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 Shihu Wind Power Project

Document version number: 7.0

Document version date: 28/03/2010

A.2. Description of the project activity:

The project is to build and operate a 49.3 MW grid connected wind farm, located in Quantou Town, Changtu County, Liaoning Province, P.R.China. The scenario existing prior to the start of the implementation of the project activity is Northeast China Power Grid providing the same electricity supply as the proposed project.The project installs totally 58 wind turbines with a nominal capacity of 850 KW. During the operation period, the wind generators will deliver about 101,420 MWh to the Liaoning Power Grid that is integral to and forms a part of the Northeast China Power Grid. The electricity generated by the project is expected to displace grid electricity generated from fossil fuels in Northeast China Power Grid and reduce GHG emissions by an amount of approximately 115,689 tCO_2e(tons of carbon dioxide equivalent) per year for the duration of the project activity. A reduction of approximately 809,823 tCO_2e, is forecast for the first 7-year crediting period.

The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

Wind power is a priority development area as a green energy supply technology in China. The project can improve energy security and air quality and contribute to sustainable development in various ways:

- It increases the share of renewable energy in the national grid and helps to stimulate the growth of the wind power industry in China, thereby contributing to the national private expertise in the installation and operation of such technology.
- It is accorded with the government’s energy policy objective, which promotes the local economy and creates local employment during the installation and operation periods.
- It reduces greenhouse gas emissions resulting from the power generation industry in China, compared to a business-as-usual approach.
- The success of the project activity will promote other business groups to invest in similar type of projects which will also help developing economy in the region(s).

>>

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
China (host)	Tieling Longyuan Wind Power Co., Ltd.	No
Switzerland	Essent Trading International S.A.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Please see Annex 1 for detailed contact information

>>

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

P.R.China

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

Liaoning Province

A.4.1.3. City/Town/Community etc:

Quantou Town, Changtu County, Tieling City

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

The project is located in Quantou Town, Changtu County, Tieling City, Liaoning Province of China. The geographical co-ordinates are: longitude 124°13′00″, and northern latitude 42°52′00″, and altitude 200-300 m. Figure 1 gives an illustration of the location.

Figure 1 Location of Liaoning Changtu Shihu Wind Power Project

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

Sectoral Scope 1: Energy Industries

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

The proposed project is the installation of a new grid-connected zero-emission renewable power generation activity. The purpose of the proposed project is to generate electricity using wind power resources in the project region and replace the same amount of power generation in Northeast China Power Grid. Prior to the implementation of the project activity, there were 36,216 MW of thermal power plants, 6,126 MW of hydropower plants, 530 MW of wind power plants and 22 MW of other power plants in operation in Northeast Power Grid[1].

The project is to install totally 58 wind turbines (Gamesa58-850kW) with a nominal capacity of 850 KW, providing a total capacity of 49.3 MW. Table 1 provides main technical information of wind turbines in the project. Each turbine will have a 690V-to-10kV transformer, and every 6-8 transformers are parallel-connected with a 10kV line to a local transformer 10kV-to-66kV station, where electricity generated by the proposed project is delivered to the power grid through a 220kV line in Changtu transformer Substation. The wind turbines and transmission facility could be monitored and controlled either by onsite central control room or remotely through Internet.

Table 1 Main technical Characteristics of wind turbines for the project

Rotor 850 kW	
Type	3-bladed, horizontal axis, upwind
Rotor Diameter	58 m
Swept Area	2642 m^2
RPM	30.8/14.6 RPM
Cut in-cut-out wind	3 / 21m/s
Nominal Output at velocity	12 m/s
Design conditions in terms of velocity	52.5 m/s (IEC)
Lifetime of turbine	20 years
Blades	
Blade Length	28.3 m
Material	Epoxy reinforced glass fibre
Generator	
Nominal Power	850 kW
Type	Doubly fed machine, oil pump with oil cooler
Synchronous speed	1620 r.p.m
Towers	
Type	Tubular (cone-shaped)
Hub heights	65 m

Data sources from：http://www.gamesa.es/files/File/G58-ingles.pdf

The feasibility study report of Liaoning Changtu Shihu Wind Power Project, P44, Table 5-1-1

[1] China Electric Power Yearbook 2007

The wind turbine (Gamesa58-850kW) used by the proposed project is the primary production of Gamesa Eólica. Gamesa Eólica is one of the biggest manufacturers and supplies of technologically advanced products installations and services in the renewable energy sectors, which has set up the subsidiary company to produce the wind turbines in Tianjin. At present, the accessories of the wind turbine (Gamesa58-850kW) mostly yielded domestically with the percent of 70. 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. Therefore, the transfer of technology contributes to promote the development of domestic wind turbines and maximum performance on all types of sites and in all types of wind resources.

>>

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

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
2010	115,689
2011	115,689
2012	115,689
2013	115,689
2014	115,689
2015	115,689
2016	115,689
Total estimated reductions (tonnes of CO_2e)	809,823
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	115,689

>>

A.4.5. Public funding of the project activity:

No public funds from countries in Annex I is involved in the 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:

Methodology:

Version 07 of ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources

Tools referenced in this methodology:

Version 05.2 of tool for the demonstration and assessment of additionality

Version 02 of tool to calculate project or leakage CO_2 emissions from fossil fuel combustion

Version 01.1 of tool to calculate the emission factor for an electricity system

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

>>

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

The proposed project status is corresponding to the methodology ACM0002, the applicability of methodology ACM0002 for the proposed project are 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.

>>

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

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

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

Spatial boundary:

The spatial extend of the project boundary includes 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 NDRC[2], the Northeast China Power Grid consists of Liaoning, Heilongjiang and Jilin power grids. In Northeast China Power Grid, there were 36,216 MW of thermal power plants, 6,126 MW of hydropower plants, 530 MW of wind power plants and 22 MW of other power plants in operation[3] The connected electricity system is North China Power Grid, which is connected by transmission lines to the project electricity system, and the Northeast China Power Grid has the electricity exports to the North China Power Grid. The flow diagram of the project boundary is as in figure 2.

Emission sources:

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

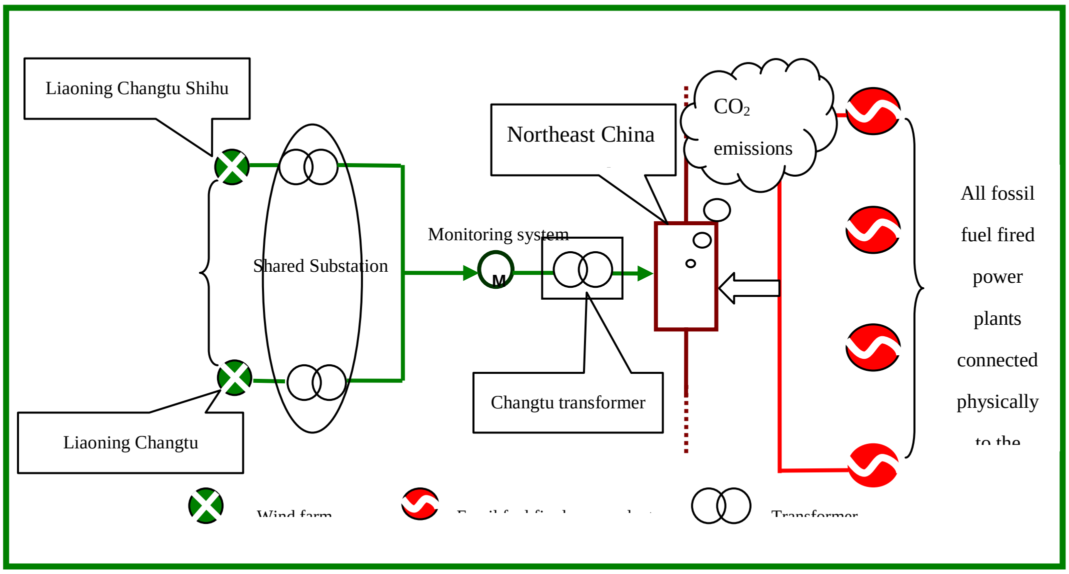


Figure 2: The diagram of the project activity boundary

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

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

	Source	Gas	Included?	Justification / Explanation
Baseline	Electricity generation in fossil fuel fired power that is dispatched due to the project activity	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	Proposed project -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.

