# Project design document form
## (Version 10.1)

| BASIC INFORMATION | |
|---|---|
| **Title of the project activity** | Jilin Qianguo Qingshantou Wind Farm Project |
| **Scale of the project activity** | ☒ Large-scale<br>☐ Small-scale |
| **Version number of the PDD** | VER 05 |
| **Completion date of the PDD** | 30/10/2018 |
| **Project participants** | Qianguo Gorlos Mongolian Autonomous County Daixu Wind Energy Co., Ltd.<br>GreenStream Network Plc<br>Climate Opportunity Fund Ky<br>Fine Post-2012 Carbon Fund Ky |
| **Host Party** | China |
| **Applied methodologies and standardized baselines** | Version 13.0.0 of ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources. |
| **Sectoral scopes linked to the applied methodologies** | Sectoral Scope 1: energy industries (renewable - / non-renewable sources) |
| **Estimated amount of annual average GHG emission reductions** | 61,077 |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

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Jilin Qianguo Qingshantou Wind Farm Project (hereinafter referred to as “the proposed project”) is located at north of Qian Gorlos Mongolian Autonomous County, Songyuan City, Jilin, P.R.China. The primary objective of the proposed project is to generate renewable electricity to meet the ever-increasing demand in the Northeast China Power Grid (NECPG).

The proposed project will install 20 sets of 1,500kw wind turbine units at the proposed project site. Based on the conditions of the local wind resource, the proposed project is expected to supply 63,391.1 MWh electricity annually to NECPG through the Jilin Grid. In the absence of the proposed project, electricity demand would be met by existing capacity and new installations of the NECPG, which is dominated by thermal power plants. Thus, the baseline scenario is the existing scenario before the implementation of the proposed project; i.e. electricity demand is met by the existing generation mix that makes up the NECPG.

Therefore, the proposed project will achieve GHG emissions reduction by displacing part of the electricity generated by fuel-fired power plants in NECPG with zero GHG emissions electricity from the proposed project. The estimated annual GHG emissions reductions are 61,077 $tCO_2e$ during the fixed crediting period.

The proposed project will not only supply renewable electricity to grid, but also contribute to the sustainable development of the local community and the host country by means of:

- Supply of reliable, zero-emitting renewable energy to NECPG;
- Saving the coal and water resources and improving the local energy infrastructure;
- Increasing local incomes and providing several job opportunities;
- Decreasing GHG emission from fossil-fuel fired power plants, particularly emission of SOx、NOx and dust.

### A.2. Location of project activity

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The project is located at north of Qian Gorlos Mongolian Autonomous County, Songyuan City, Jilin, P.R.China. The geographical coordinates of the center of the area are at the latitude 45.2853°N and the longitude 124.3088°E[1]. The location of the project is shown as Figure A.2-1 as below:

