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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Project Name: Fumeng Gulibengao Wind Farm Project
Version Number: 2.1
Date: 08/10/2011

PDD revision history

PDD version	Time	Note
Version 1.0	25/05/2011	GSP version
Version 2.0	16/08/2011	Revised based on onsite validation and Finding Logs
Version 2.1	08/10/2011	Revised based on TR's comments

A.2. Description of the project activity:

Fumeng Gulibengao Wind Farm Project (the Proposed Project Activity) is located in Hongmaozi Town, Fumeng County, Fuxin City, Liaoning Province. The Proposed Project Activity is developed by Fuxin Taihe Wind Power Co., Ltd. (the Project Owner). The purpose of the Proposed Project Activity is to generate electricity through utilizing wind resource to meet the growing needs for local economic development. The electricity generated by the project activity will be delivered to the Northeast China Grid (NECG).

The scenario existing prior to the start of the implementation of the project activity is that the electricity is supplied by NECG where the power generation is dominated by fossil fuel-fired power plants.

The project scenario is to install and operate 33 units of wind turbines with a unit capacity of 1,500 kW each. The total installed capacity will be 49.5 MW. Based on the local wind resource, the project activity is expected to deliver on average 102,600 MWh of electricity to the NECG annually; being the equivalent annual operation time of 2,073 hours under a full workload and the plant load factor is 23.66%.

The baseline scenario identified in section B.4 is the same as the scenario existing prior to start of the implementation of the Project Activity. i.e the equivalent electricity would have been supplied the NECG that is dominated by fossil fuel-fired thermal power plants in the absence of the project activity.

The project activity will generate electricity by utilizing renewable resource. The electricity with zero-emission from the Project Activity will be delivered to NECG so as to replace equivalent electricity that would have generated by NECG where it is dominated by fossil fuel-fired power plants (as shown in Table Annex 3-2 of Annex 3). Thus the Project Activity will reduce greenhouse gas emissions versus the baseline scenario where the greenhouse and gas emission sources are described in the Table B-1 of B.3. The net annual electricity delivered to NECG is estimated about 102,600 MWh. Accordingly it will achieve a reduction in greenhouse gas emission of 103,656 tCO_2e per year during crediting period (see section A.4.4).

Sustainable Development

The Project Activity will supply with clean energy through utilizing renewable energy resources to meet increasing electricity demand for local economic development. The implementation of

the project activity will contribute to improve the environment while develop local economy. The Proposed Project Activity will contribute to sustainable development in the following ways:

- Reduce exploitation of fossil fuel by supplying with renewable energy so as to improve existing energy consumption model relying on fossil fuel, also it will improve energy security;
- Reduce the emissions of pollutants associated with operation of fossil fuel-fired thermal power plant, including SO_2, NO_x and dust in the baseline/business-as-usual scenario, thus improve the local environment;
- Reduce GHG emissions compared to the baseline/business-as-usual scenario;
- Facility commercialisation of grid-connected wind power technologies and markets;
- Promote local economic development by creating local employment opportunities. The project activity will provide with job opportunities during both the construction and operational phase of the proposed project activity.

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)
People's Republic of China (host)	Fuxin Taihe Wind Power Co., Ltd.	No
United Kingdom of Great Britain and Northern Ireland	Camco Carbon Credits Limited	No

See Annex 1 for details

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Liaoning Province

A.4.1.3. City/Town/Community etc:

Hongmaozi Town, Fumeng County, Fuxin City

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

The proposed project is located at Hongmaozi Town, Fumeng County, Fuxin City, Liaoning Province, People's Republic of China. The central geographical coordinates of the proposed project is at latitude 42°11' North and longitude 121°27' East.

Figure A-1 shows the location of the proposed project.

Figure A-1 The location of the proposed project

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

The proposed project falls into:
Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)
Project Activity: Grid-connected renewable power generation; electricity capacity addition from a wind farm project

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

Scenario existing prior to the project activity & Baseline scenario

According to the information published by Chinese DNA, except for Tibet Autonomous Region, Hong Kong, Macao and Taiwan, electricity supply in China is provided by 7 independent regional grids – NECG, North China Grid, East China Grid, Central China Grid, Northwest China Grid, China Southern Power Grid and Hainan Local Grid. The proposed project will connect to NECG which includes three provincial grids: Liaoning, Jilin, and Heilongjiang girds.

Electricity supply existing prior to the start of implementation of the project activity is provided by NECG which is dominated by fossil fuel-fired thermal power plants. According to the China Electric Power Yearbook the electricity generated by different power generation technologies as listed in Table Annex3-2 of Annex 3, from 2004 to 2008, the annual percentages of fossil fuel-fired power generation among the total power generation of NECG are 93.55%, 92.02%, 94.31%, 94.47%, and 93.91%, respectively. Obviously it is not likely that such an electricity supply model will change significantly in the short term.

In the absence of the project activity, the electricity generated by the project activity would have been provided by NECG though either expanding existing capacity of fossil fuel-fired thermal power plants/units or installing new fossil fuel-fired thermal power generation units. Thus, the baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity i.e the equivalent electricity is provided by NECG.

Project Scenario

The proposed project will install 33 units of wind turbine-generator with the unit capacity of 1,500 kW. The total installed capacity is 49.5MW. The project scenario is to install and operate 33 units of wind turbines with a unit capacity of 1,500 kW each. The total installed capacity will be 49.5 MW. Based on the local wind resource, the project activity is expected to deliver on average 102,600 MWh of electricity to the NECG annually. The plant load factor is 23.66%.

The proposed project will install 28 model GW82/1500kW wind turbine units and 5 model GW87/1500kW wind turbine units, which are manufactured by Goldwind Science & Technology Co., Ltd.. The technical specification of the turbine unit is given in Table A-1.

Table A-1 The technical specification of the turbine unit

Wind turbine				
Item	**Unit**	**Index**		**Data Source**
		GW87/1500kW	**GW82/1500kW**	
Rated capacity	kW	1,500	1,500	Equipment Purchasing Contract
Rotor diameter	m	87	82	Equipment Purchasing Contract
Swept area	m^2	5874~6112	5324	Equipment Purchasing Contract
Rotational speed	rpm	9.9	9	Equipment Purchasing Contract

Wind turbine				
Item	Unit	Index		Data Source
		GW87/1500kW	GW82/1500kW	
Rated voltage	V	690	690	Equipment Purchasing Contract
Designed lifetime	years	20	20	Equipment Purchasing Contract
Generator				
Item	Unit	Index		Data Source
		GW87/1500kW	GW82/1500kW	
Rated capacity	kW	1580	1580	Equipment Purchasing Contract
Rated voltage	V	690	690	Equipment Purchasing Contract

The applied technology and equipment is domestic-made. Therefore, the project is not involved in technology transfer.

Every turbine will be configured by a transformer to upgrade voltage from 690 V steps up to 35 kV. Then electricity will be delivered to on-site substation through 220 kV transmission line. From the substation, the voltage of electricity will be step up to 220 kV then is connected to the NECG.

The net electricity delivered to the power grid will be monitored continuously on by electric meters on site. Records for electricity sold will be used for cross-check. The design of monitoring system is presented in B.7.2.

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

10 year fixed crediting period is chosen for the proposed project. The annual emissions reduction of the proposed project is estimated to be 103,656 tCO_2e and the total reduction will be 1,036,560 tCO_2e during the fixed crediting period (from 1 December 2011 to 30 November 2021).

Years	Annual estimation of emission reductions in tones of CO_2 e
01/12/2011~31/12/2011	8,638
01/01/2012~31/12/2012	103,656
01/01/2013~31/12/2013	103,656
01/01/2014~31/12/2014	103,656
01/01/2015~31/12/2015	103,656
01/01/2016~31/12/2016	103,656
01/01/2017~31/12/2017	103,656
01/01/2018~31/12/2018	103,656
01/01/2019~31/12/2019	103,656
01/01/2020~31/12/2020	103,656
01/01/2021~30/11/2021	95,018
Total estimated reductions (tonnes of CO_2e)	1,036,560
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	103,656

Note: The starting date of the fixed crediting period is 1 December 2011, and the ending date is 30 November 2021.

A.4.5. Public funding of the project activity:

No public funding from Annex I Parties is involved in this project activity.

SECTION B. Application of a baseline and monitoring methodology

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

1. '**Consolidated baseline methodology for grid-connected electricity generation from renewable sources**' (ACM0002 Version 12.1.0, valid from 26 November 2010 onwards); http://cdm.unfccc.int/UserManagement/FileStorage/VA17EM2PNDJWBTFY34KGRLZO68S9UQ

2. '**Tool for the demonstration and assessment of additionality'** (Version 05.2, valid from 26 August 2008 onwards) ; http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

3. '**Tool to calculate the emission factor for an electricity system'** (Version 02.2.0, valid from 3 June 2011 onwards); http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.0.pdf

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

This methodology is applicable to grid-connected renewable power generation project activities:

(a) Install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant);
(b) Involve a capacity addition;
(c) Involve a retrofit of (an) existing plant(s);
(d) Involve a replacement of (an) existing plant(s).

As a grid-connected wind farm project, the proposed project meets all the applicability criteria of ACM0002 as follows:

- The electricity from the project activity is proposed to be supplied to the NECG
- The project is a green-field wind farm project. The proposed project is the installation of a new wind power plant with the installation capacity of 49.5 MW at the site where no renewable power plant was operated prior to the implementation of the project activity.
- The proposed project does not involve switching from fossil fuels to a renewable energy source at the site of the project activity.

Therefore, ACM0002 is applicable to the proposed project.

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

As per ACM0002 and "Tool to calculate the emission factor for an electricity system", the spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system.

Based on the "*Tool to calculate the emission factor for an electricity system (Version 02.2.0)",* the project electricity system is defined by the spatial extent of the power plants that can be dispatched without

significant transmission constraints. According to the *2010 Baseline Emission Factors for Regional Power Grids in China* issued by the National Development and Reform Commission, NECG is selected as electricity system of the project activity, as the power plants that are connected to this grid can be dispatched without significant transmission constrains. NECG covers Liaoning, Jilin, and Heilongjiang.[1] The connected electricity system is the North China Grid (NCG), consisting of six provincial grids: Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong.

According to the methodology ACM0002, the emissions source and the category of GHG is described as in Table B-1:

Table B-1 The emission source and the category of GHG

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation of the fossil fuel fired power plants connected to the Northeast China Grid	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is deemed a conservative measure.
		N_2O	No	Excluded for simplification. This is deemed a conservative measure.
Project Activity	The proposed project	CO_2	No	According to the methodology, the project is renewable power generation, so there is no CO_2 vented
		CH_4	No	Excluded by the methodology for wind farm projects
		N_2O	No	Excluded by the methodology for wind farm projects

The flow diagram of the project boundary is shown in Figure B-1.

[1] Chinese DNA designates it on 20 Dec 2010 at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

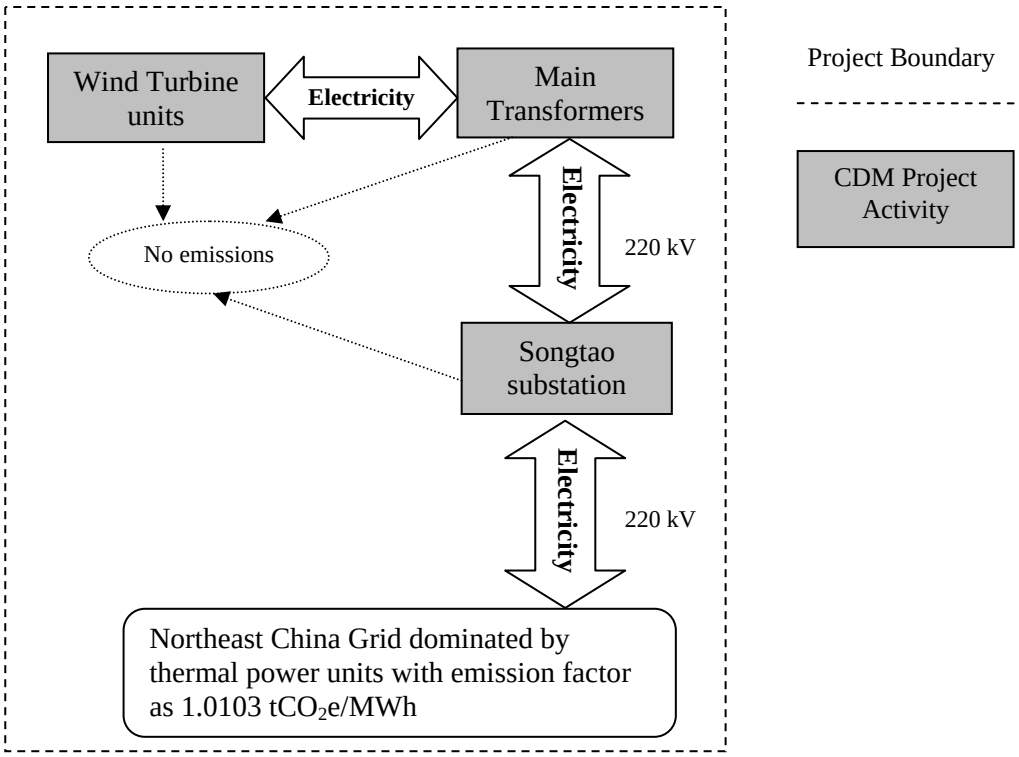

Figure B-1 The flow diagram of the project boundary

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

According to methodology ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline 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".