>>

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

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

the baseline scenario is the following:

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

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

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

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

>>

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

The implementation timeline of the proposed project activity

No.	Date	Description
1	04/2007	The EIA of the Liaoning Changtu Shihu Wind Power Project
2	22/05/2007	The approval letter by Environmental Protection Bureau of Liaoning Province
3	09/2007	The feasibility study report of Liaoning Changtu Shihu Wind Power Project
4	12/10/2007	The approval letter by Development and Reform Commission of Liaoning Province
5	20/11/2007	The propositional letter of on-grid electricity tariff for Liaoning Changtu Shihu Wind Power Project issued by Development and Reform Bureau of Changtu County
6	15/01/2008	Directorate decision of Liaoning Changtu Shihu Wind Power Project for CDM project development by Tieling Longyuan wind power Co.Ltd
7	21/01/2008	CDM development contract between Tieling Longyuan wind power Co.Ltd and China Fulin Windpower Development Corporation
8	18/02/2008	The project construction permission for Liaoning Changtu Shihu Wind Power Project issued by the construction supervision company.
9	12/2007-03/2008	The open public survey and stakeholders conference about CDM on the local villagers and residents for the proposed project
10	25/03/2008	Wind turbines purchasing agreement
11	16/04/2008	Wind turbines installation contract
12	05/06/2008	CDM Validation contract between Tieling Longyuan wind power Co.Ltd and China Environmental United Certification Center Co., Ltd
13	10/06/2008	Electric equipment installation contract of the transformer substation
14	09/07/2008	The LoI signed by the project owner with Essent Trading International S.A.
15	25/07/2008	PDD and CDM application documents submitted to NDRC.
16	11/11/2008	LoA from China
17	22/09/2008	LoA from Switzerland
18	15/11/2008.	Expected operational date of the project activity
19	01/01/2010	Expected registered date of the project activity as a CDM project

The feasibility study report of the proposed project was approved by Liaoning province DRC on 12th Oct. 2007, the project owner started to perform the exploration plan and prepare to construct and apply for the approval tariff after they received the approval of the project. During this period, the local DRC provided the propositional letter on the expected tariff on 20th Nov.2007, by which the IRR of the project was only 7.04 %(the benchmark of 8%) with the propositional tariff of 0.5622 RMB/kWh (Excluding VAT).According to the propositional letter, the directorate thought that the proposed project could not be considered as financially attractive. To implement the project with the IRR of 7.04 %, the project owner must make great efforts to apply for the CDM support or to seek the additional supports. Based on the experience of CDM exploitation, the directorate immediately invited the CDM consulting company to identify the CDM eligibility of the proposed project. After the project owner receive the positive reply, the project owner asked the consulting company to implement the correlative work (including collecting the references, designing the PDD and signing the consultation contract) to apply for CDM support step by step., During this period from Dec. 2007 to Jan.2008, the project owner simultaneously prepared other correlative work for the construction of the proposed project with the supports of the consulting company. The proposed project was approved to perform the construction on *18th Feb.2008.*

The project uses the *Tool for the Demonstration and Assessment of Additionality (version 05.2)* to demonstrate the additionality. It is including the steps as follows:

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

Define realistic and credible alternatives to the project activity(s) 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[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't be operated without support from the national policies[4].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.

Outcome of Step 1a:
Four realistic and credible alternatives to the project activity are selected and the scenario c) is excluded.

Sub-step1b. Consistency of mandatory laws and regulations

As the annual operation hours of a fossil fuel power plant and a wind farm differs considerably, the annual electricity generation and associated supply reliability for the two, which has equivalent installed capacity, remain incomparable. Based on the latest national power statistic, the operational hour of a fossil fuel plant (5612 hours) is about 2.72 times more than that of the proposed project (2057 hours) with the same capacity[5] .Therefore, a fossil fuel power plant which provides equivalent annual electricity generation would require an installed capacity lower than 20MW. According to Chinese power regulations, fossil fuel power plants of less than 135MW are prohibited for construction in the areas covered by large grids[6]Alternative b) is not in compliance with Chinese regulations. Therefore, b) is not a realistic and credible alternative.

---

3 http://www.maptown.cn/China/Map/MTM0NATrAvEl/
4 http://jjckb.xinhuanet.com/cjxw/2007-11/27/content_75467.htm;
http://finance.people.com.cn/GB/1038/59942/59949/6294546.html
*China solar resources, jinyue, Market & Envrionment, 1994-2006 China Academic Journal Electronoc Publishing House. (*Http://www.cnki.net*)*
Assessment of wind energy reserves in China, Xue Heng, Zhu Ruizhao, Yang Zhenbin, Yuan Chunhong, Acta
Energiae Solaris Sinica, 1994-2006 China Academic Journal Electronoc Publishing House.(Http://www.cnki.net)
5 China Electric Power Yearbook2007, page626
6 On Prohibition of 135MW and Smaller-scale Coal-fired Power Plants, General Office of State Council(http://www.gov.cn/gongbao/content/2002/content_61480.htm)

Outcome of Step 1b:

Mandatory legislation and regulations to each alternative are taken into account in sub-step 1b.Based on the above analysis; the proposed project activity is not the only alternative amongst the ones identified that is in compliance with legal and regulatory requirements. Therefore, the proposed CDM project activity may be additional.

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 05.2) 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 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

In according with Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects issued by State Power Corporation of China[7] the financial internal rate of return (IRR) as benchmark in China’s power generation industry is 8% considering economic assessments of hydropower projects, fossil fuel fired projects, transmission and substation projects, especially the interest rate of commercial loans over five years. Nowadays China’s existing wind power projects have also applied it as the benchmark IRR.

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

(1) Basic parameters for calculation of financial indicators

---

7 State Power Corporation of China. Interim Rules on Economic Assessment of Electrical Engineering Retrofit，China Electric Power Press, 2003， Beijing (http://www.ceppbooks.com/productinfo.asp?id=155083.7330016000000)

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

Item	**Unit**	**Figure**	**Data source**
Type of wind turbines		850	FS
Number of wind turbines		58	FS
Installed capacity	MW	49.3	FS
Annual operation hours	Hour	2,057	FS
Annual Electricity Supplied	MWh	101,420	FS
Electricity tariff (excluding VAT)	Yuan/kWh	0.5622	Propositional letter from local DRC
Static total investment	Million Yuan	409.50	FS
Liquid capital	Million Yuan	1.50	FS
Construction period	Year	1	FS
Operation time	Year	20	FS
Depreciable life of houses and buildings	Year	15	FS
Rate of residual value of fixed assets	%	10	FS
Amortization period of other assets	Year	0	FS
Rate of fixed assets maintenance in the first 10years	%	1.4	FS
Rate of fixed assets maintenance in the second 10years	%	2.8	FS
Rate of insurance premium of fixed assets	%	0.405	FS
Employee population	person	16	FS
Annual salary per capita	Million Yuan	0.031	FS
Rate of welfarism	%	41	FS
Material cost	Yuan/kW	10	FS
Other costs	Yuan/kW	30	FS
Rate of VAT	%	8.5	FS
Rate of city construction tax	%	5	FS
Rate of additional education fee	%	3	FS
Rate of income tax	%	25	FS
Staff and workers' bonus and welfare fund	%	5	FS
CERs	tCO_2e	115,689	Section B.6
CERs Unit price	ERU/ tCO_2e	12.6	Letter of intent
CERs crediting time	Year	7×3	Section C

The input values except the tariff used in the investment analysis in the PDD are all sourced from the FSR which is approved by Development and Reform Committee (DRC) of Liaoning Province.

To determine the proposed tariff for the project activity:

The tariff assumed in the FSR was followed the below way to determine[8]:

If the third parties (design institutes) can make certain judgments about the tariff according to experiences or local wind power situations, the designer would also refer to the tariff level of similar projects which was determined in the PPA (the power purchase agreement signed between the project owner and grid corporation) or the guiding tariff provided by relevant government, and use the tariff above to assess the economic feasibility of the project in the FSR.

During the period of the PDD preparation, the latest guiding tariff of wind power projects in the Liaoning Province was 0.5622 Yuan/kWh (excluding VAT) approved by NDRC in Dec. 20079.Moreover, the similar wind power projects in Liaoning Province published in EB website is with the average tariff of 0.5611 in PDDs since 2004 to the starting date of the project. Therefore, the third party designer and the project owner used the latest guiding tariff of 0.5622 Yuan/kWh (excluding VAT) by NDRC to determine the tariff and used for the IRR calculation of the proposed project.

8 The illuminates of the experts including design institute, industrial expert and union for tariff policy and the methods to determine the tariff of wind power projects in the FSR

[9] http://jgs.ndrc.gov.cn/zcfg/t20080218_192021.htm

The statistic for the similar projects as the project activity (both CDM and non CDM projects) in Liaoning Power Grid,:

The proposed project exports electricity to Liaoning Province Grid. The tariff of wind power projects is mainly set on a provincial base including similar wind resource, grid structure, geological and economic developing conditions[10] .Therefore, for the proposed project, the wind power projects in Liaoning province Grid are statistically analyzed.

Wind power projects exporting electricity to the Liaoning grid as this project activity (both CDM and non CDM projects) are listed in the table below (Table 1 and Table 2).

Table 1 the tariff of non CDM projects in Liaoning

Project name	Commissioning date	Tariff approval time	Installed capacity（MW）	Tariff (Yuan/Kw.h excluding VAT)	Note
Liaoning Xiaochangshan windfarm	Dec. 2002[11]	-	3.6	-	Demonstration[12]
Liaoning Dachangshan windfarm	Dec. 2003[13]	-	3.6	-	Demonstration[14]
Liaoning Zhangzidao windfarm	July 2002	-	3.0	-	Demonstration[15]
Liaoning Yingkou Xianrendao windfarm	July 1999 – June 2006	-	32.66	-	Demonstration[16]
Donggang windfarm	Nov. 1994 – April 2002	–	22.45	–	Demonstration[17]
Hengshan windfarm	July 1993 – May 2002	-	7.4	-	Demonstration[18]

10 “Wind Energy Industry Report in 2006”, Shi Pengfei, China Electric Year Book 2007

11 http://www.cwp-om.com/html/fdc/gnwfdc/200812/15-109.html

12 http://news.sina.com.cn/c/2005-03-22/18106162206.shtml

13 http://www.cwp-om.com/html/fdc/gnwfdc/200812/15-109.html

14 http://news.sina.com.cn/c/2005-03-22/18106162206.shtml

15 http://www.vertinfo.com/poweronline/newsdetail.asp?id=23109

16 http://www.vertinfo.com/poweronline/newsdetail.asp?id=22974

17 http://www.xjwind.com/download/%B7%C7%BC%BC%CA%F5%C2%DB%CE%C4/%D6%D0%B9%FA%B7%E7%C4%DC%BF%AA%B7%A2%C0%FB%D3%C3%CF%D6%D7%B4%D3%EB%D5%B9%CD%FB.pdf

18 http://www.xjwind.com/download/%B7%C7%BC%BC%CA%F5%C2%DB%CE%C4/%D6%D0%B9%FA%B7%E7%C4%DC%BF%AA%B7%A2%C0%FB%D3%C3%CF%D6%D7%B4%D3%EB%D5%B9%CD%FB.pdf