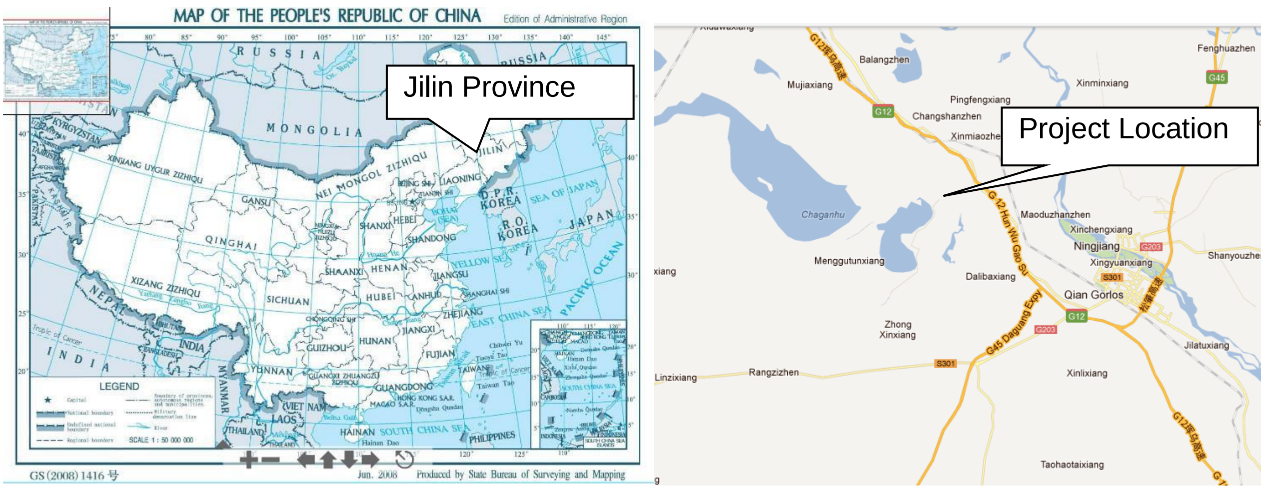


Figure A.1-1: The location of the project

[1] Page 16 of the FSR

### A.3. Technologies/measures

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The proposed project will be connected to NECPG. From 2005 to 2009, the annual percentages of fuel-fired generation among the whole generation of NECPG are 91.72%, 94.75%, 94.49%, 94.2%, and 93.1%, respectively[2]. It could be concluded that NECPG is dominated by fuel-fired power plants and the energy mix of NECPG will be unlikely to change significantly in the short term. Also the installed capacity of fuel-fired power units increased a lot from 2007 to 2009 as well. Therefore, before constructing the proposed project or without the proposed project, the electricity generated by the proposed project will be generated by NECPG through installing new capacities or uploading existing capacities, which are dominated by fuel-fired units and will cause $CO_2$ emissions by burning fossil fuel. Thus, the baseline scenario, as the same as the scenario existing prior to the start of implementation of the project activity, is the following: Equivalent electricity service provided by NECPG.

The Project involves the installation of 20 sets of 1, 500kW wind turbine units, manufactured by Guangdong Mingyang Wind Power Industry Group Co., Ltd, and the total installed capacity is 30MW. The project activity was started construction on 08/11/2011. The first turbine was commissioning on 19/07/2013, and all the wind turbines have been put into operation gradually till 21/07/2013, and well operated during this monitoring period. The technical specifications of the turbine unit are given in Table A.1-1.

Table A.1-1: Technical parameter of wind turbine generators

| Item | Unit | Index |
|---|---|---|
| Wind turbine | | |
| Type | MY1.5S1 – 89/80 | |
| Number of Wind turbines | Sets | 20 |
| Rated capacity | kW | 1,500 |
| Rotor diameter | m | 89 |
| Cut-in wind speed | m/s | 3 |
| Rated speed | m/s | 10 |
| Cut-out wind speed | m/s | 22 |
| Height of hub | m | 80 |
| Generator | | |
| Rated Capacity | kW | 1,550 |
| Rated voltage | V | 690 |
| Number of Generator | Sets | 20 |
| Life time | year | 20 |
| Plant load factor | % | 24.1%[3] |
| Manufacture | Guangdong Mingyang Wind Power Industry Group Co., Ltd | |

The power generation diagram is shown in Figure A.1-2.

[2] China Electric Power Yearbook 2006, 2007, 2008, 2009 and 2010

[3] The plant load factor is calculated as 63,391.1/30/8760*100%=24.1%.