The project activity is a wind power project that provides electricity to NECG which is dominated by fossil fuel-fired thermal power plants. The electricity delivered by the project activity would have been provided by NECG though either expanding existing capacity of fossil fuel-fired thermal power plants/units or installing new fossil fuel-fired thermal power generation units. Thus, the baseline scenario is the equivalent electricity is provided by NECG.

The baseline emission is expressed in kWh of net electricity delivered by the project activity multiplied by a CM emission factor.

The CM emission factor is determined *ex-ante* for the crediting period as the weighted average of the operating margin (OM) emission factor and the build margin (BM) emission factor with the weights of 75% and 25%, respectively.

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 starting date of the Proposed Project Activity is after 02 Aug 2008, therefore, following EB guidelines[2] the project participant informed the Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project and of the intention to seek CDM status. These notifications were made within six months of the starting date of the project as shown in the timeline below.

In addition to this confirmation of serious prior consideration of the CDM by the project participants, the timeline below indicates continuing and real actions to secure CDM status for the project in parallel with its implementation, as there is no gap greater than 2 years between these actions to secure CDM status.

The CDM consideration and decision making process:

The Feasibility Study Report of the proposed project was finished in November 2010. The investment analysis in the FSR showed that the project was not financial attractiveness (without CERs revenues). Including CER revenue will make the project to be financially attractive. It was agreed by the board on 5th January 2011 that the project activity should be developed as a CDM project[3] . The project owner submitted CDM notifications to and confirmed by China DNA (NDRC) and EB both on 7th March 2011. Accordingly the project owner signed an Emission Reduction Purchase Agreement (ERPA) with Camco on 3rd March 2011. The starting date of the project is the date to sign the general contract for construction and installation on 28th February 2011.

The project development timeline therefore complies with guidance on the CDM consideration set by the Board. The benefits of the CDM were a decisive factor in the decision to proceed with the project. The key timelines are presented in the table below:

TableB-2 Timelines in Project related and CDM related activities

Time	Project related activities	CDM related activities
Nov 2010	Environmental Impact Assessment (EIA) completed	
Nov 2010	Feasibility Study Report (FSR) completed, which indicated that without CER revenue the project is not feasible and pointed out clearly to implement the project as CDM project can make the project financially attractive.	
31st Dec 2010	EIA approved	
31st Dec 2010	FSR approved	
5th Jan 2011		Board meeting decision on developing the proposed project as CDM project
28th Feb 2011	General contract for construction and installation signed	
3rd Mar 2011		Emission Reduction Purchase Agreement

[2] "*Guidelines on the Demonstration and Assessment of Prior Consideration of the CDM (version 04)*", EB 62 Annex 13, see at http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid04.pdf

[3] Board meeting minutes

Time	Project related activities	CDM related activities
		(ERPA) signed
7th Mar 2011		Notification of the intention to develop this project as CDM confirmed by DNA
7th Mar 2011		Notification of the intention to develop this project as CDM confirmed by UNFCCC
30th Nov 2011	*Project Commissioning (expected)*	
25th Dec 2011	*Put into fully operation (expected)*	

The following steps are used to demonstrate the additionality of the proposed project according to the "Tool for the demonstration and assessment of additionality":

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

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

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

According to the "Tool for the demonstration and assessment of additionality" (Version 05.2), identify realistic and credible alternative(s) available to the project participants that provide outputs or services comparable with the proposed CDM project activity.

The Project Activity is the installation of a new grid-connected renewable power plant, and is not a capacity addition, retrofit or replacement of existing grid-connected renewable power plant/unit. Therefore, the baseline scenario according to the methodology ACM0002 (Version 12.1.0) 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 "Tool to Calculate the Emission Factor for an Electricity System".

According to the Methodological Tool[4], project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.

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

Alternative 1: The Project undertaken without being registered as a CDM project activity

Alternative 1 is in compliance with all applicable legal and regulatory requirements. But according to the detailed analysis in step 2, this scenario is less attractive with low IRR and is not realistic without CDM financing.

[4] Paragraph 4, "Tool for the Demonstration and Assessment of Additionality (version 5.2)" http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

Alternative 2: *Construction of a thermal power plant with an equivalent amount of annual electricity generation*

Taking into account the required capacity for the same annual generation, according to the current laws and regulations, it is not a realistic alternative. If taking the capacity that can generate the same annual electricity generation and estimating annual utilization hours as 5253[5] which is the average utilization hours of the thermal units in Liaoning Province in 2008, the alternative baseline scenario for the proposed project should be a fuel-fired power plant with installed capacity of 19.5 MW or lower. Further, as the proposed project is a grid-connected wind power generation project, the alternative baseline scenario must be a grid-connected fuel-fired power generation project. However, according to Chinese regulations, coal-fired power plants of less than 135 MW are prohibited to be built in the areas covered by the large grids[6]. For the reasons mentioned above, the possible alternative baseline scenario of building one 19.5 MW fuel-fired power plant conflicts with Chinese regulations.

Alternative 3: *Provision of an equivalent amount of annual power output by Northeast China Power Grid which the Project is connected to*

Alternative 3 is a realistic and feasible alternative which can provide outputs or services comparable with the proposed project and comply with applicable laws and regulations. Added capacity is dominated by thermal (coal-fired) power plants as determined in B.6.

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

According to the analysis in sub-step 1a, alternative 1 and alternative 3 are the realistic and feasible alternatives which comply with applicable laws and regulations.

Step 2. Investment analysis

The purpose of this step is to determine whether the Proposed Project Activity is not:
(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of certified emission.
To conduct the investment analysis, the following sub-steps are used. And the guidance provided by the Board on investment analysis[7] is taken into account:

Sub-step 2a. Determine appropriate analysis method

The "Tool for the Demonstration and Assessment of Additionality" recommends three analysis methods: simple cost analysis (Option I), investment comparison analysis (Option II) or benchmark analysis (Option III).

Other than CDM related income, the proposed project will earn economic benefit through the sale of electricity. Therefore, the simple cost analysis (Option I) cannot be used. The investment comparison analysis (Option II) is not applicable to the proposed project as the alternative of the proposed project is the equivalent electricity would be provided by NECG which is not a specific project. Hence, the

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5 http://www.serc.gov.cn/jgyj/ztbg/200907/W020090709363694131892.pdf

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

7 Guidelines on the Assessment of Investment Analysis (Version 05), EB 62, Annex 5 http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

benchmark analysis (Option III) is chosen and the Internal Rate of Return (IRR) is used to assess the financial viability of the project activity.

Sub-step 2b. Option III. Apply benchmark Analysis

According to "*Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*" issued by former State Power Corporation of China in 2002, a project IRR of 8% (after tax) has been applied as a benchmark to assess new investment in power sector[8]. This benchmark has been commonly used in the power sector. Therefore project IRR of 8% is applied as the benchmark in the investment analysis of the project activity. Only if the total investment IRR of the Proposed Project Activity is higher than or equivalent to this benchmark, the Proposed Project Activity is financially feasible.

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

1. Key parameters for investment analysis

The Parameters applied in the investment analysis are taken from the FSR. The key parameters are given in Table B-3.

Table B-3 Parameters for investment analysis

Item	Unit	Value	Reference
Net Electricity delivered to the grid	MWh	102,600	FSR
Total static investment	Million RMB	485.69	FSR
Expected tariff (Inc. VAT)	RMB/kWh	0.61	FSR
Annual O&M cost	Million (RMB)	13.58	FSR
VAT	%	17	FSR
City maintenance & construction tax	%	5	FSR
Surtax for education	%	3	FSR
Income tax	%	25	FSR
Depreciation period	%	15	FSR
Rate of residual value	%	3	FSR
Operational life	years	20	FSR
Expected CERs price (1EUR=10RMB)	EUR/tCO_2e	10	Estimated

2. Suitability of the applied parameters

Data source

The input values applied in the investment analysis are derived from the FSR of the project. The FSR was undertaken by Shanxi Power Exploration & Design Institute, which is independent and professional design institute[9]. The FSR was carried out based on the national regulation and sector criteria and the material and equipment price level at the time of the FSR written[10]. The FSR was approved by the local

8 State Power Corporation of China, Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects. Beijing: China Electric Power Press, 2002

9 Qualification Rank A. Gong Zi Jia 20420070002, issued by National Development and Reform Commission of P.R China

10 The FSR of Fumeng Gulibengao Wind Farm Project

government authority[11]. In this context, the FSR should be deemed as credible source to be applied to make investment decision.

The FSR was completed in November 2010 and the starting date of the project is February 2011. The period of time between the finalisation of the FSR and the project starting date is less than one year, and therefore it is not likely that the input values would have materially changed and the decision to proceed with the investment was based on the FSR.

The key input values taken from the FSR and was consistent with relevant criteria for similar projects required by government regulations. The input value is detailed and evidenced by relevant documentation and statistical data for the cross-check as follows:

Input Values

i. Investment costs

The investment cost of the Proposed Project Activity was taken from the FSR. The investment cost estimated by referring to the *Codes on Compiling Feasibility Study Report of Wind Farms*[12], *Methodology and Calculation Standard of Budget Estimation on Feasibility Study Report on Wind Farm Projects*[13], *Methodology of Wind Energy Resource Measurement for Wind Farms*[14], *Methodology of Wind Energy Resource Assessment for Wind Farms*[15].

The estimated construction investment of the project activity is 485.69 million RMB, and the unit construction investment is 9,812 RMB/kW, which falls in the range of 8,000 and 12,000 RMB/kW for the other similar wind farm projects in China[16]. And it is also within the range of the other registered projects in Liaoning Province, which is 8,065 and 11,634 RMB/kW showed in the table B-4.

Table B-4 Key parameters of similar registered wind farm projects in Liaoning (up to 31 May 2011)

Ref	Installed capacity	Unit construction investment	PLF	Tariff (inc. VAT)	Unit O&M Cost	Other O&M Cost	Other O&M cost/total O&M cost
	MW	RMB/kW	%	RMB/kWh	RMB/MWh	RMB/MWh	%
537	24.65	9267	25.11%	0.5500	N/A	N/A	N/A
539	24.65	9221	23.81%	0.5500	N/A	N/A	N/A
883	49.5	8457	20.96%	0.6100	131.79	10.57	8.02%
1446	49.5	8912	25.62%	0.6100	89.56	16.04	17.91%
1501	24.65	9146	24.98%	0.6100	166.58	27.42	16.46%
1924	49.3	8733	24.60%	0.6100	100.29	20.88	20.82%
1965	22.1	8812	24.66%	0.6100	181.29	23.14	12.77%

11 The FSR approval of Fumeng Gulibengao Wind Farm Project

12 The Codes on Compiling Feasibility Study Report of Wind Farms, issued by NDRC on 25 May 2005 http://www.windpower.org.cn/news/links/js_2005_0508.htm;

13 Methodology and Calculation Standard of Budget Estimation on Feasibility Study Report on Wind Farm Projects, DRC Energy [2005] No. 899, http://www.windpower.org.cn/news/links/js_2005_0525_3.pdf;

14 Methodology of Wind Energy Resource Measurement for Wind Farms", GB/T 18709-2002, http://windpower-china.cn/files/GBT%2018709-2002.pdf;

15 Methodology of Wind Energy Resource Assessment for Wind Farms, GB/T 18710-2002, http://www.cechina.cn/eletter/standard/wind/GBT18710-2002.pdf;

16 http://www.in-en.com/newenergy/html/newenergy-20072007042885858.html.

Ref	Installed capacity	Unit construction investment	PLF	Tariff (inc. VAT)	Unit O&M Cost	Other O&M Cost	Other O&M cost/total O&M cost
	MW	RMB/kW	%	RMB/kWh	RMB/MWh	RMB/MWh	%
2123	49.5	8923	25.03%	0.6100	96.27	17.33	18.01%
2149	49.5	8650	21.58%	0.6100	133.93	25.40	18.96%
2223	49.5	9589	23.36%	0.6100	98.62	9.77	9.91%
2817	49.3	8306	23.48%	0.6100	127.48	14.58	11.44%
2827	49.5	10425	26.24%	0.6100	140.25	19.57	13.96%
2854	20.4	8381	23.88%	0.6100	103.64	17.58	16.96%
2864	49.5	8375	22.48%	0.6100	120.71	25.39	21.03%
2918	300	9609	24.33%	0.6100	99.99	8.00	8.00%
3031	49.5	9577	22.15%	0.6100	101.27	12.89	12.73%
3112	49.5	10485	22.16%	0.6100	125.09	17.52	14.00%
3344	100.5	10261	22.17%	0.6100	119.95	6.95	5.80%
3443	49.5	9116	23.70%	0.6100	83.70	4.82	5.76%
3470	49.3	9503	25.49%	0.6100	120.73	20.15	16.69%
3806	49.3	8449	23.33%	0.6100	102.83	19.57	19.03%
3857	49.5	9398	23.34%	0.6100	86.49	18.45	21.33%
3862	49.5	9343	23.83%	0.6100	133.82	19.16	14.32%
3867	100.5	10179	24.24%	0.6100	108.29	6.00	5.54%
3894	49.5	10301	23.93%	0.6100	100.84	14.30	14.18%
3934	49.5	9810	23.56%	0.6100	85.44	4.84	5.67%
4059	49.5	10183	24.57%	0.6100	131.43	6.51	4.95%
4067	30	8410	20.90%	0.6100	125.63	10.00	7.96%
4104	49.5	9225	24.26%	0.6100	120.36	14.12	11.73%
4195	49.5	8065	25.46%	0.6100	174.18	22.42	12.87%
4320	300	9889	23.52%	0.6100	116.91	4.85	4.15%
4367	49.5	11634	24.83%	0.6100	102.79	13.79	13.42%
4415	48	10331	24.18%	0.6100	113.82	8.00	7.03%
4416	49.5	10237	24.01%	0.6100	121.12	14.26	11.78%

Source: UNFCC website

The investment cost is estimated by an independent qualified design institute with the highest grade (Grade A) in the FSR. The final contracted value of the main investment (including wind turbines purchase, tower purchase, box-type transformer purchase, general construction & installation), which accounts for 90.22% of the total static investment estimated in FSR, is 3.40% higher than the ex-ante estimate in the FSR.