Jinzhou windfarm	Mar. 1999 – February 2001	-	3.75	-	Demonstration[19]

Table 2 the tariff of CDM projects in Liaoning

No.	Pproject name	UNFCCC Reference Number	Commissioning date	Guidance Tariff(Yuan/Kw.h excluding VAT)	Tariff documentation No.
1	Liaoning Zhangwu 24.65MW Wind-farm Project	0539	18/11/2004	0.5069 for 10.2MW; 0.5622 for14.45MW	NDRC[2003]424
2	Liaoning Kangping 24.65MW Wind-farm Project	0537	18/11/2004	0.5069 for 10.2MW; 0.5622 for14.45MW	NDRC[2003]424
3	Liaoning Huanren Niumaodashan Wind Power Project	1501	15/05/2006	0.5622	NDRC[2007]3303
4	Liaoning Xingcheng Haibin Wind Farm Project	1446	24/11/2006	0.47	NDRC[2007]3303
5	Shenyang Faku Wanghaisi Wind Power Project	2854	12/10/2006	0.5622	NDRC[2007]3303
6	Liaoning Changtu Wind Farm Project	0883	01/01/2007	0.5622	NDRC[2007]3303
7	Liaoning Changtu Quantou Wind Power Project.	2219	08/02/2007	0.5622	NDRC[2007]3303
8	Liaoning Linghai Nanxiaoliu Wind Farm Project		01/06/2007	0.47*	NDRC [2009]1906
9	Liaoning Kangping Furaoshan Wind Power Project	2864	01/06/2007	0.5622	NDRC[2007]3303

---

19 http://www.xjwind.com/download/%B7%C7%BC%BC%CA%F5%C2%DB%CE%C4/%D6%D0%B9%FA%B7%E7%C4%DC%BF%AA%B7%A2%C0%FB%D3%C3%CF%D6%D7%B4%D3%EB%D5%B9%CD%FB.pdf

10	Liaoning Beipiao Beitazi I Wind Farm Project	2830	20/09/2007	0.47*	NDRC [2009]1906
11	Liaoning Xingcheng Liutaizi Wind Farm Project		28/09/2007	0.47	NDRC [2009]1906
12	Liaoning Faku Wanghaisi East Wind Power Project	1965	29/7/2007	0.5622	NDRC[2007]3303
13	Liaoning Changtu Shihu Wind Power Project	2817	25/03/2008	0.5622	NDRC [2009]1906
14	Liaoning Qujiagou Wind Farm Project		20/07/2008	0.5622	NDRC [2009]1906
15	Liaoning Fuxin Gaoshanzi 100.5MW Wind Power Project		1/01/2008	0.5622	NDRC[2008]1876
16	Liaoning Faku 1st phase Wind Power Project	2223	15/03/2008	0.5622	NDRC [2009]1906
17	Liaoning Linghai Shengli Wind Farm Project		10/01/2008	0.47	NDRC [2009]1906
18	Liaoning Changtu Taiyangshan Phase One 49.5MW Wind Farm Project		18/11/2008	0.5622	NDRC [2009]1906
19	Liaoning Faku Baijiagou Wind Power Project	2123	12/08/2008	0.5622	NDRC [2009]1906
20	Huaneng Liaoning Fuxin Phase II Wind Farm Project		30/06/2008	0.5622	NDRC [2009]1906
21	Liaoning Faku Heping Wind Power Project	1924	03/04/2008	0.5622	NDRC [2009]1906
22	Liaoning Changtu Manjing Wind Power Project		28/10/2008	0.5622	NDRC [2009]1906
23	Liaoning Province Zhangwu Mazongshan Wind Farm Project		10/11/2008	0.5622	NDRC [2009]1906
24	Liaoning Kangping Zhangqiang Wind Power Project		05/04/2009	0.5622	NDRC [2009]1906

25	Liaoning Faku Ciensi Wind Power Project		17/8/2009	0.5622	NDRC [2009]1906

***Note:** On 20 July 2009, NDRC issued a document "*Notice about the tariff policy for wind power projects*", which defined four different wind resource area (region I , II, III and IV) in China and, different tariff (including VAT) should be applied in different region (0.51 for region I, 0.54 for region II, 0.58 for region III and 0.61 for region IV). According to the* Notice, *tariff for wind projects should determined according to the location of the projects, so the tariff for projects 18-30 in table 1 should be either 0.47 or 0.5622 (excluding VAT).*

As shown in the above table, the projects established before 2002 were all demonstration projects as analyzed in the common practice of the PDD. Since 2002, reform in China's electric power industry has been making steady progress and it has brought some fundamental changes to the industry. For the proposed project , the tariff applied in the investment analysis, 0.5622 Yuan/kWh (excluding VAT) was in line with the higher tariffs issued in Liaoning province (0.5622 Yuan/kWh, excluding VAT)

(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 7.04%, 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 10.44%, 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.

Table 3 Comparison of financial indicators with and without CERs revenues

Scenario	IRR (the benchmark of 8%)
Without CERs revenues	7.04%
With CERs revenues	10.44%

According to the requirements from VVM paragraph 112, even if the loan interests were considered, the IRR of the proposed project would be 7.97%, i.e. still below the benchmark of 8%.

(Detail calculations for O&M cost and income tax of the investment analysis in PDD and FSR have been illustrated in Annex 5)

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 four 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	-7.5%	-6.8%	-5.0%	-2.5%	0%	2.5%	5.0%	7.5%	10.0%

Parameters									
Total investment	8.11%	**8.00%**	7.74%	7.38%	7.04%	6.71%	6.40%	6.09%	5.80%

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

IRR Range / Parameters	**-32.3%**	**-7.5%**	**-5.0%**	**-2.5%**	**0%**	**2.5%**	**5.0%**	**7.5%**	**10.0%**
O&M cost	**8.00%**	7.27%	7.19%	7.12%	7.04%	6.97%	6.89%	6.81%	6.74%

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

IRR Range / Parameters	**-10%**	**-7.5%**	**-5.0%**	**-2.5%**	**0%**	**2.5%**	**5.0%**	**6.8%**	**7.5%**
Tariff	5.57%	5.94%	6.31%	6.68%	7.04%	7.40%	7.75%	**8.00%**	8.10%

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

IRR Range / Parameters	**-10%**	**-7.5%**	**-5.0%**	**-2.5%**	**0%**	**2.5%**	**5.0%**	**6.7%**	**7.5%**
PLF	5.64%	6.00%	6.35%	6.70%	7.04%	7.38%	7.72%	**8.00%**	8.05%

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 by 6.8%, the IRR of the proposed project begins to exceed the benchmark. According to the tariff of wind power projects in Liaoning issued by NDRC, the guiding tariff of other same projects in the same regions is of 0.47-0.5622 Yuan/kWh （exclude VAT） at the start of the proposed project[20]. Moreover, the estimated tariff of the proposed project is in line with the highest tariff of 0.5622 Yuan/kWh（exclude VAT） of wind power project in Liaoning. Based on the latest guiding tariff of other same projects in Liaoning issued by NDRC, the tariff of wind power projects in Liaoning is stable 0.5622 Yuan /kWh (excluding VAT)[21]. The trend of tariff for

20 http://www.xlgl.gov.cn/ggfw/tzz/tscy/dian/200705/t20070525_11554.html
http://www.hebwj.gov.cn/upfiles/xy_col32gjc___20070718164220007126.htm
http://jgs.ndrc.gov.cn/zcfg/t20080813_230722.htm
21 http://www.sdpc.gov.cn/jggl/zcfg/W020080813590887230873.pdf

wind power projects in Liaoning is stable during the recent 10 years[22.] Recently, the tariff concluded in Liaoning area[23] lately shows: it is very difficult that the actual tariff will be higher than the guidance tariff of 0.5622 Yuan/kWh (excluding VAT). Therefore, considering the tariff is regulated by the regulating entities and relevant governmental departments, the probability that tariff is higher than the approved value is impossible. Therefore within the reasonable range of tariff, 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 6.8%, the IRR of the proposed project begins to exceed the benchmark. Since 83.67% of the total investment of the proposed project is used to the purchase and installation of electric equipments (wind turbines and transformers)[12].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[13].Furthermore, it was shown that the real costs in those contracts signed with the key contractors and the equipment suppliers of the Project, including Wind Turbine Purchase Agreement, Construction Contract of the Wind Turbine & Generator, Construction Contract of the Substation were slightly higher than the sub-items estimated in the FSR. Hence, it is impossible to lower the expected total investment of the project in the Feasibility Study. Within 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 power generation. In the case that the PLF increases by 6.7%, the IRR 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[14]. 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 and is positive correlation with the wind speed. 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. As shown in Figure, the average wind speed is 3.5 m/s and the max wind speed is 4.5

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

[23] *http://www.gov.cn/zwgk/2008-02/19/content_892937.htm*
12 The feasibility study report of Liaoning Changtu Shihu Wind Power Project
13 http://info.electric.hc360.com/2007/06/28101158551-6.shtml
14 http://www.gov.cn/ziliao/flfg/2005-06/21/content_8275.htm

m/s in the past 30 years[24]. Moreover, the annual average wind speed of the project site tends to decrease and to gradually be stable over the past 30years .Moreover, the load factor of 23% is derived from the Feasibility Study Report determined by the third independent design institute(China Fulin Wind power Development Corporation). Therefore, the probability that PLF is 6.7% higher than the estimated value （the PLF of 23% in the FSR） is very small.