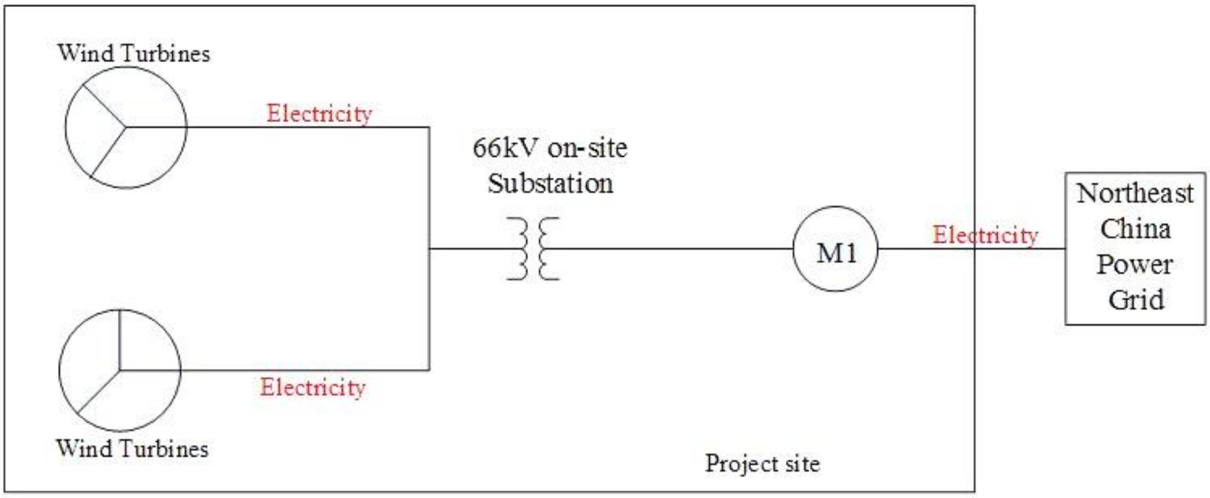


Figure A.1-2: The Power Generation Diagram

## A.4. Parties and project participants

| Parties involved | Project partic'ipants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| People's Republic of China (host Party) | Qianguo Gorlos Mongolian Autonomous County Daixu Wind Energy Co., Ltd. | No |
| Finland | GreenStream Network Plc<br>Climate Opportunity Fund Ky<br>Fine Post-2012 Carbon Fund Ky | No |

## A.5. Public funding of project activity

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

## A.6. History of project activity

**>>**
The PP hereby confirms in line with PDD completion guidelines that
(a) The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA); and
(b) The proposed CDM project activity is not a project activity that has been deregistered.

## A.7. Debundling

>>
N.A

# SECTION B. Application of selected methodologies and standardized baselines

## B.1. Reference to methodologies and standardized baselines

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1. Version 13.0.0 of ACM0002: *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

2. Version06.0.0 of *Tool for the demonstration and assessment of additionality*.

3. Version 02.2.1 of *Tool to calculate the emission factor for an electricity system*.
For more information regarding the methodology, please refer to the link:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

## B.2. Applicability of methodologies and standardized baselines

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

Table B-1 Applicability criteria analysis

| Applicable conditions of the methodology ACM0002 | The Project |
|---|---|
| The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; | The proposed project is the installation of a wind power plant. Therefore, the project meets the applicability requirement of the methodology ACM0002. |
| In the case of capacity additions, retrofits or replacements(except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity; | The proposed project is installation of a new wind power plant. Therefore, this condition is not applicable to the project. |
| In case of hydro power plants, one of the following conditions must apply:<br>The project activity is implemented in an existing reservoir, with no change in the volume of reservoir;<br>The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$;<br>The project activity results in new reservoirs | The project is wind farm project, not a hydro power plant project. So the applicability requirement can be skipped. |

| | |
|---|---|
| and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m$^2$. | |
| The methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site. | The project does not involve switching from fossil fuels to renewable energy sources at the site of the project activity, which meets the applicability requirement of the methodology ACM0002. |
| The methodology is not applicable to biomass fired power plants. | The project is to install a new wind farm, not a biomass fired power plants. Therefore, the project meets the applicability requirement of the methodology ACM0002. |
| The methodology is not applicable to hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m$^2$. | The project is wind farm project, not a hydro power plant project. So this condition can be skipped. |
| In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”. | The proposed project is installation of a new wind power plant. Therefore, this condition is not applicable to the project. |

Therefore, ACM0002 is applicable to the proposed project.

### B.3. Project boundary, sources and greenhouse gases (GHGs)

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According to the information published by China’s DNA[4], except Tibet Autonomous Region, Hong Kong, Macao and Taiwan, China is covered by 7 independent grids –North China Grid, (NECPG), East China Grid, Central China Grid, Northwest China Grid, South China Grid and Hainan Local Grid. It is officially claimed that NECPG covers Heilongjiang Province, Jilin Province and Liaoning Province.

The spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system. The project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Based on the significant transmission between the sub-regional grids within NECPG and the difficulty in distinguishing between theses individual regional grids, NECPG has been selected as electricity system of the proposed project.

According to the methodology ACM0002, the emissions source and category of GHG is described in Table B- 2:

**Table B- 2 The Emission Source and the Category of GHG**

[4] *2011 Baseline Emission Factors for Regional Power Grids in China*, 20th October 2011 (available at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf )

| | Source | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Electricity generation of the fossil-fuel fired power plants connected to the NECPG | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Excluded for simplification. This is deemed a conservative measure. |
| | | $N_2O$ | No | Excluded for simplification. This is deemed a conservative measure. |
| Project activity | For geothermal power plants | $CO_2$ | No | Not related |
| | | $CH_4$ | No | Not related |
| | | $N_2O$ | No | Not related |
| | $CO_2$ emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | $CO_2$ | No | Not related |
| | | $CH_4$ | No | Not related |
| | | $N_2O$ | No | Not related |
| | For hydro power plants, emissions of $CH_4$ from the reservoir | $CO_2$ | No | Not related |
| | | $CH_4$ | No | Not related |
| | | $N_2O$ | No | Not related |

The flow diagram of the project boundary is shown in Figure B1-1.

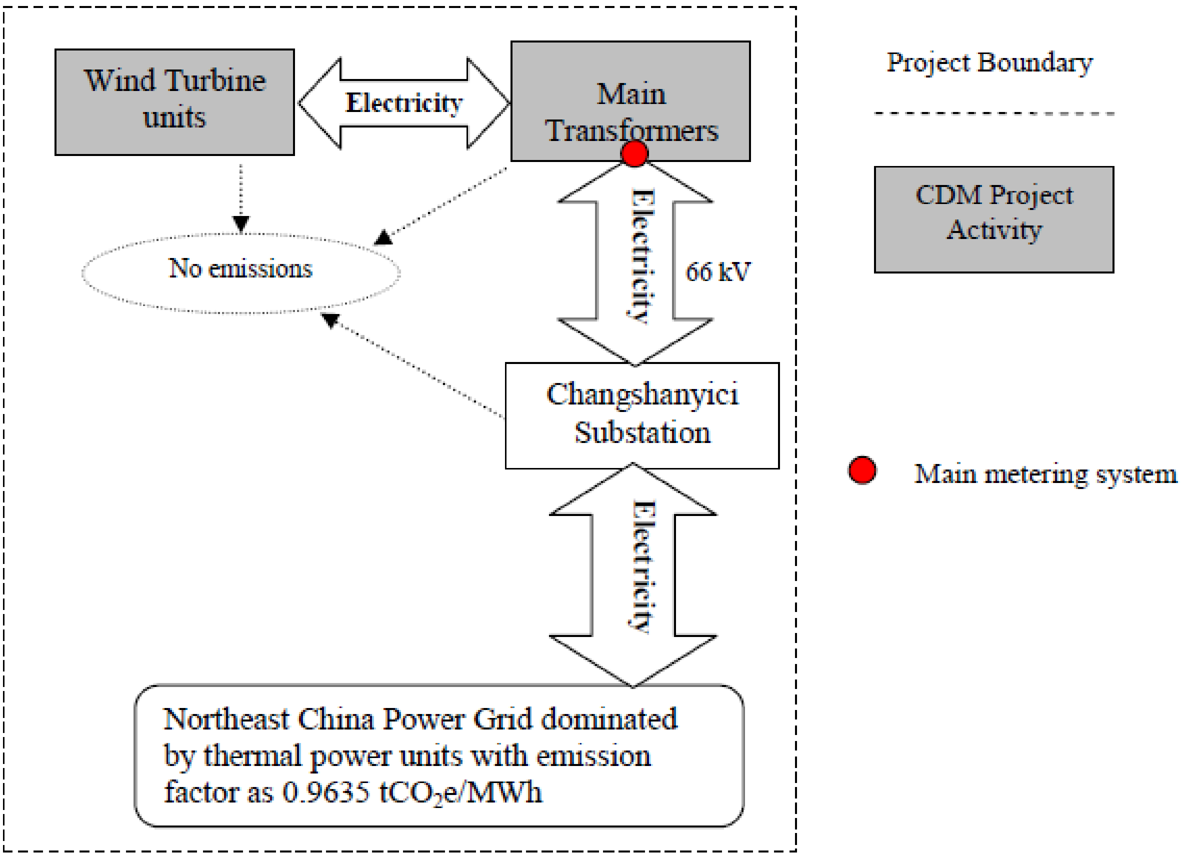


Figure B1- 1 The flow diagram of the project boundary

## B.4. Establishment and description of baseline scenario

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According to methodology ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline is the following: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

The generation from the proposed project is delivered to NECPG, so the baseline scenario is the following: Equivalent electricity service provided by NECPG.

## B.5. Demonstration of additionality

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The starting date of the proposed project as 08/11/2011 which is the signing date of the construction contract of the on-site substation (66kV) and office building, is after 02 August 2008, therefore, following EB guideline, *Guidelines on the demonstration and assessment of prior consideration of the CDM,* Version 04 (EB 62 Annex 13), the project participant informed the Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of the intention to seek CDM status. These notifications were made within six months of the proposed project start date as shown in the timeline below.

**Table B-3 Milestone timeline of the proposed project**

| Time | Milestone |
|---|---|
| 11/2010 | Environmental Impact Assessment (EIA) completed |
| 03/12/2010 | EIA approved |
| 08/2011 | Feasibility Study Report (FSR) completed, taking CER revenue into account |
| 16/09/2011 | Board decision |
| 03/11/2011 | FSR approved |
| 08/11/2011 | Construction contract of the on-site substation (66kV) and office building (starting date of the project) |
| 28/03/2012 | Notification of the intention to develop this project as CDM signed by the DNA |
