



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

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**SECTION A. General description of project activity****A.1. Title of the project activity:**

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Shandong Taipingshan Wind Farm Project

Version number of the document: 05

Date: 12/04/2012

Version history of the PDD

Version number	Date	Nature of revision(s)
01	21/03/2011	Completed version of the PDD, prepared for GSP process.
02	01/06/2011	Revised according to the DOE's revision requests during the validation phase.
03	16/09/2011	Revised according to the DOE's revision requests during the validation phase
04	02/12/2011	Revised according to the DOE's revision requests during the validation phase
05	12/04/2012	An editorial change to some typographical errors in the previous PDD

A.2. Description of the project activity:

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Shandong Taipingshan Wind Farm Project (hereinafter referred to as the proposed project) is to utilize wind resources for electricity generation through the construction of a wind farm with a total capacity of 49.3MW and an 110kV substation in Weifang City, Shandong Province, P. R. China. The electricity generated from the project will be sold to North China Power Grid (NCPG). The proposed project will achieve obvious greenhouse gas (GHG) emission reductions through the displacement of electricity delivered by North China Power Grid which is a fossil-fuel dominated grid. The proposed project is invested and developed by Anqiu Taipingshan Wind Power Co., Ltd..

The purpose of the proposed project is to generate wind power and deliver it to North China Power Grid. For the proposed project,

- (a) Prior to the start of implementation of the project activity, there is no power generation unit at the site of the proposed project, and the electricity was supplied by the North China Power Grid which was dominated by fossil fuel-fired power plants.
- (b) The project scenario is the implementation of the proposed project, the installation and operation of 58 sets of wind turbines with a total capacity of 49.3MW which will supply an average annual generation of 91,030.5MWh to North China Power Grid and replace the same amount of electricity generated by fossil fuel-fired power plants connected to North China Power Grid. According to ACM0002 applied, the proposed project is a zero-emission electricity generating activity.
- (c) The baseline scenario of the proposed project is the electricity supply of equal amount as the proposed project from the North China Power Grid. The baseline scenario of the proposed project is the same as the scenario prior to the start of the implementation of the project activity.



The proposed project is located in Weifang City, Shandong Province, P. R. China. The proposed project involves the installation of 58 wind turbines with capacity of 850 kW each, which amount to a total installed capacity of 49.3MW. The proposed project is constructed and operated by Anqiu Taipingshan Wind Power Co., Ltd.. The estimated annual net electricity generation supplied to the grid is 91,030.5 MWh and the annual full-load operation time amount to 1,846 h per year. The estimated emission reduction is 84,740 tCO_{2e} annually.

The proposed project makes contribution to the local sustainable development as follows:

1. GHG emission reduction

The project will help reduce the greenhouse gas GHG emissions versus the high-growth, coal-dominated business-as-usual scenario in the NCPG by reducing the electricity generation from the fossil-fuel fired power plants, particularly the emission of SO_x, NO_x and dust.

2. Employment opportunities

The conducting of the proposed project will create employment opportunities during the construction phase and operational period.

3. Economic Improvement

The construction of the wind farm will promote local economy by contributing to local government with more tax revenues through selling power generation.

A.3. Project participants:

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Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

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)	Anqiu Taipingshan Wind Power Co., Ltd.	No
France ¹	EDF Trading Ltd	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

¹ EDF Trading Ltd is registered in United Kingdom, but it applies for French LoA for the proposed project.

**A.4.1. Location of the project activity:****A.4.1.1. Host Party(ies):**

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People's Republic of China

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

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Shandong Province

A.4.1.3. City/Town/Community etc.:

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Weifang City

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

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The proposed project is in Weifang City, Shandong Province, P. R. China. The project has geographical coordinates with east longitude from 118°42'46"E to 118°50'27"E and north latitude from 36°10'20"N to 36°13'30"N. The figure A1 and A2 shows the geographical location of the proposed project.



Figure A1. The proposed project on the map of P. R. China

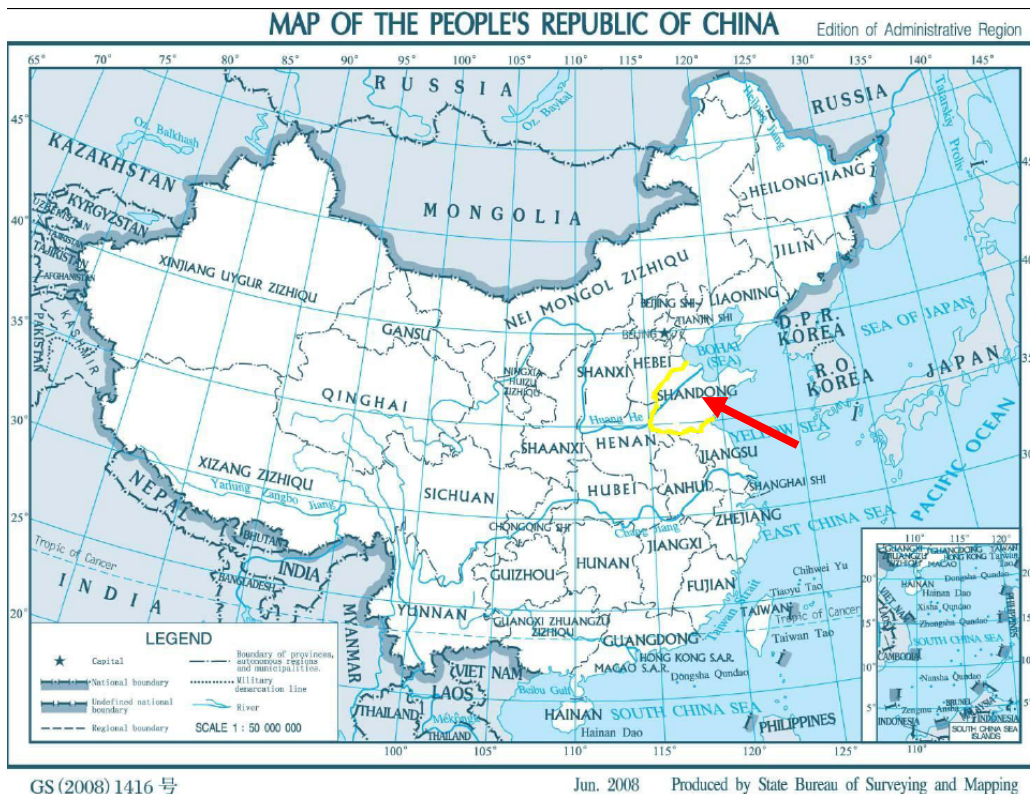


Figure A2. The proposed project on the map of Weifang City, Shandong Province, P. R. China



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

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Category: Renewable electricity in grid-connected applications

Sectoral Scope: 1 Energy industries

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

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The proposed project is to utilize wind resources for electricity generation in Weifang City, Shandong Province, P. R. China. The proposed project is a grid-connected renewable energy project.

Prior to the start of implementation of the project activity, there is no power generation unit at the site of the proposed project, and the electricity was supplied by the North China Power Grid. The baseline scenario of the proposed project is the electricity supply of equal amount as the proposed project from the North China Power Grid.

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

The proposed project involves the installation of 58 wind turbines with capacities of 850 kW each, which amount to a total installed capacity of 49.3MW. The estimated power output is 91,030.5MWh. The annual full-load operation time amount to 1,846 h per year and the load factor is 0.211².

The main technical specifications of the wind turbine are provided in the following table.

Parameter	Data ³	
Model	G58-850 kW	
Quantity	58	
Height of hub	65 m	
Wind Turbine	Diameter	58 m
	Number of blades	3
	Rated wind speed	16 m/s
	Cut-in wind speed	3 m/s
	Cut-off wind speed	21 m/s
Generator	Rated Power	850 kW
	Rated voltage	690V
	Life time	20 years

² According to Annex 11 of EB 48 Report, Guideline for the reporting and validation of plant load factors (version 01), the plant load factor shall be defined ex-ante in the CDM-PDD according to one of the following three options: (a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval; (b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company). The plant load factor of the proposed project is 21.1% according to the Project Application Report (PAR), which is determined by the accredited designing institute Shandong Industrial Design Institute Co., Ltd., which is the third party contracted by the project participants.

³ Values of the parameters in the table are based on the WTG contract.



The wind power generated will be switched through a 110 kV substation at the project site, and then connected to the 220 kV Muling substation, then transmitted to the North China Power Grid finally.

The grid-connected electricity generated by the proposed project will be monitored through metering equipments (meter monitoring both electricity input and electricity output) installed on the 35kV transmission lines at the project site.

The to-grid and from-grid electricity will be cross-checked with the electricity receipts.

The proposed project does not involve any technology transfer.

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

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A crediting period of 7 years (01/03/2012-28/02/2019, renewable twice) is selected for the project activity. An estimation of emissions reductions expected over the crediting period is provided in the table below.

Years	Annual estimation of emission reductions in tonnes of CO₂e
01/03/2012-28/02/2013	84,740
01/03/2013-28/02/2014	84,740
01/03/2014-28/02/2015	84,740
01/03/2015-29/02/2016	84,740
01/03/2016-28/02/2017	84,740
01/03/2017-28/02/2018	84,740
01/03/2018-28/02/2019	84,740
Total estimated reductions (tonnes of CO₂e)	593,180
Total number of the first crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO₂e)	84,740

A.4.5. Public funding of the project activity:

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There is no public funding from Parties included in Annex I is involved in this project.

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

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The approved methodology applied in the proposed project activity is ACM0002 (version 12.2.0) – “Consolidated methodology for grid-connected electricity generation from renewable sources”.

Reference:

<http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L>

“Tool for the Demonstration and Assessment of Additionality (version 05.2.1)”

Reference:

<http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-01-v5.2.1.pdf>

“Tool to calculate the emission factor for an electricity system (version 02.2.1)”

Reference:

<http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.2.1.pdf>

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

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The proposed project installs a new power plant at a site where no renewable power was operated prior to the implementation of the project activity. It meets all applicability conditions of methodology ACM0002 (version 12.2.0) which is listed as follows:

- 1) The proposed project is a grid-connected renewable new wind power project; and it does not involve capacity addition, retrofit or replacement;
- 2) The proposed project does not involve switching from fossil fuels to renewable energy at the site.