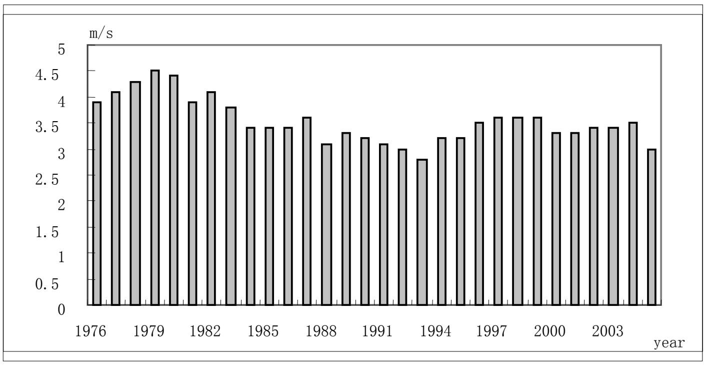


Figure 3 The Average Wind speed provided by local meteorological station

The impact of the annual O&M cost is the slightest. The IRR of the proposed project could reach the benchmark when the annual O&M cost decreases by 32.3%. 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.

In the recent years, the price of material and salaries of the employees and tax rates are gradually increasing in China[25]. At the same time, the maintenance costs for accessorial equipments of wind turbines are also increasing, because the wind turbines demand exceeds supply in the whole world[26]. As above description, the annual O&M cost is gradually increasing during the operation period for the proposed project. Therefore, it is impossible that the annual O&M cost could decrease 32.3%, so the proposed project is always lack of financial attractiveness within the reasonable range of annual O&M cost.

Outcome of Step 2:

After the sensitivity analysis it is concluded that the proposed CDM project activity is unlikely to be financially attractive, and then proceed to Step 4 (Common practice analysis)

Step 4. Common practice analysis

24 The feasibility study report of the proposed project.

25 http://www.c-bm.com/hydt/lianjie1.asp?id=33552 l
http://www.ycwb.com/ePaper/xkb/html/2008-09/23/content_316261.htm
http://www.gutx.com/news/gjcj/1111966.htm

26 http://www.86wind.com/info/detail/4-5335.html
http://www.dragonraja.com.cn/20097/22009795257.html

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

Similar to the proposed project with the capacity of below 75 MW, there are several grid-connected wind farms in Liaoning province, as shown in Table 8.

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

	Project name	Grid-connected time	Installed capacity（MW）	Tariff (RMB/Kw.h) Excluding VAT	Note
1	Liaoning Xiaochangshan windfarm	Dec.2002	3.6	-	Demonstration
2	Liaoning Dachangshan windfarm	Dec.2003	3.6	-	Demonstration
3	Liaoning Zhangzidao windfarm	July.2002	3.0	-	Demonstration
4	Liaoning Yingkou Xianrendao windfarm	July.1997-July.2005	32.66	-	Demonstration
5	Donggang windfarm	Dec.1997	22.45	-	Demonstration
6	Hengshan windfarm	Aug.1996	7.4	-	Demonstration
7	Jinzhou windfarm	Dec.1994	3.75	-	Demonstration
8	Liaoning Zhangwu windfarm	July.2003	24.65	0.5069	Registered in EB
9	Liaoning Kangping wind farm	July.2003	24.65	0.5069	Registered in EB
10	Liaoning Changtu windfarm	Mar.2007	49.5	0.6000	Registered in EB
11	Liaoning Huanren Niumaodashan windfarm	Dec.2007	24.65	0.5622	Registered in EB
12	Liaoning Kangping Furaoshan windfarm	Jan.2008	49.3	0.5622	Apply for being a CDM project
13	Liaoning Faku Wanghaishi East windfarm	Jan.2008	20.4	0.5622	Applying for being a CDM project

Data sources:

1. http://news.sina.com.cn/c/2005-03-22/18106162206.shtml
2. http://news.sina.com.cn/c/2005-03-22/18106162206.shtml
3. http://www.vertinfo.com/poweronline/newsdetail.asp?id=23109
4. http://www.ccwewind.com/gongcheng-detail.asp?id=118

   http://www.vertinfo.com/poweronline/newsdetail.asp?id=22974
5. http://www.xjwind.com/download/%B7%C7%BC%BC%CA%F5%C2%DB%CE%C4/%D6%D0%B9%FA%B7%E7%C4%DC%BF%AA%B7%A2%C0%FB%D3%C3%CF%D6%D7%B4%D3%EB%D5%B9%CD%FB.pdf
6. http://www.xjwind.com/download/%B7%C7%BC%BC%CA%F5%C2%DB%CE%C4/%D6%D0%B9%FA%B7%E7%C4%DC%BF%AA%B7%A2%C0%FB%D3%C3%CF%D6%D7%B4%D3%EB%D5%B9%CD%FB.pdf
7. http://www.xjwind.com/download/%B7%C7%BC%BC%CA%F5%C2%DB%CE%C4/%D6%D0%B9%FA%B7%E7%C4%DC%BF%AA%B7%A2%C0%FB%D3%C3%CF%D6%D7%B4%D3%EB%D5%B9%CD%FB.pdf
8. http://www.chinalawedu.com/news/1200/22016/22034/22529/2006/3/wa00257132360020-0.htm

9. http://www.chinalawedu.com/news/1200/22016/22034/22529/2006/3/wa00257132360020-0.htm
10. http://www.86wind.com/info/detail/37-5758.html
11. http://jgs.ndrc.gov.cn/zcfg/t20080218_193011.htm
12. http://cdm.unfccc.int/Projects/Validation/DB/K07URPWU55DQWDAG3I9V7T0KIPYOJS/view.html
13. http://cdm.unfccc.int/Projects/Validation/DB/ZSH8OQVCIFJZEGCZ03FM7TYPYMQC1N/view.html

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

Since the Shandong Rongcheng wind power plant that is the first wind power plant in China connected into the Grid and operated in May 1986, the development of wind power in China has carried through several different phases. The demonstration projects and experimental projects have been exploited to obtain the experiences for the extensive implementation in the first phased from 1986 to 1990. During this phase, four wind power plants had been built with the total capacity of 4.215MW. With the successful implementation of demonstration projects and the advance of wind technology, the development of wind power in China has come into the second phase from 1991 to 1995. During second phase, wind power technology has been spread step by step with the total capacity of 33.285MW.However, the scales of the wind power plants were yet small and the nominal capacity of wind turbines was under 500kW. After 1996, the nation added the investment on the wind power plants and promoted fleetly the development of wind power, including the scale, the technology and the max nominal capacity of wind turbines[27]. When the State Council approved Reform Plan of Power System was implemented on 2002, the price cap regulation for wind power electricity tariff is impossible for wind farm developers[28]. Therefore, the phase from 1996 to 2002 should be third phase defined as the protective development. Hereafter, the development of wind power must follow the commercial rule after 2002.

The wind farms shown in Table 8 were all constructed before 2002, which enjoyed higher tariff or constructed as demonstration projects. Moreover, during this phase, the wind farms enjoyed other favourable policies from the nation including degrading the tax and financial allowance[29], which are essential distinctions between the present project and the parts of existing similar projects in Table 8. Without all kinds of favourable policies, the proposed project faces the investment barriers and technology barriers. Since there is serious barrier for the proposed project, the CDM has been considered in the early evaluation period to overcome investment and technological barriers. In addition, wind power accounted for only 1.77% of the total installed capacity of the Northeast China Power Grid in 2006[30].therefore, it is clear that wind power is not a common practice generally.

27 http://www.ctgpc.com.cn/news/view_info.php?mNewsId=18194
28http://www.ndrc.gov.cn/xwfb/t20050708_28096.htm
29 http://www.grchina.com/gb/greenpower/advise-0-5.htm
30 China Electric Power Yearbook 2007

Outcome of Step 4:

Sub-steps 4a and 4b are satisfied, similar activities are observed, but essential distinctions between the project activity and similar activities had reasonably been explained, then the proposed project activity is additional.

B.6. Emission reductions:

>>

B.6.1. Explanation of methodological choices:

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

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

Baseline emissions

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

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

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr).

EG_y = Electricity supplied by the project activity to the grid (MWh).

$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (version 01.1).

The methodological tool "Tool to calculate the emission factor for an electricity system" (version 01.1) determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity.

The methodological tool "Tool to calculate the emission factor for an electricity system" (version 01.1) provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for grid connected power generation in year y

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

STEP 1: Identify the relevant electric power system.

STEP 2: Select an operating margin (OM) method.

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

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

STEP 5: Calculate the build margin emission factor.

STEP 6: Calculate the combined margin (CM) emissions factor.

Step1: Identify the relevant electric power system.

Using the boundary definitions of the Chinese NDRC[31], The spatial extent of the project boundary includes the proposed project and all power plants connected physically to the Northeast China Power Grid that the CDM project power plant is connected to. The Northeast China Power Grid is defined as the project electricity system, which consists of independent province-level electricity systems including Liaoning, Heilongjiang and Jilin province that can be dispatched without significant transmission constraints. The connected electricity system is North China Power Grid, which is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

Electricity transfers from connected electricity systems to the project electricity system are defined as electricity imports and electricity transfers to connected electricity systems are defined as electricity exports. The Northeast China Power Grid has the electricity exports to the North China Power Grid.

31 http://cdm.ccchina.gov.cn/web/index.asp

For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system (Northeast China Power Grid), since the electricity exports to North China Power Grid account for a very small percentage and recent or likely future additions to transmission capacity will not enable significant increases in exported electricity.

For the purpose of determining the operating margin emission factor, electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the electricity emission factors.