| 12/04/2012 | Notification of the intention to develop this project as CDM on UNFCCC[5] |
| 06/05/2012 | Wind turbine purchase contract |
| 12/04/2012 | EPRAs signed with buyers. |
| 20/11/2012 | CDM registration date |
| 19/07/2013 | Project commissioning |
| 21/07/2013 | Full operation |

The incentive from the CDM had been taken into account prior to the starting date of the project activity, aiming to obtain the additional funding to secure the project financially. In the feasibility study of the project, the revenue from CDM was analyzed and it is concluded that if the project is registered as a CDM project, the revenue from CDM will make the project attractive financially. Therefore, the project owner decided to apply for CDM registration to overcome the financial barriers and signed the Emission Reduction Purchase Agreement (ERPA) with the CER buyer in April 2012. The prior notifications were also send to UNFCCC and China DNA, respectively. Therefore, CDM was seriously considered in the decision to implement the project activity.

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

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

Sub-step 1a. Define alternatives to the project activity:
Realistic and credible alternatives available to the proposed project that provide outputs or services comparable to the proposed project activity include:
a) The proposed project itself, but undertaken without being registered as a CDM project activity;
b) Construction of a fuel-fired power plant with equivalent electricity service;

[5] There are two notifications of the proposed project on the UNFCCC website. The early one on 29/03/2012 has a mistake of the project owner’s name, thus, corrected by the following notification on 12/04/2012.

c) Construction of a power plant using other renewable sources with equivalent electricity service, such as hydropower projects, biomass power plants or solar power plants;
d) Equivalent electricity service provided by NECPG.

Besides wind energy, other grid-connected renewable energy technologies such as solar PV, geothermal, biomass and hydro are possible alternatives that could be applied in NECPG. Due to the technology development status and the high cost for power generation, solar PV[6], geothermal[7] and biomass[8] of the similar installed capacity as the proposed project are alternatives regarded as unattractive investments in China[9]. Only hydro power projects can have an investment return rate that competes with that of wind power projects in China[10]. But the proposed project is located on the Songnen plain, not suitable for hydropower Therefore, the alternative c) is not feasible.
Sub-step 1b. Consistency with mandatory laws and regulations:

b) Construction of a fuel-fired power plant with equivalent amount of annual electricity generation. According to Chinese power regulation[11], construction of fuel-fired power plants of less than 135MW is prohibited in areas covered by large grids. Alternative b) would conflict with Chinese regulations and is, therefore, not a realistic and credible alternative.
For alternative a), the proposed project not undertaken without being registered as a CDM project activity satisfies China's regulations.
For alternative d), equivalent electricity service provided by NECPG satisfies China's regulations.

