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Table 3 Comparison of financial indicators with and without CERs revenues

Scenario	IRR (the benchmark of 8%)
Without CERs revenues	7.17
With CERs revenues	9.67

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Sub-step 2d. Sensitivity analysis

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. Four factors are considered in following sensitivity analysis:

1) Total investment
2) Annual operation and maintenance cost(**O&M cost**)
3) Tariff

4) Plant load factor(PLF)

The fuor financial parameters were identified as the main variable factors for sensitive analysis of financial attractiveness. Their impacts on IRR of total investment were analyzed in the below tables(Table 4 –Table7).

Table 4 Sensitivity of total investment IRR to **total investment**

IRR / Range / Parameters	-7.5%	-5.4%	-2.5%	0%	2.5%	5.0%
Total investment	8.34	8.00	7.54	7.17	6.81	6.46

Table 5 Sensitivity of total investment IRR to **O&M cost**

IRR / Range / Parameters	-25.9%	-20%	-10%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.0%
O&M cost	8.00	7.81	7.49	7.41	7.33	7.25	7.17	7.09	7.00

Table 6 Sensitivity of total investment IRR to **tariff**

IRR / Range / Parameters	-10%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.4%	7.5%
Tariff	5.58	5.99	6.38	6.78	7.17	7.55	8.00	8.31

Table 7 Sensitivity of total investment IRR to **PLF**

IRR / Range / Parameters	-10%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.4%	7.5%
PLF	5.58	5.99	6.38	6.78	7.17	7.55	8.00	8.31

As shown in the above tables, the tariff is the most important factor affecting the financial attractiveness of the proposed project. In the case that the tariff increases by5.4%, the FIRR of the proposed project begins to exceed the benchmark. According to the market rules of Northeast China power market, the proposed project is an un-tendering project that doesn't been implemented via public bidding while the tariff is regulated by the regulating entities. According to China's Management Rules on Tariff issued by NDRC[10], the tariff of the un-tendering projects should be determined by the government with reference to the tariff of tendering wind projects. Thereafter, the PPA of the tariff of power projects is determined by the grid company and project owners according to the guiding price of the government. As a whole, the

[10]Trial Measures for the Administration of the Pricing of, and the Sharing of Costs in Connection with, the Generation of Electricity Using Renewable Energy Resources, FAGAIJIAGE(2006) No.7

tariff for newly built project is generally not allowed to be higher than the tariff provided in the latest guiding price .By this pricing principle, China government is gradually lowering down the wind power in-grid tariff[11.] Moreover, the trend of tariff for wind power projects in China is fleetly decreasing during the recent 10 years[12.] Recently, the tariff concluded in Liaoning area lately [13] shows: it is very difficult that the actual tariff will be higher than the latest governmental tariff of 0.5622 Yuan. However, the Official Letter about the tariff of the proposed project issued by the Development and Reform Bureau of Changtu County in Liaoning Province in Jan. 2007 regulated the tariff of the proposed project as no more than 0.5714 Yuan/kWh (Excluding VAT), which is 1.63% higher than the latest governmental tariff of 0.5622 Yuan[14].The Table 8 shows that the tariff of wind farms in Liaoning Province is also gradually decreasing. Therefore it is impossible that the expected tariff of the proposed project could increase 5.4%, so the proposed project is always lack of financial attractiveness.

The next important factor for financial attractiveness is the total investment. In the case that total investment decreases by about 5.4%, the IRR of the proposed project begins to exceed the benchmark. Since 86.38% of the total investment of the proposed project is used to the purchase and installation of electric equipments (wind turbines and transformers)[15].Moreover, the main parts of wind turbines are imported, and the wind turbines demand exceeds supply in the whole world that leads the price of wind turbines gradually increasing [16].Hence, it is impossible to lower the expected total investment of the project in the Feasibility Study. Wthin the reasonable range of total investment, the proposed project is always lack of financial attractiveness.

The sensitivity analysis of PLF is equivalent to the sensitivity analysis of tariff (both impact the turnover the same way). In the case that the PLF increases by 5.4%, the FIRR of the proposed project begins to exceed the benchmark. According to the Chinese Renewable Energy Law enacted on January 1st 2006, wind power generation should be purchased fully by the grid[17]. Therefore, the PLF reflects the annual generation output of the proposed project, which depends on the average wind speed at the project site for a specific wind turbine. According to the feasibility study report of the proposed project, the annual output is estimated basing on the long term weather statistic data provided by local meteorological station and wind resources measurement, which first using professional software WAsP to select the rich wind source area, then using software WindFarmer to optimize the location of each turbine for maximize power generation. Moreover, the PLF value is positive correlation with the wind speed, the annual average wind speed of the project site tends to decrease and to gradually be stable over the past 30years for which data are available recently[18] as shown in Figure 2. Therefore, the probability that PLF is 5.4% higher than the estimated value is very small.

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[11] http://www.eri.org.cn/manage/upload/uploadimages/eri200672795944.pdf

[12] http://www.2008red.com/member_pic_461/files/qiangweinengyuan/html/article_2757_1.shtml

[13] http://www.gov.cn/zwgk/2008-02/19/content_892937.htm

[14] http://www.gov.cn/zwgk/2008-02/19/content_892937.htm

[15] The feasibility study report of Liaoning Changtu Quantou Wind Power Project(P104)

[16] http://info.electric.hc360.com/2007/06/28101158551-6.shtml

[17] http://www.gov.cn/ziliao/flfg/2005-06/21/content_8275.htm

[18] The feasibility study report of the proposed project.

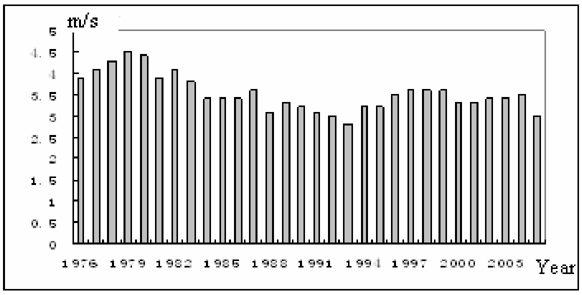

Figure 2 The Average Wind speed provided by local meteorological station

The impact of the annual O&M cost is the slightest. The FIRR of the proposed project could reach the benchmark when the annual O&M cost decreases by 25.9%. However, according to the Feasibility Study Report of the proposed project, the detailed operation costs is composed of four kinds of costs - maintenance costs, annual salaries for the employees, insurance premium of fixed assets and other costs. The Average Annual O&M Cost listed in Table 2 is the sum of the four kinds of costs and is the same as that in the cash flow table in of the electronic spreadsheet which has been provided to DOE for validation. Moreover, the price of material and salaries of the employees are gradually increasing in China, which leads annual O&M cost gradually increasing[19]. Therefore, it is impossible that the annual O&M cost could decrease 25.9%, so the proposed project is always lack of financial attractiveness within the reasonable range of annual O&M cost.

Outcome of Step 2: as illustrated above, under the reasonable variations in the critical assumptions, the conclusion regarding the financial additionality is robust and supported by sensitivity analysis. So *the proposed CDM project activity is unlikely to be financially attractive.*

Step 3. Barrier analysis

Investment analysis has argued that the project is the economically less attractive than other alternatives without the revenue from the sale of CERs. According to "*Tool for the Demonstration and Assessment of Additionality (version 04)*", this PDD skips the barrier analysis and argues the additionality.

Step 4. Common practice analysis

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

Similar to the proposed project with the capacity of 10-50MW, there are several grid-connected wind farms in Liaoning province, as shown in Table 8.

Table 8 Grid-connected wind farms similar with the project in Liaoning province

	Project name	Installed capacity	Grid-connected	On-grid Tariff	Note

[19] http://www.china.com.cn/chinese/EC-c/1246238.htm
http://www.chinadaily.com.cn/hqcj/2007-09/03/content_6075777.htm

		(MW)	time	(RMB/kWh)	
1	Donggang windfarm	22.45	Dec.1997	0.9154	Demonstration project
2	Hengshan windfarm	7.4	Aug.1996	0.9	Demonstration project
3	Zhangwu windfarm	24.65	Under construction	—	Applying for being a CDM project
4	Faku Wanghaishi windfarm	21.25	Under construction	0.72	Applying for being a CDM project
5	Huanren Niumaodashan windfarm	24.65	Under construction	—	Applying for being a CDM project
6	Kangping windfarm	49.3	Feasible work	—	prepare to Apply for being a CDM project
7	Changtu windfarm	49.5	Mar.2007	0.6555	Registered in EB

Data source: Shi Pengfei (Deputy Director, Chinese Wind Energy Association), Statistics on China Wind Farm Installed Capacity in 2005. *(http://www.cwea.org.cn/upload/200612391640820.doc)*
http://www.huaxiawind.com.cn/detail.asp?infoId=2168
http://www.jindaban.com/chinawind/dachangshan.htm

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

The existing wind farm projects do not call into question the claim that the proposed project is financially unattractive as discussed in Step 2. The first two wind farms in Table 8 enjoyed higher tariff than the proposed project. Moreover, the first two wind farms are funded by international low interest loan or national soft loan[20] , while the proposed project does not enjoy these favourable policies and the loan is difficult to be obtained and the interest rate is higher because of the commercially unattractive condition.

Secondly, since there is serious investment barrier for the proposed project, the CDM has been considered in the early evaluation period. Other wind farms in Table 8 are also applying for CDM projects to overcome investment, technological and tariff barriers and Changtu windfarm has been registered as CDM projects. They do not contradict the claim that the proposed project activity is financially unattractive.

To conclude, there are essential distinctions between the proposed project and existing similar projects. The existence of these projects in Table 8 does not contradict the claim that the proposed project activity is financially unattractive.

As described above, the proposed project is still exceptive and lack of common practices in Liaoning province.As described above, the proposed project activity passed all criteria of “Tool for the demonstration and assessment of additionality” (version 04). Therefore, the proposed project is additional.