Therefore, it can be concluded that the applied investment cost in the FSR is reasonable.

ii. Power Generation / plant load factor

The power generation / plant load factor of the Project Activity derived from the FSR was estimated by Shanxi Power Exploration & Design Institute on the basis of the assessment on the local wind resource combining wind measurement data on-site and modeling simulations for 30 years (1979 to 2008). As stated above, Shanxi Power Exploration & Design Institute is an independent and qualified design institute with qualification in Grade A. Therefore, the applied power generation and plant load factor are

in line with the EB's guidance regarding determination of plant load factor[17]. The PLF is within the range of wind farm projects in the province as listed table B-3 above.

iii. Tariff

The on-grid tariff of 0.61 RMB/kWh is used in investment analysis for the whole lifetime. The tariff rate is derived from the FSR. Also the tariff rate is consistent with the most recent approved tariffs for wind farms in classified wind resource regions in Liaoning at the time of writing FSR (November 2010). According to *Notification on Improving Wind Power On-grid Tariff issued by NDRC on 20 Jul 2009*[18], the unified on-grid tariff for the wind farms in the categorized Level IV of Wind Resource Region is 0.61 RMB/kWh (incl. VAT). The project is located in Liaoning that is categorized as level IV. As such tariff rate 0.61 RMB/kWh (incl. VAT) is the latest approved tariff rate available at the time of investment decision making. Therefore, the tariff of 0.61 RMB/kWh (incl. VAT) is appropriate to be used in the investment analysis.

Also according to *Information Note on the Highest Tariffs Applied by the Executive Board in Its Decisions on Registration of Projects in the People's Republic of China (Version 02)", published on 03 June 2011*, the highest historical tariff in Liaoning Province is 0.61 RMB/kWh (incl. VAT). Therefore, the tariff used in the investment analysis is appropriate when taking the highest historical tariff into account.

iv. Operation and maintenance cost (O&M)

The annual O&M costs for the Proposed Project Activity were estimated at 13.58 million RMB. O&M cost consists of following components:

i) Material cost rate: 20 RMB/kW

Material cost refers to the expenditure of all the fuel, power, daily materials, back-up parts/spare parts and low-value consumables during the operation, maintenance, and accident treatment of the wind farms. It is commonly estimated based on the capacity of the wind farm.

The material cost rate for the proposed project applied in the investment analysis section is derived from the FSR on page 152. This rate is estimated by an independent qualified design institute with the highest grade (Grade A) based on sufficient project experience in Liaoning province, available statistical data of the price index for raw materials, fuels, and power in recent years, and information about materials specific to the proposed project.

Additionally, the rate falls into the range of 0 and 40 RMB/kW presented by the other similar registered projects in Liaoning province[19]. Therefore, it can be concluded that the estimated rate is reasonable.

ii) Employee expenditure:

- Number of employees: 15
- Salary: 0.06 million RMB per capita per annum
- Benefits: 41% of salary

[17] *Guidelines for the Reporting and Validation of Plant Load Factors (EB48 Annex 11)*

[18] NDRC *Notification on Improving Wind Power On-grid Tariff Policy,* Fa Gai Jia Ge [2009] No.1906 http://www.sdpc.gov.cn/zcfb/zcfbtz/2009tz/t20090727_292827.htm

[19] Statistic about key parameters of similar registered projects in Liaoning Provinces

Employee expenditure, consisting of staff salary and welfare, is determined by the number of employees, annual salary on the average, and the percentage of the welfare to the salary.

The annual salary of the operation staffs is derived from the FSR on page 152. This expenditure is estimated based on the previous salary of the project owner on the average. In fact, the average salary of project owner in the past is about 20% higher than the estimated level[20], which demonstrates the cost estimation is conservative and the expenditure during the operation period is expected to be higher in the future.

Staff welfare comprises all mandatory social insurance including pension, medical, unemployment, injury, maternity, as well as housing provident fund, which should be paid by the project owner as required by applicable laws and regulations, and some additional benefits specially provided by the project owner (e.g. additional medical insurance, personal accident insurance). The percentage of the welfare to the salary for the proposed project is estimated to be 41%. In fact, if following the applicable local regulations, the percentage could reach up to 51.6%, which is even higher than the estimated value and implies a lower project IRR; even applying the required minimum limit of 35.2%, the project IRR is 6.33%, which is still below the benchmark. Please find more details for each social insurance (as listed below) from the government's official website of Fuxin city[21], where the propose project is located.

pension insurance	20%
medical insurance	6.5%
unemployment insurance	2%
injury insurance	0.7%~2.1%
maternity insurance	1%
housing provident fund	5%~20%

Generally speaking, the estimation for employee expenditure is conservative and reasonable.

iii) Repairs and maintenance: 1.8% of fixed assets investment[22]
iv) Other O&M cost: 35 RMB/kW

Other O&M cost represents overhead. It is defined as the remaining items of O&M cost except for maintenance and repairs, insurance and employee expenditures in accordance with the *Economic Evaluation Method and Parameters for Project Construction*[23]. Normally it is measured as percentage of total O&M cost. According to the Chinese accounting policy, the other O&M cost should cover the costs listed below[24]:

A. Management salary and benefit
B. Technical transfer fee (if any)
C. Company expenditure: including expendable supplies, travel cost, office cost, share the cost of the Board, entertainment cost etc.

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20 Wage Payment Summary of Fuxin Taihe Wind Power Co., Ltd.

21 http://www.fxdsj.gov.cn/newdetail.jsp?id=000000487

22 P111 Practical skill and the analysis to problematic issues in financial appraisal for Feasibility Study and Evaluation on the projects applying bank loan, planning publisher 2007

23 P97- p98, Ministry of Construction of Notional Development and Reform Commission, Economic Evaluation Method and Parameters for Project Construction, version 3, China Planning Press, Beijing, 2006, page 97.

24 P112 Practical skill and the analysis to problematic issues in financial appraisal for Feasibility Study and Evaluation on the projects applying bank loan, planning publisher 2007

D. Benefit expenditure: company pays medical, health, housing fund, pension, training cost, insurance, unemployment cost for employees, labor union cost,
E. Social service cost: including lawyer cost, auditing cost.
F. Public welfare expenditure: including tax on property, stamp duty, green-built charge, pollutant charge, tax on vehicle and vessel use, property tax, land tax, the sewage treatment charge.

The other O&M cost of the project is 12.76% of total O&M cost which falls into the range from 4.15% to 21.33% listed in the Table B-4 above.

The estimated average annual O&M cost of the project activity is 132 RMB/MWh, which is comparable to the O&M cost of similar projects in Liaoning. These similar projects as shown in Table B-4 have a range from 84 RMB/MWh to 181 RMB/MWh. Therefore, it can be concluded that the estimated average annual O&M costs in the FSR are reasonable.

Therefore, it can be concluded that the estimated O&M cost of the Project Activity is appropriate.

v. Insurance premium

Insurance premium rate is 0.35% of net value of fixed assets derived from the FSR and is also compliant with national policy[25].

vi. Depreciation Period and Residual rate

Depreciation period of 15 years and residual rate of 3% from the FSR were applied in the investment analysis. Both are compliant with national regulation[26].

vii. Taxes

Each of the tax rates used in the FSR is in accordance with Chinese law as indicated below.

i) Income Tax: 25%

According to the law of business income tax promulgated by state council on 16 March 2007, effective as of 1 Jan 2008, the rate for business income tax was regulated as 25%[27].

ii) Value Added Tax

VAT in tariff rate
According to the Provisional Regulations of the Peoples Republic of China on Value Added Tax[28] which was effective on 1 Jan. 2009, VAT rate is of 17%.

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25 Page 21, the Estimation of Engineering, China Electric Publisher 2008 See http://jc.cepp.com.cn

26 Implementing regulation on Business Income Tax Law of People's Republic of China http://www.gov.cn/zwgk/2007-12/11/content_830645.htm

27 Business Income Tax Law of People's Republic of China, issued by state council (2007) No. 63, http://www.gov.cn/flfg/2007-03/19/content_554243.htm

28 Provisional Regulations of the Peoples Republic of China on Value Added Tax Order 538 of the State Council; http://www.chinaacc.com/new/63_67_/2008_11_17_wa8088515201711180021980.shtml

In accordance with *Notice of the Ministry of Finance and the State Administration of Taxation about Policies regarding the Value Added Tax on Comprehensive Utilization of resources and other products*, a preferential VAT policy was awarded to wind farm project. Half of VAT rate could be claimed back by project owner[29]. Such VAT reduction in electricity tariff rate has been considered in investment analysis

VAT on purchase of the equipments

The Value Added Tax on the purchase of the equipment for renewable energy projects can be offset from the VAT on sales revenue during operation period in accordance with *Notice about Implementation of VAT Reform in China*[30]

iii) Education Tax & City Construction Surtax

Education tax: According to "*Interim Provision on Education Tax Law*", the education tax rate is 3% of the paid VAT[31].

City construction surtax: According to *National City Tax Law,* city construction tax rate is 5% of the paid VAT[32].

3. Comparison of the project IRR and the financial benchmark

In accordance with the benchmark analysis, if the financial indicators of the project, such as the project IRR, are lower than the benchmark, then the project is not considered to be financially attractive.

Table B-5 shows the project IRR (after tax) with and without the income from CERs revenue. Without the revenue, the project IRR is 6.38%, this is lower than the financial benchmark. Thus the project is not financially acceptable. Taking into account the CDM revenues, the project IRR is 8.78%, higher than the financial benchmark. Therefore, the CDM revenues enable the project to overcome the investment barrier.

Table B-5 Comparison of IRR with and without the income from CERs sale

Item	Without CDM	Benchmark	With CDM
IRR	6.38%	8%	8.78%

Sub-step 2d. Sensitivity analysis

According to EB guidance[33], only variables that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variations. For the Proposed Project Activity, the key variables analysed, which constitute more than 20% of costs or revenues are following parameters:

29 Circular on Value Added Tax Policy of Comprehensive Utilization of Resources and Other Products http://www.chinaacc.com/new/63_67_/2008_12_15_wa23902542951218002153 45.shtml

30 Notice about Implementation of VAT Reform in the Whole Country" issued by Ministry of Finance and State Administration of Taxation of People's Republic of China on19 Dec 2008 , Cai Shui [2008] No. 170. http://www.js-n-tax.gov.cn/Page1/StatuteDetail.aspx?StatuteID=8965

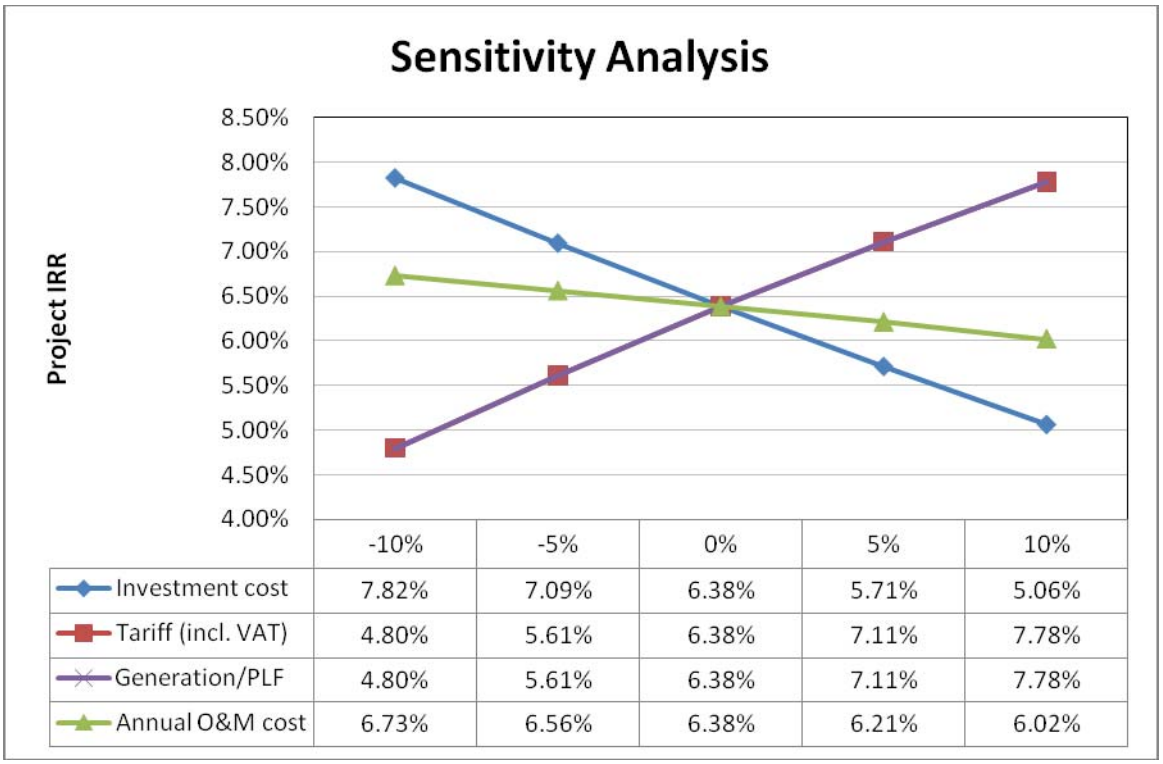
31 http://www.law-lib.com/law/law_view1.asp?id=99771.