Step2: Select an operating margin (OM) method

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

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

The simple OM method (option a) can only be used if low-cost/must-run resources [32] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

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

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

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

alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

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

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

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

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

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

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

In terms of Method (d) and Method (a): The average OM emission factor (option d) is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) above for the simple OM, but including in all equations also low-cost/must-run power plants. The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants. Considering the low-cost/ must run resources only constitute5.43%, 4.72%, 6.46%, 8.28% and 5.25% of total generation of Northeast China Power Grid from the year 2002 to 2006 [33]. Therefore, method (a) is chosen to calculate OM emission factor for the proposed project.

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

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- ◆ Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or

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

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

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

For the proposed project, the data on fuel consumption, net electricity generation and the average efficiency of each power unit are unavailable, thus option A and option B cannot be used. Nevertheless, the data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system are available, and, nuclear and renewable power

33 China Electric Power Yearbook 2003-2007 generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known, therefore, Option C can be used.

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

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \bullet NCV_{i,y} \bullet EF_{CO2,i,y}}{\sum_{m} EG_{m,y}} \quad (2)$$

Where:

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

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

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

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

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

m = All power plants / units serving the grid in year y except low-cost / must-run power plants / units

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

y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

For this approach (simple OM) to calculate the operating margin, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units.

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

As chosen in step 2, the simple OM emission factor is calculated by using Ex-ante option of data vintages, i.e. a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

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

Given the above, the simple operating margin CO2 emission factor ($EF_{grid,OMsimple,y}$) of Northeast China Power Grid is 1.2561tCO2/MWh. The detailed calculations and data are listed in the annex 3 (The baseline emission factor OM is same as that provided by Chinese NDRC, the website is http://cdm.ccchina.gov.cn/web/index.asp).

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

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

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

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[34].

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

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

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

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

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

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

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

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the

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

build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

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

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

Step 5: Calculate the build margin emission factor

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

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

Where:

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

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

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year y (tCO_2/MWh)

m = Power units included in the build margin

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

No matter which option for calculating BM factor mentioned in step 4 was adopted for the proposed project; the same issue on data availability must be addressed. Currently, it is very difficult to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity

generated and delivered to the grid and fuel consumption data in power unit m are regarded as commercial secrets or only for internal usage. Then the following deviation was adopted to calculate the Build Margin emission factor. 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_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ)

♦ 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. The breakdown data by power plants are not while the aggregate data by different types of fuels are available. Considering this situation, the *m* sample group will consist of capacity addition by power sources with same fuel instead of by power plants. For the proposed project the *m* sample group will consist of fossil fuel fired capacity addition, hydropower capacity addition and other capacity addition;

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

The capacity addition belonging to *m* sample group thus could be identified. For the proposed project, the most recent year of which data is available is 2006, while t_0=2000, the total capacity addition during 2000 to 2006 consisting of 7283.5MW of fossil fuel fired capacity, 1034.1MW of the low-cost/ must run resources capacity, which accounts for 19.39% of total installed capacity in 2006[35] (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

[35] China Electric Power Yearbook2001-2007

not be separated from current statistical data on fossil fuel fired capacity, the following approach was adopted for calculating the emission factor of fossil fuel fired capacity addition:

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

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (4)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} FC_{i,j,y} NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (5)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (6)$$

Where:

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

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

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

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

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

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

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (7)$$

Where:

$CAP_{Total,y}$ = The total capacity addition
$CAP_{Thermal,y}$ =The fossil fuel fired capacity addition

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

Step 6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \qquad (8)$$

Where:
$EF_{grid,BM,y}$ =Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ =Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM} =Weighting of operating margin emissions factor (%)
w_{BM} =Weighting of build margin emissions factor (%)

Wind project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non dispatchable nature) for the first crediting period and for subsequent crediting periods. The default weights are adopted for the proposed project, the baseline emission factor is:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} = 1.1407 \text{ t}\mathbf{CO_2/MWh}$$

Project emissions

For wind power project activities, $PE_y = 0$

Leakage

For wind power project activities, $LE_y = 0$

Emission reductions

To sum up, the Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad (9)$$

Where:
ER_y = Emission reductions in year y (t CO_2e/yr).

BE_y = Baseline emissions in year y (t CO_2e/yr).

PE_y = Project emissions in year y (t CO_2/yr).

LE_y = Leakage emissions in year y (t CO_2/yr).

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

Data / Parameter:	$FC_{i,,j,y}$
Data unit:	t/m^3
Description:	Amount of fuel *i* consumed in year(s)
Source of data used:	China Energy Statistical Yearbook2005-2007
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:	

Data / Parameter:	$EG_{m,y}$
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 Electric Power Yearbook 2005-2007
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since the detailed generation data by power plants are not publicly available, therefore the aggregated data by fuel types are used instead.
Any comment:	

Data / Parameter:	$NCV_{i,j}$
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 2005-2007
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:	

Data / Parameter:	*OXIDi*
Data unit:	%

Description:	Oxidation factor of the fuel *i*
Source of data used:	2006 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:	

Data / Parameter:	$EF_{CO2,I,j,y}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per unit of energy of the fuel *I*
Source of data used:	2006 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:	

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:	37.28
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 10^{th} “Five-Year Plan” 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:	48.81
Justification of the choice of data or description of measurement methods and procedures actually	According to EB guidance, the statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10^{th} “Five-Year Plan” period can be used.

applied :	
Any comment:	

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

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

Baseline emissions

Operating Margin emission factor ($EF_{OM,y}$)（tCO2/MWh）：1.2561
Build Margin emission factor ($EF_{BM,y}$) （tCO_2/MWh）：0. 7946

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

Project emissions

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

$$PE_y = 0$$

Leakage

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

$$L_y = 0$$

Project Emission Reductions

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

$$ER_y = BE_y - PE_y - L_y$$

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

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

Annual generation of the proposed project is estimated as 101,420MWh. Using the approach above, the annual emission reductions are estimated to be 115,689 tCO_2 .the proposed project activity is expected to achieve 809,823 tCO_2 of net emission reductions during the first 7-year crediting period. (details in Annex3).

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

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)
2010	0	115,689	0	115,689
2011	0	115,689	0	115,689
2012	0	115,689	0	115,689
2013	0	115,689	0	115,689
2014	0	115,689	0	115,689
2015	0	115,689	0	115,689
2016	0	115,689	0	115,689
Total (tonnes of CO_2e)	0	809,823	0	809,823

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

B.7.1. Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity supplied to the grid by the project in year y
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	101,420
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording. The data will be kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The metering equipments are calibrated and checked periodically by qualified institute for accuracy according to Chinese electric industry regulation *DL/T448-2000.* The operational process and the data Management System strictly follows *the regulations of monitoring and management for CDM project* The error in the metering equipments shall not exceed 0.5%. Net electricity supplied by the project activity to the grid is double checked by the evidence of sales
Any comment:	-

Data / Parameter:	$EG_{export,y}$
Data unit:	MWh
Description:	Electricity exported to Northeast China Power Grid in year y
Source of data to be used:	Electricity meters in project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement	Hourly measurement and monthly recording.

methods and procedures to be applied:	The data will be kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The metering equipments are calibrated and checked periodically by qualified institute for accuracy according to Chinese electric industry regulation *DL/T448-2000.* The operational process and the data Management System strictly follows *the regulations of monitoring and management for CDM project* The error in the metering equipments shall not exceed 0.5%.
Any comment:	-

Data / Parameter:	$EG_{import,y}$
Data unit:	MWh
Description:	Electricity imported from Northeast China Power Grid in year y
Source of data to be used:	Electricity meters in project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording. The data will be kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The metering equipments are calibrated and checked periodically by qualified institute for accuracy according to Chinese electric industry regulation *DL/T448-2000.* The operational process and the data Management System strictly follows *the regulations of monitoring and management for CDM project* The error in the metering equipments shall not exceed 0.5%.
Any comment:	-

Data / Parameter:	$EG_{accident\ import,y}$
Data unit:	MWh
Description:	the electricity that imports from the grid used by civil Transformer Substation from Northeast China Power Grid in year y
Source of data to be used:	Electricity meters in project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording. The data will be kept during the crediting period and 2 years after.
QA/QC procedures to be applied:	The metering equipments are calibrated and checked periodically by qualified institute for accuracy according to Chinese electric industry regulation *DL/T448-2000.* The operational process and the data Management System strictly follows *the regulations of monitoring and management for CDM project* The error in the metering equipments shall not exceed 0.5%. Double checked by the evidence of purchases
Any comment:	-

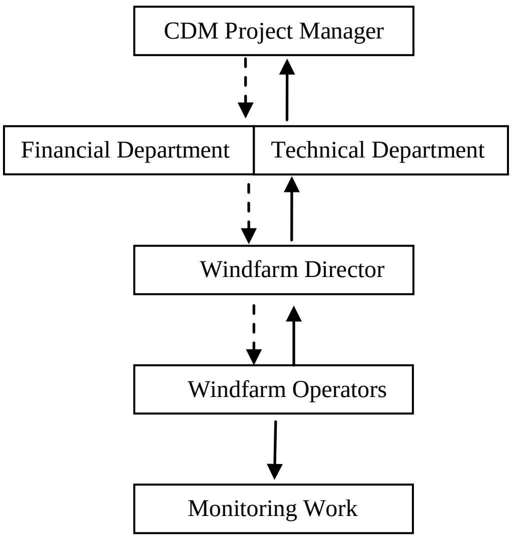
B.7.2. Description of the monitoring plan:

1. Introduction

The project adopts the approved consolidated baseline and monitoring methodology ACM0002 " Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 07) to determine the emission reductions from the wind farm. This plan describes the process in more detail.