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B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

To determine baseline scenario emissions, firstly emission factors of Operating Margin ($EF_{OM,y}$) and Build Margin ($EF_{BM,y}$) were calculated based on the history data of the Northeast China Power Grid, which include the installed capacity, electricity generation and different types of fuel consumptions of all

[20] http://www.nepri.com.cn/dljs/aaa/qw/2001/DLQK-DB-DBDL-2001-011-005.pdf

the power plants connected into the Northeast China Power Grid. Secondly, the baseline emission factor (EF_y) was calculated as a combined margin(CM) of the Operating Margin (OM) and Build Margin (BM) emission factors as described in following three steps. All the calculation in compliance with requirement of the baseline methodology (ACM0002), the details is listed in the following steps.

Step 1: Calculation the Operating Margin emission factor ($EF_{OM,y}$ ***)***

Calculation of OM emission factor should be based on one of the four following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch Data Analysis OM, or

(d) Average OM.

The justifications of the choice of methodology to calculate OM emission factor are as follows:

Method (a): Simple OM

Method (a) can only be used where 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 normal 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. From 2000 to 2004, the hydropower in the Northeast China Power Grid accounts for about 4-9%[24], the sum of which is much less than 50%. Therefore, method (a) is applicable for the project.

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Method (b): Simple adjusted OM

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 were not available publicly. Therefore, method (b) is not applicable for the project as well.

Method (c): Dispatch Data Analysis OM

If the dispatch data is available, method (c) should be the first methodological choice. 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 every operation hour period. Since the dispatch data, power plants operation data are considered as commercial secret materials and only for internal usage not available publicly. Thus, method (c) is not applicable for the project.

Method (d): Average OM

[24] China Power Yearbook 2001-2005

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Method (d) will only be used when (1) low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and (2) where detailed data to apply option (c) above is unavailable. From 2000 to 2004, the fired power in the Northeast China Power Grid accounts for about 92.93-95.28%, and wind power or other sources low-cost/ must run resources constitute less 1%[24]. Hence method (d) is not applicable for the project.

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In conclusion, method (a) is the only reasonable and feasible method among the four methods for calculating the Operating Margin emission factor ($EF_{OM,y}$) of the project.

According to the ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants, the detailed formulas are as following:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_j GEN_{j,y}} \qquad (1)$$

Where:

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

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid[21],

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

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by sources j .

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i \qquad (2)$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i , (TJ/ mass or volume unit）, country-specific values are used[22].

$OXID_i$ is the oxidation factor of the fuel i ， the 1996 Revised IPCC default values are used,

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$EF_{CO_2,i}$ is the CO_2 emission factor per unit of energy of the fuel i (tCO_2e/TJ). $EF_{CO_2,i}$ of fossil fuels is from the 1996 Revised IPCC default.

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[24] China Electricity Power Yearbook 2001-2005

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[21] As described above, an import from a connected electricity system should be considered as one power source j .

[22] China Energy Statistic Yearbooks

Based on the calculation results, the Operation Margin emission factor ($EF_{OM,y}$) of the Northeast China Power Grid is **1.1983 tCO_2/MWh** ***(http://cdm.ccchina.gov.cn)***. The detailed data and calculation are listed in Annex 3.

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Step2: Calculation the Build Margin emission factor ($EF_{BM,y}$)

According to the ACM0002, the baseline Build Margin emission factor was calculated using the following formula (3).

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \quad (3)$$

where:

$F_{i,m,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by *m* power plants in year(s) *y*,

$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2/ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by *m* power plants and the percent oxidation of the fuel in year(s) *y*,

$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by *m* power plants.

According to the baseline methodology (ACM0002), the Build Margin emission factor $EF_{BM,y}$ *ex-ante* was selected to identify sample group for calculating Build Margin emission factor, which based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either

- The sample group *m* consists of either the five power plants that have been built most recently, or
- The power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

However, no matter which options mentioned above 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 electricity generation and fuel consumption data of each power plant are regarded as commercial secrets and only for internal usage. According to the guidance from the CDM Executive Board for a deviation of the baseline methodology of AM0005, which had combined into the baseline methodology of ACM0002, the following deviation was adopted to calculate the Build Margin emission factor.
(http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQK K7WYJ)

♦ Use of capacity additions for estimating the build margin emission factor for grid electricity.
♦ Use of weights estimated using installed capacity in place of annual electricity generation.
♦ Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

Following the EB's guidance the build margin is calculated as follows:

1. Due to breakdown data by power plants are not available while the aggregate data by different types of fuels are available, therefore, 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 2004, while t_0=1997, the total capacity addition during 1997 to 2004 consisting of 7945.9MW of fossil fuel fired capacity, 745MW of hydropower capacity and 217.3MW of other capacity, which accounts for 23.28% of total installed capacity in 2004 (See Annex 3 for detailed calculation).

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:

Step 2a: 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

with the energy balance sheet in China Energy Statistical Yearbook for the most recent year, calculating the respective percentages of CO_2 emissions from coal fired power generation, oil fired power generation, and gas fired power generation against total CO_2 emissions from fossil fuel fired power generation:

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

Deleted: 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 2005, while t_0=1998, the total capacity addition during 1998 to 2005 consisting of 7829MW of fossil fuel fired capacity, 489.1MW of hydropower capacity and 256.3MW of other capacity, which accounts for 23.34% of total installed capacity in 2005[23] (See Annex 3 for detailed calculation).

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

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

where:

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

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

COAL,OIL, and GAS are the aggregation of various kinds of coal, oil, and gas as fossil fuels.

Step 2b: calculating the corresponding emission factor for fossil fuel fired power generation

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (8)$$

where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ 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).

Step 2c: Calculating the $EF_{BM,y}$ of local grid

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 $EF_{BM,y}$ of Northeast China Power Grid (See Annex 3 for detailed calculation):

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}, \quad (9)$$

where:

CAP_{Total} is the total capacity addition,

$CAP_{Thermal}$ is the fossil fuel fired capacity addition.

Following the three steps above, the Build Margin emission factor $EF_{BM,y}$ of the Northeast China Power Grid is calculated to be: **0.8108 tCO2/MWh***(http://cdm.ccchina.gov.cn)***.** The detailed calculation and data were listed in the annex 3**.**

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Data sources for $EF_{OM,y}$ and $EF_{BM,y}$ calculation: Data on installed capacity, power generation, and self-usage rate of power plants are from China Electric Power Yearbooks 1998-2005. The consumption data of various types of fuels and their net caloric values are from China Energy Statistical Yearbooks 2001-2005. The CO_2 emission factors per unit of energy and the oxidation factors are from the 1996 Revised IPCC Guidelines for National Greenhouse Gas Inventories.

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Step3: Calculation the baseline emission factor (EF_y)

According to the baseline methodology (ACM0002), the baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \tag{10}$$

Where: the weights ω_{OM} and ω_{BM} are 75% and 25% respectively by the default, and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above.

The Baseline Emission factor (EF_y) of the Northeast China Power Grid was 1.1014 tCO_2/MWh. The detailed calculation and data were listed in the annex 3.

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

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Data / Parameter:	*Fi,y*
Data unit:	t/m^3
Description:	Amount of fuel *i* consumed in year(s)
Source of data used:	China Energy Statistical Yearbook2001-2005
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since the detailed fuel consumption data by power plants are not publicly available, therefore the aggregated data by fuel types are used instead
Any comment:	

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Data / Parameter:	*GENi,y*
Data unit:	MWh
Description:	Electricity (MWh) delivered to the grid excluding low operating cost/must run power plants in year *y*
Source of data used:	China Power Yearbook 2001-2005
Value applied:	100751
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since the detailed generation data by power plants are not publicly available, therefore the aggregated data by fuel types are used instead.
Any comment:	

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Data / Parameter:	*NCVi*
Data unit:	$TJ/t(m^3)$
Description:	Net calorific value (energy content) per mass or volume unit of fuel *i*
Source of data used:	China Energy Statistical Yearbook 2001-2005
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002, the national specific value shall be used preferentially
Any comment:	

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Data / Parameter:	*OXIDi*
Data unit:	%
Description:	Oxidation factor of the fuel *i*
Source of data used:	1996 Revised IPCC default value
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The country specific values of oxidation factors in China are not available. As such IPCC default values are used instead.
Any comment:	

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Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per unit of energy of the fuel *I*
Source of data used:	1996 Revised IPCC default value
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The country specific values of fuel CO2 emission factor in China are not available. As such IPCC default values are used instead.
Any comment:	

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Data / Parameter:	Coal fire power supply efficiency
Data unit:	%
Description:	the best commercially available technology of coal fired power generation
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	36.53
Justification of the choice of data or	According to EB guidance, the statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan"

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description of measurement methods and procedures actually applied :	period can be used.
Any comment:	

Data / Parameter:	Oil and gas fire power supply efficiency
Data unit:	%
Description:	the best commercially available technology of oil and gas fired power generation
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	45.87
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to EB guidance, the statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan" period can be used.
Any comment:	

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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）：1.1983

Build Margin emission factor ($EF_{BM,y}$)（tCO_2/MWh）：0.8108

Baseline Emission factor (EF_y)（tCO_2/MWh）：1.1014

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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 100751MWh. Using the approach above, the annual emission reductions are estimated to be 110967 tCO_2 .the proposed project activity is expected to achieve 776769 tCO_2 of net emission reductions during the first 7-year crediting period. (details in Annex3).