32 http://202.108.90.130/chinatax/jibenfa/jibenfa0401.htm.

33 Paragraph 20, Guidelines on the Assessment of Investment Analysis (Version 05), EB 62 Annex 5 http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

1) Investment cost
2) Tariff（Incl. VAT)
3) Power supplied to the grid
4) Annual O&M cost

In terms of the guidance on the assessment of investment analysis from EB41, Annex45, paragraph17, the sensitivity analysis was should at least cover a range of -10 to 10%. Figure B-2 summarizes the results of the sensitivity analysis;



	-10%	-5%	0%	5%	10%
Investment cost	7.82%	7.09%	6.38%	5.71%	5.06%
Tariff (incl. VAT)	4.80%	5.61%	6.38%	7.11%	7.78%
Generation/PLF	4.80%	5.61%	6.38%	7.11%	7.78%
Annual O&M cost	6.73%	6.56%	6.38%	6.21%	6.02%

Figure B-2 Sensitivity analysis of the proposed project

As shown in Figure B-2, even the financial indicators fluctuated within the range from -10% to +10%, the project IRR is still below the benchmark. The additionality of the Project is not changed.

Justification of the project IRR of the proposed project will not be above the benchmark:

Table B-6 shows, in any single condition when the static total investment decreases by 11.2%, the annual net power generation increases by 11.7%, the annual O&M cost decreases by 49.8% or the electricity tariff increases by 11.7%, the project IRR of the project will reach to the benchmark. However, these variations do not reflect a realistic range of the input parameters for the financial analysis. This is explained below for each situation specifically.

Table B-6 Variation of financial parameters to make the project IRR reaching 8%

Static total investment	-11.2%
Annual net power generation	11.7%
Annual O&M cost	-49.8%
Electricity tariff	11.7%

1. Decrease in total static investment

If the static total investment lowered by 11.2%, the project IRR would exceed the benchmark. However, this is very unlikely to happen due to the increasing trend of prices in Liaoning Province from 2005 to 2009. In 2005, 2006, 2007 and 2008, 2009, the Liaoning Province total price indices of investment in fixed assets were 2.8%, 2.1%, 4.3%[34], 9.11%, and -3.05%, respectively[35]. There is clearly a trend of increasing investment costs. Indices for ex-factory products from 2005 to 2009 are 5.1%, 4.1%, 4.4%[36], 10.88%, and -5.97%, respectively[37]. Therefore the total cost of this project is extremely unlikely to decrease.

Please note that the decrease in the total price indices of investment in fixed asset and the index for ex-factory products in year of 2009 is the consequences of the once-in-a-century global financial crisis that hit the world in the second half of 2008 due to a series of bank and insurance failures. This demonstrates the decrease was totally an accidental exceptional affair and could be regarded as a sign of continuing decrease in trend analysis. In fact, according to the Liaoning Statistical Communiqué on the 2010 National Economic and Social Development, the total price indices of investment in fixed asset and the index for ex-factory products in 2010 were 3.3% and 7.4%, respectively, which keep showing an increasing trend as usual.

Given that all costs have been keeping upward, the decrease in fixed assets investment is considered to be extremely unlikely. Therefore the project IRR of the project will remain below the benchmark.

2. Increase in power generation

The expected power generation of the Proposed Project Activity is calculated by an independent qualified design institute with the highest grade (Grade A) in the FSR. Therefore, the generation and plant load factor determination are in line with both options of "Guidelines for the Reporting and Validation of Plant Load Factors (EB48 Annex 11)": (a) provided to the government while applying the project activity for implementation approval, and (b) determined by a third party contracted by the Project Owner.

The electricity report in the FSR is based on onsite wind measurements, the wind assessment records for 1979 to 2008 and the output characteristics of the turbines, using a scientific approach applied internationally. The volume of annual generation therefore is expected to accurately represent the long-term average power supply during the lifetime of the wind farm, taking into account yearly variations in power generation, and it is not credible to assume that generation would be significantly higher over the lifetime of the Proposed Project Activity than that which can be expected from the long-term averages.

As per the FSR, the estimated net supplied power is calculated from the turbine availability, grid availability and the wind speed. The calculations for the proposed project are carried out using professional software designed for the wind energy industry. The output is maximized through selection of the most suitable turbines, optimal turbine layout in the wind farm, and considering the specific turbine characteristics, and the grid connection. The output calculations account for issues such as air density

34 http://www.tj.yc.gov.cn/tjwz/ShowArticle.asp?ArticleID=557

35 http://219.235.129.58/indicatorYearQuery.do

36 Liaoning Statistical Communique on National Economy and Social Development 2007 http://www.ln.gov.cn/zfxx/tjgb2/ln/200804/t20080422_188101.html

37 http://219.235.129.58/indicatorYearQuery.do

corrections, turbine efficiency, planned maintenance, contaminated rotors, and auxiliary power use, etc. The method of anticipating power generation is also approved by the government and is widely used in China for wind energy.

Therefore, it is not credible to assume that generation from the proposed project would increase by 11.7% each year on average over the lifetime of the project in order to reach the benchmark 8%.

3. Increase in tariff rate of electricity

The tariff would need to increase by 11.7%, at 0.681 RMB/kWh, for the Proposed Project Activity IRR to reach the benchmark, however this case is unlikely to happen. This is because in China, the electricity tariff of wind farm project is priced and managed by central and local government. From the movement on tariff rate over past five years, the increase in tariff rate is far below 11.7%.

The expected on-grid tariff used for the financial analysis in the FSR refers to the most recent tariffs for wind farms in the same region, as available at the time of writing the FSR. The FSR specifically refers to the tariff notification issued by NDRC in Jul 2009 (Fa Gai Jia Ge [2009] No. 1906), which indicated that the unified tariff in the project region was 0.61 RMB/kWh (incl. VAT). Indeed, this latest notification clarified that the proposed project is in the categorized Level IV of Wind Resource Region and all future projects in this area approved after 01 Aug 2009 would automatically be awarded this tariff upon their FSR approval. The FSR of the project was approved on 31 December 2010 and the tariff was therefore automatically fixed at 0.61 RMB/kWh (incl. VAT) in line with the NDRC notification.

Table B-7 collected all tariff notifications issued for Liaoning in the past three years. As shown in the table, the tariffs for wind projects in the region have been kept the same since 2007, and therefore it was reasonable to assume in the FSR that the tariff would eventually be fixed at this level, and any variation from this original assumption, therefore, cannot be considered credible.

Table B-7 Public tariff notifications for Liaoning

Date	Document reference	Tariff (RMB/kWh, incl. VAT)
28 May 2003	*Fa Gai Jia Ge [2003] No. 424*	0.55
03 Dec 2007	*Fa Gai Jia Ge [2007] No. 3303*	0.61
20 Jul 2009	*Fa Gai Jia Ge [2009] No. 1906*[38] (Level IV of Wind Resource Region)	0.61

As the tariff had already been fixed, prior to the starting date of the project which is after the approval of the FSR, any variation in tariff is not credible, but even when applying a 10% increase in the tariff the project would not reach the benchmark.

Highest historical tariff

According to "*Information Note on the Highest Tariffs Applied by the Executive Board in Its Decisions on Registration of Projects in the People's Republic of China (version 01)*", published on 24 Jun 2010, the highest historical tariff in Liaoning is 0.61 RMB/kWh (incl. VAT). However, the proposed project requires a tariff of 0.681 RMB/kWh for the project life to reach the benchmark 8% (see IRR spreadsheet), which is higher than the highest historical tariff awarded. Therefore, the tariff used in the investment analysis is appropriate when taking the highest historical tariff into account.

[38] http://www.ndrc.gov.cn/jggl/jggs/t20090727_292846.htm

4. Decrease in Annual O&M cost

O&M cost is consists of employee expenditure, maintenance and repair rate, insurance, materials cost and other O&M cost. The employee expenditure, maintenance and repair rate, materials cost consist of more than 76% of O&M cost. According to statistics in Liaoning, index of annual wage amount is 15.2%, 11.6%, 13.11%, 14.5%, 12.2% from 2005-2009[39] and index of price of raw materials, fuels and power is 8.1%, 4.2%, 4.8%,1.66% -6.66% in 2005, 2006, 2007, 2008 and 2009[40], separately. The statistics show a clear trend of increasing employee expenditure, maintenance and repair cost, and materials cost. Thus it is extremely unlikely that annual O&M cost would decrease.

Please note that the decrease in the index for raw materials, fuels and power in year of 2009 is the consequences of the once-in-a-century global financial crisis that hit the world in the second half of 2008 due to a series of bank and insurance failures. This demonstrates the decrease was totally an accidental exceptional affair and could be regarded as a sign of continuing decrease in trend analysis. In fact, according to the Liaoning Statistical Communiqué on the 2010 National Economic and Social Development, the index for raw materials, fuels and power in 2010 were 8.6%, which keeps showing an increasing trend as usual.

Given that all costs have been keeping upward, the decrease in O&M costs is considered to be extremely unlikely. Therefore the project IRR of the project will remain below the benchmark.

From the analysis above, it can be seen that the proposed project is not financially attractive to the project owner. Without further incentivisation, in this case from the CDM, project owner would not be able to carry out the proposed project.

Outcome of step 2:
Based on the investment analysis above, the proposed project is not financially attractive without the revenues generated from CER sales.

Step 3. Barrier analysis

The investment analysis has fully demonstrated and explained the additionality of the project, so step 3 is skipped.

Step 4. Common practice analysis

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

According to the latest version "Tool for the Demonstration and Assessment of Additionality (Version 05.2)", projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing (financing condition), etc. Other CDM project activities (including registered project activities and the projects that are under validation process) are not to be included in the common practice analysis.

39 Index of wage amount in statistic report (2004-2008), see at http://219.235.129.58/indicatorYearQuery.do

40 Liaoning Statistical Communique on National Economy and Social Development 2005~2009 http://219.235.129.58/indicatorYearQuery.do

Following the requirements of the Tool and taking into account of the characteristics of the proposed project, other activities are considered similar if they are located in the same region, use broadly similar renewable energy technology (e.g. wind turbines), and are of a similar scale with an installed capacity varying within a range of -50% and 50%, experience similar wind conditions (in categorized same regions of wind resource) and take place in a comparable environment with respect to policy framework, access to human resource, material costs and access to financing and technology, for example. According to the criteria, similar projects are identified as below:

1. Projects located in Liaoning Province

- The unique geological conditions in Liaoning Region results in the different wind resources, compared to wind plants in other provinces connected to NECG;
- The investment environment of each province in China is different. This is due to a number of factors including the economic development level, the industrial structure, and the fundamental infrastructure of the province, the development strategy and the policy framework. These can all affect the final investment decision;
- Finally, a number of other key economic factors vary from province to province, including tariff rates of products, the cost of materials, and other utilities such as water, the cost of labor and services and the types of loan that can be obtained;

2. Projects with installed capacity which varies within a range between -50% ~50% of the project

Different project scale may lead to variation of investment risky due to discrepancy investment cost and operation cost etc.. With respect to the principle, the projects with the installed capacity between 24.75 MW ~ 74.25 MW are included in the range of similar projects.

3. Projects implemented after 2002

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

5. Project other than CDM activities

According to EB38 meeting report (paragraph 60) stating that "The board clarified that in the context of conducting common practice analysis, the project participants may exclude registered CDM project activities and project activities which have been published on the UNFCCC CDM website for global stakeholder consultation as part of the validation process".

Based on the public and accessible information in China[41] and the principles discussed above, there are no commissioned projects similar to the proposed project activity, other than CDM projects.

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

Without favorable financial support, further development of large scale wind farms in Liaoning Province faces considerable barriers. All projects in Liaoning have all been registered as or are applying for the

[41] Available on the China Electric Power Yearbook 2009, China DNA website (http://cdm.ccchina.gov.cn/web/index.asp), and UNFCCC website (http://cdm.unfccc.int/Projects/projsearch.html)

CDM projects to obtain the support from CDM fund. With the CDM income, they can solve barriers like the proposed project is subject to. This further demonstrates the project is additional.