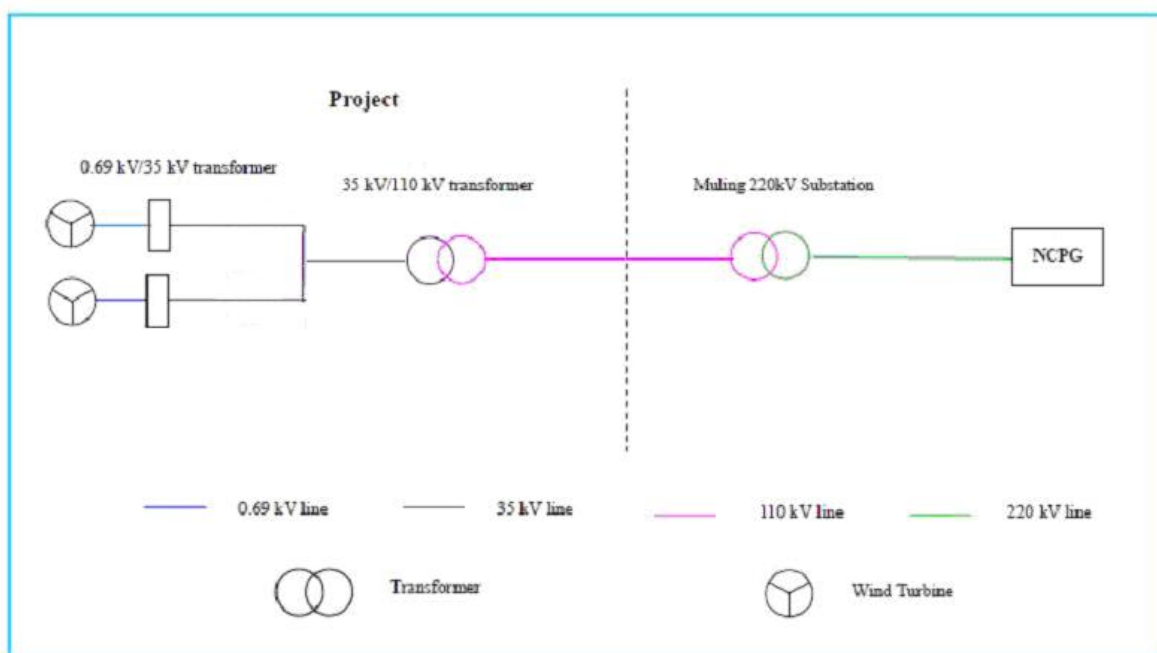
B.3. Description of the sources and gases included in the project boundary

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	Source	Gas	Included?	Justification / Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel-fired power plants that is displaced due to the project activity.	CO ₂	Yes	Main emission sources
		CH ₄	No	Minor emission source.
		N ₂ O	No	Minor emission source.
Project Activity	The wind power plant	CO ₂	No	According to ACM0002, the proposed project generates electricity by renewable energy, thus No GHG emissions emitted.

		CH ₄	No	According to ACM0002, the proposed project generates electricity by renewable energy, thus No GHG emissions emitted.
		N ₂ O	No	According to ACM0002, the proposed project generates electricity by renewable energy, thus No GHG emissions emitted.

The flow diagram of the project boundary is illustrated as follow:



The spatial extent of the proposed project boundary includes the proposed project site and all power plants connected physically to the North China Power Grid (NCPG).

According to the “Tool to calculate the emission factor for an electricity system” (version 02.2.1), the delineation of grid boundaries as provided by the DNA⁴ of China is used. North China Power Grid composed of Beijing, Tianjin, Hebei, Shanxi, Shandong and Inner Mongolia Power Grids is the project electricity system.

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

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According to ACM0002 (version 12.2.0), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline is the following:

⁴ Source: 2010 Baseline Emission Factors for Regional Power Grids in China

<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf>



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” (version 02.2.1).

Parameters used to determine the baseline emission are listed in the following table:

Parameter	Data	Source
$EF_{grid,OM,y}$ (tCO ₂ /MWh)	0.9914	Calculated in Annex 3
$EF_{grid,BM,y}$ (tCO ₂ /MWh)	0.7495	Calculated in Annex 3
$EF_{grid,CM,y}$ (tCO ₂ /MWh)	0.9309	Calculated in Annex 3

Therefore, supply of equivalent annual power output by the North China Power Grid is the baseline scenario for the proposed project activity.

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

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The additionality of the proposed project is demonstrated and assessed by the approved “Tool for the Demonstration and Assessment of Additionality” (Version 05.2.1). Following steps include:

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

Define realistic and credible alternatives to the project activity (ies) that can be (part of) the baseline scenario through the following sub-steps:

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

Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity.

These alternatives are to include:

- 1) The proposed project not undertaken as CDM project;
- 2) Construction of a fossil fuel power plant with equivalent amount of annual electricity output;
- 3) Construction of a power plant using other source of renewable energy with equivalent amount of annual electricity output; and
- 4) Supply of equivalent annual power output by the Grid to which the proposed project is connected.

The alternative 3) is to construct renewable power plants whose annual power supply is equivalent to the projects. However, due to the technology development status and high investment costs for power generation, solar PV⁵ geothermal⁶ and biomass⁷ options are far from being economically attractive.

⁵ <http://www.chinanews.com/ny/2011/06-03/3087409.shtml>



Only hydropower projects have the investment return rate that can compete over that of wind power projects in China. However, the city of Weifang where the proposed project is located in is characterized as a city which is short of water resources⁸. Thus, there won't be exploitable hydro resources on the project site. Hence, Alternative 3) is not a realistic and credible alternative.

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

The alternative fossil fuel power plant with the equivalent power output as the proposed project will be less than 49.3MW, while fossil fuel-fired plants with a capacity of 135 MW or less are prohibited from development in large grid such as provincial grid⁹ according to current regulations in China. Consequently, Alternative 2) is not a realistic and credible alternative.

The alternative 1) and 4) are in line with the existing Chinese laws and regulations.

Step 2. Investment analysis

The purpose of this step is to determine whether the proposed project activity is economically or financially less attractive than other alternatives without an additional funding that may be derived from the CDM project activities. The investment analysis was conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

The three analysis methods suggested by *Tools for the demonstration and assessment of additionality* (version 05.2.1) are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the proposed project will earn revenues from not only the CDM but also the electricity output, the simple cost analysis method is not appropriate. The proposed project will use benchmark analysis method based on total investment project IRR.

Sub-step 2b. Apply benchmark analysis (Option III)

With reference to *Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects* (Guodianfa [2002] No.623), issued by the State Power Corporation in 2002, which is designed to guide the economic assessment of retrofit and new projects in electric power industry in China. The Project IRR benchmark adopted as a guideline for investments in the electric power industry in China is 8%¹⁰. Only if the Project's IRR is higher than or equivalent to this benchmark, the proposed project is financially feasible to investors. This benchmark is widely adopted by qualified electric power design institutes in economic assessment of retrofit and new projects, including the design institute of the proposed project. Therefore, 8% is adopted as the Project IRR benchmark which is in line with the approved Project Application Report.

⁶http://www.information.org/index.php?main=ch_energy_geothermal&lang=chinese&encoding=utf8&letter=chinese_gen_ene_pol&subject=能源%20-%20地热能&countries=menua_countries.

⁷ Source: Biomass generation needs policy supply due to the high investment cost.
http://news.xinhuanet.com/energy/2009-07/10/content_11674750.htm

⁸ Source: PAR Page 114.

⁹ Notice on Strictly Prohibiting the Installation of Fuel-fired Generation with the Capacity of 135MW or below issued by the General Office of the State Council, decree no. 2002-6

¹⁰ Page 34, *Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects*

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

Based on the above-mentioned benchmark, the calculation and comparative analysis of financial indicators for the proposed project are carried out in sub-step 2c.

(1) Basic parameters for calculation of financial indicators

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

NO.	Parameters	Value	Unit	Data source
1	Installed capacity	49.3	MW	PAR Page 142
2	Annual power supply	91,030.5	MWh	PAR Page 142
3	Project lifetime	21(one year for construction and twenty years of operation)	years	PAR Page 142
4	Tariff	0.6100	RMB / KWh (including VAT)	PAR Page 145 & Tariff Letter ¹¹
5	Total Static Investment	522.325	Million RMB	PAR Page 142
6	Debt interest	7.83	%	PAR Page 144
7	Debt-equity ratio	65/35		PAR Page 143
8	Annual O&M Cost ¹²	5.84 (1 st -2 nd year) 10.66(3 rd -20 th year)	Million RMB	IRR Spreadsheet
9	Residue value rate	4	%	PAR Page 144
10	Depreciation rate	6.4	%	PAR Page 144
11	Tax of city construction ¹³	7	%	PAR Page 145
12	Education surtax rate ¹⁴	3	%	PAR Page 145
13	Income Tax ¹⁵	25	%	PAR Page 145

¹¹ According to the Approval of the Tariff for the Proposed Project issued by the Shandong Provincial Price Bureau, the tariff of the proposed project was 0.6100 RMB/kWh (including VAT). The document has been submitted to DOE for validation.

¹² Annual O&M costs contain the maintenance expense, employee payroll and welfare fund, and miscellaneous costs. Based on the PAR, the maintenance tax is 0.25% for the first two years, because it is in the quality guarantee period in the first two years. The maintenance rate is 1.2% from 3rd year 20th year during the operational period. As a result, the annual O&M cost were not the same for the different period during the operation

¹³ Source: An official document *The provisional regulation of city construction tax of PRC* (<http://www.gxxhcpa.com/Article.asp?id=762>)

¹⁴ Source: *Decree No. 395* of the State Council of the People's Republic (http://www.gov.cn/zwggk/2005-09/27/content_70440.htm)



14	VAT of electricity sale ^{16&17}	8.5	%	PAR Page 145
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(2) Comparison of IRR for the proposed project and the financial benchmark

In accordance with the benchmark analysis (Option III), the proposed project will not be considered as financially attractive if its financial indicators (such as Project IRR) are lower than the benchmark.

Table 1 shows the IRRs of the proposed project, without CDM-related income. Without CDM-related income, the Project IRR is lower than the benchmark and the proposed project is not financially acceptable.

Table 1. Financial indicators of the Proposed Project

	Project IRR (post-tax benchmark = 8%)
Without CDM-related income	4.28%

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive.

According to “Guidance on the assessment of investment analysis” (version 03), only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation, and a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%.