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009	0	110967	0	110967
2010	0	110967	0	110967
2011	0	110967	0	110967
2012	0	110967	0	110967
2013	0	110967	0	110967
2014		110967		110967
2015	0	110967	0	110967
Total (tonnes of CO_2e)	0	776769	0	776769

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

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B.7.1. Data and parameters monitored:

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Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity generated by the project
Source of data to be used:	Measured and verified against sales data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100751
Description of measurement methods and procedures to be applied:	Electronic with paper back-up. Data will be kept up for the duration of the crediting period +2 years; Net amount of power supplied to the grid and double checked according to receipts of power selling to the grid and invoices for power buying by the project activity.
QA/QC procedures to be applied:	QA/QC procedures aren't being undertaken for date monitored. The data will be directly used to calculate emission reductions. The record of sales to the grid and other relevant records are used to ensure consistency.
Any comment:	

Data / Parameter:	$EG_{self\text{-}use}$
Data unit:	MWh
Description:	Electricity utilized by the project
Source of data to be used:	Measured and verified against sales data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Electronic with paper back-up. Data will be kept up for the duration of the crediting period +2 years; Net amount of power supplied to the grid and double checked according to receipts of power purchasing from the grid.
QA/QC procedures to be applied:	QA/QC procedures aren't being undertaken for date monitored. The data will be directly used to calculate emission reductions. The record of purchase from the grid and other relevant records are used to ensure consistency.
Any comment:	

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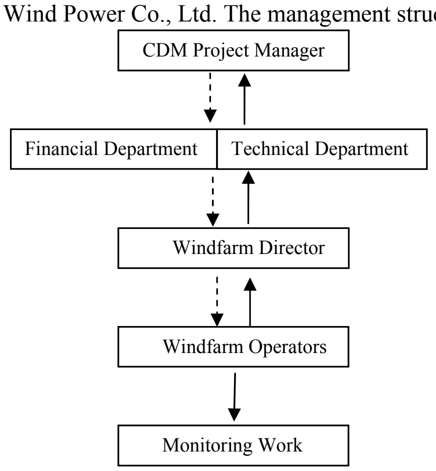
B.7.2. Description of the monitoring plan:

Monitoring plan is a division and schedule of a series of monitoring tasks. Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

1. Management structure and staff for implementation of monitoring plan

This monitoring plan will be implemented by professional staff authorized by the owner of the proposed project, i.e. Tieling Longyuan Wind Power Co., Ltd. The management structure is illustrated as follows:



The Management Group has all received sufficient training in terms of monitoring and verification. They have received general training on wind power project operation organized the project owner, including reading and calibration of the meter, recording of the readings, adjustment of readings, and reporting of readings. On the other hand, they have received CDM training organized by China Fulin Windpower

Development Corporation, including validation, registration and verification. When necessary, the CDM Manager is responsible for organizing or attending trainings on Monitoring and Verification.

2. Monitoring train

The Management Group has all received sufficient training in terms of monitoring and verification. They have received general training on wind power project operation organized the project owner, including reading and calibration of the meter, recording of the readings, adjustment of readings, and reporting of readings. On the other hand, they have received CDM training organized by China Fulin Windpower Development Corporation, including validation, registration and verification. When necessary, the CDM Manager is responsible for organizing or attending trainings on Monitoring and Verification.

3. Calibration of Meters & Metering

An agreement should be signed between the proposed project owner and Liaoning Electric Power Company that defines the metering arrangements and the required quality control procedures to ensure accuracy.

The proposed project shares the same transformer, substation or transmission line with Liaoning Changtu Shihu wind farm. To monitor the net electricity supplied by both the proposed project and Liaoning Changtu Shihu wind farm, four electronic multifunctional electricity meters(accuracy degree is 0.2s-0.5, bidirectional) are installed in the transformer substation The sketch of the location of final meter systems is shown in Annex 4. The detail information about six meters is described as follows:

- One electronic multifunctional electricity meter installed by the Grid (accuracy degree is 0.2S, bidirectional) is installed in Changtu substation of the Grid to measure the total electricity including EG_{total} and $EG_{total\ self\text{-}use}$ of the two wind farms.

- Two electronic multifunctional electricity meters and two backup meters installed by the project owner (accuracy degree is 0.2S, bidirectional) are installed in the transformer substation to measure the electricity including $EG_{project}$ and $EG_{project.self\text{-}use}$ of the two wind farms, respectively.

- One electronic multifunctional electricity meter installed by the project owner (accuracy degree is 0.5) is installed in the transformer substation as the backup meter to measure the electricity that imports from the grid used by the transformer substation when the two wind farms implement the examination and repair or occur unexpected malfunction.

- The metering equipment will be properly configured and checked annually according to the requirement from Technical administrative code of electric energy metering (DL/T448 －2000).

Calibration is carried out by the Liaoning Electric Power Company with the records being provided to the proposed project owner, and these records will be maintained by the proposed project owner and the third party designated.

4. Monitoring

According to the meters system mentioned above, the net electricity supplied by the proposed project activity is calculated based on the recording measured by metering systems installed at the project site, recording exports to the grid(supply) and imports from the grid (consumption). Net generation supplied is calculated as exports minus imports. The recording frequency will be hourly measured and monthly recorded.

The net electricity supplied by the project activity ($EG_{project}$) will be calculated as follows:

$$EG_{net\ electricity\ supply\ to\ the\ grid} = EG_{project} - EG_{project.self\text{-}use}$$

$$EG_{project} = EG_{total} * EG_{project} / (EG_{project} + EG_{other})$$

$$EG_{project\text{-}self\text{-}use} = EG_{total\text{-}self\text{-}use} * EG_{project\ \text{-}self\text{-}use} / (EG_{project\text{-}self\text{-}use} + EG_{other\text{-}self\text{-}use})$$

Where:

EG_{total} is the total electricity supplied to the grid based on the data metered by the main meter;
$EG_{project}$ is the electricity generation from the proposed project activity metered by the separate meter;
EG_{other} is the electricity generation from Liaoning Changtu Shihu wind farm metered by the other separate meter.
$EG_{project\text{-}self\text{-}use}$ and $EG_{other\text{-}self\text{-}use}$ are the electricity f imported from the Grid, respectively.

The information of main monitoring data was shown in the below Table:

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_{total}	Total electricity supplied to the grid by the two projects	ammeter	MWh	*m*	hourly measured and monthly recorded	100%	paper	During the crediting period and two years after	Electricity supplied by the project activity to the grid. rechecked by the meter recordings of the project owner

2. $EG_{total.self-use}$	Total electricity utilized by two projects, respectively.	ammeter	MWh	*m*	hourly measured and monthly recorded.	100%	paper	During the crediting period and two years after	rechecked by the meter recordings of the project owner
3.$EG_{project}$	Electricity generated by the two projects, respectively.	ammeter	MWh	*m*	hourly measured and monthly recorded	100%	electronic	During the crediting period and two years after	Electricity supplied by the project activity to the grid. rechecked by receipt of sales.
4. $EG_{.project.self-use}$	Electricity utilized by two projects, respectively.	ammeter	MWh	*m*	hourly measured and monthly recorded.	100%	electronic	During the crediting period and two years after	rechecked by receipt of purchases

The specific steps to monitoring are listed below:

● The project owner reads the meter and records data on the same day of every month (which day to be determined).

● The project owner supplies readings to Liaoning Changtu Electric Power Company.

●Liaoning Changtu Electric Power Company provides electricity sales invoice to the project owner.

● The project owner provides the meter's data readings to DOE for verification.

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

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

●Should reading of the meter 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:

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

2) 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 Liaoning Changtu Electric Power Company shall jointly prepare an estimate of the correct reading; and

3) If the project owner and the Liaoning Changtu Electric Power Company fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to agreed procedures.

5. 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 on an annual basis according to this PDD and the CDM manual.

6. Data Management System

This provides information on record keeping of the data collected during monitoring. Record keeping is the most important exercise in relation to the monitoring process. Without accurate and efficient record keeping, project emission reductions cannot be verified. Below follows an outline of how project related records will be managed.

Overall responsibility for monitoring greenhouse gas emissions reductions will rest with the CDM monitoring staff of the proposed project. The CDM manual sets out the procedures for tracking information from the primary source to data calculations, in paper format. If data and information are from internet, the website must be provided. Moreover, the credibility and reliability of those data and information from internet must be confirmed by the CDM developer. Physical documentation such as paper-based maps, diagrams and environmental assessment will be collated in a central place, together with this monitoring plan. In order to facilitate auditor's reference, monitoring results will be indexed. All paper-based information will be stored by Tieling Longyuan Wind Power Co., Ltd and kept at least one copy.

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

Table List of the key documents relevant to monitoring and verification

I.D.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	Report on the qualifications of the operators	Technical post ,working experience etc.	Proposed project owner
F-5	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. Verification and monitoring results

The verification of the monitoring results of the proposed project is a mandatory process required for all CDM projects. The main objective of the verification is to independently verify that the project has achieved the emission reductions as reported and projected in the PDD. It is expected that the verification will be done annually.

>>

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

Date of completion of baseline study:30/01/2009

Deleted: 09
Deleted: 8
Deleted: 8

Names of person/entity determining the baseline are listed as follows:

- Mr. Li Gang,
  Address: Floor 8th, Tower C, International Investment Building, No.6-9, North Ave.Fuchengmen, Xicheng District, 100034, Beijing,P,R,China.
  Telephone/fax: +8610-66091326 / 66091396
  E-mail: Fulin_ligang@126.com

- Mr. SUN Bingzhi,
  Entity: China Fulin Windpower Development Corporation.
  Address: Floor 8th, Tower C, International Investment Building, No.6-9, North Ave.Fuchengmen, Xicheng District, 100034, Beijing,P,R,China.
  Telphone: +8610-66091379
  E-mail: Sunsunng1019@sina.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:

08/02/2007(Construction permission date)

>>

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

21 years

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

>>

C.2.1. Renewable crediting period

>>

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

01/01/2009.(The final starting date is the registered date.)

>>

C.2.1.2. Length of the first crediting period:

7 years
>>

C.2.2. Fixed crediting period:

N/A
>>

C.2.2.1. Starting date:

N/A
>>

C.2.2.2. Length:

N/A
>>

SECTION D. Environmental impacts

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

In accordance with relevant environmental law and regulations, the Environmental Assessment Report of the project has been approved by the Environmental Protection Administration of Liaoning Province, referred as "Liaoning Environment Construction (Table) [2006] No.67". A summary of the report is illustrated as follows:

- **Main Potential Environmental Impacts Associated with the project**

– Impacts from the construction of the wind farm include construction noise, dust as well as water and soil loss etc;
– Impacts from noise and the electromagnetism pollutions of the turbines during the exploitation of the wind farm;
– Impacts on native vegetation and environment as a result of construction activities for windmill towers, transformers, and access roads;
– Impacts on Socio-Economy from the construction and operation of the project

- **Impacts on Air Environment**

Wind Power plants are known to contribute to zero atmospheric pollution as no fuel combustion is involved during any stage of the operation. However, the sources of air pollution are mainly due to the construction activities including the transportation of construction material, road construction and Improvement and cadre construction etc. The impacts on air environment are temporarily that the impact will be ended when the construction is completed. It is suggested that several measures shall be taken into account, such as the construction under strong wind weather is prohibited, reducing as much as possible the area of construction, spraying water when undertaking construction, and reducing the speed of vehicles in the field. Hence, air pollution caused by the project is not significant to the surrounding environment.