Outcome of step 4:

From the above analysis and discussion, the proposed project is not common practice.

In conclusion, the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

ACM0002 and *2010 Baseline Emission Factors for Regional Power Grids in China* [42] are applied as the following steps, and the data are from *China Electric Power Yearbook* and *China Energy Statistical Yearbook.*

I. Calculating the Baseline Emission（BE_y）;
II. Calculating the Project Emission（PE_y）;
III. Calculating the Leakage Emission（ LE_y）;
IV. Calculating the Emission Reduction（ER_y）

I. Calculating the Baseline Emission

The baseline emission factor is calculated as a Combined Margin, which consists of the weighted average of Operating Margin emission factor and Build Margin emission factor by utilizing the latest data vintage for NECG, then the baseline emission (BE_y) is calculated as below:

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

Where,

BE_y = Baseline emission in year y (tCO_2e/yr)

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

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y (tCO_2e/MWh)

The project activity is the installation of a new grid-connected renewable power plant at the site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where,

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/yr)

According to *Tool to calculate the emission factor for an electricity system* (Version 02.2.0), seven steps are applied to calculate the baseline emission factor:

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[42] Chinese DNA designates it on 20 Dec 2010 at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

Step 1 –Identify the relevant electric power system.
Step 2 –Choose whether to include off-grid power plants in the project electricity system (optional).
Step 3 –Select a method to determine operating margin (OM).
Step 4 –Calculate the operating margin emission factor according to the selected method.
Step 5 –Calculate the build margin (BM) emission factor.
Step 6 –Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electric power system

The power generated by the project will be supplied to the NECG. According to *"2010 Baseline Emission Factors for Regional Power Grids in China"* which is renewed by the Office of the National Coordination Committee on Climate Change of the National Development and Reform Commission (NDRC) of China (the Chinese DNA) in 20 December 2010, the NECG is a regional grid, consisting of three provincial grids: Liaoning, Jilin, and Heilongjiang .

The connected electricity system is the North China Grid (NCG), consisting of six provincial grids: Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong. However, as power is exported to the connected electricity system, NCG is not included in the project boundary: electricity exports are not subtracted from electricity generation data used for calculating and monitoring the baseline emission rate.

For the purpose of determining the operating margin emission factor, one of the following options to determine the CO_2 emission factor(s) for net electricity imports from a connected electricity system within the same host country(ies) is used:

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

For imports from connected electricity systems located in another host country(ies), the emission factor is 0 tonnes CO_2 per MWh.

Electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the electricity emission factors.

Following the calculations of the DNA, the weighted average operating margin (option (b)) is used to calculate the CO_2 emission factors for net electricity imports (EF_grid,import,y).

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

According to Chinese administrative regulation for power plants, all power plants should be connected to power grid. The power grids undertake most of power supply. Therefore, only gird power plants are included in the calculation. Accordingly, Option I is applicable to the Project Activity.

Step 3. Select a method to determine operating margin (OM)

The calculation of $EF_{grid,OM,y}$ is based on one of the four following methods:

(a) Simple OM, or
(b) Simple Adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

Because the detailed dispatch data of NECG is unavailable, method (c) and method (b) are not applicable. According to the total electricity generated in 2004-2008 by NECG, the low-cost / must-run resources constitute less than 50% of total amount of grid generating output (see Annex 3 for details). Therefore, the Average OM method is not applicable.

The Simple OM method can be used to calculate the OM emission factor.

For the simple OM method, the emission factor can be calculated using either of the two following data vintage:

- 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 displace grid electricity, requiring the emission factor to be updated annually during monitoring.

The project participants chose to use the ex-ante vintages and fix the emission factor for the duration of the crediting period.

Step 4. Calculate the Operating Margin emission factor according to the selected method

According to the Tool, the simple OM emission factor in *y* year ($EF_{grid,OMsimple,y}$) is calculated as generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2e/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants. It may be calculated:

- Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:
(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

In China, there is no available data for the detailed net electricity generation and CO_2 emission factor of each power unit; only nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and off-grid power plants are not included in the calculation. Therefore option B is selected for calculating the OM

emission factor. The formula of $EF_{grid,OM,simple,y}$ is:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{EG_y} \quad (3)$$

Where:

$EF_{grid,OM,simple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2e/MWh)
$FC_{j,y}$ = Amount of fossil fuel type i consumed in NECG 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 in year y (tCO_2e/GJ)
EG_y = Net electricity generated and delivered to NECG by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i = All fossil fuel types combusted in power sources in NECG 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)

Step 5. Calculate the build margin (BM) emission factor

The Tool emphasises that project participants should use the set of power units that comprises the larger annual generation, so we choose (b) to calculate.

In terms of vintage of data, project participants can choose between one of the following two options:

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

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emission 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.

The proposed project applies option 1 to calculate the build margin emission factor ex-ante.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);
(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to

the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥ 20%) and determine their annual electricity generation (AEG_{SET}-≥20%, in MWh);

(c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SET_{sample});

The Tool emphasises that project participants should use the set of power units that comprises the larger annual generation, so we choose (b) to calculate.

But recently in China, the power plants see the build margin as the vital business data, so it is very difficult to find the available data about the power units consists of either the set of five power units that have been built most recently, or 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. To resolve this problem, the Executive Board (EB) has approved the project participants to use the methodological deviation[43] as follows:

(1) Use of capacity additions during the last 1-3 years for estimating the build margin emission factor for grid electricity.
(2) Use of weights estimated using installed capacity in place of annual electricity generation. And it is suggested that the project participants use the efficiency level of the best technology commercially available in the provincial, regional or national grid of China, as a conservative proxy.

Step 6. Calculate the Build Margin emission factor

According to the Tool, the Build Margin emission factor ($EF_{grid,BM,y}$) is calculated as the generation-weighted average emission factor of a sample of power plants *m*, the formula is as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \quad (4)$$

Where:

$EF_{grid,BM,y}$ = Build Margin CO_2 emission factor in year *y* (tCO_2e/MWh)
$EG_{m,y}$ = Net Quantity of electricity generated and delivered to NECG by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2e/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

The CO_2 emission factor of power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in Step 3 for the simple OM, using option B1 (Deviation relevant details in Step 4 can be the reference), so we can conclude the formula of calculating $EF_{grid,BM,y}$ from the formula in option B1 and formula (2) as follow:

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total fuel-fired installed capacity, according to the permitted deviation by CDM EB, the Build Margin emission factor ($EF_{grid,BM,y}$) will be calculated as: 1) Based on the most recent year's energy balance of NECG,

[43] EB guidance for "Request for guidance: Application of AM0005 and AMS-ID in China，2005.10.7": Request for clarification on use of approved methodology AM0005 for several projects in China. http://cdm.unfccc.int/Projects/Deviations

calculating the percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions; 2) based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the fuel-fired emission factor of NECG; 3) calculating the Build Margin emission factor ($EF_{grid,BM,y}$) through fuel-fired emission factor times the weighted-average of fuel-fired installed capacity which is more close to 20% in the new capacity additions. The detailed calculation as follows:

Sub-step 1:
Calculate the proportion of CO_2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO_2 emissions from the total fossil fuel electricity generation (sum of CO_2 emissions from coal, oil and gas).

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

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

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

(7)

Where:
$FC_{i,j,y}$= the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y;
$NCV_{i,y}$= the net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit) ;
$EF_{i,j,y}$ = the CO_2 emission factor of fuel i in year(s) y (tCO_2e/GJ) ;
λ_{Coal} = the percentage of CO_2 emissions from the coal-fired power plants in total fuel-fired CO_2 emissions;
λ_{Oil} = the percentage of CO_2 emissions from the oil-fired power plants in total fuel-fired CO_2 emissions;
λ_{Gas} = the percentage of CO_2 emissions from the gas-fired power plants in total fuel-fired CO_2 emissions;

Sub-step 2:
Calculate the operating margin emission factor of fuel-based generation:

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

Where:
$EF_{Thermal}$ = the fuel-fired emission factor;
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are corresponding to the emission factors of coal, oil and gas fired power plants which are applied by the most advanced commercialized technologies.

The weighted average of coal consumption per kWh supplied of 68 new built 600MW sub critical units in 2008 is adopted to determine the emission factor of the best advanced coal fired generation technology, which is 314.35 gce/kWh. In other words, the efficiency of best advanced coal fired generation technology is 39.08%.

The maximum electricity supplied efficiency of oil and gas fired generation plants are regarded as approximate estimation of commercially optimal efficiency technology. Similarly, the fuel consumption per kWh supplied of best advanced oil and gas fired generation technology is determined to be 238.74 gce/kWh, which means a generation efficiency of 51.46%.

The installation capacity, generation data, and average self consumption rate data are from the China Electric Power Yearbooks (2007-2009) and China Energy Statistical Yearbook (2007).

The data of fuel consumption per electricity generated and low calorific values of fuels are from the China Energy Statistical Yearbooks 2009.

The $EF_{CO2,i}$ data by fuels are from Table 1-2 in P.1.6 and Table 1-4 in P.1.8 in first chapter of "2006 IPCC Guidelines for National Greenhouse Gas Inventories".

Sub-step 3:
Calculate the Build Margin emission factor

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

Where:
$EF_{grid,BM,y}$ = the Build Margin emission factor with advanced commercialized technologies for year *y*;
CAP_{Total} = the new capacity additions;
$CAP_{Thermal}$ = the new fuel-fired capacity additions.

As mentioned above, the build margin emission factor of the baseline is calculated *ex-ante* and will not be renewed in the first crediting period.

Step 6. Calculate the Combined Margin emission factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = \omega_{OM} \cdot EF_{grid,OM,y} + \omega_{BM} \cdot EF_{grid,BM,y} \quad (10)$$

Where:
$EF_{,grid,BM,,y}$ = Build Margin CO_2 emission factor in year *y* (tCO_2e/MWh)
$EF_{grid,OM,,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2e/MWh)
ω_{OM} = Weighting of operating margin emissions factor (%)
ω_{BM} = Weighting of build margin emissions factor (%)

According to Tool, the default weights of wind farm projects are as follows:
ω_{OM}=0.75, ω_{BM} = 0.25

Therefore, baseline emission can be calculated as below:

$$BE_y = EF_{grid,CM,y} \times EG_{facility,y} \quad (11)$$

II. Project Emission

According to ACM0002, there are no expected project emissions for a wind farm project.
Therefore, $PE_y = 0$

III. Leakage Emission

According to ACM0002, no leakage emissions are considered.

IV. Emission Reduction

Emission reductions will be estimated based on the baseline emission, the project emission and the leakage emission. The emission reduction ER_y due to the proposed project activity during a given year y is calculated as follows:

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

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

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid from Liaoning, Jilin, Heilongjiang in 2006-2008
Source of data used:	Electric Power Yearbooks 2007-2009 and China Energy Statistical Yearbook 2007-2009
Value applied:	Details in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the Chinese official statistics.
Any comment:	Official data, used for OM and BM calculation

Data / Parameter:	$FC_{i,y}$
Data unit:	10^4t, 10^7m^3
Description:	Amount of fossil fuel type *i* (in a mass or volume unit) consumed in NECG in 2006-2008
Source of data used:	China Energy Statistical Yearbook 2007-2009
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the Chinese official statistics.
Any comment:	Official data, used for OM and BM calculation

Data / Parameter:	$EF_{CO2,i,y}$

Data unit:	tCO_2e/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in 2006-2008
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the IPCC because the local data is not available.
Any comment:	Official data, used for OM and BM calculation

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/t, GJ/m^3
Description:	Net calorific value (energy content) of fossil fuel type *i* in 2006-2008
Source of data used:	China Energy Statistical Yearbook 2009
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the Chinese official statistics.
Any comment:	Official data, used for OM and BM calculation

Data / Parameter:	$CAP_{i,y}$
Data unit:	MW
Description:	Installed capacities of Liaoning, Jilin, Heilongjiang in 2006-2008
Source of data used:	China Electric Power Yearbook 2007-2009
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	Official data, used for BM calculation

Data / Parameter:	*Auxiliary Power Ratio*
Data unit:	%
Description:	The auxiliary power ratio of source *j* in Liaoning, Jilin, Heilongjiang in 2006-2008
Source of data used:	China Electric Power Yearbook 2007-2009 and China Energy Statistical Yearbook 2007
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods	Data that is collected from the official statistics.

and procedures actually applied :	
Any comment:	Official data, used for OM and BM calculation

Data / Parameter:	$EF_{Coal,Adv}$
Data unit:	%
Description:	The fuel consumption rate of coal-fired power plants which are applied by the most advanced commercialized technologies.
Source of data used:	From Chinese DNA
Value applied:	39.08%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	Official data, used for BM calculation

Data / Parameter:	$EF_{Oil,Adv}$
Data unit:	%
Description:	The fuel consumption rate of Oil-fired power plants which are applied by the most advanced commercialized technologies.
Source of data used:	From Chinese DNA
Value applied:	51.46%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	Official data, used for BM calculation

Data / Parameter:	$EF_{Gas,,Adv}$
Data unit:	%
Description:	The fuel consumption rate of Gas-fired power plants which are applied by the most advanced commercialized technologies.
Source of data used:	From Chinese DNA
Value applied:	51.46%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data that is collected from the official statistics.
Any comment:	Official data, used for BM calculation

B.6.3 Ex-ante calculation of emission reductions:

I. Baseline Emission

Therefore, the Operating Margin emission factor ($EF_{grid,OM,simple,y}$) is the weighted emission factors of 2006–2008:
$EF_{grid,OM,simple,y}$ = 1.1109 tCO_2e/MWh

The Build Margin emission factor can be calculated by formula (4)-(9):
$EF_{grid,BM,y}$ = 0.7086 tCO_2e/MWh

The baseline emission factor $EF_{,grid,CM,,y}$ is calculated as formula (10). Thus,
$EF_{,grid,CM,,y}$ = 1.0103 tCO_2e/MWh

The baseline emission BE_y is calculated as formula (11):
BE_y = 1.0103×102,600＝103,656 tCO_2e/year

See annex 3 for details.