The critical factors that influence the Project IRR are mainly as follows:

- 1) Total static investment;
- 2) Annual O&M cost;
- 3) Annual power supply;
- 4) Tariff

They are fluctuated within the range from -10% to +10% in the PAR and the selection is also in accordance with the Guidance from “Tool for the demonstration and assessment of additionality”

¹⁵ Source: *The Enforcement Regulation of Business Income Tax Law of PRC*, State Council Decree No.521 (http://www.gov.cn/zwggk/2007-12/11/content_830645.htm)

¹⁶ Source: *The Provisional Regulation of VAT of PRC* validated from 1st Jan. 1994 Issued by State Council, (<http://www.taxchina.com/ssfg/1993-12/03/cms72624article.shtml>)

¹⁷ Source: *Council and Financial Tax [2001] No.198 Notification* issued by China Tax Bureau, (<http://www.dxtax.com/tax/cs01-198.htm>)

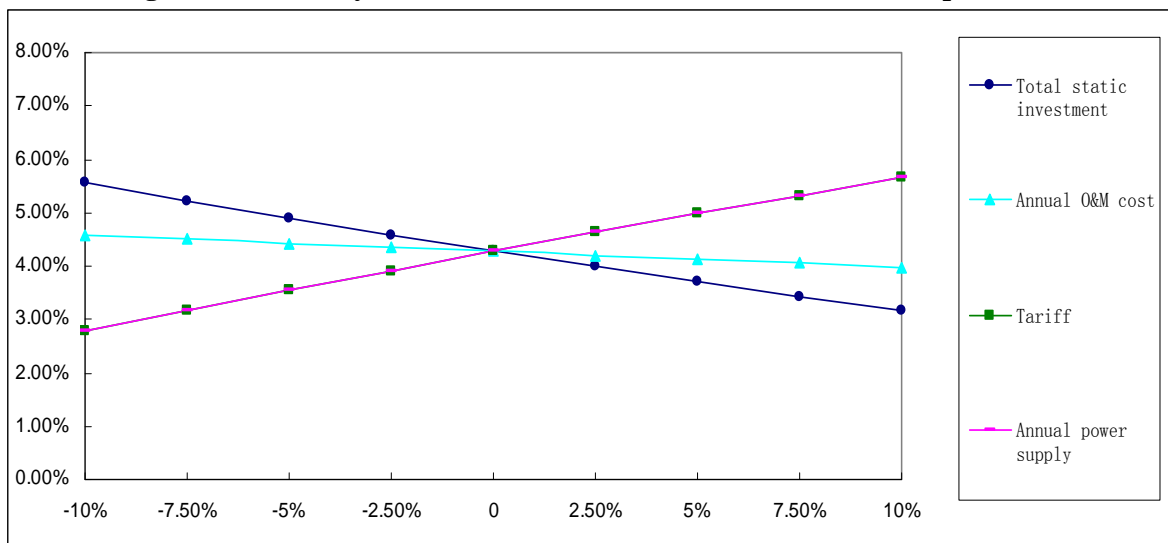


(Version 05.2.1). Their impacts on Project IRR of the proposed project were presented in Table 2 and Figure 2.

Table 2. Sensitivity of total investment IRR to different financial parameters

Parameter	Range								
	-10%	-7.50%	-5%	-2.50%	0%	2.50%	5%	7.50%	10%
Total static investment	5.57%	5.23%	4.90%	4.58%	4.28%	3.99%	3.71%	3.43%	3.17%
Annual O&M cost	4.58%	4.51%	4.43%	4.36%	4.28%	4.20%	4.13%	4.05%	3.98%
Annual power supply	2.79%	3.18%	3.55%	3.92%	4.28%	4.63%	4.98%	5.32%	5.65%
Tariff	2.79%	3.18%	3.55%	3.92%	4.28%	4.63%	4.98%	5.32%	5.65%

Figure 2. Sensitivity of total investment IRR to different financial parameters



From Table 2 and Figure 2, as the chosen parameters vary within the reasonable range, the project IRR does not surpass the benchmark under any of the assumptions.

The total static investment needs to decrease by 25% when the project IRR meets the benchmark of 8%. However, considering the majority part of total static investment has been spent, since the main equipment purchase contracts and the construction contracts have been signed. The amount of the majority part of the signed contracts, including WTG purchase contract, the construction contract, the WTG tower contract, main transformer contract etc, is 501.54 million RMB, which have covered 96% of total static investment. As a result, the total investment of the proposed project is unlikely to be decreased by over 25% to exceed benchmark.



The annual O&M cost needs to decrease by 100% when the project IRR will not meet the benchmark of 8%. O&M cost consists of five basic parameters. They are raw material cost, insurance, employee payroll and welfare fund, maintenance expense and miscellanea. Any change of the five basic parameters will result in the change of the annual O&M cost change.

Based on the Price Index from 2002 to 2008 listed on below table 3, it is indicated that Chinese economy is experiencing a relatively high inflation. Furthermore, the price of material and fuel are gradually increasing in China, which leads annual O&M cost gradually increasing. Besides, compared with the O&M costs of previous wind projects which have been registered as CDM project in Shandong Province, the O&M/Total static Investment of the proposed project (1.95%) falls into the range from 0.75% to 4.81%, which means the costs of the proposed project is reasonable. Therefore the O&M cost is impossible to decrease by 100%. Hence, the IRR does not exceed the benchmark of 8%.

Table3 Price index from 2002~2008* (100 for previous years)

Item\Year	2002	2003	2004	2005	2006	2007	2008
Total Index	97.7	104.8	111.4	108.3	106.0	104.4	110.5
Fuel, power, price	100.1	107.4	109.7	115.0	111.9	104.3	120.6

* The price index of past 7 years prior to the investment decision was cited from the National Bureau of Statistic of China.¹⁸

The tariff needs to increase by 29% when the project IRR meets the benchmark of 8%. According to the approved tariff of the proposed project, which was issued by the Shandong Provincial Price Bureau, 0.61 RMB/kWh (Include VAT) will be applied to the proposed project. Furthermore, the tariffs issued by NDRC Fa Gai Jia Ge [2008] No.1876 on 23/07/2008, and Fa Gai Jia Ge [2009] No.1906 on 20/07/2009 show that the tariff of the wind power projects with the same region is fixed at 0.61 RMB/kWh (Incl. VAT). Additionally, according to the “Information note on the highest tariffs applied by the EB in its decisions on registration of projects in the People's Republic of China”(version 2)¹⁹ published by the EB, for the project activity category, wind power projects, the highest tariff in Shandong province is 0.61 RMB Yuan/kWh (including VAT) for first 30,000 hours, and then the tariff 0.3969 RMB/kWh (including VAT)²⁰ for thermal plants should be applied. In line with the two-part tariff, the project IRR (post-tax) without CDM is 3.55%, which is still lower than the benchmark 8%. Therefore, the tariff in the PDD is appropriate and unlikely to increase by 29%.

With an increase in annual net electricity supplied to grid by 29%, the post-tax Project IRR of the project can reach benchmark of 8%. For the proposed project, the annual operating hours was calculated by Shandong Industrial Design Institute Co., Ltd. based on the on-site monitoring data of local wind resources from 1977 to 2006 and the output characteristics of the turbines, using a scientific approach applied internationally. The annual generation represents a long-term average

¹⁸ <http://www.stats.gov.cn/tjsj/ndsj/2009/indexch.htm>

¹⁹ http://cdm.unfccc.int/Reference/Notes/reg_note07.pdf

²⁰ The tariff for the thermal plants in Shandong Province was 0.3724 RMB/kWh (including VAT), which was issued by National Development and Reform Commission on 29/06/2008 (Fa Gai Jia Ge [2008]1677). (source:http://www.sdpc.gov.cn/zcfb/zcfbtz/2008tongzhi/t20080702_222220.htm), Based on the value in 2008, the tariff for the thermal plants in Shandong Province was increased by 0.0245 RMB/kWh, which was issued by National Development and Reform Commission on 27/05/2011 (Fa Gai Jia Ge [2011]1101). (Source: http://www.sdpc.gov.cn/zfdj/jggg/dian/t20110602_416532.htm). Hence, the latest tariff for the thermal plants in Shandong Province is 0.3969 RMB/kWh (including VAT).



power supply throughout the lifetime of wind farm, where the yearly-variations have already been taken into account. The PLF of the proposed project is 0.211, which is in the range from 0.188 to 0.258 of the similar projects in Shandong Province. Therefore, it can be concluded that the estimated annual power supply in the PAR is reasonable. Therefore, the power generation of the proposed project is unlikely to increase by 29% to exceed benchmark of 8%.

In conclusion of the sensitive analysis, as the financial indicators vary within reasonable range, the proposed project remains financially unattractive without CDM support and the proposed project is additional. Hence, the Scenario 1) is not a realistic alternative.

Step 3. Barrier analysis

The barrier analysis is not employed for the Project.

Step 4. Common practice analysis

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

In China, the general environment of projects of wind power projects such as the wind resources, tariff, and investment climate are only similar and comparable in the same province. Therefore, the common practice region and comparable framework is provincial and the proposed project is compared to other projects in Inner Mongolia Autonomous Region.

In April 2002, China implemented the policy "Separate power plants from network and compete in price to enter network"²¹ The objective of this power sector reform is to establish a more commercialized power market in China. Power project investment has to be under a more commercialized condition and considers project investment return more seriously. Since market condition for wind power project development changes much since April 2002, this common practice analysis starts from April 2002.

According to the methodology ACM0002, projects with installed capacity of or below 15 MW belong to small scale projects. Since the installed capacity of the proposed project is 49.3MW. Hence, this common practice analysis compares projects larger than 15 MW.

With reference to Statistic of installed capacity of China's Wind Farms in recent years²² and the website of Verified Carbon Standard²³, there are 23 similar wind farms (capacity over 15 MW) as proposed project put into commission in Shandong Province.

Table 3 shows the similar projects commissioned (more than 15MW and within Shandong Province) since 2002.

²¹ China implemented the policy "Separate power plants from network and compete in price to enter network"

²² Reference: 2007: <http://www.cwea.org.cn/upload/20080324.pdf>
2008: <http://www.cwea.org.cn/upload/20090305.pdf>
2009: <http://www.cwea.org.cn/upload/201006102.pdf> and <http://www.windpower-china.com/node/1446>

Statistic of installed capacity of China's Wind Farms is compiled by Professor Shi Pengfei.