2. Responsibility

Tieling Longyuan Wind Power Co., Ltd is overall responsible for monitoring and carrying out this monitoring plan. The CDM project manager of Tieling Longyuan Wind Power Co., Ltd. is responsible for the monitoring and reporting to the wind farm. The management structure is illustrated as follows:



3. Training

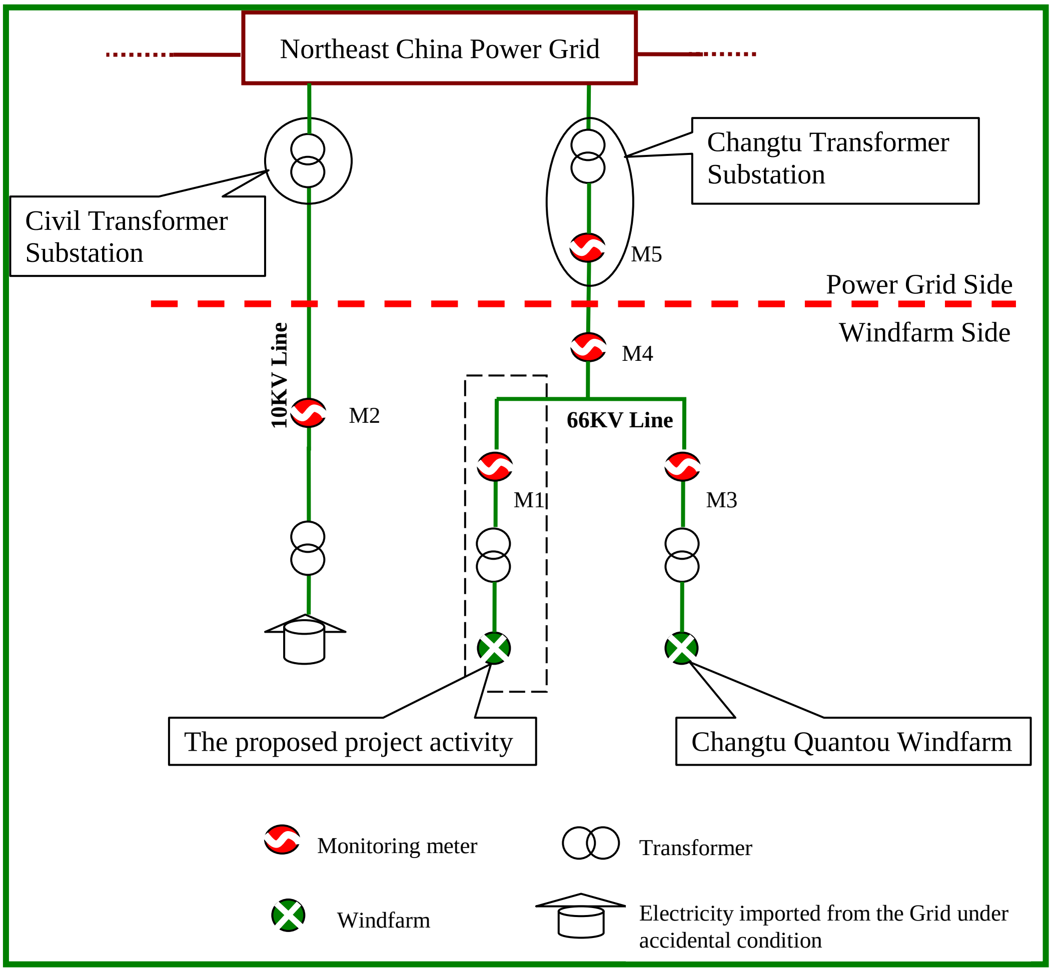
Tieling Longyuan Wind Power Co., Ltd. will assign and train the dedicated people on carrying out the monitoring work. The monitoring personnel training by professional CDM consulting company will be completed before the registration, further training work will be completed before initial verification.

4. Meters system

The proposed project shares transformer substation and transmission line with Changtu Quantou windfarm. In the shared transformer substation, five meters had been installed to monitor the electricity exported to and imported from the power grid by the proposed project and Changtu Quantou windfarm, respectively.

For the proposed project, the meter (M 1) was installed to directly monitor the electricity exported to and imported from the power grid. To determine conservatively the net electricity supplied to the power grid by the project, the project owner thought about the electricity imported from the Grid under accidental condition that was directly monitored by M2. M5 was installed as backup meter for cross checking the data measured by M1. The detail information about metering system was shown in diagram of monitoring system and table below:

Metering diagram



Meter	Calibration frequency	Accuracy degree	Monitoring style	Monitor data
M1	Annually	0.5	bidirectional	1.Monitor the electricity exported to the power grid by the proposed project ($EG_{export,y}$); 2. Monitor the electricity imported from the power grid by the proposed project ($EG_{import,y}$)
M2	Annually	0.5	Monomial	Monitor the electricity imported from the power grid under accidental condition($EG_{accident\ import,y}$)
M3	Annually	0.5	bidirectional	Monitor the total electricity exported to and imported from the power grid by Changtu Quantou wind farm
M4,M5	Annually	0.5	bidirectional	Monitor the total electricity exported to and imported from the power grid by the two projects; M4 is the backup meter of M5.

5. Calibration

The metering equipments at the transformer substations are calibrated and tested yearly by a qualified third party appointed by the Northeast China Power Grid for accuracy according to *the requirement from Technical administrative code of electric energy metering (DL/T448 —2000).* For the proposed project, all the meters installed shall be tested by a qualified institute which is authorized by the Northeast China Power Grid - within 10 days after: the detection of meter reading beyond allowable error level; the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. The meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

6. Monitoring data

According to the meters system mentioned above, the net electricity supplied by the proposed project activity is directly determined based on the data measured by M1 and M2 installed at the project side including the electricity exports to the grid ($\mathbf{EG}_{export,y}$) and imports from the grid ($\mathbf{EG}_{import,y}$). The data of the meters (M1 and M2) will be hourly measured and monthly recorded.

The net electricity supplied to the grid by the project is determined using following equations:

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

Where:

EG_y is the net electricity supplied to the power grid by the proposed project;

$EG_{export,y}$ is the electricity supplied to the power grid by the proposed project;

$EG_{import,y}$ is the electricity imported from the power grid by the proposed project;

$EG_{accident\ import,y}$ is the electricity imported from the power grid under accidental condition.

All relevant parameters were listed in Section B 7.1 and will be monitored according to the methodology requirements and description of measurement methods and procedures to be applied. The net electricity supplied to the power grid should be measured continuously and recorded monthly as required by the methodology applied. The data and meter reading will be well documented and be readily accessible for DOE.

The specific steps to monitoring are listed below:

a) The project owner directly monitors the meters(M1 and M2) to determine the the net electricity supplied to the power grid by the proposed project

b) The readings of the meters(M1and M2) are measured hourly and then recorded monthly at the end of each month（expected）or the date determined by the project owner and the power grid .

c) The project owner provides the records of the meters (M1and M2) monthly to the local Electric Power Company.

d) The local Electric Power Company checks the records based on M5 and the whole meters system, and then provides the relevant reckoning documents to the project owner.

e) The project owner provides electricity sales invoice to the local Power Grid Company.

f) The project owner keeps the records of two meters' readings and photocopies of the evidences and provides them to DOE for verification.

7. Quality assurance and Quality control

Tieling Longyuan Wind Power Co., Ltd specially issued *the regulations of monitoring and management for CDM project*[36] *(*hereafter refer as *CDM Manual)* to monitor and verify the emission reductions from the proposed project. Moreover, the management procedures and regulations like operation, meter recordings, maintenance and emergency management are established in the *CDM Manual,* which guides the technicians to operate and guarantee the quality assurance and quality control procedures for recording, maintaining and archiving data in

[36] *the regulations of monitoring and management for CDM project* issued by Tieling Longyuan Wind Power Co., Ltd on 1st August 2007

detail. 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 methodology ACM0002.

Several processes required to meet the requirements for emissions reduction monitoring include:

- The project owner reads the relevant separate meters (M1, M2) monthly and supplies the recordings to the local Electric Power Company. The local Electric Power Company checks the recordings supplied by the project owner according to Meter (M5) monthly.
- If either party finds any reading of the Meters more than the allowable error or the monitoring equipment functions improperly, it should inform the other party immediately. The project owner and the local Power Grid Company should retain a qualified measure institute together to check the meters or equipment, solve the problems and get everything into normal condition; In the mean time, both sides shall jointly prepare an acceptable estimation method according to *Regulations and Rules of Power Supply*[37] issued by State Electricity Regulatory Commission of China to calculate the electricity exported to the Grid, and provide evidence to DOE for the verification to show the estimation is reasonable and conservative.
- For the handling of disputes between the proposed project owner and the Grid, measures will be adopted according to relevant articles of *Interim Measures for Settlement of Electricity Charges between the Power Generating Enterprises and the Grid Enterprises*[38] issued by State Electricity Regulatory Commission of China.

8. Data Management System

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. Moreover, the credibility and reliability of those data and information must be confirmed. 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, and all data including calibration records is kept until 2 years after the end of the total crediting period of the CDM project.

[37] http://www.serc.gov.cn/flfg/bmgz/200802/t20080220_5931.htm

[38] http://www.chinapower.com.cn/article/1130/art1130580.asp

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

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

>>

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: 25/06/2009

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

(Not the project participants listed in Annex 1)

- Mr. Li , Gang,

  Entity: China Fulin Windpower Development Corporation.

  Address: The 6th-9, North Avenye Fuchengmen Xicheng District, Beijing 100034, China

  Telephone/fax: +8610-66091326 /66091396

  E-mail: ligang@clypg.com.cn

  >>

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:

18/02/2008(the permission construction time)

The permission construction date is the earliest date of the real actions (including construction and equipment purchase) of the project activity during the starting period. The correlative timelines were shown in B5.

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

20 years

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

The project will use a renewable crediting period of up to 7 years.