II. Project Emission

PE_y = 0.

III. Emission Reduction

The Emission Reductions (ER_y) for the proposed project activity could be calculated as the formula (12):
ER_y =103,656－0 = 103,656 tCO_2e/year

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)
01/12/2011~31/12/2011	0	8,638	0	8,638
01/01/2012~31/12/2012	0	103,656	0	103,656
01/01/2013~31/12/2013	0	103,656	0	103,656
01/01/2014~31/12/2014	0	103,656	0	103,656
01/01/2015~31/12/2015	0	103,656	0	103,656
01/01/2016~31/12/2016	0	103,656	0	103,656
01/01/2017~31/12/2017	0	103,656	0	103,656
01/01/2018~31/12/2018	0	103,656	0	103,656
01/01/2019~31/12/2019	0	103,656	0	103,656
01/01/2020~31/12/2020	0	103,656	0	103,656
01/01/2021~30/11/2021	0	95,018		95,018
Total (tonnes of CO_2e)	0	1,036,560	0	103,6560

Note: The starting date of the fixed crediting period is 1 December 2011, and the ending date is 30 November 2021.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid 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	102,600 MWh
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording; 100% of data will be monitored and electronically archived.
QA/QC procedures to be applied:	The measurement and calibration will be undertaken in compliance with JJG 596-1999 or DLT448-2000 by the qualified checking institute.
Any comment:	Cross check measurement results with records for sold and purchased electricity

Data / Parameter:	$E_{generation,y}$
Data unit:	MWh
Description:	Electricity generated by the proposed project activity based on the data metered by the onsite meters M_1 (export direction)
Source of data to be used:	Measured by meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	102,600 MWh
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording; 100% of data will be monitored and electronically archived.
QA/QC procedures to be applied:	The measurement and calibration will be undertaken in compliance with JJG 596-1999 or DLT448-2000 by the qualified checking institute.
Any comment:	Cross check measurement results with records for sold electricity

Data / Parameter:	$E_{turbines,y}$
Data unit:	MWh
Description:	Electricity achieved by the project from the Grid for the use of wind turbines in case of shut down in year y as metered by the onsite meters M_1 (import direction)
Source of data to be	Measured by meters

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 MWh
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording; 100% of data will be monitored and electronically archived.
QA/QC procedures to be applied:	The measurement and calibration will be undertaken in compliance with JJG 596-1999 or DLT448-2000 by the qualified checking institute.
Any comment:	Cross check measurement results with records for sold electricity

Data / Parameter:	$E_{self\,aux,y}$
Data unit:	MWh
Description:	Electricity for the power plant's self use
Source of data to be used:	Measured by meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording; 100% of data will be monitored and electronically archived.
QA/QC procedures to be applied:	The measurement and calibration will be undertaken in compliance with JJG 596-1999 or DLT448-2000 by the qualified checking institute.
Any comment:	Cross check measurement results with records for purchased electricity

Data / Parameter:	$E_{backup,y}$
Data unit:	MWh
Description:	Electricity achieved by the proposed project from the Power Grid in year *y* for emergency condition, when the whole plant is shutting down and no electricity could be transferred from the 220kv transmission line.
Source of data to be used:	Measured by meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording; 100% of data will be monitored and electronically archived.
QA/QC procedures to	The measurement and calibration will be undertaken in compliance with JJG

be applied:	596-1999 or DLT448-2000 by the qualified checking institute.
Any comment:	Cross check measurement results with records for purchased electricity

B.7.2 Description of the monitoring plan:

The monitoring plan is to serve as a guideline for the project owner to monitor the emission reduction of the proposed project. A more detailed Monitoring and Management Manual of the proposed project will be completed before the project operation. The contents of the Monitoring and Management Manual are highlighted as follows:

1. Monitoring subject

The main data to be monitored for the CDM project activity is:

$EG_{facility,y}$ the net electricity supplied to the grid by the proposed project in year y;

As the proposed project shares the same transformer, substation or transmission line and metering equipment at the substation with the other additional capacity, the data from the onsite meter (M_1) are used to calculate the net electricity supplied by the project as below:

$$EG_{facility,y} = E_{generation,y} – E_{turbines,y} - E_{self\ aux,y} - E_{backup,y}$$

Where:

$E_{generation,y}$ the electricity generated by the proposed project activity based on the data metered by the onsite meters M_1 (export direction);

$E_{turbines,y}$ the electricity achieved by the project from the Grid for the use of wind turbines in case of shut down in year y based on the data metered by the onsite meters M_1 (import direction);

$E_{self\ aux,y}$ the electricity for self auxiliary consumption of the proposed project in year y as metered by $M_{self\ aux}$;

$E_{backup,y}$ the electricity achieved by the project from the Grid in year y for emergency condition as metered by $M_{backup,y.}$

The calibration procedure, QA/QC and date management of the proposed project will also be monitored.

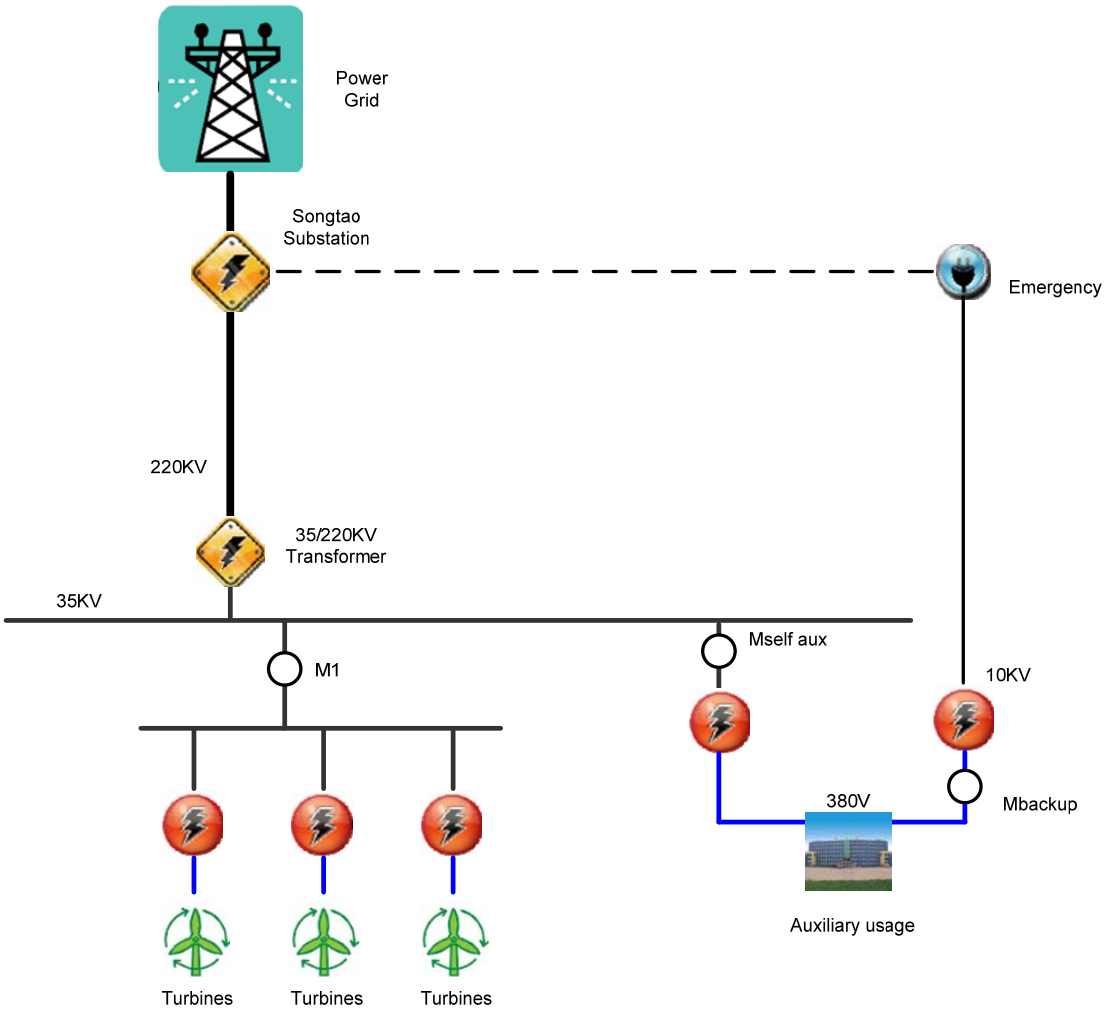

Figure B-4 Measurement of the proposed project

2. Monitoring management structure

In order to obtain effective monitored data, the project owner will establish a CDM Monitoring Office and designate qualified staffs responsible for all relevant matters, including monitoring, data collection and archiving, QC/QA, and verification. The structure of the CDM Monitoring Office is outlined in Figure B-5.

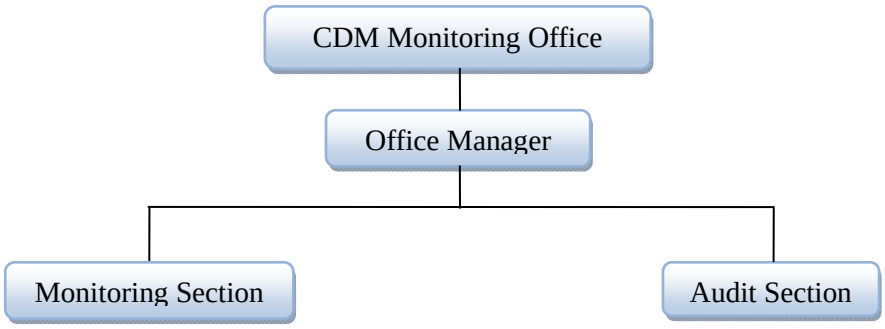

Figure B-5 Organization Chart of the CDM Project Management Office

The responsibilities of the sections are briefly described as following:

- Office Manager: Manage the work of CDM Monitoring Office; Charge of all relevant matters with the monitoring activity.
- Monitoring Section: Monitor, collect and archive the data according to the Monitoring and Management Manual.
- Audit Section: Audit the work of Monitoring Section and execute the QC/QA procedures according to the Monitoring and Management Manual.

3. Monitoring apparatus and installation

The metering systems will be installed in accordance with national and industry standards. The accuracy of the meters is 0.5 or above and will be calibrated regularly.

As showed in Figure B-4, the metering system to be installed includes M_1, $M_{self,aux}$ and M_{backup}.

- M_1 with bidirectional reading is installed before the main transformer;
- $M_{self,aux}$ and M_{backup} are single direction meters;

$M_{self,aux}$ and M_{backup} are shared with the other projects. For conservative calculation, the value monitored from M_{backup} and $M_{self,aux}$ will be used directly without being shared when calculating the net generation of the project activity.

The meters will be measured and recorded manually and electronically. The data of the meters will be cross-checked against the relevant monthly electricity purchase receipts and/or records from the grid.

4. Calibration of Meters

The meters will be checked and calibrated by the qualified checking institute in compliance with the requirements of Checking Regulation of Electronic Power Meters (JJG 596-1999) or Technical Management Regulation of Power Metering Device (DLT448-2000). The frequency of calibration is no less than one time per year, and the validated periods of all calibration reports should be successive.

In any case there is any problem for the meters, the relevant qualified third party is responsible to correct the meters and write the corrective action records. After handling of the emergency, the project owner must prepare a report regarding the emergency to explain to DOE that the handling method is reasonable.

5. Data Management System

The data management system will be established to save data and information during the monitoring process. All the monitoring and calculated records should be archived in electric documents and paper documents. The paper documents, such as maps, diagrams and Environmental Impact Assessment (EIA) Report, should be kept at the fixed location together with the monitoring plan.

All the electronic and paper documents relevant to CDM must be archived for more than two years since the end of the crediting period or the last issuance of CERs.

6. Certification

The project owner has the responsibility to provide any necessary data, information and document required by DOE during the certification process.

All the electronic and paper documents will be archived during the crediting period and two years after.

7. Training program

The project owner will entrust the professional engineers and experts to train all the relative staffs before operation of generators. The training contains CDM knowledge, operational regulations, quality control (QC) standard flow, data monitoring requirements and data management regulations etc.