²³ Source: <http://www.vcsprojectdatabase.org/>

**Table 3 Similar Wind Farm Development in Shandong Province (since 2002)²⁴**

No.	Project Name	Installed Capacity (MW)	Construction year	Remark
1	Shandong Penglai Wind Farm Phase II Project	48	2009	Registered as CDM project, reference No.4402
2	Shandong Huaneng Hekou Phase I Wind Farm Project	49.5	2009	Registered as CDM project, reference No.3718
3	Shandong Rushan Luneng Wind Farm	42	2009	Registered as CDM project, reference No.2814
4	Yantai Dongyuan 25.5 MW Wind Farm Project Phase I	25.5	2008	Registered as CDM project, reference No.3616
5	Huaneng Changyi Phase I Wind Farm Project	49.5	2008	Registered as CDM project, reference No.3353
6	Shandong Dongying 1st phase Wind Power Project	49.5	2008	Registered as CDM project, reference No.2584
7	Shandong Luneng Dongying 48MW Wind Power Project	48	2008	Registered as CDM project, reference No.2019
8	Shandong Changdao 27.2 MW Wind Power Project	27.2	2007	Registered as CDM project, reference No.1090
9	Shandong Huaneng Shouguang 49.5MW Wind Farm Project	49.5	2007	Registered as CDM project, reference No.3391
10	Huadian Laizhou Wind Farm Project	40.5	2007	Registered as CDM project, reference No.2831
11	Yantai Dongyuan Laizhou 48.5 MW Wind Farm Project Phase I	48.5	2007	Registered as CDM project, reference No.2764
12	Shandong Laizhou phase I Wind Power Project	49.5	2007	Registered as CDM project, reference No.2530
13	Guohua Binzhou Zhanhua 49,5MW Wind farm Project (Phase I)	49.5	2007	Registered as CDM project, reference No.2438

²⁴ Reference: *Statistic of installed capacity of China's Wind Farms in 2007,2008 and 2009* issued by Chinese Wind Energy Association; UNFCCC web-site.



14	Guohua Dongying Hekou 49.5 MW Wind Farm Project (Phase 1)	49.5	2007	Registered as CDM project, reference No.2436
15	Laizhou Diaolongzui Wind Farm	48.75	2007	Registered as CDM project, reference No.1010
16	Guohua Dongying Lijin 49.5 MW Wind Farm Project (Phase 1)	49.5	2006	Registered as CDM project, reference No.2442
17	The 48MW wind power project in Lubei, Shandong Province	48	2006	Registered as CDM project, reference No.2094
18	Roncheng Wind Power Project, 48.75MW	48.75	2006	Registered as CDM project, reference No.1755
19	Qixia Tangshanpeng Windfarm Project	21.75	2006	Registered as CDM project, reference No.1019
20	Shandong Penglai Pingdingshan Wind Farm Project	48	2005	Registered as CDM project, reference No.2397
21	Shandong Weihai 69 MW Wind Power Project	69	2005	Registered as CDM project, reference No.1128
22	Shandong Jimo Qingdao Huawei Wind Power Project	16.4	2003	Received Official Development Assistance support
23	Shandong Changdao Wind Farm Project	17.55	2004	VCS

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

As for Table 3, the Shandong Jimo Qingdao Huawei Wind Power Project commissioned in 2003 and enjoyed a higher tariff of 0.76RMB/kWh²⁵, which is much higher than the proposed project. The tariff of Shandong Jimo Qingdao Huawei Wind Power Project was approved in 2001. This project was an early demonstration project and received ODA support from DEG (part of KfW Bankengruppe)²⁶. Considering *Electric Power Industry Reform* published by the State Council in February 2002, reform in China's electric power industry has been making steady progress and it has brought some fundamental changes to the industry. Therefore, the tariff of 0.76RMB/kWh in 2001 is not comparable to the later tariff of 0.61RMB/kWh in 2009, since there is significant policy environment and the No. 22 project is a demonstration project, it is not suitable for common practice. Moreover,

²⁵ The tariff of Shandong Jimo Qingdao Huawei Wind Power Project was approved in 2001, which is prior to the power policy reform - "Separate power plants from network and compete in price to enter network". Reference: Notice of Electricity Tariff of Qingdao Huawei Wind Power Company by Shandong Provincial Price Bureau and Shandong Power Grid.

Source: http://www.34law.com/lawfg/law/1797/3388/law_252417438946.shtml

²⁶Source: <http://www.jimo.gov.cn/government/inc/webmenupagegongkai.asp?newsid=10233>



the tariff of wind power in Shandong province was fixed to be 0.61 RMB/kWh on July 20th, 2009 by NDRC²⁷ and could not be changed.

Shandong Changdao Wind Farm Project (project ID: 517)²⁸ applied for Voluntary Emission Reduction under Verified Carbon Standard (VCS) to obtain the support from VCS VER funding to solve the financial barriers.

The other wind power projects all have been applying for CDM support or have been successfully registered as CDM project. CDM-related income is an effective measure for the project developers to overcome the barriers they encounter during project development. Hence, the development of this type of project activity in Shandong Province is hard to be brought forth without CDM support.

As stated above, it is concluded that the proposed project is not common practice within the region.

Therefore, the proposed project activity is additional.

Prior consideration of the CDM

Time	Milestone
December 2007	Environmental Impact Assessment (EIA) developed
11/01/2008	EIA approved by Shandong Provincial Environment Protection Bureau
May 2008	Project Application Report (PAR) developed
11/06/2008	PAR approved by Shandong Provincial Development and Reform Committee
03/03/2009	Board decision on the CDM development was made
08/08/2009	Turbines Purchasing Agreement signed (Project starting date)
11/08/2009	Construction started
27/08/2009	Civil construction contract signed
17/10/2009	CDM Consultancy Agreement signed
18/12/2009	ERPA signed
20/01/2010	The prior consideration of the CDM form was accepted by EB
08/02/2010	The prior consideration of the CDM form was accepted by Chinese DNA
13/06/2011	The Chinese LoA was obtained
05/10/2011	The French LoA was obtained.

Based on the PAR finished in May 2008 and approved tariff of Shandong Province, the project developer found the Project IRR is much lower than the benchmark of 8% without revenue from CERs. The proposed project is thus financially unattractive to investors. Then the project owner, Anqiu Taipingshan Wind Power Co., Ltd., decided to seek additional financial support from CDM on the Board meeting held on 03/03/2009, and made investment decision therefore.

The Turbines Purchasing Agreement signed on 08/08/2009, the construction of the project started on 11/08/2009. And the civil construction contract signed on 27/08/2009. The CDM consulting contract

²⁷ Source: http://www.ndrc.gov.cn/jggl/jggs/t20090727_292846.htm.

²⁸ Source: <https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=517>



was signed with Easy Carbon consultancy on 17/10/2009. The prior consideration of the CDM forms were accepted by EB and Chinese DNA on 20/01/2010 and 08/02/2010, respectively. The Chinese LoA was obtained on 13/06/2011, and the French LoA was obtained on 05/10/2011. The development procedure shows that CDM was seriously considered before the proposed project started.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The key methodological steps are as follows:

1. Calculating the Baseline Emission (BE_y)
2. Calculating the Project Emission (PE_y)
3. Calculating the Leakage Emission (LE_y)
4. Calculating the Emission Reduction (ER_y)

1. Calculating the Baseline emissions

The baseline emissions (BE_y) is the product of the baseline emissions factor ($EF_{grid,CM,y}$ in tCO₂e/MWh) calculated, times the electricity supplied by the project activity to the grid ($EG_{PJ,y}$ in MWh), as follows:

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

1.1 Calculation of the baseline emissions factor

Following ACM0002, the baseline emission factor is calculated as a combined margin ($EF_{grid,CM,y}$), consisting of the combination of operating margin ($EF_{grid,OM,y}$) and build margin ($EF_{grid,BM,y}$) factors according to the following seven steps defined in the “Tool to calculate the emission factor for an electricity system” (version 02.2.1). Data for the calculations are based on official national statistics books: China Energy Statistical Yearbook and China Electric Power Yearbook.

Step 1. Identify the relevant electricity systems

For determining the electricity emission factors, a project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

Similarly, a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used.

The DNA of China has published a delineation of the project electricity system and connected



electricity systems, which is used by the proposed project. According to the DNA delineation, the project electricity system is the NCPG, which consists of Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia Autonomous Region, and Shandong Province Power Grids. The proposed project is located in Shandong Province and covered by the NCPG. Therefore, NCPG is chosen as the relevant electric power system.

The connected electricity system is Northeast China Power Grid which consists of Liaoning, Jilin and Heilongjiang Power Grids, and Central China Power Grid which consists of Henan, Hubei, Hunan, Jiangxi, Sichuan and Chongqing Power Grids.

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

For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system, except where recent or likely future additions to transmission capacity enable significant increases in imported electricity. In such cases, the transmission capacity may be considered a build margin source.

The electricity imports from Northeast China Power Grid (NECPG) and Central China Power Grid (CCPG) to NCPG have not changed significantly from 2006 to 2008²⁹. Therefore, the spatial extent is limited to NCPG for the purpose of determining the build margin emission factor.

For the purpose of determining the operating margin emission factor, use one of the following options to determine the CO₂ emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from a connected electricity system within the same host country(ies):

- (a) 0 tCO₂/MWh, or
- (b) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in step 4 (d) below; or
- (c) The simple operating margin emission rate of the exporting grid, determined as described in step 4 (a), if the conditions for this method, as described in step 3 below, apply to the exporting grid; or
- (d) The simple adjusted operating margin emission rate of the exporting grid, determined as described in step 4 (b) below.

The option (a) is selected for the proposed project.

²⁹ According to China Electric Power Yearbook (2006-2008), the electricity import of NCPG from NECPG and CCPG was: 2,618,060MWh and 497,060MWh in 2006, 1,789,750MWh and 803,000MWh in 2007, 5,286,140MWh and 0 MWh in 2008. (Source: The data from *China Electric Power Yearbook 2006-2008* for the calculation of OM issued on <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf>)

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

According to the Approval of electricity connection to North China Power Grid, all the power generated by the project activity will be supplied to the power grid company. Thus, the proposed project does not include off-grid power plants in the project electricity system referred in apply to “Tool to calculate the emission factor for an electricity system”.

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

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

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

Detailed information to carry out a dispatch data analysis is not publicly available; therefore, method (b) and method (c) is not suitable for the proposed project.

According to ACM0002, the Simple OM method is applicable to the project if the low-cost resources constitute less than 50% of total grid generation on average in the five most recent years or based on long-term averages for hydroelectric production.

The share of low-cost/must-run generation in NCPG is 1.18% in 2008, 0.752% in 2007, 0.745% in 2006, 0.749% in 2005, and 0.708% in 2004³⁰. The Simple OM method, therefore, is selected to calculate the Operating Margin emission factor of the proposed project.

The Simple OM can be calculated using either of the two following data vintages for years(s) y:

- (Ex-ante option): If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use 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.
- (Ex-post option): If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring.

Here ex-ante vintage is chosen, and the $EF_{grid,OM}$ is fixed during the first crediting period.

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

³⁰ China Electric Power Yearbook 2005-2009



The Simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. The simple OM may be calculated:

- Option A: Based on the net electricity generation and a CO₂ 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.