- **Impacts on Noise Environment**

The noise of the project in construction phase is from vehicles and machines on-site. According to the monitoring data from the construction site, the noise is at a level between 91-102 dB. Based on the formula of declining of sound emitted from a non-directional source, it is estimated that the maximum noise effective distance of the project is 50m in daytime and 300m at night. Moreover, the magnitude of the impacts during construction phase exists for a temporary period of time till the end of construction phase. However, operational noise from the rotating blades is expected to be minimal due to the higher background noise caused by strong winds. The closest residential area to the site of the Project is over 5km away. Therefore, the noise of the project will not have impact on nearby residents.

- **Impacts on Water and Solid Waste**

The wind-farm does not consume any water, nor does it generate any wastewater in the operation phase. The possible negative impacts are the household wastewater and solid waste produced by builders and staff, and the waste earth from digging of the foundation in the construction phase. Under normal conditions with highly automated monitoring and control system, the household wastewater will be first treated in a septic tank, and then be disinfected to discharge for circumjacent virescence. Moreover, the amount of household solid waste will be very little, which will not have impact on the environment. Besides, the solid waste will be collected and moved to the landfill site of the nearest city. The waste earth from the digging should be firstly used for refilling. The rest of the waste earth should be placed in the low area of the site and replanted with grass. Following the suggestion, the water and solid waste should have no significant impact on the environment.

- **Impacts on telecommunications and television transmissions**

Since set of 166kV substation will be constructed in the project, the electromagnetism impact of the project shouldn't be evaluated. Based on the analogies of the built wind-farms, the result concludes that the operation of wind farm will not have electromagnetism impact on the nearby enterprises and residential areas that are 5 km away from the wind-farms. Therefore, the electromagnetism of this project in the operation phase doesn't impact the production and daily life of nearby enterprises and residents.

- **Impacts on Ecosystem Environment**

A serious potential concern for wind farms is their impact on vegetation, animals and migrating birds. The land on which the project activity takes place is barren and unfertile. Prior to the project activity the land had no beneficial use. The vegetation in the project area was substituted by grassland for livestock use and land for cultivation. So the minor quantity of solid / liquid discharge, likely to be generated during the construction phase has no noticeable impact on soil use and the project proponent has made arrangements to dispose them in an environmentally acceptable manner. Moreover, there are no migratory birds / endangered species in the region of project activity. Therefore, the activities to be carried out will not generate any negative impact on the ecological environment.

- **Socio-Economic Impacts**

The preliminary appraisal assumed a larger installed capacity and higher coal displacement in the project. The project is estimated to supply 100.751 GWh of power to the Liaoning Power Grid, which is estimated that 35000 tce will be saved. So the project generates eco-friendly, GHG free power that contributes to sustainable development of the region. Moreover, the locals have benefited economically through land sales and revenues. The project activity not only helps the uplift of skilled and unskilled manpower in the region, but also improves employment rate and livelihood of local populace in the vicinity of the project.

- **Conclusion**

The project activity does not have any major adverse impacts on environment during its construction and operational phase. The project is definitely an environmentally more friendly way of providing power than others power plants.

>>

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

The construction and operation of the proposed project have no significant environmental impacts, and the proposed project is definitely an environmentally more friendly way of providing power than others power plants.

>>

SECTION E. Stakeholders' comments

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

According to the requirement by the *Measures for Operation and Management of Clean Development Mechanism Projects in China* and PDD, the staff of Tieling Longyuan Wind Power Co., Ltd. held an open public survey and a stakeholders conference on the local villagers and residents during Dec. 2006-Jan.2007. In the public survey and conference, the stakeholder representatives were respectively from the local government and the nearby village where the proposed project is located.

- Public survey: during Dec. 2006-Jan.2007, one-page questionnaire was used to carry out a survey on the local stakeholders .
- Stakeholder conference: the meeting w was held in Jan. 2007 in Changtu County to explain CDM，better understand the stakeholders' interests and obtain their comments.

The public survey and the stakeholders conference was designed to comment as following sections:

1) The impacts of the proposed project on the local environment including construction noise, dust as well as water and soil loss etc;
2) The influents of proposed project on the land use and soil erosion；
3) The influences of the proposed project on the ecologic and social environment ；

4) The suggestions to the company regarding the proposed project;
5) Whether or not agree with the construction of the proposed project.

>>

E.2. Summary of the comments received:

The summary of the comments received is listed in the following sections:

- Summary of the stakeholder interviewed

The survey of the proposed project involved 43 representatives (30 questionnaires and 13 representatives), mainly from the local Development and Reform Bureau, the local Environmental Protection Bureau, the local Power Supply Corporation, and the nearby village. Among the stakeholder interviewed, there are 80% of males and 20% of females, education level of the stakeholder: primary level or below (23%); middle level (60%); high level (17%).

- Summary of the stakeholder comments received

No.	Discussional items	Options	Percentage（%）
1	Will the project improve the local development or increase job opportunities?	*Yeah*	95
		No	5
2	Will the project have negative impacts on their livelihood?	*Yeah*	9
		No	91
3	Are they satisfied with their life conditions and surrounding environment?	*Yeah*	85
		No	15
4	What the impacts on environment should be considered?	*Ecological environment*	45
		Noise pollution	70
		Water pollution	24
		Solid waste	10
		Air pollution	0
5	Will they support the construction of the project?	*Yeah*	100
		No	0

- Summary of the survey results

1) There are no adverse comments on the project activity, and mostly stakeholders interviewed were supportive of the proposed project.

2) The successful implementation of the proposed project will diversify local power mix, mitigate electricity shortage, and promote the development of local tourism and other tertiary industries.

3) The local villagers are satisfied with compensation by the project owner for occupation on part of land occupation.

4) Many of stakeholders interviewed suggested the project entity pay special attention to and make efforts to vegetation recovery, soil and water conservation and related facility construction.

>>

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

No negative comments have received on the proposed project. Moreover, the local stakeholders have strong positive comments on the effects that the proposed project will bring the local economy and society. However, to reduce the impacts on the local environment produced from the construction of the proposed project, the project owner should adopt relative measures as follow:

1) The project owner should guarantee and suitably add the investment of environmental protection.
2) The construction processes should be strictly implemented according to the national environment criterions.
3) The measures of environmental protection should been carried out to mitigate the environmental impacts according to the EIA report.

>>

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I countries is involved in the proposed project.

Annex 3

BASELINE INFORMATION

The Annex 3 provides the basic data and results of the baseline emission factor in the Northeast China Power Grid (without the Eastern Inner Mongolia Grid) from 2002 to 2005. the installed capacity and annual electricity generation in the baseline scenario from 2002 to 2004 were shown in tables A-1～A-4, in which the main data sources come from China electric Power Yearbook 2003, 2004 and 2005, the detailed reference pages are listed below the tables.

Table A-1 Installed capacity and annual electricity generation in the Northeast China Power Grid in 2002

	Installed capacity （MW）				Electricity generation （TWh）			
	Total	Hydro power	Thermal Power	Other	Total	Hydro power	Thermal Power	Other
Liaoning	15729.8	1261.4	14389.9	78.5	72.124	1.551	70.45	0.123
Jilin	8939.2	3573.9	5335.2	30.1	30.934	4.9	26.034	0
Heilongjiang	11620.9	814.9	10806	0	46.624	1.564	45.06	0
Total	36289.9	5650.2	30531.1	108.6	149.682	8.015	141.544	0.123
Share(%)	100	15.57	84.13	0.30	100	5.35	94.56	0.08

Data source：China Electric Power Yearbook 2003,P584-585，P593.

Table A-2 Installed capacity and annual electricity generation in the Northeast China Power Grid in 2003

	Installed capacity （MW）				Electricity generation （TWh）			
	Total	Hydro power	Thermal Power	Other	Total	Hydro power	Thermal Power	Other
Liaoning	16350.1	1396.2	14816.4	137.5	82.336	2.383	79.751	0.202
Jilin	9408.5	3585.8	5792.6	30.1	33.883	4.08	29.739	0.064
Heilongjiang	11889	834.6	11054.4	0	49.598	1.105	48.493	0
Total	37647.6	5816.6	31663.4	167.6	165.817	7.568	157.983	0.266
Share(%)	100	15.45	84.10	0.45	100	4.56	95.28	0.16

Data source：China Electric Power Yearbook 2004, P709.

Table A-3 Installed capacity and annual electricity generation in the Northeast China Power Grid in 2004

	Installed capacity （MW）				Electricity generation （TWh）			
	Total	Hydro power	Thermal Power	Other	Total	Hydro power	Thermal Power	Other
Liaoning	16506.4	1404.1	14960.3	142	88.754	3.947	84.543	0.264
Jilin	9595.9	3601.2	5958.7	36.1	39.47	6.147	33.242	0.081
Heilongjiang	12143	844.6	11259.1	39.3	54.866	1.338	53.482	0.046
Total	38245.3	5849.9	32178.1	217.4	183.09	11.432	171.267	0.391
Share(%)	100	15.30	84.14	0.57	100	6.24	93.54	0.21

Data source：China Electric Power Yearbook 2005, P473-474.

Table A-4 Fired electricity supply to the Northeast China Power Grid from 2002 to 2004

	2002			2003			2004		
	Electricity generation (TWh)	Self-consumption rates (%)	electricity supply (TWh)	Electricity generation (TWh)	Self-consumption rates (%)	electricity supply (TWh)	Electricity generation (TWh)	Self-consumption rates (%)	electricity supply (TWh)
Liaoning	70.45	7.42	65.22	79.751	7.17	74.033	84.543	7.21	78.447
Jilin	26.034	7.81	24.001	29.739	7.32	27.562	33.242	7.68	30.689
Heilongjiang	45.061	8.88	41.06	48.493	8.48	44.381	53.482	7.84	49.289
Total	141.54	—	130.283	157.983	—	145.976	171.267	—	158.425

Data source：China Electric Power Yearbook 2003, P591; China Electric Power Yearbook 2004, P670; China Electric Power Yearbook 2005, P472.