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: 08/10/2011

Name of persons determining the baseline study and monitoring methodology:

Contact Information of the responsible person	**Is organisation a Project Participant *Yes/No***
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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:

Starting date is 28/02/2011 (Signing date of general contract for construction and installation)

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

20 years 0 month

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

C.2.1. Renewable crediting period

Not chosen

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

A fixed 10-year crediting period is chosen

C.2.2.1. Starting date:

01/12/2011 or the date of registration whichever is later

C.2.2.2. Length:

10 years 0 month

SECTION D. Environmental impacts

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

The EIA of the proposed project was completed by Liaoning Academy of Environmental Sciences and approved by Liaoning Environmental Protection Administration. The summary of this evaluation is as following:

1. **The environmental impacts of the project and measures to be taken during the construction period:**

   Ambient air: The air pollution in the construction period is mainly due to the dust emitted from the construction activities including the earth excavation, loading/uploading of construction materials, vehicle transportation, and etc.. Measures recommended include onsite sprinkling for dust control, strengthening landscaping, minimizing the excavation area, and covering the temporarily-placed excavation.

   Acoustic environment: Noise during the construction period mainly comes from the construction machinery and transportation vehicles. The major measures for noise control include applying low-noise machinery and technology, optimizing the construction plan, maintaining the construction machinery regularly, slowing speed and forbidding auto horns during the nighttime and resting time; keeping the construction away from the residential area and habitat.

   Water environment: Wastewater of the proposed project is dominated by domestic wastewater from the staff activities. Measures recommended include: no constructing during raining days, covering piled earthwork; utilizing the sanitary facilities nearby or setting temporary WC, and discharging domestic wastewater after onsite treatment.

   Solid waste: Construction wastes (e.g. waste packing materials, construction scrap, and etc.) and excavated materials are regarded as significant source in addition to domestic solid waste. Construction wastes will be collected and reclaimed by the construction entity. The excavation will be backfilled to the wind farm to the fullest extent, so as to minimize the waste excavation which will be placed at the designated site and then treated by engineering and biology measures. Domestic solid waste will be collected and treated by the local sanitary department.

   Ecological Environment: The ecological impacts of the proposed project during the construction period mainly include the vegetation destruction due to temporary and permanent occupation of land. Measures to be taken to minimize the potential ecological impacts during the construction period include: to reinforce the construction management and minimize the land occupation; to avoid the disturbance of the vegetation to the highest extent; keep the surface soil for restoration; to conduct ecological compensation immediately after the completion of the construction.

2. **The environmental impacts of the project and measures to be taken during the operation period:**

   Acoustic environment: The operation of wind turbines constitutes the major source of noise during the operational period. According to the noise attenuation calculation, the noise energy dissipates at a distance of 500 m from the proposed site. The distance of wind turbines with the environmental

sensitive areas nearby can satisfy the noise protection distance of 500 m, and therefore the noise impact of the proposed project on the surrounding residents is negligible.

Optic environment: there is no resident within 500 m of the proposed project, which is identified as the light-shadow protection distance, and thus the project will not have negative impacts on the ambient optic environment.

Ambient air: The operation of wind farm will not impact the air quality.

Water environment: Wastewater generated onsite during the operation period primarily includes domestic wastewater. Wastewater will be applied to the farm land as fertilizer after treatment through septic tank.

Solid Waste: Domestic solid waste generated from the staff activities during the operation period of the proposed project will be collected and treated by dedicated sanitary department.

Ecological Environment: The ecological impacts of the proposed project during the operation period mainly include the impacts of staff activities and running of wind turbines on wild animals within the proposed site. The proposed project is not located in the main bird migrate route of Liaoning province and will not impact the migratory birds. Measures to be taken to minimize the potential ecological impacts during the operation period include: planting along roadside and the around wind turbines; taking slope protection measures to control water loss and soil erosion; reinforcing the ecological construction and maintenance; and increasing the environmental awareness of employees.

3. Conclusion

After the measurements above are performed, the negative impacts on environments will be minimized below the requirements of laws and regulations during the construction and implementation. Furthermore, as renewable power project, the proposed project can reduce the consumption of fossil fuel sources and GHG emission. In addition, the operation of the proposed project will improve the development of the local tourism.

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:

According to EIA, no significant environmental impacts are discovered by the project participants or the host party. Liaoning Environmental Protection Administration has approved the EIA 31st December 2010.

SECTION E. Stakeholders' comments

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

To ensure the sustainability of the project as one of the key requirements of CDM project, the project owner carried out stakeholder consultation process around the project site from January to February 2011. The process is present as below:

1. Invitation and notification

The meeting invitation and project notification were posted near the residents' living areas and some public places on 6th January 2011. The notification contained the brief introduction of the project and the agenda of the meeting together with contact way for collecting comments from those who could not physically attend the meeting.

2. Stakeholder consultation meeting

On 15th February 2011, the public consultation meeting was held in the meeting room of the project's site. More than 35 people attended the meeting including the local official representations, experts from the Turbines Manufacture Company, and representations from the Construction Company, farmers living around and staffs in the project owner company, which are summarized in the Table E-1 below. During the whole meeting, the representation from government introduced the project firstly, and 36 questionnaires were distributed with 34 returned effective questionnaires, giving a response rate of 94%. Table E-1 summarized the basic detail of the respondents from the questionnaires returned.

Table E-1 Structure of the respondents

Basic Info	Classification	Number of Respondents	Percentage
Sex	Male	30	88%
	Female	4	12%
Age	≤ 20	0	0%
	21～30	3	9%
	31～40	8	24%
	≥ 41	23	68%
Occupation	Farmer	22	65%
	Herdsman	0	0%
	Worker	7	21%
	Teacher	2	6%
	Student	0	0%
	Retiree	0	0%
	Officials	0	0%
	Others	3	9%
Education	Primary school or below	0	0%
	Middle school	27	79%
	College or above	7	21%

The respondents are representative in terms of age, occupation and education, so their attitude towards the impacts of the project can therefore be seen as a comprehensive reflection of the attitudes of the residents possibly affected by the project.

E.2. Summary of the comments received:

>>

Comments received through the course of the consultant are summarized and given as below:

1. Comments from the course of the consultant meeting

During the course of meeting, no question was raised. Some people expressed positive view of the project hiring workers locally during the construction period.

2. Comments from the questionnaires and the meeting

A summary of the 34 completed questionnaires is given in table E-2 below:

Table E-2 Outcome of the questionnaires

Questions	Opinion	Number of person
1. Are you satisfied with the local environment?	Yes	
	No	34
	Uncertain	
2. Do you think the site selection of the proposed project is reasonable?	Yes	
	No	34
	Uncertain	
3. Do you think the project will raise serious noise?	Yes	
	No	33
	Uncertain	1
4. Do you think the project will cause electromagnetic pollution?	Yes	
	No	32
	Uncertain	2
5. What do you think the project will impact the surrounding ecological environment?	Positive	
	Zero	34
	Negative	
6. What do you think the installation of wind turbines of the proposed project will impact the local landscape environment?	Positive	32
	Zero	1
	Negative	1
7. What do you think the proposed project will impact the local employment environment?	Positive	34
	Zero	
	Negative	
8. What do you think the proposed project will impact the local economic development	Positive	34
	Zero	
	Negative	
9. Do you support the construction of the project?	Yes	34
	No	
	Uncertain	

It can be concluded from the summary of the questionnaires:

1) All of the responders support the project. Most of them thought the project will positively promote local sustainable development.
2) Most of the responders thought the project will not do any negative impact to the around area while still few of them were uncertain about the impacts of radioactivity and noise.

By participating in the meeting, all the participants had a better understanding of the project and it's influences on the environment, economy and local community, and expressed their full support for the development of the project.

3. Comments received through notification

No comments were received by e-mail or by telephone.

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

The residents and local government are all very supportive to the project. via explanation of EIA by the project owner during the stakeholder consultation, people who were worrying about the radioactivity and ecosystem impact would be raised from the project all think that the impact could be neglected. No negative comments have been received on the project. The result of the consultant meeting was posted in the neighbouring area lasted for one month, and no objection or any more comments have been received.

Considering the full support from local stakeholders with their view of the construction of the project will benefit to the local economy, environment and society, there is no need to make adjustment to the design and implementation of the project. Meanwhile, the project owner expressed that they would take full advantage of the CDM opportunity to facilitate the development of the project and invited the local stakeholders to monitor the course of the construction and implementation of the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I parties are involved in this project activity.

ANNEX 3

BASELINE INFORMATION

Based on the approved methodology ACM0002, the "tool to calculate the emission factor for an electricity system", and the document "*2010 Baseline Emission Factors for Regional Power Grids in China*" released at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf on 20 December 2010, the emission factor of Northeastwest China Power Grid (NECG) calculation was shown below:

The potential Emission Factors and the Average Low Caloric Values used in calculate OM and BM are as Table Annex3-1:

Table Annex 3-1 The parameters of the fuels

Fuel	*Average Low Caloric Value*	*Emission Factor ($kgCO_2/TJ$)*	**Oxidation**
Raw Coal	20,908 kJ/kg	87,300	**1**
Cleaned Coal	26,344 kJ/kg	87,300	**1**
Briquettes	20,908 kJ/kg	87,300	
Other Washed Coal [44]	8,363 kJ/kg	87,300	**1**
Coke	28,435 kJ/kg	95,700	**1**
Crude Oil	41,816 kJ/kg	71,100	**1**
Gasoline	43,070 kJ/kg	67,500	**1**
Diesel Oil	42,652 kJ/kg	72,600	**1**
Fuel Oil	41,816 kJ/kg	75,500	**1**
Other Petroleum Products	41,816 kJ/kg	72,200	**1**
Natural Gas	38,931 kJ/m3	54,300	**1**
Coke Oven Gas [45]	16,726 kJ/m3	37,300	**1**
Other Gas [46]	5,227 kJ/m3	37,300	**1**
LPG	50,179 kJ/kg	61,600	**1**
Refinery Gas	46,055 kJ/kg	48,200	**1**

Sources: *Emission Factor: "2006 IPCC Guidelines for National Greenhouse Gas Inventories" Volume 2 Energy，Chapter 1, P1.21 – P1.24, Table 1.3 and Table 1.4.*

Average Low Caloric Value: "China Energy Statistics Yearbook 2009" p507-508

Step 1. Identify the relevant electricity system

[44] *China Energy Statistics Yearbook 2008,* p283, calculate based on the low caloric value of washed middlings. The calculation result is conservative due to the average low caloric value of slimes is higher than washed middlings.

[45] *China Energy Statistics Yearbook 2008,* p283, calculate based on the lower value 16,726-17,981 kJ/m^3 of caloric value range of coke oven gas.

[46] *China Energy Statistics Yearbook 2008,* p283, calculate based on the lowest value of the low caloric value of the gas furnace, heavy oil catalytic cracking, heavy oil thermal cracking, pressure gasification, and water coal gas.

See B.6. The project electricity system is NECG. The connected electricity systems are NCG.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

See B.6. Option I is chosen: only grid power plants are included in the calculation.

Step 3. Select a method to determine operating margin (OM)

As shown in Table Annex3-2, NECG is a coal-fired dominated power grid, where the installed capacity of low cost and must run plants account for 6.45%, 7.98%, 5.69%, 5.53% and 6.09% in 2004, 2005, 2006, 2007, and 2008, respectively, much lower than 50%. So method (a): Simple OM was chosen to calculate operating margin (OM).