For the proposed project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

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

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{\sum_m EG_y} \quad (2)$$

Where:

- $EF_{grid,OMsimple,y}$ = Simple operating margin CO₂ emission factor in year y (tCO₂e/MWh)
- $FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
- $NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
- $EF_{CO_2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂e/GJ)
- EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
- i = All fossil fuel types combusted in power sources in the project electricity system in year y
- y = The relevant year as per the data vintage chosen in Step 3

For this approach (simple OM) to calculate the operating margin, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and including electricity imports to the grid. Electricity imports should be treated as one power plant source.

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO_2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. The Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2009. Emission factors ($EF_{CO_2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

On the basis of the data available, the three-year average operating margin emission factor is



calculated by the DNA as a full-generation-weighted average of the emission factors:

$$EF_{grid,OMsimple} = 0.9914 \text{ tCO}_2\text{e/MWh}$$

Step 5. Calculate the build margin emission factor

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 emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In this PDD, Option1 is chosen to calculate the build margin emission factor.

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y ($\text{tCO}_2\text{e/MWh}$)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y ($\text{tCO}_2\text{e/MWh}$)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

Currently, it is very difficult to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity generated and delivered to the grid and fuel consumption data in power unit m are regarded as commercial secrets or only for internal usage. Then the following



deviation³¹ approved by the EB was adopted to calculate the Build Margin emission factor.

According to the guidance from the CDM Executive Board for a deviation of the baseline methodology of AM0005, which had combined into the baseline methodology of ACM0002, the following deviation was adopted to calculate the Build Margin emission factor.

1) Use the efficiency level of the best technologies commercially available in the provincial/regional or national grid of China, as a conservative proxy, for fuel i consumption estimation to estimate the $EF_{grid,BM,y}$.

2) Use capacity additions during last several years for estimating the $EF_{grid,BM,y}$, i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity. For the proposed project, the data from Year 2006 to 2008 is used to calculate $EF_{grid,BM,y}$.

3) Use installed capacity to replace annual power generation to estimate weights.

The BM emission factor in this PDD is calculated as following sub-steps.

Sub-step 1. Calculation of weights of CO₂ emissions of solid, liquid and gaseous fossil fuels in total emissions for power generation

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

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

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

Where:

$FC_{i,j,y}$ = Amount of fossil fuel type i consumed in province j in year y (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/t or GJ/m³)

$EF_{CO_2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂e/GJ)

Coal, *Oil* and *Gas* refer to the group of solid, liquid, and gaseous fossil fuels, respectively.

³¹Source:http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ



Sub-step 2: Calculation of Emission Factor of Relevant Thermal Power

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (7)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ refer to the emission factors representing best technologies commercially available for coal, oil and gas fired power plants, respectively.

Sub-step 3: Calculation of BM of the Grid

Using the share of different type of capacity in total capacity addition as weight, the weighted average of emission factors of different type capacity is calculated as the Build Margin emission factor $EF_{grid,BM,y}$ of North China Power Grid.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (8)$$

Where:

CAP_{Total} = The total newly added electricity generation capacity (MW)

$CAP_{Thermal}$ = The newly added electricity generation capacity of thermal power (MW)

Following the four steps above, the build margin emission factor $EF_{grid,BM,y}$ of the NCPG is calculated to be: 0.7495 tCO₂e/MWh (see Annex 3 for more details).

Step 6. Calculate the combined margin emission factor

The baseline emissions factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the Operating Margin emission factor and Build Margin emission factors following ACM0002. For wind projects, the default weights are as follows: $w_{OM} = 0.75$ and $w_{BM} = 0.25$:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (9)$$

Where:

$EF_{grid,BM,y}$ = Build margin CO₂ emission for the project electricity system factor in year y (tCO₂e/MWh)

$EF_{grid,OM,y}$ = Operating margin CO₂ emission factor for the project electricity system in year y (tCO₂e/MWh)

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

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

On the basis of these weights for the first crediting period, the combined margin emission factor is calculated, and fixed ex-ante:

$$EF_{grid,CM,y} = 0.9914 \times 0.75 + 0.7495 \times 0.25 = 0.9309 \text{ tCO}_2/\text{MWh}$$

Baseline emissions (BE_y) now can be calculated as the combined margin CO₂ emission factor



$(EF_{\text{grid,CM},y})$ multiplied by the annual net generation of the Proposed Project ($EG_{PJ,y}$).

Calculation of $EG_{PJ,y}$

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

$$EG_{PJ,y} = EG_{\text{facility},y} \quad (10)$$

where:

$EG_{PJ,y}$ = 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)

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

2 Calculating the Project Emission (PE_y)

According to ACM0002 (version 12.2.0), for most renewable power generation project activities, $PE_y = 0$.

3 Calculating the Leakage Emission (LE_y)

According to ACM0002 (version 12.2.0), no leakage is considered. The main emissions potentially giving rise to leakage are neglected.

4 Calculating the Emission Reduction (ER_y)

The annual emission reductions ER_y for the project activity are calculated as the baseline emissions minus the project emissions and minus the leakage emissions. Being the project of a zero-emission activity the final GHG emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (11)$$

where:

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

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

PE_y = Project emissions in year y (t CO₂e/yr)

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

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Data / Parameter:	FC_{i,m,y}
Data unit:	tonnes or m ³
Description:	Amount of fossil fuel type i consumed by power plant / unit m in year y
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 :	Official statistical data
Any comment:	Applied for calculating OM and BM

Data / Parameter:	NCV_{i,y}
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Data unit:	kJ/kg or kJ/m^3
Description:	Net calorific value (energy content) of fossil fuel type i in year y in the North China Power Grid
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 :	Official statistical data
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$\text{EF}_{\text{CO}_2,i,y}$
Data unit:	tc/TJ
Description:	CO_2 emission factor of fossil fuel type i in year y in the North China Power Grid
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 :	IPCC default value
Any comment:	Applied for calculating OM and BM

Data / Parameter:	Installed Capacity
Data unit:	MW
Description:	The Installed Capacity of the power plants in the grid in the year y in the North China Power Grid
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 :	Official statistical data
Any comment:	Applied for calculating BM

Data / Parameter:	GEN_y
Data unit:	MWh
Description:	The electricity generation of the power plants in the grid in the year y in the North China Power Grid
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3 for details



Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Applied for calculating BM

Data / Parameter:	Electricity self-consumption ratio
Data unit:	%
Description:	The ratio of electricity self-consumption to the total electricity generation of the power plants
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 :	Official statistical data
Any comment:	Applied for calculating BM

Data / Parameter:	Efficiency of the best technology commercially
Data unit:	%
Description:	Best commercial available efficiency of coal, gas, oil fuel power plant
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	Best efficiency for coal plant is 39.08% Best efficiency for oil plant is 51.46% Best efficiency for gas plant is 51.46%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value
Any comment:	Applied for calculating BM

B.6.3 Ex-ante calculation of emission reductions:

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As described in B.3., the emission reductions of the proposed project are calculated as follows:

Baseline emissions

Annual generation (net of auxiliary power i.e. the on-site electricity usage for the operation of the wind farm) is estimated as 91,030.5 MWh.

$$EF_{\text{grid,OM,y}} = 0.9914 \text{ t CO}_2 / \text{MWh}$$



$$EF_{\text{grid,BM,y}} = 0.7495 \text{ t CO}_2/\text{MWh}$$

$$EF_{\text{grid,CM,y}} = 0.9914 \times 0.75 + 0.7495 \times 0.25 = 0.9309 \text{ tCO}_2/\text{MWh}$$

$$BE_y = 91,030.5 \times 0.9309 = 84,740 \text{ tCO}_2\text{e}$$

The ex-ante baseline emission factor: **0.9309 tCO₂/ MWh**

Annual baseline emissions: **84,740 tCO₂e** (details in Annex 3)

Project emissions

According to ACM0002 (version 12.2.0), for most renewable power generation project activities, $PE_y = 0$.

Leakage

According to ACM0002 (version 12.2.0), no leakage is considered. The main emissions potentially giving rise to leakage are neglected.

Project Emission Reductions

$$ER_y = BE_y - PE_y$$

The total annual baseline emissions are 84,740 tCO₂.

The total annual project emissions are 0 tCO₂.

$$ER_y = BE_y - PE_y = 84,740 - 0 = 84,740 \text{ tCO}_2$$

The annual emission reductions are estimated to be: 84,740 tCO₂. The proposed project activity is expected to achieve 593,180 tCO₂e of net emission reductions during the first 7-year crediting period.

B.6.4 Summary of the ex-ante estimation of emission reductions:
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Year	Estimation of project activity emissions (tonnes of CO ₂ e)	Estimation of baseline emissions (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of overall emission reductions (tonnes of CO ₂ e)
01/03/2012-28/02/2013	0	84,740	0	84,740
01/03/2013-28/02/2014	0	84,740	0	84,740
01/03/2014-28/02/2015	0	84,740	0	84,740
01/03/2015-29/02/2016	0	84,740	0	84,740
01/03/2016-28/02/2017	0	84,740	0	84,740
01/03/2017-28/02/2018	0	84,740	0	84,740
01/03/2018-28/02/2019	0	84,740	0	84,740
Total	0	593,180	0	593,180



(tonnes of CO ₂ e)				
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B.7 Application of the monitoring methodology and description of the monitoring plan:
B.7.1. Data and parameters monitored:

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Data / Parameter:	$EG_{export,y}$
Data unit:	MWh
Description:	Electricity exported by the project activity to the grid in year y
Source of data to be used:	The summation of the electricity meter readings from M3 and M4 installed on the 35kV transmission lines at the project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	91,030.5
Description of measurement methods and procedures to be applied:	The data will be continuously measured and monthly recorded. Data will be archived for 2 years following the end of the crediting period.
QA/QC procedures to be applied:	The meters M3 and M4 at the project site and meters M1 and M5 will be calibrated once a year according to the national rules of Relative Technical Administrative Code of Electric Energy Metering. Electricity supplied to the grid will be double checked against electricity sales receipts. Meter readings from meters M1 ($EG_{output,y}$) and M5 ($EG_{B,y}$) will also be used for cross checking. Conservative values will be adopted for ERs calculation.
Any comment:	NA

Data / Parameter:	$EG_{import,y}$
Data unit:	MWh
Description:	Electricity imported from the grid by the project activity in year y
Source of data to be used:	The summation of the electricity meter readings of M3 and M4 installed on the 35kV transmission lines at the project site.
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:	The data will be continuously measured and monthly recorded. Data will be archived for 2 years following the end of the crediting period.
QA/QC procedures to be applied:	The meters M3 and M4 at the project site and meters M1 and M5 will be calibrated once a year according to the national rules of Relative Technical Administrative Code of Electric Energy Metering. Electricity imported from the grid will be double checked against electricity sales receipts. Meter readings from meter M1 measuring electricity imported by both projects



	will also be used for cross checking. Conservative values will be adopted for ERs calculation.
Any comment:	NA

Data / Parameter:	$EG_{\text{facility},y}$
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:	Calculation by $EG_{\text{export},y}$ minus $EG_{\text{import},y}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5	91,030.5
Description of measurement methods and procedures to be applied:	The net electricity supplied to the Grid by the proposed project will be calculated through $EG_{\text{export},y}$ and $EG_{\text{import},y}$.
QA/QC procedures to be applied:	The electricity generation by the proposed project will be monitored and recorded. The project operator is responsible for recording such data.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The proposed project adopts the approved consolidated monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (version 12.2.0) to determine the emission reductions from the net electricity generation from the wind farm. This plan describes in more detail the process.