Key parameters for the emission factors calculation

The key parameters in OM and BM calculation include the net caloric values (NCVs), oxidation factors (OXIDs), and CO_2 emission factor per unit of energy (EF_{co2}s) of various types of fuels, and power supply efficiency of various power generation technologies.

Table A-5 NCVs, OXIDs, and EF_{co2}s of various types of fuels

Fuel	NCV	EF_{co2} (tc/TJ)	OXID
Coal	20908 kJ/kg	25.80	0.98
Washed coal	26344 kJ/kg	25.80	0.98
Other Washed Coal [1]	8363 kJ/kg	25.80	0.98
Coke	28435 kJ/kg	29.50	0.98
Crude oil	41816 kJ/kg	20.00	0.99
Gasoline	43070 kJ/kg	18.90	0.99
Kerosene	43070 kJ/kg	19.60	0.99
Diesel	42652 kJ/kg	20.20	0.99
Fuel oil	41816 kJ/kg	21.10	0.99
Other petroleum products[2]	38369 kJ/kg	20.00	0.99
Natural gas	38931 kJ/m^3	15.30	0.995
Coke oven gas[24]	16726 kJ/m^3	13.00	0.995
Other gas[25]	5227 kJ/m^3	13.00	0.995
LPG	50179 kJ/kg	17.20	0.995
Refinery gas	46055 kJ/kg	18.20	0.995

Data sources:

[1] 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.

[2] 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 2005, P 365.

[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 2005, P 365.

NCVs are from China Energy Statistical Yearbook 2005, P365.

EF_{co2} are from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, Chapter 1, P1.6, Table 1-2.

OXID are from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, Chapter 1, P1.8, Table 1-4.

Table A-6.Caculation of emission factor of advanced electricity generation technology

	variable	efficiency of electricity transmission	Emission Factor of fuel	Carbon oxidation rate	Emission Factor of power plant
		A	B	C	D=3.6/A/100*B*C*44/12
coal-fired power plant	EFcoal,adv	36.53%	25.8	0.98	0.9136
gas-fired power plant	EFgas,adv	45.87%	15.3	0.995	0.4381
oil-fired power plant	EFoil,adv	45.87%	21.1	0.99	0.6011

Step1 .Calculation of the Operating Margin Emission Factor ($EF_{OM,y}$)

According to the ACM0002 methodology, the Simple method OM was used to calculate the OM emission factors of the years 2002, 2003 and 2004, and then weighted average emission coefficient was calculated and selected as the $EF_{OM, y}$ for primary fuel input for thermal power supply to the Northeast China grid.

The power data and processes for the calculation of the $EF_{OM, y}$ in the Northeast China grid were shown in tables A-7～A-10 . The detailed calculation formulas are described in the section B6.

Table A-7 the calculation data and average emission of the Northeast China Power Grid in 2002

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Sub-Total	Carbon content（tc/TJ）	OXID（%）	NCV（MJ/t,m³,tce）	CO_2 emissions（tCO_2e）
		A	B	C	D=A+B+C	E	F	G	H=D*E*F*G*44/12/100
Raw coal	Mt	32.5852	19.2897	24.2227	76.0976	25.8	98	20908	147502935.5
Clean coal	Mt	0.0145	0	0.0931	0.1076	25.8	98	26344	262791.4
Other washed coal	Mt	3.4755	0.1365	1.404	5.016	25.8	98	8363	3888990
Coke oven gas	Billion m^3	0.189	0	0	0.189	13	99.5	16726	149931.1
Other gas	Billion m^3	0.662	0	0	0.662	13	99.5	5227	164115
Crude oil	Mt	0.0863	0	0	0.0863	20	99	41816	261993.1
Diesel	Mt	0.006	0.01	0.0011	0.0171	20.2	99	42652	53480.26
Fuel oil	Mt	0.2547	0.0175	0.0831	0.3553	21.1	99	41816	1137959
LPG	Mt	0.0004	0	0	0.0004	17.2	99.5	50179	1259.5
Refinery gas	Mt	0.0699	0	0.0038	0.0737	18.2	99.5	46055	225377.3
Natural gas	Billion m^3	0	0.002	0.256	0.258	15.3	99.5	38931	560662.1
Other energy	Mtce	0.1214	0	0	0.1214	0		29271.2	0
								Total	154209494.9

Data sources: *Climate Change Country Study*,P57-58;
WU Zongxin, CHEN Wenying. Coal Based Diversified Clean Energy Strategy,P145-146;
China Energy Statistical Yearbook 2000-2002, P224-227, P236-239, P248-251, P535;
Revised 1996IPCC Guidelines for National Greenhouse Gas Inventories.

Table A-8 the calculation data and average emission of the Northeast China Power Grid in 2003

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Sub-Total	Carbon content（tc/TJ）	OXID（%）	NCV（MJ/t,m³,tce）	CO_2 emissions（tCO_2e）
		A	B	C	D=A+B+C	E	F	G	H=D*E*F*G*44/12/100
Raw coal	Mt	35.5651	20.0666	27.6362	83.2679	25.8	98	20908	161401406.7
Clean coal	Mt	0.7083	0	0.03	0.7383	25.8	98	26344	1803150
Other washed coal	Mt	6.1704	0.159	0.5341	6.8635	25.8	98	8363	5321388
Coke oven gas	Billion m^3	0.166	0	0	0.166	13	99.5	16726	131685.5
Other gas	Billion m^3	0.531	0	0	0.531	13	99.5	5227	131639.1
Crude oil	Mt	0.0339	0	0	0.0339	20	99	41816	102915
Diesel	Mt	0.0032	0.0034	0	0.0066	20.2	99	42652	20641.5
Fuel oil	Mt	0.1487	0.007	0.0432	0.1989	21.1	99	41816	637039.5
LPG	Mt	0.0155	0	0	0.0155	17.2	99.5	50179	48806.39
Refinery gas	Mt	0.0403	0	0.0046	0.0449	18.2	99.5	46055	137305.8
Natural gas	Billion m^3	0	0.004	0.447	0.451	15.3	99.5	38931	980072.1
Other energy	Mtce	0.2938	0	0	0.2938	0		29271.2	0
								Total	170716049.7

Data sources: *Climate Change Country Study*,P57-58;
WU Zongxin, CHEN Wenying. Coal Based Diversified Clean Energy Strategy,P145-146;
China Energy Statistical Yearbook 20074, P166-177, P301;
Revised 1996IPCC Guidelines for National Greenhouse Gas Inventories.

Table A-9 the calculation data and average emission of the Northeast China Power Grid in 2004

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Sub-Total	Carbon content（tc/TJ）	OXID（%）	NCV（MJ/t,m³,tce）	CO_2 emissions（tCO_2e）
		A	B	C	D＝A+B+C	E	F	G	H=D*E*F*G*44/12/100
Raw coal	Mt	41.442	23.109	30.848	95.399	25.8	98	20908	184915589.29
Clean coal	Mt	0.8475	0.0109	0.0488	0.9072	25.8	98	26344	2215654.15
Other washed coal	Mt	5.7767	0.1426	0.61	6.5293	25.8	98	8363	5062277.31
Coke oven gas	Billion m^3	0.483	0.291	0	0.774	13	99.5	16726	614003.60
Other gas	Billion m^3	5.733	0.419	0	6.152	13	99.5	5227	1525129.39
Crude oil	Mt	0	0	0	0	20	99	41816	0.00
Diesel	Mt	0.0204	0.0116	0.0024	0.0344	20.2	99	42652	107586.02
Fuel oil	Mt	0.1281	0.0178	0.0286	0.1745	21.1	99	41816	558890.85
LPG	Mt	0.0219	0	0	0.0219	17.2	99.5	50179	68958.70
Refinery gas	Mt	0.0979	0	0.0114	0.1093	18.2	99.5	46055	334243.41
Natural gas	Billion m^3	0	0.003	0.253	0.256	15.3	99.5	38931	556315.89
Other energy	Mtce	0.2697	0.0507	0	0.3204	0		29271.2	0.00
								Total	195958648.61

Data sources: *Climate Change Country Study*,P57-58;
WU Zongxin, CHEN Wenying. Coal Based Diversified Clean Energy Strategy,P145-146;
China Energy Statistical Yearbook 2005, P222-233, P365;
Revised 1996IPCC Guidelines for National Greenhouse Gas Inventories.

Table A-10 the calculation of the OM emission factor of the Northeast China Power Grid

		2002	2003	2004
Total CO_2 emissions （tCO_2e）	A_i	154209494.9	170716049.7	195958648.61
Fossil-fired electricity （TWh）	B_i	130.283	145.976	158.425
$EF_{OM,y}$ （tCO_2/MWh）	$C_i = A_i/B_i \times 10^{-6}$	1.18365	1.16948	1.23691
$EF_{OM,y}$ of NorthEast China Power Grid(*Weight Average*) （tCO_2/MWh）		1.19830		

Data source：China Electric Power Yearbook 2003,2004,2005.

Step 2. Calculation of the Build Margin Emission Factor （$EF_{BM,y}$）

According to the ACM0002 methodology, the Build Margin emission factor $EF_{BM,y}$ *ex-ante* was selected to identify sample group for calculating Build Margin emission factor. Based on the description of formulas in section B6, the Build Margin emission factor is calculated to be 0.8108 tCO_2/MWh.

The power data and processes for the calculation of the $EF_{BM,y}$ in the Northeast China grid were shown in tables A-11～A-13 . The detailed calculation formulas are described in the section B6.