Table Annex3- 2 Electricity Generation of NECG (2004-2008)

Year	Electricity Generation (MWh)					Split of Thermal	Split of low-cost/must-run resources
	Hydro	Thermal	Wind	Others	Total	%	%
2004	11,432,000	171,267,000	322,000	58,000	183,079,000	93.55%	6.45%
2005	15,078,000	178,670,000	371,000	37,000	194,156,000	92.02%	7.98%
2006	11,213,000	199,214,000	706,000	105,000	211,238,000	94.31%	5.69%
2007	11,190,000	218,530,000	1,390,000	203,000	231,313,000	94.47%	5.53%
2008	10,424,000	225,779,000	3,540,000	4,218,000	240,421,000	93.91%	6.09%

Sources: China Electric Power Yearbook 2005-2009

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

As said previously, Option (C) was chosen to calculate the Operating Margin Emission Factor ($EF_{grid,OM,y}$) as bellows:

Table Annex 3-3 Calculating CO_2 Emission of Northeast China Grid in 2006

Fuel	*Unit*	*Liaoning*	*Jilin*	*Heilongjiang*	*Total*	Carbon	Oxidatio	EF	NCV	**CO_2 Emission（tCO_2e）**
						tc/TJ	%	kgCO2/TJ	MJ/t,km^3	**I=D×G×H/100000 (mass)**
		A	**B**	**C**	**G=A+B+C**	**E**	**F**	**G**	**H**	**I=D×G×H/10000 (volume)**
Raw Coal	10^4t	4681.99	2738.24	3698.29	11118.52	25.8	100	87,300	20,908	202,942,832
Cleaned coal	10^4t	0.03			0.03	25.8	100	87,300	26,344	690
Other Washed Coal	10^4t	674.74	17.83	96	788.57	25.8	100	87,300	8,363	5,757,270
Briquettes	10^4t				0	26.6	100	87,300	20,908	0
Coke	10^4t	3.32			3.32	29.2	100	95,700	28,435	90,345
Coke Oven Gas	10^8m^3	2.68	0.16	1.44	4.28	12.1	100	37,300	16,726	267,021
Other Gas	10^8m^3	55.26	1.43		56.69	12.1	100	37,300	5,227	1,105,268
Crude Oil	10^4t	0.49			0.49	20	100	71,100	41,816	14,568
Gasoline	10^4t				0	18.9	100	67,500	43,070	0
Diesel Oil	10^4t	0.75	0.39	0.3	1.44	20.2	100	72,600	42,652	44,590
Fuel Oil	10^4t	11.73	0.45	1.44	13.62	21.1	100	75,500	41,816	429,998
LPG	10^4t				0	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	8.55		4.27	12.82	15.7	100	48,200	46,055	284,585
Natural Gas	10^8m^3		0.19	2.1	2.29	15.3	100	54,300	38,931	484,095
Other	10^4t				0	20	100	72,200	41,816	0
Other Coking Products	10^4t				0	25.8	100	95,700	28,435	0
Other Energy	10^4tc	12.16	17.6	82.77	112.53	0	0	0	0	0
Total										211,421,263

Sources: China Energy Statistical Yearbook 2007

Table Annex3- 4 Electricity Generation of Northeast China Grid in 2006

Province name	*Electricity generation of fuel-fired power plants（MWh）*	*Auxiliary power ratio（%）*	**Total Electricity Supplied to the Grid（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			**183,890,005**

Sources: China Electric Power Yearbook 2007, China Energy Statistical Yearbook 2007

Table Annex 3-5 Calculating CO_2 Emission of Northeast China Grid in 2007

Fuel	*Unit*	*Liaoning*	*Jilin*	*Heilongjiang*	*Total*	Carbon	Oxidatio	EF	NCV	**CO_2 Emission（tCO_2e）**
						tc/TJ	%	kgCO2/TJ	MJ/t,km^3	**I=D×G×H/100000 (mass)**
		A	**B**	**C**	**G=A+B+C**	**E**	**F**	**G**	**H**	**I=D×G×H/10000 (volume)**
Raw Coal	10^4t	4869.32	2873.45	3736.11	11478.88	25.8	100	87,300	20,908	209,520,369
Cleaned coal	10^4t				0	25.8	100	87,300	26,344	0
Other Washed Coal	10^4t	747.85	16.52	106.81	871.18	25.8	100	87,300	8,363	6,360,397
Briquettes	10^4t				0	26.6	100	87,300	20,908	0
Coke	10^4t	4.99			4.99	29.2	100	95,700	28,435	135,789
Coke Oven Gas	10^8m^3	5.53	1.44	1.89	8.86	12.1	100	37,300	16,726	552,758
Other Gas	10^8m^3	68.38	9.06		77.44	12.1	100	37,300	5,227	1,509,825
Crude Oil	10^4t	0.24			0.24	20	100	71,100	41,816	7,135
Gasoline	10^4t				0	18.9	100	67,500	43,070	0
Diesel Oil	10^4t	0.96	0.39	0.47	1.82	20.2	100	72,600	42,652	56,357
Fuel Oil	10^4t	8.43	0.45	1.48	10.36	21.1	100	75,500	41,816	327,076
LPG	10^4t				0	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	7.33		1.99	9.32	15.7	100	48,200	46,055	206,890
Natural Gas	10^8m^3		0.02	2.03	2.05	15.3	100	54,300	38,931	433,360
Other	10^4t	0.01			0.01	20	100	72,200	41,816	302
Other Coking Products	10^4t	0.46			0.46	25.8	100	95,700	28,435	12,518
Other Energy	10^4tc	12.41	2.43	51.35	66.19	0	0	0	0	0
Total										219,122,778

Sources: China Energy Statistical Yearbook 2008

Table Annex3- 6 Electricity Generation of Northeast China Grid in 2007

Province name	*Electricity generation of fuel-fired power plants（MWh）*	*Auxiliary power ratio（%）*	**Total Electricity Supplied to the Grid（MWh）**
Liaoning	106,500,000	7	99,045,000
Jilin	43,700,000	7.68	40,343,840
Heilongjiang	68,400,000	7.67	63,153,720
Total			202,542,560

Sources: China Electric Power Yearbook 2008

Table Annex 3-7 Calculating CO_2 Emission of Northeast China Grid in 2008

Fuel	*Unit*	*Liaoning*	*Jilin*	*Heilongjiang*	*Total*	Carbon	Oxidatio	EF	NCV	**CO_2 Emission（tCO_2e）**
						tc/TJ	%	kgCO2/TJ	MJ/t,km^3	**I=D×G×H/100000 (mass)**
		A	**B**	**C**	**G=A+B+C**	**E**	**F**	**G**	**H**	**I=D×G×H/10000 (volume)**
Raw Coal	10^4t	4973.05	3289.16	3873.45	12135.66	25.8	100	87,300	20,908	221,508,367
Cleaned coal	10^4t				0	25.8	100	87,300	26,344	0
Other Washed Coal	10^4t	791.96	15.58	112.97	920.51	25.8	100	87,300	8,363	6,720,551
Briquettes	10^4t				0	26.6	100	87,300	20,908	0
Coke	10^4t	5.77			5.77	29.2	100	95,700	28,435	157,015
Coke Oven Gas	10^8m^3	4.12	1.06	5.54	10.72	12.1	100	37,300	16,726	668,799
Other Gas	10^8m^3	61.11	7.63		68.74	12.1	100	37,300	5,227	1,340,204
Crude Oil	10^4t	0.37			0.37	20	100	71,100	41,816	11,001
Gasoline	10^4t	0.02			0.02	18.9	100	67,500	43,070	581
Diesel Oil	10^4t	0.84	1.07	0.37	2.28	20.2	100	72,600	42,652	70,601
Fuel Oil	10^4t	10.64	1.06	1.29	12.99	21.1	100	75,500	41,816	410,108
LPG	10^4t				0	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	7.54		3.77	11.31	15.7	100	48,200	46,055	251,065
Natural Gas	10^8m^3		0.39	1.85	2.24	15.3	100	54,300	38,931	473,526
Other	10^4t				0	20	100	72,200	41,816	0
Other Coking Products	10^4t				0	25.8	100	95,700	28,435	0
Other Energy	10^4tc	16.9	3.04	68.19	88.13	0	0	0	0	0
Total										231,611,818

Sources: China Energy Statistical Yearbook 2009

Table Annex3- 8 Electricity Generation of Northeast China Grid in 2008

Province name	*Electricity generation of fuel-fired power plants（MWh）*	*Auxiliary power ratio（%）*	**Total Electricity Supplied to the Grid（MWh）**
Liaoning	108,500,000	7.18	100,709,700
Jilin	46,400,000	7.76	42,799,360
Heilongjiang	71,500,000	7.53	66,116,050
Total			209,625,110

Sources: China Electric Power Yearbook 2009

Weighted average calculating the Electricity Supplied and Fuel Emission in 2006-2008, the *ante* Operating Margin Emission Factor during the first crediting period is: $EF_{grid,OM,simple}$ = 1.1109 tCO_2e/MWh

Step 5. Calculate the build margin emission factor

Sub-step 1. Calculating the percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions.

Table Annex 3-9 The percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions

Fuel	**Unit**	Liaoning	Jilin	Heilongjiang	Subtotal	NCV	EF	Oxidation	CO_2 Emission（tCO2e）
		A	B	C	G=A+…+F	H	I	J	K=G×H×I×J/100000
Raw Coal	10^4 t	4,973.05	3,289.16	3,873.45	12,135.66	20,908	87,300	1	221,508,367
Cleaned Coal	10^4 t	0	0	0	0	26,344	87,300	1	0
Other Washed	10^4 t	791.96	15.58	112.97	920.51	8,363	87,300	1	6,720,551
Briquettes	10^4 t				0	20,908	87,300	1	0
Coke	10^4 t	5.77	0	0	5.77	28,435	95,700	1	157,015
Other Coking	10^4 t	0			0	28,435	95,700	1	0
Subtotal									228,385,933
Crude Oil	10^4 t	0.37	0	0	0.37	41,816	71,100	1	11,001
Gasoline	10^4 t	0.02	0	0	0.02	43,070	67,500	1	581
Diesel Oil	10^4 t	0.84	1.07	0.37	2.28	42,652	72,600	1	70,601
Fuel Oil	10^4 t	10.64	1.06	1.29	12.99	41,816	75,500	1	410,108
Other Petroleum	10^4 t	0	0	0	0	41,816	72,200	1	0
Subtotal									492,291
Natural Gas	10^7m^3	0	3.9	18.5	22.4	38,931	54,300	1	473,526
Coke Oven Gas	10^7m^3	41.2	10.6	55.4	107.2	16,726	37,300	1	668,799
Other Gas	10^7m^3	611.1	76.3	0	687.4	5,227	37,300	1	1,340,204
LPG	10^4 t	0	0	0	0	50,179	61,600	1	0
Refinery Gas	10^4 t	7.54	0	3.77	11.31	46,055	48,200	1	251,065
Subtotal									2,733,594
Total									231,611,818

Sources: China Energy Statistical Yearbook 2009

The result from the above table: $\lambda_{Coal,y}$ =98.61%, $\lambda_{Oil,y}$ =0.21%, $\lambda_{Gas,y}$ =1.18%

Sub-step 2. Calculating the fuel-fired emission factor

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

Where:
$EF_{Thermal}$ is the fuel-fired emission factor;
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are corresponding to the emission factors of coal, oil and gas fired power plants which are applied by the most advanced commercialized technologies.

Table Annex 3-10 Emission factors of Coal, Oil and Gas with the most advanced commercialized technologies applied by the fuel-fired power plants

	Parameters	Fuel consumption rate	Fuel Emission Factor($kgCO_2/TJ$)	Oxidation	Emission Factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1000000*B*C
Coal-fired plant	$EF_{Coal,Adv}$	39.08%	87300	1	0.8042
Gas-fired plant	$EF_{Oil,Adv}$	51.46%	75500	1	0.5282
Oil-fired plant	$EF_{Gas,Adv}$	51.46%	54300	1	0.3799

Sources: 2010 Baseline Emission Factors for Regional Power Grids in China, NRDC.

Then, calculating
$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} =$ 0.7986 tCO_2/MWh

Sub-step 3. Calculating the Build Margin Emission Factor

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$

Where:
$EF_{BM,y}$ = the Build Margin emission factor with advanced commercialized technologies for year *y*;
CAP_{Total} = the new capacity additions;
$CAP_{Thermal}$ = the new fuel-fired capacity additions.

Table Annex3- 11 Installed Capacities of the Northeast China Grid 2008

Installed Capacity	*Unit*	*Liaoning*	*Jilin*	*Heilongjiang*	Total
Fuel-fired	MW	19,900	8,350	16,570	44,820
Hydro	MW	1,430	3,890	940	6,260
Nuclear	MW	0	0	0	0
Wind & Others	MW	860	760	620	2,230
Total	MW	22,190	13,000	18,130	53,320

*Sources：China Electric Power Yearbook 200*9

Table Annex3- 12 Installed Capacities of the Northeast China Grid 2007

Installed Capacity	*Unit*	*Liaoning*	*Jilin*	*Heilongjiang*	Total
Fuel-fired	MW	19,720	7,580	14,080	41,380
Hydro	MW	1,410	3,890	870	6,170
Nuclear	MW	0	0	0	0
Wind & Others	MW	359	514	230	1,103
Total	MW	21,489	11,984	15,180	48,653

Sources：China Electric Power Yearbook 2008

Table Annex3- 13 Installed Capacities of the Northeast China Grid 2006

Installed Capacity	*Unit*	*Liaoning*	*Jilin*	*Heilongjiang*	Total
Fuel-fired	MW	16,721	7,039	12,456	36,216
Hydro	MW	1,401	3,872	853	6,126
Nuclear	MW	0	0	0	0
Wind & Others	MW	216	221	115	552
Total	MW	18,338	11,132	13,424	42,894

Sources：China Electric Power Yearbook 2007

Table Annex3- 14 Change Installed Capacity from 2006-2008

Unit: MW

	Year 2006	*Year 2007*	*Year 2008*	*2006-2008 New Capacity*	*2007-2008 New Capacity*	Percentage of New Capacity Additions
	A	B	C	D	E	
Fuel-fired	36,216	41,380	44,820	14,292	4,126	88.73%
Hydro	6,126	6,170	6,260	138	90	0.86%
Nuclear	0	0	0	0	0	0.00%
Wind	552	1,103	2,230	1,678	1,127	10.42%
Total	42,894	48,653	53,320	16,108	5,343	100.00%
Percentage of Year 2008				30.21%	10.02%	

Then, the result is $EF_{BM,y} = EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$

= **0.7986×88.73%=0.7086 tCO_2/MWh**

Step 6. Calculate the combined margin Emission Factor ($EF_{grid,CM,y}$ **)**

$\boldsymbol{EF_{grid,CM,y}}$= 0.75×$EF_{grid,OM,y}$+0.25×$EF_{grid,BM,y}$= *0.75×1.1109+0.25×0.7086 =1.0103 tCO_2e/MWh*

Annex 4

MONITORING INFORMATION

No Supplement Information.