1. Monitoring Object

The monitoring is to justify the realistic amount of emission reduction from the CDM project. The monitoring plan will provide credible, accurate, transparent and conservative monitoring data and ensure the real, measurable, long-term GHG emission reduction from this project.

2. Management Structure

The project owner will use this document as guideline in monitoring of the project emission reduction performance and will adhere to the guidelines set out in this monitoring plan to ensure that the monitoring is credible, transparent and conservative.

The responsibilities of the project staff are as follow:

General Manager: To be responsible for supervising the whole monitoring procedure.

CDM Project Manager: To be responsible for data management and compiling monitoring report.

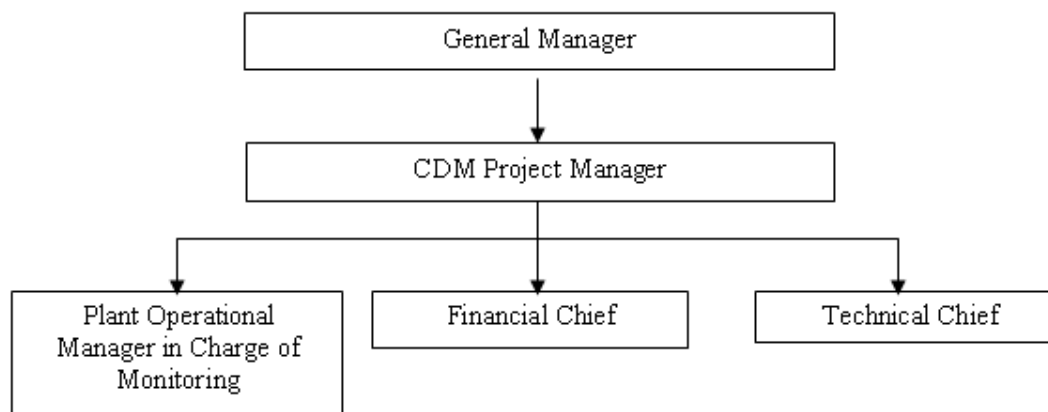
Operational and monitoring manager: To be responsible for collecting data and do internal audit.

Financial chief: To be responsible for collection of sales receipts.

Technical chief: To be responsible for preparing operational reports of the project activity,



recording the daily operation of the wind farm, including operating periods, equipment defects, etc.



3. Monitoring Program and Equipments

The 58 sets of wind turbines of the project are connected with two 35kV transmission lines. Two electricity meters (M3 and M4) are installed on the 35kV transmission lines at the project site. The M3 and M4 are used to measure the electricity supplied to the grid and electricity imported from the grid by the project, which are equal to the summation of the readings of M3 and M4. The accuracies of the two meters are no lower than 0.5s, and the calibration accuracy is once a year in line with the national rules of Relative Technical Administrative Code of Electric Energy Metering.

Since the project is sharing the meter M1 (with M2 as backup meter) at Muling 220kV substation, meter M1 at the Muling 220kV substation measures the electricity exchange between the proposed CDM project and another project (Shandong Yishui Tangwangshan Wind Farm project, hereafter referred to Project B). Electricity exchange between Project B and the grid is measured by meter M5 installed at the project site. The accuracies of the two meters M1 and M5 are no lower than 0.5s, and the calibration accuracy is once a year in line with the national rules of Relative Technical Administrative Code of Electric Energy Metering. Meter readings from M1 and M5 will be used for cross checking purpose only. Also, sales receipts for the proposed CDM project activity will be used for double checking following the requirement in the applied methodology.

For cross checking of the electricity exported by the proposed project against meter readings from M1 and M5, the following equation will be applied.

$$EG_{\text{export},y} = \frac{EG_{A,y}}{EG_{A,y} + EG_{B,y}} \times EG_{\text{output},y}$$

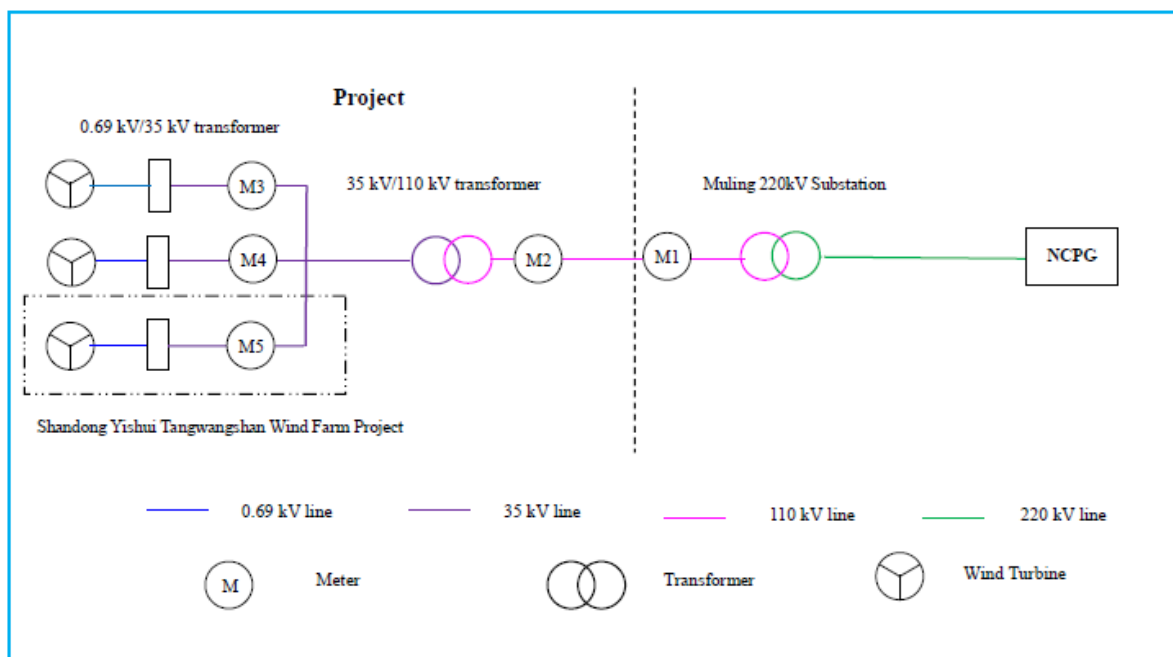
Where:

- $EG_{\text{export},y}$ = Electricity exported by the project activity to the grid in year y
- $EG_{\text{output},y}$ = Total electricity supplied to the grid by the proposed project and *Project B* in the year y, which is measured by the main meter M1.
- $EG_{A,y}$ = Electricity supplied to the grid by the proposed project in the year y, which is measured by the meters M3 and M4.
- $EG_{B,y}$ = Electricity supplied to the grid by the *Project B* in the year y, which is measured

by the meter M5.

Meter readings from meter M1 which measures the electricity imported by both the proposed CDM project and project B will be directly applied for cross checking of electricity imported from the grid by the proposed CDM project activity.

A diagram shows how parameters are monitored is presented as follows:



Before the project is in operation, both the project owner and the grid company will check the metering equipments to ensure its work properly.

4. Monitoring procedure

The electricity supplied to the grid and the electricity imported from the grid will be based on the meter installed on the 35kV transmission lines at project site. Meter readings from meters M1 and M5 will be used for cross checking purpose only. The sales receipts of the electricity supplied to the power grid by this proposed CDM project and the electricity imported from the power grid by both projects will be used for double checking purpose.

The net generation is calculated as exports minus imports.

5. Quality Assurance and Quality Control

The workers are trained to be competent and the metering equipments are calibrated and sealed as per the industry practices at regular intervals, with the purpose to provide credible, accurate, transparent and conservative monitoring data and ensure the real, measurable, long-term GHG emission reduction from this project.

Monthly net on-grid electricity supplied data will be approved and signed off by the Manager before it is accepted and stored. This audit will check compliance with monitoring procedures in this monitoring plan. This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years. The monitoring officers will also attend a training



session organized by the CDM consultant. The purpose of training is to assure those staffs are competent to conduct the monitoring plan, thus to make the monitored data accurate.

6. Calibration of Meters & Metering

The metering equipments involved in the monitoring plan are calibrated and checked for accuracy so that the metering equipment shall have sufficient accuracy within the agreed limits. The metering equipments are calibrated and checked annually by qualified third party for accuracy. The records will be supplied to the wind farm operator, and maintained by the operator.

If any error is detected, the party owning the meter shall repair, recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.

Meters should be tested by a qualified metric organization co-authorized by the project owner and the grid company within 10 days after:

- I The detection of the readings of the meters M1 and M2 that exceeds the allowable tolerance.
- II The equipments malfunction caused by improper operation

All the calibration test records should be maintained safely for the verification.

7. Data Management System

To keep safely the record of the data collected during monitoring, this project will set up a complete data management system. The project will perfect the whole monitoring procedure by developing the CDM manual, tracking information from the primary source to the end-data calculations in paper document format. It is the responsibility of the proposed project owner to provide additional necessary data and information for validation and verification requirements of respective DOE. Physical documentation such as paper-based maps, diagrams and environmental assessment will be collated in a central place, together with this monitoring plan. All paper-based information will be stored by the proposed project owner and kept at least one copy.

At the end of each month, the monitoring data will be filed in a spreadsheet and the paper-based printout will be archived as well. Furthermore, the project owner collects the sales receipts for the project as a cross-check, and compiles the monitoring report including the monitoring data and relevant evidence for verification.

All the data will be kept for two years following the end of the last crediting period.

8. Monitoring Report

After the CDM project manager collects and sorts the monitored data, the monitoring report is prepared. The format and content of the monitoring report are requested to be consistent with the monitoring methodology in the registered PDD.

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)
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Date of completion of baseline and monitoring methodology study 12/04/2012

Name of person/entity determining the baseline:



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Above persons and entity are not Project Participants.