Step 2a : 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

Table A-11 Calculation of emission weight of solid fuel, liquid fuel and gas fuel in all fuel emission

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Total	Emission Factor（Tc/TJ）	Carbon oxidation rate （%）	NCV（MJ/t,km3,tce）	CO2 emissions（tCO2e） H=G*D*E*F*44/12/10000 (Quality unit)
		A	B	C	D＝A+B+C	E	F	G	H=D*E*F*G*44/12/1000 (Volume unit)
Raw coal	10^4t	4144.2	2310.9	3084.8	9539.9	25.8	98	20908	184915589.3
Clean coal	10^4t	84.75	1.09	4.88	90.72	25.8	98	26344	2215654.154
Other washed coal	10^4t	577.67	14.26	61	652.93	25.8	98	8363	5062277.314
coke	10^4t				0	29.5	98	28435	0
Total									192193520
Crude oil	10^4t				0	20	99	41816	0
Diesel	10^4t	2.04	1.16	0.24	3.44	20.2	99	42652	107586.019
Fuel oil	10^4t	12.81	1.78	2.86	17.45	21.1	99	41816	558890.849
Gasoline									
other petroleum product	10^4t				0	20	99	38369	0
Total	10^4t								666477
Coke oven gas	10^{11} m^3	4.83	2.91		7.74	13	99.5	16726	614003.5988
Other gas	10^{11} m^3	57.33	4.19		61.52	13	99.5	5227	1525129.391
LPG	10^4t	2.19			2.19	17.2	99.5	50179	68958.7015
Refinery gas	10^4t	9.79		1.14	10.93	18.2	99.5	46055	334243.4057
Natural gas	10^{11} m^3		0.03	2.53	2.56	15.3	99.5	38931	556315.8924
Total									3098651
Sum Total									195958648.6

From above table and formulae (5),(6) and (7),the weights are as follows:
λ*Coal* =98.79%，λ*Oil* =0.34%，λ*Gas* =0.87%

Step 2b: calculating the corresponding emission factor for fossil fuel fired power generation

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9084$$

Step 2c: calculating the $EF_{BM,y}$ of local grid

Table A- 12 The new installed capacity from 1977-2004 in the Northeast China Power Grid

	Installed capacity in 1997（MW）	Installed capacity in 1998（MW）	Installed capacity in 2004（MW）	Addition capacity from 1997 to 2004（MW）	Addition share（%）
	A	B	C	D=C-A	
Thermal（MW）	24238.2	26104.9	32184.1	7945.9	89.26%
Hydro（MW）	5104.9	5482.3	5849.9	745	8.37%
Nuclear（MW）	0	0	0	0	0.00%
Wind（MW）	0	17	217.3	217.3	2.44%
Total（MW）	29343.1	31604.2	38245.3	8902.2	100.00%
Share of 2004 installed capacity	76.72%	82.64%	100%		

Data sources: Installed capacity in 1997 from http://www.chinapower.com.cn/yearbook/article/1998/51601001.html;
China Electric Power Yearbook1999, P551;
China Electric Power Yearbook2005, P473.

Step 3. Calculation of the Baseline Emissions Factor（EF_y）

Table A-13 Baseline Emission factor (EF_y) of the Northeast China Power Grid

Calculation of the Key factors:

Operating Margin emission factor（$EF_{OM,y}$）（tCO_2/MWh）：1.1983

Build Margin emission factor（$EF_{BM,y}$）（tCO_2/MWh）：0.9084×89.26%=0.8108

Baseline Emission factor（EF_y）（tCO_2/MWh）：1.119830×0.75+0.8108×0.25=1.1014

Note: the latest version of ACM0002 (version 6) provides the following default weights for wind and solar projects: Operating Margin, W_{OM} = 0.75; Build Margin, W_{BM} = 0.25.

Deleted: The Annex 3 provides the basic data and results of the baseline emission factor in the Northeast China Power Grid. The information provided by the tables includes data, data resources and the underlying computation.
Table A-1～A-3 provides the Thermal power electricity generation in Northeast China Power Grid in the baseline scenario from 2003 to 2005, in which the main data sources come from China electric Power Yearbook 2004, 2005 and 2006.

Table A-1 Thermal power electricity generation in Northeast China Power Grid in 2003 ... [1]

IRR calculation of the proposed project.

Tables B1 show the Parameters needed for calculation of IRR.

The below Formulas are used in the IRR calculation process. They are based on «Method and Parameter of economic analysis for construction project » published by National Development and Reform Commission:

a) Cash inflow= sales revenue+ fixed assets residue+ recovered liquid capital
b) Sales revenue= annual output× tariff (excl. VAT)
c) Fixed assets residual value= original fixed assets value × rate of assets residual value
d) Recovered liquid capital= liquid capital input at beginning of project operation
e) Cash outflow= capital construction investment + liquid capital+ operating cost + sales tax and extra charges + income tax

   Where:
   Capital construction investment = Static total investment
   Liquid capital = Liquid capital input of current year;
   Operating cost= annual salary per capita ×employee population × (1+ rate of welfarism) + the sum of original value of buildings and equipment × (rate of maintenance + rate of insurance premium) + (fixed amount of material cost+ fixed amount of other costs) × installed capacity;
   Sales tax and extra charges=sales revenue × rate of VAT × (rate of city construction tax + rate of additional education fee);
   Income tax= 〔sales revenue- sales tax and extra charges - operating cost - original value of houses and buildings × (1- expected rate of residual value) ÷ expected depreciable life - machinery × (1- expected rate of residual value) ÷ expected depreciable life - other assets ÷ amortizing period〕 × rate of income tax;
f) Net cash flow = cash inflow - cash outflow

g) The FIRR of the proposed project is calculated with the following formula:

$$\sum_{1}^{n} \frac{annual\ net\ cash\ flow_n}{(1+\ FIRR)^n} = 0$$

   where:
   n is the project life time(including construction period and operation period);
   $annual\ net\ cash\ flow_n$ is the net cash flow in NO. n year.
   FIRR is the financial internal rate of return, a financial indicator of the proposed project.
h) Net cash flow with CERs income = net cash flow without CERs income +〔CERs income excl. VAT －CERs income excl. VAT × VAT rate ×(rate of city construction tax + rate of additional education fee))×（1 - rate of income tax)
i) The FIRR of the proposed project with CERs income is calculated with the following formula:

$$\sum_{1}^{n} \frac{annual\ net\ cash\ flow_n^{'}}{(1+\ FIRR^{'})^n} = 0$$

   where:
   n is the project life time;
   $annual\ net\ cash\ flow_n^{'}$ is the net cash flow with CERs income in NO. n year.
   $FIRR^{'}$ is the financial internal rate of return of the proposed project with CERs income.

Table B-1 Main Parameters needed for calculation of key financial indicators

No.	Item	Unit	Figure
1	Type of wind turbines	***	850
2	Number of wind turbines		58
3	Installed capacity	MW	49.3
4	Annual operation hours	Hour	2044
5	Annual generation delivered to the grid	10000 kWh	10075
6	Electricity tariff(Excl. VAT)	Yuan/kWh	0.5742
7	Static total investment	10000 Yuan	41654
7.1	Share of investment in 1st year	%	12.5
7.2	Share of investment in 2nd year	%	87.5
8	Liquid capital	10000 Yuan	150
9	Construction period	Year	1
10	Operation lifetime	Year	20
11	Depreciable life of fixed assets	Year	15
12	Rate of residual value of fixed assets	%	3
13	Amortization period of other assets	Year	5
14	Rate of fixed assets maintenance	%	1.4
15	Rate of insurance premium of fixed assets	%	0.405
16	Employee population		20
17	Annual salary per capita	10000 Yuan	3.1
18	Rate of welfarism	%	41
19	Material cost	Yuan/kW	0
20	Other costs	Yuan/ kW	40
21	Rate of VAT	%	8.5
22	Rate of city construction tax	%	5
23	Rate of additional education fee	%	3
24	Rate of income tax	%	33
25	**CERs**	Ton	110967
26	**CERs Unit price**	ERU/Ton	9
27	**CERs income (incl. VAT)**	10000 Yuan	1081
28	**CERs income (excl. VAT)**	10000 Yuan	996
29	Exchange rate	ERU:RMB	10.074

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Date source: items (1-6) and (8-24) are from the feasibility study report of the proposed project, The source of item 7 see page 11 of the PDD. item 29 is according to the exchange rate when the PDD was finished.

Cash Flow Table (total investment)

Unit：10000 Yuan RMB

No.	Item	Total	Construction Period		Operation Period							
			1	2	3	4	5	6	7	8	9	10
	（10000kW.h）Annual output	201500	0	10075	10075	10075	10075	10075	10075	10075	10075	10075
	Tariff (Yuan/kWh, excl. VAT)	***	0	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742
	Rate of fixed assets maintenance (%)	***	0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	Rate of income tax (%)	***	0	0	0	15	15	15	33	33	33	33
1	Cash inflow	117101	0	5785	5785	5785	5785	5785	5785	5785	5785	5785
1.1	Sales revenue	115701	0	5785	5785	5785	5785	5785	5785	5785	5785	5785
1.2	Fixed assets residual value	1250	0	0	0	0	0	0	0	0	0	0
1.3	Recovered liquid capital	150	0	0	0	0	0	0	0	0	0	0
2	Cash outflow	82556	41654	1226	1076	1378	1378	1378	1741	1741	1741	1741
2.1	Construction investment	41654	41654									
2.2	Liquid capital	150		150								
2.3	Operating cost	26561		1036	1036	1036	1036	1036	1036	1036	1036	1036
2.4	Sales tax & extra charges	787	0	39	39	39	39	39	39	39	39	39
2.5	Income tax	13404		0	0	302	302	302	665	665	665	665
3	Net cash flow (1-2)	34545	-41654	4559	4709	4407	4407	4407	4044	4044	4044	4044
4	Accumulative total of net cash flow	***	-41654	-37095	-	-27979	-23572	-19165	-15121	-11077	-7032	-2988

					32385							
5	Net cash flow with CERs income	48993	-41654	5549	5699	5248	5248	5248	4707	4707	4707	4707