C.2.1. Renewable crediting period

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

01/01/2010 （or the date of registration.）

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, an environmental impact assessment (EIA) of the project was completed in May 2007.The project is likely to cause the following environmental impacts:

- **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 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 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 101,420 MWh of power to the Liaoning Power Grid. 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 net impact under environmental pollution category would be positive as all necessary abatement measures would be adopted and periodically monitored. The project activity does not have any major adverse impacts on environment during its construction or operational phase. The project is definitely an environmentally more friendly way of providing power than the coal-fired power and to a lesser extent hydropower.

>>

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. The Environmental Assessment Report of the project has been approved by the Environmental Protection Administration of Liaoning Province, referred as "Liaoning Environment Construction (Table) [2007] No.46".

>>

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 December 2007-March 2008. 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 December 2007-March 2008, one-page questionnaire was used to carry out a survey on the local villagers, which was designed easily to fill in as following sections:

1) Respondent's basic information and education level;
2) The influences on their surrounding environment and livelihoods during construction and operation of the project;

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

The survey had a 100%response rate (30 questionnaires returned out of 30, education level of the respondents: primary level (93%); middle level (7%)) and the statistical result was shown in table 8.

- Stakeholder conference: the meeting was held on March 25th 2008 in Changtu District to explain CDM， better understand the stakeholders' interests and obtain their comments. In the meeting, the presentations were followed by a question and answer section and further discussion. Present at the conference were totally 10 representatives and experts, mainly from the local Development and Reform Bureau, the local Environmental Protection Bureau, the local Power Supply Corporation, and the nearby village.

>>

E.2. Summary of the comments received:

The public survey and conference not only obtained the stakeholder's comment on the project, but also introduced the information of the project and CDM to the stakeholders. According to the comments of stakeholder representatives, there are no adverse comments on the project activity, and mostly representatives were supportive of the project. The summary of the comments is as follows:

- Comments from the local government: Wind power projects are environment friendly projects and are highly encouraged by China central government. Both the Development and Reform Commission of and Environmental Protection Administration of Tieling City highly support the development of wind power projects. They hope the successful implementation of the project will diversify local power mix, mitigate electricity shortage, and promote the development of local tourism and other tertiary industries.
- Comments from villager representatives: The project site is located on meadow and sand areas, and there are no permanent residents and cropland nearby. Therefore, the construction of the wind power plant does not result in moving local residents or noise disturbance. The local villagers are satisfied with compensation by the project owner for occupation on part of land occupation. The local villagers also benefit from the infrastructure such as transportation improvement constructed for the proposed project. However, many of them also suggested the project entity pay special attention to and make efforts to vegetation recovery, soil and water conservation and related facility construction.

Table 8 Statistic of the comments in the survey

No.	Discussional items	Options	Percentage

			（%）
1	Will the project improve the local development or increase job opportunities?	*Yeah*	100
		No	0
2	Will the project have negative impacts on their livelihood?	*Yeah*	30
		No	70
3	Are they satisfied with their life conditions and surrounding environment?	*Yeah*	100
		No	0
4	What the impacts on environment should be considered? (Multi-options)	*Ecological environment*	77
		Noise pollution	30
		Water pollution	0
		Solid waste	10
		Air pollution	7
5	Will they support the construction of the project?	*Yeah*	100
		No	0

>>

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

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Entity:

Organization:	Tieling Longyuan Wind Power Co., Ltd
Street/P.O.Box:	Quanqiutong Biuld, Yinzhou Road ,Yinzhou District
Building:	——
City:	Tieling
State/Region:	Liaoning Province
Postfix/ZIP:	117000
Country:	P.R.China
Telephone:	+86 10 66091317
FAX:	+86 10 66091396
E-Mail:	ququ15@126.com
URL:	
Represented by:	Huang Qun
Title:	-
Salutation:	
Last Name:	Qun
Middle Name:	-
First Name:	Huang
Department:	-
Mobile:	-
Direct FAX:	+86 10 66091396
Direct tel:	+86 10 66091317
Personal E-Mail:	ququ15@126.com

CERs Buyer:

Organization:	Essent Trading International S.A.
Street/P.O.Box:	Rue des Glacis-de-Rive 12-14
Building:	—
City:	Geneva
State/Region:	—
Postfix/ZIP:	1207
Country:	Switzerland
Telephone:	+41 22 918 3433
FAX:	+41 22 918 3399
E-Mail:	nyame.degroot@essenttrading.com
URL:	http://www.essenttrading.com
Represented by:	Nyame de Groot
Title:	Vice President Emissions
Salutation:	Mr.
Last Name:	de Groot
Middle Name:	—
First Name:	Nyame
Department:	—
Mobile:	—
Direct FAX:	+41 22 918 3399
Direct tel:	+41 22 918 3433
Personal E-Mail:	nyame.degroot@essenttrading.com

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 calculation for determining baseline and IRR.

Table A-1～A-3 provides the Thermal power electricity generation in Northeast China Power Grid in the baseline scenario from 2004 to 2006, in which the main data sources come from China electric Power Yearbook 2005, 2006 and 2007.

Table A-1 Thermal power electricity generation in Northeast Power Grid in 2004

Province	Generating capacity （MWh)	Rate of electricity consumption （%）	Power supply （MWh)
Liaoning	84,543,000	7.21	78,447,449.70
Jilin	33,242,000	7.68	30,689,014.40
Heilongjiang	53,482,000	7.84	49,289,011.20
Total（MWh)			**158,425,475.30**

《China Electric Power Yearbook 2005》P472，P474

Table A-2 Thermal power electricity generation in Northeast Power Grid in 2005

Province	Generating capacity （MWh)	Rate of electricity consumption （%）	Power supply （MWh)
Liaoning	83,697,000	7.03	77,813,100.90
Jilin	35,294,000	6.59	32,968,125.40
Heilongjiang	58,000,000	7.96	53,383,200.00
Total（MWh)			**164,164,426.30**

《China Electric Power Yearbook 2006》P568，P559

Table A-3 Thermal power electricity generation in Northeast Power Grid in 2006

Province	Generating capacity （MWh)	Rate of electricity consumption （%）	Power supply （MWh)
Liaoning	96,282,000	6.62	89,908,132
Jilin	38,576,000	6.78	35,960,547
Heilongjiang	62,964,000	7.85	58,021,326
Total（MWh)			183,890,005

《China Electric Power Yearbook 2007》P626，P627

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 $EF_{co2}s$ of various types of fuels

Fuel	NCV	EF_{co2} (tc/TJ)	OXID
Coal	20,908 kJ/kg	25.80	1
Washed coal	26,344 kJ/kg	25.80	1
Other Washed Coal [1]	8,363 kJ/kg	25.80	1
Anthracite	20,908 kJ/kg	26.60	1
Coke	28,435 kJ/kg	29.20	1
Crude oil	41,816 kJ/kg	20.00	1
Gasoline	43,070 kJ/kg	18.90	1
Kerosene	43,070 kJ/kg	19.60	1
Diesel	42,652 kJ/kg	20.20	1
Fuel oil	41,816 kJ/kg	21.10	1
Other petroleum products[2]	38,369 kJ/kg	20.00	1
Other coke products	28,435 kJ/kg	25.80	1
Natural gas		15.30	1
Coke oven gas[39]	16,726 kJ/m^3	12.10	1
Other gas[40]	5,227 kJ/m^3	12.10	1
LPG	50,179 kJ/kg	17.20	1
Refinery gas	46,055 kJ/kg	15.70	1

Data sources:

NCVs are from China Energy Statistical Yearbook 2007, 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.

[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 38,369 kJ/kg, i.e., 1.3108 tce/t, on the basis of Energy Balance Sheets (physical quantity) and conversion factor against SCE

[39] The NCV value here adopts the lower limit of the NCV value range, i.e., 16,726-17,981 kJ/m^3, for coke oven gas provided in China Energy Statistical Yearbook 2007, P 287.

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

Table A-5 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	EF*coal,adv*	37.28%	25.8	1	0.9135
Gas-fired power plant	EF*gas,adv*	48.81%	15.3	1	0.4138
Oil-fired power plant	EF*oil,adv*	48.81%	21.1	1	0.5706

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

According to the ACM0002 methodology, the Simple method OM was used to calculate the OM emission factors of the years 2004, 2005 and 2006, 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 North East China grid.

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

Table A-6 The fuel consumption and total emissions of Northeast 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	100	20,908	188,689,376.8
Clean coal	Mt	0.8475	0.0109	0.0488	0.9072	25.8	100	26,344	2,260,871.6
Other washed coal	Mt	5.7767	0.1426	0.61	6.5293	25.8	100	8,363	5,165,589.1
Coke oven gas	Billion m^3	0.483	0.291	0	0.774	12.1	100	16,726	574,367.5
Other gas	Billion m^3	5.733	0.419	0	6.152	12.1	100	5,227	1,426,676.9
Crude oil	Mt	0	0	0	0	20	100	41,816	0.0
Diesel	Mt	0.0204	0.0116	0.0024	0.0344	20.2	100	42,652	108,672.7
Fuel oil	Mt	0.1281	0.0178	0.0286	0.1745	21.1	100	41,816	564,536.2
LPG	Mt	0.0219	0	0	0.0219	17.2	100	50,179	69,305.2
Refinery gas	Mt	0.0979	0	0.0114	0.1093	15.7	100	46,055	289,779.7
Natural gas	Billion m^3	0	0.003	0.253	0.256	15.3	100	38,931	559,111.4
Other energy	Mtce	0.2697	0.0507	0	0.3204	0		29,271.2	0
Total									**199,708,287.3**
Data sources: China Energy Statistical Yearbook 2005									