**SECTION C. Duration of the project activity / crediting period****C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

>>

08/08/2009 (Turbines Purchasing Agreement signed date, which is considered as the earliest date of the proposed project)

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

>>

20 years operational lifetime

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

>>

01/03/2012

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

>>

Not applicable

C.2.2.2. Length:

>>

Not applicable

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

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The environmental impact assessment for this project was carried out by Shandong Academy of Environmental Science in December 2007 and approved by Shandong Provincial Environmental Protection Bureau on 11/01/2008. The approval number is Luhuanshen [2008] 3 A summary of the report is illustrated as below:

Ambient air

The impact on ambient air quality of the proposed project is mainly from dust during construction stage, by sprinkling water frequently and timely clearing can reduce the dust pollution. When the project is in operational period, there will be no air pollutions. In conclusion, the proposed project will not pose any threat on the quality of ambient air.

Impact from noise

There is some noise during the operation of wind turbines. The equipments and techniques with lower noise will be chosen to apply. Improvement on construction process and strengthening of equipment maintenance is emphasized. *Noise Limits in Construction site (GB12523-90)* and *Industry Company and Factory Noise Standards (GB12348-2008)* Level II noise standard would be fulfilled during the construction and operational period. Consequently, the noise of operation has little impact to the surrounding environment. Hence, the noise will not impact the work and daily life of local residents.

Electromagnetic impact

The electromagnetic pollution generated from operation of the wind blades has limited effect within about 20m around, whereas no wireless communication facilities exist within, so the electronic magnetic pollution to the surrounding environment is insignificant.

Impact from Solid waste

There is mainly some waste of stone, bricks or domestic waste in the construction stage and basically no solid waste in the operational period. Solid waste will be collected and handled properly. Hence, it will not result any environmental impact.

Impact from Wastewater

Wastewater is mainly domestic wastewater. Wastewater quantity is fairly small and treatment methods will be applied for on-site primary treatment, and then the wastewater will be treated together with the local wastewater. Small-scale septic tanks should be built on the site, through which the discharging wastewater can reach the *Water quality standard for urban miscellaneous water consumption (GB/T18920-2002)*. Therefore, the impact of wastewater is limited and mitigated.

No migrating birds have been found in the project field. Therefore, the project is not located on the passage of migrating birds, and the project construction will not influence the migration of birds.



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:

>>

he Project use clean renewable energy to generate electricity whose environmental impact comply with relevant environmental laws and regulations in the host country. The environmental impacts of the proposed project are not considered as significant.

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

>>

Comments on the construction of the proposed project is invited through means of putting up a notice and holding stakeholder meeting to guarantee the successful implementation of proposed project with the interest of stakeholder being taken into account.

The project developer conducted a survey among the potential stakeholders, collecting public opinion regarding the proposed project activity. 50 copies of questionnaires were all received. Among the interviewees, there were 22 farmers, 13 workers, 2 are officers, 4 are teachers and 9 others with other occupation; 28 of them have educational level of middle school, 14 of high school, 4 of technical secondary school and 4 of collage. The questions regarding the proposed project were mainly as follows:

- a) How do you think the general condition of the local environmental quality?
- b) Do you currently experience electromagnetic interference when watching TV at home?
- c) Are there any negative impacts of the proposed project on the everyday life of local residents?
- d) Is the proposed project going to help improve the living and/or working environment?
- e) How the proposed project impact the acoustic environment (noise) quality?
- f) Which is the environmental topic that concerns you the most during the construction and operation of the proposed project?
- g) Do you support the proposed project?

E.2. Summary of the comments received:

>>

The summary of survey is listed as the following:

- 35 (70%) of them think the local environmental quality is very well, 15(30%) of them think it is general;
- All (100%) of them currently do not experience electromagnetic interference when watching TV at home;
- 47 (94%) of them think there will not be any negative impacts on their everyday life, and the remainder is unsure;
- All (100%) of them think the proposed project will help improve their living and/or working environment;
- All (100%) of them are unsure whether the proposed project will make noise;
- Regarding the construction and operation of the propose project, 22 (44%) of them are most concerned with electromagnetic interference, 28 (56%) of them are most concerned with the noise level, and none of them are most concerned with wastewater from the project;
- All (100%) of them support the implementation of the proposed project.

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

>>

During the survey local residents support the propose project as they showed in the questionnaires. Some people express their concerns about the negative impacts of the project, but they don't think it is



serious. About the environment impacts of the project, the requirements in the EIA report will be strictly conducted by the project owner and be supervised by the municipal environmental protection bureau. Therefore, the proposed project can be carried out as planned.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the Shandong Taipingshan Wind Farm Project.



Annex 3
BASELINE INFORMATION

All the tables related to the calculation of baseline emission reduction are presented below:

Calculation of Operating Margin (OM)

Table A1. Simple OM Emission Factor of North China Power Grid in 2006

Fuel types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Carbon Content (tc/TJ)	Oxidation rate (%)	Emission Coefficient of Fuel (kgCO ₂ /TJ)	Average low Caloric value (MJ/t, km ³)	CO ₂ emission (tCO ₂ e) L=G×J×K/10000 0 (unit of mass)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K	L=G×J×K/10000 (unit of volume)
Raw coal	10000 ton	796.63	1639.2	6867.99	6968.88	8404.05	10930.66	35607.41	25.8	100	87,300	20,908	649,930,803
Cleaned coal	10000 ton						39.77	39.77	25.8	100	87,300	26,344	914,643
Other washed coal	10000 ton	6.36		214.13	371.14	61.77	544.6	1198	25.8	100	87,300	8,363	8,746,477
Briquette	10000 ton	7.97					27.77	35.74	26.6	100	87,300	20,908	652,351
Coke	10000 ton						3.23	3.23	29.2	100	95,700	28,435	87,896
Coke oven gas	10 ⁸ m ³	0.38	0.63	5.8	22.32	0.64	5.79	35.56	12.1	100	37,300	16,726	2,218,517
Other coal gas	10 ⁸ m ³	20.66	6.58	69.72	13.79	22.76	7.22	140.73	12.1	100	37,300	5,227	2,743,772



Crude oil	1000 0 ton					0.74		0.74	20	100	71,100	41,816	22,001
Gasoline	1000 0 ton			0.01				0.01	18.9	100	67,500	43,070	291
Diesel	1000 0 ton	0.21		3.01		0.07	6.32	9.61	20.2	100	72,600	42,652	297,577
Fuel oil	1000 0 ton	6.38		0.08			4.1	10.56	21.1	100	75,500	41,816	333,391
LPG	1000 0 ton						0.01	0.01	17.2	100	61,600	50,179	309
Refinery gas	1000 0 ton			2.43			2.32	4.75	15.7	100	48,200	46,055	105,443
Natural gas	10 ⁸ m ³	3.41	0.73		0.53			4.67	15.3	100	54,300	38,931	987,216
Other oil product	1000 0 ton						0.28	0.28	20	100	72,200	41,816	8,454
Other coking product	1000 0 ton							0	25.8	100	95,700	28,435	0
Other fuel	1000 0 tce	6.83		47.11	230.76	12.51	132.29	429.5	0	0	0	0	0
												Subtotal	667,049,139

Source: China Energy Statistical Yearbook 2007

TableA2. Thermal Power Generation of North China Power Grid in 2006

Province	Power Generation (MWh)	Ratio of Self Power Consumption of Plant (%)	Power Supply(MWh)
Beijing	20,705,000	7.51	19,150,055
Tianjin	35,924,000	6.86	33,459,614
Hebei	143,888,000	6.63	134,348,226



Shanxi	150,250,000	7.45	139,056,375
Inner Mongolia	139,593,000	7.58	129,011,851
Shandong	230,922,000	7.12	214,480,354
Total	721,282,000		669,506,473

Source: China Electric Yearbook 2007

Table A3. Emission Factor of North China Power Grid in 2006

	Parameter	Unit	Value	Source
A	Net Import from Northeast China Power Grid to North China Power Grid (MWh)	MWh	2,618,060	China Power Industry Statistics 2007
B	Total Emissions of Northeast China Power Grid	tCO ₂ e	211,421,263	Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook
C	Total Power Supply of Northeast China Power Grid	MWh	183,890,005	China Electric Power Yearbook 2007
D	Average Emission Factor of Northeast China Power Grid	tCO ₂ e /MWh	1.14972	D=B/C
E	Net Import from Central China Power Grid to North China Power Grid (MWh)	MWh	497,060	China Power Industry Statistics 2007
F	Total Emissions of Central China Power Grid	tCO ₂ e	378,031,235	Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook
G	Total Power Supply of Central China Power Grid	MWh	337,056,176	China Electric Power Yearbook 2007
H	Average Emission	tCO ₂ e /MWh	1.12157	H=F/G



	Factor of Central China Power Grid			
I	Total Power Supply of North China Power Grid	MWh	672,621,593	$E = \text{Total Power Generation of North China Power Grid} + A + E$
J	Total Emissions of North China Power Grid	tCO ₂ e	670,617,037	
K	Emission Factor of North China Power Grid	tCO ₂ e /MWh	0.99702	$G = J/I$

China Energy Statistical Yearbook 2007

Table A4. Simple OM Emission Factor of North China Power Grid in 2007

Fuel types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Carbon Content (t/TJ)	Oxidation rate (%)	Emission Coefficient of Fuel (kgCO ₂ /TJ)	Average low Caloric value (MJ/t, km ³)	CO ₂ emission (tCO ₂ e) $L = G \times J \times K / 100000$ (unit of mass)
		A	B	C	D	E	F	$G = A + B + C + D + E + F$	H	I	J	K	$L = G \times J \times K / 10000$ (unit of volume)
Raw coal	10000ton	816.17	1753.99	7716.13	7510.06	10434.25	11884.83	40115.43	25.8	100	87,300	20,908	732,214,267
Cleaned coal	10000 ton						18.43	18.43	25.8	100	87,300	26,344	423,859