Item	Operation Period										
	11	12	13	14	15	16	17	18	19	20	21	
(10000kW.h) Annual output	10075	10075	10075	10075	10075	10075	10075	10075	10075	10075	10075	
Tariff (Yuan/kWh, excl. VAT)	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	0.5742	
Rate of fixed assets maintenance (%)	1.4	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	
Rate of income tax (%)	33	33	33	33	33	33	33	33	33	33	33	
Cash inflow	5785	5785	5785	5785	5785	5785	5785	5785	5785	5785	7185	
Sales revenue	5785	5785	5785	5785	5785	5785	5785	5785	5785	5785	5785	
Fixed assets residual value	0	0	0	0	0	0	0	0	0	0	1250	
Recovered liquid capital	0	0	0	0	0	0	0	0	0	0	150	
Cash outflow	1741	2132	2132	2132	2132	2132	3021	3021	3021	3021	3021	
Construction investment												
Liquid capital												
Operating cost	1036	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	
Sales tax & extra charges	39	39	39	39	39	39	39	39	39	39	39	
Income tax	665	473	473	473	473	473	1362	1362	1362	1362	1362	
Net cash flow (1-2)	4044	3653	3653	3653	3653	3653	2764	2764	2764	2764	4164	
Accumulative total of net cash flow	1056	4709	8362	12016	15669	19323	22087	24852	27616	30381	34545	
Net cash flow with CERs income	4707	4316	4316	4316	4316	4316	3428	3428	3428	3428	4827	

FIRR without CERs income	**7.17%**
FIRR with CERs income	**9.67%**

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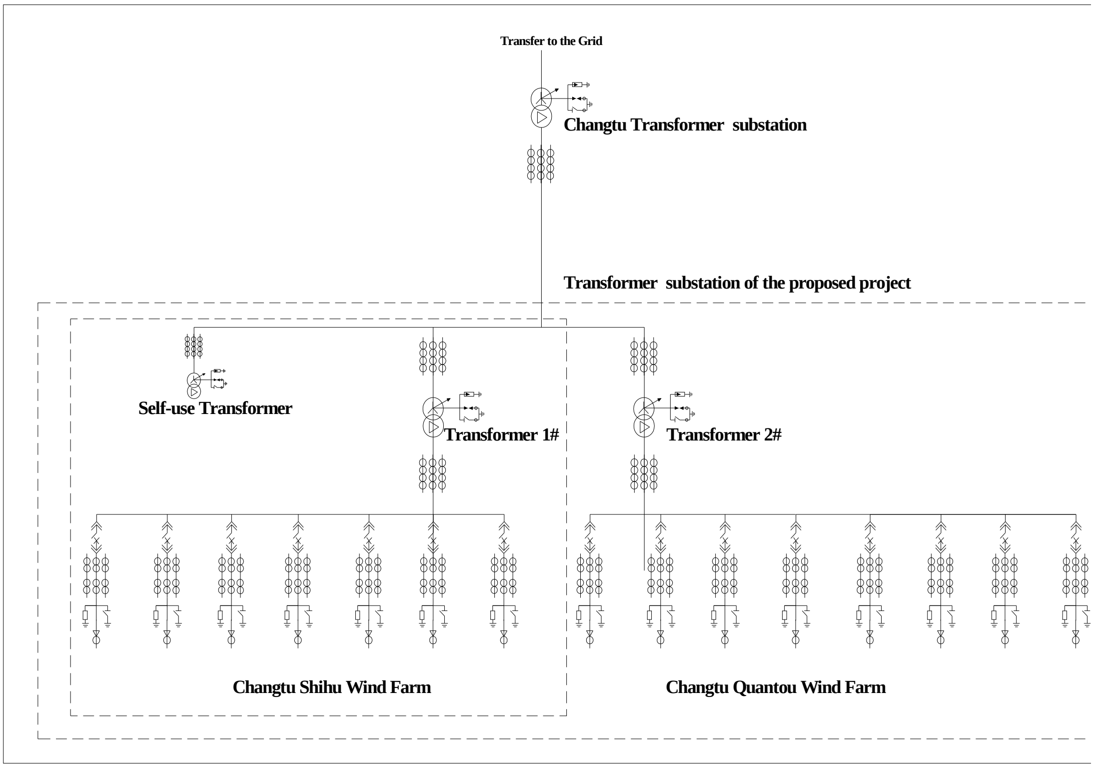
Annex 4

MONITORING INFORMATION

Please refer to B7.2 in the PDD.



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The Annex 3 provides the basic data and results of the baseline emission factor in the Northeast China Power Grid. The information provided by the tables includes data, data resources and the underlying computation.

Table A-1～A-3 provides the Thermal power electricity generation in Northeast China Power Grid in the baseline scenario from 2003 to 2005, in which the main data sources come from China electric Power Yearbook 2004, 2005 and 2006.

Table A-1 Thermal power electricity generation in Northeast China Power Grid in 2003

Province	Generating capacity （MWh)	Rate of electricity consumption （%）	Power supply （MWh)
Liaoning	79751000	7.17	74,032,853.30
Jilin	29739000	7.32	27,562,105.20
Heilongjiang	48493000	8.48	44,380,793.60
Total（MWh)			**145,975,752.10**

《China Electric Power Yearbook 2004》P709，P670

Table A-2 Thermal power electricity generation in Northeast China Power Grid in 2004

Province	Generating capacity （MWh)	Rate of electricity consumption （%）	Power supply （MWh)
Liaoning	84543000	7.21	78,447,449.70
Jilin	33242000	7.68	30,689,014.40
Heilongjiang	53482000	7.84	49,289,011.20
Total（MWh)			**158,425,475.30**

《China Electric Power Yearbook 2005》P472，P474

Table A-3 Thermal power electricity generation in Northeast China Power Grid in 2005

Province	Generating capacity （MWh)	Rate of electricity consumption （%）	Power supply （MWh)
Liaoning	83697000	7.03	77,813,100.90
Jilin	35294000	6.59	32,968,125.40
Heilongjiang	58000000	7.96	53,383,200.00
Total（MWh)			**164,164,426.30**

《China Electric Power Yearbook 2006》P559, P568

Key parameters for the emission factors calculation

The key parameters in OM and BM calculation include the net caloric values (*NCVs*), oxidation factors (*OXIDs*), and CO_2 emission factor per unit of energy ($EF_{co2}s$) of various types of fuels, and power supply efficiency of various power generation technologies.

Table A-4 NCVs, OXIDs, and EFco2s of various types of fuels

Fuel	NCV	EF_{co2} (tc/TJ)	OXID
Coal	20908 kJ/kg	25.80	1
Washed coal	26344 kJ/kg	25.80	1
Other Washed Coal [1]	8363 kJ/kg	25.80	1
Coke	28435 kJ/kg	25.80	1
Crude oil	41816 kJ/kg	20.00	1
Gasoline	43070 kJ/kg	18.90	1
Kerosene	43070 kJ/kg	19.60	1
Diesel	42652 kJ/kg	20.20	1
Fuel oil	41816 kJ/kg	21.10	1
Other petroleum products[2]	38369 kJ/kg	20.00	1
Natural gas	38931 kJ/m^3	15.30	1
Coke oven gas[1]	16726 kJ/m^3	12.10	1
Other gas[2]	5227 kJ/m^3	12.10	1
LPG	50179 kJ/kg	17.20	1
Refinery gas	46055 kJ/kg	18.20	1

Data sources:

NCVs are from China Energy Statistical Yearbook 2006, P287.

$EFco_2$ are from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, table 1-3.

OXID are from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, table 1-4.

Table A-5 Caculation of emission factor of advanced electricity generation technology

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[1] 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.

[2] 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

[1] 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 2005, P 365.

[2] 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 2005, P 365.

	Variable	Efficiency of electricity transmission A	Emission factor of fuel B	Carbon oxidation rate C	Emission factor of power plant D=3.6/A/1000*B*44/12
Coal-fired power plant	EF*coal,adv*	35.82%	25.8	1	0.9508
Gas-fired power plant	EF*gas,adv*	47.67%	15.3	1	0.4237
Oil-fired power plant	EF*oil,adv*	47.67%	21.1	1	0.5843

Step1 .Calculation of the Operating Margin Emission Factor ($EF_{OM,y}$)

According to the ACM0002 methodology, the Simple method OM was used to calculate the OM emission factors of the years 2003, 2004 and 2005, and then weighted average emission coefficient was calculated and selected as the $EF_{OM,\ y}$ for primary fuel input for thermal power supply to the Northeast China grid.

The power data and processes for the calculation of the EF_{OM}, y in the Northeast China grid were shown in tables A-6～A-9. The detailed calculation formulas are described in the section B6.

Section Break (Next Page)

Table A-6 The fuel consumption and total emissions of Northeast China Power Grid in 2003

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Sub-Total	Carbon content（tc/TJ）	OXID（%）	NCV（MJ/t,m^3, tce）	CO_2 emissions（tCO_2e）
		A	B	C	D＝A+B+C	E	F	G	H=D*E*F*G*44/12/100
Raw coal	Mt	35.5651	20.0666	27.6362	83.2679	25.8	100	20908	164,695,313.0
Clean coal	Mt	0.7083	0	0.03	0.7383	25.8	100	26344	1,839,948.7
Other washed coal	Mt	6.1704	0.159	0.5341	6.8635	25.8	100	8363	5,429,988.0
Coke oven gas	Billion m^3	0.166	0	0	0.166	12.1	100	16726	123,184.8
Other gas	Billion m^3	0.531	0	0	0.531	12.1	100	5227	123,141.3
Crude oil	Mt	0.0339	0	0	0.0339	20	100	41816	103,954.6
Diesel	Mt	0.0032	0.0034	0	0.0066	20.2	100	42652	20,850.0
Fuel oil	Mt	0.1487	0.007	0.0432	0.1989	21.1	100	41816	643,474.2
LPG	Mt	0.0155	0	0	0.0155	17.2	100	50179	49,051.6
Refinery gas	Mt	0.0403	0	0.0046	0.0449	18.2	100	46055	137,995.8
Natural gas	Billion m^3	0	0.004	0.447	0.451	15.3	100	38931	984,997.1
Other energy	Mtce	0.2938	0	0	0.2938	0		29271.2	0.0
Total									**174,151,899.2**