Table A-7 The fuel consumption and total emissions of Northeast 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	20,908	200,454,895.9
Clean coal	Mt	0	0	0	0	25.8	100	26,344	0.0
Other washed coal	Mt	5.2474	0.1926	0.2416	5.6816	25.8	100	8,363	4,494,939.9
Coke oven gas	Billion m^3	0.103	0.357	0.068	0.528	12.1	100	16,726	391,816.6
Other gas	Billion m^3	1.262	0.837	0	2.099	12.1	100	5,227	486,767.7
Crude oil	Mt	0.0116	0	0	0.0116	20	100	41,816	35,571.5
Diesel	Mt	0.0118	0.0148	0.0057	0.0323	20.2	100	42,652	102,038.7
Fuel oil	Mt	0.0932	0.0246	0.0155	0.1333	21.1	100	41,816	431,247.4
LPG	Mt	0.0012	0	0	0.0012	17.2	100	50,179	3,797.5
Refinery gas	Mt	0.0548	0	0.0132	0.068	15.7	100	46,055	180,283.8
Natural gas	Billion m^3	0	0.084	0.224	0.308	15.3	100	38,931	672,681.0
Other energy	Mtce	0.1618	0	0	0.1618	0	100	29,271.2	0.0
Total									**207,254,040**

Data sources: China Energy Statistical Yearbook 2006

Table A-8 The fuel consumption and total emissions of Northeast Power Grid in 2006

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	46.8199	27.3824	36.9829	111.1852	25.8	100	20,908	219,912,851
Clean coal	Mt	0.0003	0	0	0.0003	25.8	100	26,344	748
Other washed coal	Mt	6.7474	0.1783	0.96	7.8857	25.8	100	8,363	6,238,691
Coke coal	Mt	0.0332	0	0	0.0332	29.2	100	28,435	101,075
Coke oven gas	Billion m^3	0.268	0.016	0.144	0.428	12.1	100	16,726	317,609
Other gas	Billion m^3	5.526	0.143	0	5.669	12.1	100	5,227	1,314,667
Crude oil	Mt	0.0049	0	0	0.0049	20	100	41,816	15,026
Diesel	Mt	0.0075	0.0039	0.003	0.0144	20.2	100	42,652	45,491
Fuel oil	Mt	0.1173	0.0045	0.0144	0. 1362	21.1	100	41,816	440,629
LPG	Mt	0	0	0	0	17.2	100	50,179	0
Refinery gas	Mt	0.0855	0	0.0427	0.1282	15.7	100	46,055	339,888
Natural gas	Billion m^3	0	0.0019	0.021	0.0229	15.3	100	38,931	38931
Other energy	Mtce	0.1216	0.176	0.827	1.1253	0	100	0	0
Total									229,226,818
Data sources: China Energy Statistical Yearbook 2007									

Table A-9 The OM factor of Northeast Power Grid

Years	Thermal generation delivered to Northeast Power Grid	The emissions from Northeast Power Grid	OM
	A	B	C=B/A
2004	158,425,475.3	199,708,287.3	1.260581904
2005	164,164,426.30	207,254,040.0	1.262478386
2006	183,890,005	229,226,818	1.246543
Generation-weighted OM (/tCO2MWh)			1.256099

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 0.7946 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

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,km^3,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	Mt	46.8199	27.3824	36.9829	111.1852	20,908	25.80	1	219,912,851
Clean coal	Mt	0.0003	0	0	0.0003	26,344	25.80	1	748
Other washed coal	Mt	6.7474	0.1783	0.96	7.8857	8,363	25.80	1	6,238,691
Anthracite	Mt	0	0	0	0	20,908	26.6	1	0
coke	Mt	0.0332	0	0	0.0332	28,435	29.20	1	101,075
Sub-total									226,253,365
Crude oil	Mt	0.0049	0	0	0.0049	41,816	20.00	1	15,026
Gasoline	Mt	0	0	0	0	43,070	18.90	1	0
Kerosene	Mt	0	0	0	0	43,070	19.60	1	0
Diesel	Mt	0.0075	0.0039	0.003	0.0144	42,652	20.20	1	45,491
Fuel oil	Mt	0.1173	0.0045	0.0144	0.1362	41,816	21.10	1	440,629
other petroleum product	Mt	0	0	0	0	38,369	20.00	1	0
Other coke product	Mt	0	0	0	0	28,435	25.80	1	0
Sub-total									501,146
Natural gas	10^7m^3	0	1.9	21	22.9	38,931	15.30	1	500,143
COG	10^7m^3	26.8	1.6	14.4	42.8	16,726	12.10	1	317,609
Other Gas	10^7m^3	552.6	14.3	0	566.9	5,227	12.10	1	1,314,667
LPG	Mt	0	0	0	0	50,179	17.20	1	0
Refinery gas	Mt	0.0855	0	0.0427	0.1282	46,055	15.70	1	339,888
Sub-total									2,472,307
Total									229,226,818
Data sources: *China Energy Statistical Yearbook 2007*									

From above table and formulae (5),(6) and (7),the weights are as follows:

λ_{Coal} =98.70%, λ_{Oil} =0.22%, λ_{Gas} =1.08%

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

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9074.$$

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

Table A-11 Installed capacity of Northeast Power Grid in 2006

Installed capacity	unit	Liaoning	Jilin	Heilongjiang	total
Thermal Power	MW	16,721	7,039	12,456	36,216
Hydropower	MW	1,401	3,872	853	6,126
Nuclear	MW	0	0	0	0
Wind power and other	MW	216	221	115	552
Total	MW	18,338	11,132	13,424	42,894

Data sources:《China Electric Power Yearbook2007》

Table A-12 Installed capacity of Northeast Power Grid in 2000

Installed capacity	unit	Liaoning	Jilin	Heilongjiang	total
Thermal Power	MW	13,937.9	4,924.7	10,069.9	28,932.5
Hydropower	MW	1,248.5	3,536.7	814.8	5,600
Nuclear	MW	0	0	0	0
Wind power and other	MW	43.9	0	0	43.9
Total	MW	15,230.3	8,461.4	10,884.7	34,576.4

Data sources:《China Electric Power Yearbook2001》

Table A-13 Installed capacity of Northeast Power Grid in 1999

Installed capacity	unit	Liaoning	Jilin	Heilongjiang	total
Thermal Power	MW	12,425.7	4,583.1	10,128.1	27,136.9
Hydropower	MW	1,240	3,508.2	774.5	5,522.7
Nuclear	MW	0	0	0	0
Wind power and other	MW	22.9	0	0	22.9
Total	MW	13,688.6	8,091.3	10,902.6	32,682.5

Data sources:《China Electric Power Yearbook2000》

Table A-14 The new installed capacity from 2000-2006 in the Northeast Power Grid

	Installed capacity in 1999	Installed capacity in 2000	Installed capacity in 2006	Addition capacity from 2000 to 2006	Addition share**(%)**
	A	B	C	D=C-B	
Thermal Power	27,136.9	28,932.5	36,216	7,283.5	87.57
Hydropower	5,522.7	5,600	6,126	526	6.32
Nuclear	0	0	0	0	0.00
Wind power	22.9	43.9	552	508.1	6.11
Total（MW）	32,682.5	34,576.4	42,894	8,317.6	100.00
Share of 2006 installed capacity(%)	76.19	80.61	100.00		

$EF_{BM,y}=EF_{Thermal}\times CAP_{Thermal}/CAP_{Total}=0.9074\times 87.57\%=0.7946$

where:

CAP_{Total} is the total capacity addition,

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

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 Power Grid

Calculation of the Key factors:
Operating Margin emission factor ($EF_{OM,y}$)（tCO_2/MWh）： 1.2561
Build Margin emission factor ($EF_{BM,y}$) （tCO_2/MWh）： 0.9074×87.57%=0.7946
Baseline Emission factor (EF_y) （tCO_2/MWh）： 1.2561×0.75+0.7946×0.25=1.1407

Note: the latest version of ACM0002 (version 07) provides the following default weights for wind and solar projects: Operating Margin, W_{OM} = 0.75; Build Margin, W_{BM} = 0.25.

Annex 4

MONITORING INFORMATION

\- - - - -

Annex 5

O&M cost calculation

According to the Economical Assessment Method and Parameters for Construction Project (3rd edition) issued by NDRC and Ministry of Construction of China on August 2006, the Calculation formula of O&M cost could be expressed as:

Operating cost = Maintenance Fee + Salary and Welfare Fee + Material and other cost + Insurance Fee

 Maintenance Fee = Original Fixed Assets Value × Rate of Maintenance
 Salary and Welfare Fee = Annual Salary of each Staff × Number of Staff × (1 +41%)
 Material and other cost = (fixed amount of material cost+ fixed amount of other costs) × installed capacity
 Insurance Fee= original value of fixed assets × rate of insurance premium

The calculation of maintenance is included in above formulae.
The parameters in the above formulae are given in the FSR and used for financial analysis in PDD.
Detailed data was determined as follows:
Original Fixed Assets Value of the project is 409.50 Million Yuan;
Rate of Maintenance during the first decade of the operation period is 1.4%; the last decade is 2.8%;
Rate of Insurance Premium is 0.405%;
For the Salary and Welfare Fee, assumed staff number is 16, annual salary of each staff is 31,000 RMB, welfare is 14% of annual salary, social insurance and housing Funding are 17% and 10%, respectively.;
Fixed amount of material cost is 10 Yuan/ KW;
Fixed amount of other cost is 30 Yuan/ KW.

Income tax calculation

According to the Economical Assessment Method and Parameters for Construction Project (3rd edition) issued by NDRC and Ministry of Construction of China on August 2006, the Calculation formula of income tax could be expressed as:
Income Tax = Income Tax Rate × Total profit before interest
=Income Tax Rate × (electricity sales revenue - Sales tax and extra charge –O&M cost-depreciation)