Other washed coal	10000 ton	5.76		156.89	478.81	48.57	756.84	1446.87	25.8	100	87,300	8,363	10,563,452
Briquette	10000 ton	7.93					42.86	50.79	26.6	100	87,300	20,908	927,054
Coke	10000 ton			0.02			4.09	4.11	29.2	100	95,700	28,435	111,843
Coke oven gas	10 ⁸ m ³	0.07	0.72	3.13	25.46	2.58	13.61	45.57	12.1	100	37,300	16,726	2,843,020
Other coal gas	10 ⁸ m ³	11.8	7.6	88.38	72.8	28.17	29.64	238.39	12.1	100	37,300	5,227	4,647,821
Crude oil	10000 ton							0	20	100	71,100	41,816	0
Gasoline	10000 ton			0.01				0.01	18.9	100	67,500	43,070	291
Diesel	10000 ton	0.33		2.35		0.62	5.08	8.38	20.2	100	72,600	42,652	259,490
Fuel oil	10000 ton	4.74		0.18			2.35	7.27	21.1	100	75,500	41,816	229,522
LPG	10000 ton							0	17.2	100	61,600	50,179	0
Refinery gas	10000 ton	0.06		2.85			1.65	4.56	15.7	100	48,200	46,055	101,225
Natural gas	10 ⁸ m ³	5.03	0.73		0.54	4.22	0.01	10.53	15.3	100	54,300	38,931	2,225,993
Other oil product	10000 ton	1.72						1.72	20	100	72,200	41,816	51,929
Other coking product	10000 ton	4.74						4.74	25.8	100	95,700	28,435	128,986
Other fuel	10000 tce	11.94		77.25	360.26	30.75	163.48	643.68	0	0	0	0	0
												Subtotal	754,728,750

Source: China Energy Statistical Yearbook 2008

Table A5. Thermal Power Generation of North China Power Grid in 2007



Province	Power Generation (MWh)	Ratio of Self Power Consumption of Plant (%)	Power Supply(MWh)
Beijing	22,300,000	7.51	20,625,270
Tianjin	39,900,000	6.53	37,294,530
Hebei	163,300,000	6.67	152,407,890
Shanxi	173,400,000	7.99	159,545,340
Inner Mongolia	180,100,000	7.77	166,106,230
Shandong	259,100,000	7.23	240,367,070
Total	838,100,000		776,346,330

Source: China Electric Yearbook 2008

Table A6. Emission Factor of North China Power Grid in 2007

	Parameter	Unit	Value	Source
A	Net Import from Northeast China Power Grid to North China Power Grid	MWh	1,789,750	China Power Industry Statistics 2008
B	Total Emissions of Northeast China Power Grid	tCO ₂ e	219,122,791	Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook
C	Total Power Supply of Northeast China Power Grid	MWh	202,542,560	China Electric Power Yearbook 2008
D	Average Emission Factor of Northeast China Power Grid	tCO ₂ e /MWh	1.08186	D=B/C
E	Net Import from Central China Power Grid to North China Power Grid	MWh	803,000	China Power Industry Statistics 2008



F	Total Emissions of Central China Power Grid	tCO ₂ e	419,013,395	Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook
G	Total Power Supply of Central China Power Grid	MWh	380,239,080	China Electric Power Yearbook 2008
H	Average Emission Factor of Central China Power Grid	tCO ₂ e /MWh	1.10197	H=F/G
I	Total Power Supply of North China Power Grid	MWh	778,939,080	I=Total Power Generation of North China Power Grid + A + E
J	Total Emissions of North China Power Grid	tCO ₂ e	757,552,268	
K	Emission Factor of North China Power Grid	tCO ₂ e /MWh	0.97254	K=J/I

Table A7. Simple OM Emission Factor of North China Power Grid in 2008

Fuel types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Subtotal	Carbon Content (t/TJ)	Oxidation rate (%)	Emission Coefficient of Fuel (kgCO ₂ /TJ)	Average low Caloric value (MJ/t, km ³)	CO ₂ emission (tCO ₂ e) L=G×J×K/ 100000 (unit of mass)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K	L=G×J×K/ 10000 (unit
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K	L=G×J×K/ 10000 (unit



													of volume)	
Raw coal	10000ton	755.75	1,800.1 2	7,353.3 3	7,854.3 9	12,607.8 2	12,360.75	42,732.1 6	25.8	100	87300	20,908	779,976,61 3	
Cleaned coal	10000 ton						23.88	23.88	25.8	100	87300	26,344	549,200	
Other washed coal	10000 ton	5.05		134.52	582.39	66.2	691.21	1,479.37	25.8	100	87300	8,363	10,800,731	
Briquette	10000 ton	5.66			32.49		45.38	83.53	26.6	100	87300	20,908	1,524,647	
Coke	10000 ton			0.02			6.07	6.09	29.2	100	95700	28435	165,723	
Coke oven gas	10 ⁸ m ³	0.11	0.86	8.37	24.55	3.55	16.2	53.64	12.1	100	37300	16,726	3,346,491	
Other coal gas	10 ⁸ m ³	10.4	9.08	187.54	36	34.32	29.76	307.10	12.1	100	37300	5,227	5,987,440	
Crude oil	10000 ton					0.02		0.02	20	100	71100	41,816	595	
Gasoline	10000 ton							0.00	18.9	100	67500	43,070	0	
Diesel	10000 ton	0.15		3.08		0.35		3.58	20.2	100	72600	42,652	110,856	
Fuel oil	10000 ton	2.56		0.25				2.81	21.1	100	75500	41,816	88,715	
LPG	10000 ton							0.00	17.2	100	61600	50,179	0	
Refinery gas	10000 ton	0.44		2.93				3.37	15.7	100	48200	46,055	74,809	
Natural gas	10 ⁸ m ³	11.09	0.7		0.97	2.12		14.88	15.3	100	54300	38,931	3,145,563	
Other oil product	10000 ton	1.45						1.45	20	100	72200	41,816	43,777	
Other coking product	10000 ton	7.97		7.61				15.58	25.8	100	95700	28,435	423,968	
Other fuel	10000 tce	4.9	2.34	61.02	466	63.72	141.71	739.69	0	0	0	0	0	
													Subtotal	806,239,12



D	Average Emission Factor of Northeast China Power Grid	tCO ₂ e /MWh	1.104886	D=B/C
E	Total Power Supply of North China Power Grid	MWh	808,083,490	E=Total Power Generation of North China Power Grid + A
F	Total Emissions of North China Power Grid	tCO ₂ e	812,079,707	
G	Emission Factor of North China Power Grid	MWh	1.00495	G=F/E

Table A10. Operating Margin Emission Factor of North China Power Grid

		Year 2006	Year 2007	Year 2008	Total
A	Emissions (tCO ₂ e /year)	670,616,651	757,549,895	812,079,707	2,240,246,253
B	Power Supply (MWh)	672,621,593	778,939,080	808,083,490	2,259,644,163
C	CO ₂ Emission Factor (tCO ₂ e/MWh)	C = A/B			0.9914

Calculation of Build Margin (BM):

**Step 1. Calculation of weights of CO2 emissions of solid, liquid and gas fuel in total emissions for power generation**

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

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

Where:

$FC_{i,j,y}$: Amount of fossil fuel type i consumed in province j in year y (mass or volume unit, for solid and wet fuel, the unit is ton, for gas fuel, the unit is m^3);

NCV_{ij} : Net thermal value of fuel type i in year y (for solid and wet fuel, the unit is GJ/t, for gas fuel, the unit is GJ/ m^3);

$EF_{CO_2,i,y}$: CO₂ emission factor of fossil fuel type i in year y (tCO₂/GJ);

COAL, OIL and GAS respectively refers to the group of solid, liquid, and gas fuels.

Based on China Energy Statistical Yearbook 2009, the calculation of the weights of solid, liquid, and gas fuels in North China Power Grid are:

$$\lambda_{Coal} = 98.41\%, \quad \lambda_{Oil} = 0.03\%, \quad \lambda_{Gas} = 1.56\%$$

Step 2: Calculation of Emission Factor of Relevant Thermal Power

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

Where: $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas, Adv}$ respectively refers to the emission factor representing best technology commercially available for fuel of coal, oil or gas fired power plants. For specific workings, see the following:



Thermal Power	MW	4,760.0	7,490.0	29,870.0	35,250.0	45,740.0	55,930.0	179,040.0
Hydropower	MW	1,050.0	0.0	1,540.0	790.0	830.0	1,050.0	5,260.0
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and Others	MW	0.0	0.0	700.0	0.0	2,300.0	370.0	3,370.0
Total	MW	5,810.0	7,490.0	32,110.0	36,040.0	48,860.0	57,350.0	187,660.0

Source: China Power Yearbook 2009

Table A13. Installed Capacity of North China Power Grid in 2007

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal Power	MW	3,900	6,920	29,020	30,950	39,870	54,140	164,800
Hydropower	MW	1050	10	780	790	830	1,050	4,510
Nuclear Power	MW	0	0	0	0	0	0	0
Wind Power and Others	MW	2.7	0	410	0	1,096.5	210	1,719.2
Total		4,952.7	6,930	30,210	31,740	41,796.5	55,400	171,029.2

Source: China Power Yearbook 2008

Table A14. Installed Capacity of North China Power Grid in 2006

Installed Capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal Power	MW	3,984	6,512	26,087	26,661	28,899	49,395	141,538
Hydropower	MW	1,053	5	785	790	818	553	4,004



Nuclear Power	MW	0	0	0	0	0	0	0
Wind Power and Others	MW	24	24	218	0	565	106	937
Total	MW	5,061	6,541	27,090	27,451	30,282	50,054	146,479

Source: China Power Yearbook 2007

Table A15. Calculation of BM of North China Power Grid (MW)

	Installation in year 2006	Installation in year 2007	Installation in year 2008	New Additions from 2006 to 2008*	New Additions from 2007 to 2008*	Ratio in New Additions
	A	B	C	D	E	F
Thermal Power (MW)	141,538	164,800	179,040	46111	17,847	93.98%
Hydro Power (MW)	4,004	4,510	5,260	520	9	1.06%
Nuclear Power (MW)	0	0	0	0	0	0.00%
Wind Power and Others (MW)	937	1,719	3,370	2433	1,651	4.96%
Total (MW)	146,479	171,029	187,660	49,064	19,508	100.00%
Percentage compared with installation of 2008				26.15%	10.40%	

*Calculated with the consideration of installed, shut-down and pumped storage capacity

$$EF_{\text{grid,BM,y}} = 0.7975 \times 93.98\% = 0.7495 \text{ tCO}_2/\text{MWh}$$

Table A16. Baseline Emission Factor of North China Power Grid

	Parameter	Unit	Amount
A	Operating Margin Emission Factor	tCO ₂ /MWh	0.9914
B	Build Margin Emission Factor	tCO ₂ /MWh	0.7495
C	Combined Emission Factor (C=0.75*A+0.25*B)	tCO ₂ /MWh	0.9309



Table A17. Electricity Generation Baseline Emissions

	Parameter	Unit	Amount	Source or Equation
A	Project installed capacity	MW	49.3	Feasibility Study
B	Annual electricity supplied	MWh	91,030.5	Feasibility Study
C	Baseline Emissions Factor	tCO ₂ /MWh	0.9309	Table A16
D	Electricity generation baseline emissions	tCO ₂ /year	84,740	D= B * C



Annex 4

MONITORING PLAN

Please refer to B.7.2 in the PDD.