Table A-7 The fuel consumption and total emissions of Northeast China Power Grid in 2004

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Sub-Total	Carbon content（tc/TJ）	OXID（%）	NCV（MJ/t,m^3, tce）	CO_2 emissions（tCO_2e）
		A	B	C	D＝A+B+C	E	F	G	H=D*E*F*G*44/12/10
Raw coal	Mt	41.442	23.109	30.848	95.399	25.8	100	20908	188,689,376.8
Clean coal	Mt	0.8475	0.0109	0.0488	0.9072	25.8	100	26344	2,260,871.6
Other washed coal	Mt	5.7767	0.1426	0.61	6.5293	25.8	100	8363	5,165,589.1
Coke oven gas	Billion m^3	0.483	0.291	0	0.774	12.1	100	16726	574,367.5
Other gas	Billion m^3	5.733	0.419	0	6.152	12.1	100	5227	1,426,676.9
Crude oil	Mt	0	0	0	0	20	100	41816	0.0
Diesel	Mt	0.0204	0.0116	0.0024	0.0344	20.2	100	42652	108,672.7
Fuel oil	Mt	0.1281	0.0178	0.0286	0.1745	21.1	100	41816	564,536.2
LPG	Mt	0.0219	0	0	0.0219	17.2	100	50179	69,305.2
Refinery gas	Mt	0.0979	0	0.0114	0.1093	18.2	100	46055	335,923.0
Natural gas	Billion m^3	0	0.003	0.253	0.256	15.3	100	38931	559,111.4
Other energy	Mtce	0.2697	0.0507	0	0.3204	0		29271.2	0
Total									**199,754,430.5**

Data sources: China Energy Statistical Yearbook 2005

Table A-8 The fuel consumption and total emissions of Northeast China Power Grid in 2005

Fuel	Unit	Liaoning	Jilin	Heilongjiang	Sub-Total	Carbon content（tc/TJ）	OXID（%）	NCV（MJ/t,m3, tce）	CO_2 emissions（tCO2e）
		A	B	C	D＝A+B+C	E	F	G	H=D*E*F*G*44/12/100
Raw coal	Mt	43.0541	24.4613	33.8321	101.3475	25.8	100	20908	200,454,895.9
Clean coal	Mt	0	0	0	0	25.8	100	26344	0.0
Other washed coal	Mt	5.2474	0.1926	0.2416	5.6816	25.8	100	8363	4,494,939.9
Coke oven gas	Billion m^3	0.103	0.357	0.068	0.528	12.1	100	16726	391,816.6
Other gas	Billion m^3	1.262	0.837	0	2.099	12.1	100	5227	486,767.7
Crude oil	Mt	0.0116	0	0	0.0116	20	100	41816	35,571.5
Diesel	Mt	0.0118	0.0148	0.0057	0.0323	20.2	100	42652	102,038.7
Fuel oil	Mt	0.0932	0.0246	0.0155	0.1333	21.1	100	41816	431,247.4
LPG	Mt	0.0012	0	0	0.0012	17.2	100	50179	3,797.5
Refinery gas	Mt	0.0548	0	0.0132	0.068	18.2	100	46055	208,991.4
Natural gas	Billion m^3	0	0.084	0.224	0.308	15.3	100	38931	672,681.0
Other energy	Mtce	0.1618	0	0	0.1618	0	100	29271.2	0.0
Total									**207,282,747.6**

Data sources: China Energy Statistical Yearbook 2006

Table A-9 The OM factor of Northeast China Power Grid

Years	Thermal generation delivered to Northeast China Power Grid	The emissions from Northeast China Power Grid	OM
	A	**B**	**C=B/A**
2003	145,975,752.1	174,151,899.2	1.193019366
2004	158,425,475.3	199,754,430.5	1.260873166
2005	164,164,426.3	207,282,747.6	1.262653257
Total	**468,565,653.7**	**581,189,077.4**	
Average OM			**1.2404**

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Step 2. Calculation of the Build Margin Emission Factor **（$EF_{BM,y}$）**

According to the ACM0002 methodology, the Build Margin emission factor $EF_{BM,y}$ *ex-ante* was selected to identify sample group for calculating Build Margin emission factor. Based on the description of formulas in section B6, the Build Margin emission factor is calculated to be **0.8632** tCO_2/MW·h.
The power data and processes for the calculation of the $EF_{BM,y}$ in the North East China grid were shown in tables A-10～A-14 . The detailed calculation formulas are described in the section B6.

Step 2a: calculating the respective percentages of CO_2 emissions from coal fired power generation, oil fired power generation, and gas fired power generation against total CO_2 emissions from fossil fuel fired power generation

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Table A-10 Calculation of emission weight of solid fuel, liquid fuel and gas fuel in all fuel emission

Fuel	unit	Liaoning	Jilin	Heilongjiang	Total	NCV(MJ/t,km³,tce)	Emission Factor(Tc/TJ)	Carbon oxidation rate(%)	CO_2 emission(tCO_2e)
		A	B	C	D=A+B+C	H	I	J	K=G*H*I*J*44/12/100
Raw coal	10^4t	4305.41	2446.13	3383.21	10134.75	20908	25.80	1	200,454,896
Clean coal	10^4t	0	0	0	0.00	26344	25.80	1	0
Other washed coal	10^4t	524.74	19.26	24.16	568.16	8363	25.80	1	4,494,940
coke	10^4t	0	0	0	0.00	28435	25.80	1	0
Sub-total									**204,949,836**
Crude oil	10^4t	1.16	0	0	1.16	41816	20.00	1	35,571
Gasoline	10^4t	0	0	0	0	43070	18.90	1	0
Kerosene	10^4t	0	0	0	0	43070	19.60	1	0
Diesel	10^4t	1.18	1.48	0.57	3.23	42652	20.20	1	102,039
Fuel oil	10^4t	9.32	2.46	1.55	13.33	41816	21.10	1	431,247
other petroleum product	10^4t	0	0	0	0	38369	20.00	1	0
Sub-total					0				**568,858**
Natural gas	10^7m^3	0	8.4	22.4	30.8	38931	15.30	1	672,681
COG	10^7m^3	10.3	35.7	6.8	52.8	16726	12.10	1	391,817
Other Gas	10^7m^3	126.2	83.7	0	209.9	5227	12.10	1	486,768
LPG	10^4t	0.12	0	0	0.12	50179	17.20	1	3,798
Refinery gas	10^4t	5.48	0	1.32	6.8	46055	18.20	1	208,991
Sub-total									**1,764,054**
Total									**207,282,748**

Data sources: *China Energy Statistical Yearbook 2006*

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From above table and formulae (5),(6) and (7),the weights are as follows:
λ_{Coal} =99.88%，λ_{Oil} =0.85%，λ_{Gas} =0.27%

Step 2b: calculating the corresponding emission factor for fossil fuel fired power generation

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9453.$$

Step 2c: calculating the $EF_{BM,y}$ of local grid

Table A-11 Installed capacity of Northeast China Power Grid in 2005

Installed capacity	unit	Liaoning	Jilin	Heilongjiang	total
Thermal Power	MW	15999	6359.4	11575.6	33934
Hydropower	MW	1403.9	3720.8	846.7	5971.4
Nuclear	MW	0	0	0	0
Wind power and other	MW	135.5	85.4	52.4	273.3
Total	MW	17538.4	10165.6	12474.7	40178.7

Data sources:*China Electric Power Yearbook2006* ,p571

Table A-12 Installed capacity of Northeast China Power Grid in 1999

Installed capacity	unit	Liaoning	Jilin	Heilongjiang	total
Thermal Power	MW	12425.7	4583.1	10128.1	27136.9
Hydropower	MW	1240	3508.2	774.5	5522.7
Nuclear	MW	0	0	0	0
Wind power and other	MW	22.9	0	0	22.9
Total	MW	13688.6	8091.3	10902.6	32682.5

Data sources: *China Electric Power Yearbook2000*

Table A-13 Installed capacity of Northeast China Power Grid in 1998

Installed capacity	unit	Liaoning	Jilin	Heilongjiang	total
Thermal Power	MW	12560.3	4428.6	9116	26104.9
Hydropower	MW	1223.1	3474.7	784.5	5482.3
Nuclear	MW	0	0	0	0
Wind power and other	MW	17	0	0	17
Total	MW	13800.4	7903.3	9900.5	31604.2

Data sources: *China Electric Power Yearbook1999*

Table A-14 The new installed capacity from 1998-2005 in the Northeast China Power Grid

	Installed capacity in 1998	Installed capacity in 1999	Installed capacity in 2005	Addition capacity from 1998 to 2005	Addition share**(%)**
	A	B	C	D=C-A	
Thermal Power	26104.9	27136.9	33934	7829.1	91.31%
Hydropower	5482.3	5522.7	5971.4	489.1	5.70%
Nuclear	0	0	0	0	0.00%
Wind power	17	22.9	273.3	256.3	2.99%
Total（MW）	31604.2	32682.5	40178.7	8574.5	100.00%
Share of 2004 installed capacity	78.66%	81.34%	100.00%		

$EF_{BM,y}=EF_{Thermal}\times CAP_{Thermal}/CAP_{Total}=0.9453\times 91.31\%=0.8362$

where:

CAP_{Total} is the total capacity addition,

$CAP_{Thermal}$ is the fossil fuel fired capacity addition.

Step 3. Calculation of the Baseline Emissions Factor（EF_y）

According to the baseline methodology (ACM0002), the baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), as shown in table A-15:

Table A-15 Baseline Emission factor (EF_y) of the Northeast China Power Grid

Calculation of the Key factors:
Operating Margin emission factor（$EF_{OM,y}$）（tCO_2/MWh）：1.2404
Build Margin emission factor（$EF_{BM,y}$）（tCO_2/MWh）：0.9453×91.31%=0.8632
Baseline Emission factor（EF_y）（tCO_2/MWh）：1.2404×0.75+0.8632×0.25=1.1461

Note: the latest version of ACM0002 (version 6) provides the following default weights for wind and solar projects: Operating Margin, W_{OM} = 0.75; Build Margin, W_{BM} = 0.25.