**Outcomes of sub-step 1b:**
Therefore, alternative a) and alternative d) comply with China's regulations and will be analyzed in Step 2 as potential alternative scenarios.

**Step 2. Investment Analysis**
***Sub-step 2a. Determine appropriate analysis method***
The "Tool for the Demonstration and Assessment of Additionality" recommends three analysis methods: simple cost analysis, investment comparison analysis or benchmark analysis.

Other than CDM related income, the proposed project produces economic benefit through the sale of electricity. Therefore, the simple cost analysis cannot be used. The investment comparison analysis is not applicable to the proposed project because the alternative of the proposed project is "Equivalent electricity service provided by NECPG", not a single project. Hence, the benchmark analysis is chosen and the Internal Rate of Return (IRR) is used to assess the financial viability of the project activity.

***Sub-step 2b. Option III. Apply benchmark Analysis***
With reference to *Interim Rules on Economic Assessment of Electrical Engineering Technology Retrofit Projects* published by the State Power Corporation of China[12], the financial benchmark rate of return (after tax) for Chinese Power Industries is 8% of total investment, which has been used widely for wind power projects in China.

***Sub-step 2c. Calculation and comparison of financial indicators***
1) Parameters required to calculate IRR
According to the relevant documents of the proposed project, the parameters needed for calculation of IRR are given in Table B-4.

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6 http://finance.people.com.cn/GB/1038/59942/59949/6294546.html
7 http://www.newenergy.org.cn/html/0098/870929050.html
8 http://finance1.jrj.com.cn/news/2008-04-10/000003510351.html
9 http://tech.bjx.com.cn/html/20090310/118549.shtml
10 http://jjckb.xinhuanet.com/cjxw/2007-11/27/content_75467.htm
11 Notice on Strictly Prohibiting the Illegal Installation of coal-fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Guo Ban Fa Ming Dian decree No. 2002-6.
12 Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects. State Power Corporation of China, Beijing: China Electric Power Press, 2003

**Table B- 4 Parameters for calculation of IRR**

| Item | | | Unit | Value | Reference Source |
|---|---|---|---|---|---|
| Installed capacity | | | MW | 30 | Feasibility Study Report (FSR) |
| Annual electricity generation | | | MWh | 63,391.1 | FSR |
| Static investment | | | Million (RMB) | 288.62 | FSR |
| Expected tariff (Incl. VAT) | | | RMB/kWh | 0.580 | FSR |
| Annual O&M cost in average | Employee expenditure | No. of Staff | Person | 12 | FSR |
| | | Annual Salary | Yuan (RMB) | 70000 | |
| | | Welfare rate | % | 63 | |
| | Maintenance and repairs rate | | % | 0.50 (first 2 years) | |
| | | | % | 1.80 (rest years) | |
| | Insurance rate | | % | 0.25 | |
| | Material expenditure | | Yuan(RMB/kw) | 20 | |
| | Other O&M expenditure | | Yuan(RMB/kw) | 30 | |
| VAT | | | % | 17 | FSR |
| City maintenance & construction tax | | | % | 5 | FSR |
| National surtax for education | | | % | 3 | FSR |
| Provincial surtax for education | | | % | 2 | FSR |
| Income tax | | | % | 25 | FSR |
| Rate of residual value | | | % | 5 | FSR |
| Depreciation rate | | | % | 6.33 | FSR |
| Operational life | | | years | 20 | FSR |
| Expected CERs price | | | EUR/t$CO_2$e | 10.5[13] | ERPA |

**Taxes:**

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

a) Value Added Tax: Firstly, The reduced VAT rate is applicable to the wind power industry in accordance with VAT policy which is *Notification about the VAT Policy on Comprehensive Utilization of Resource and Other Produces (Caishui[2008]156)* [14]released by Ministry of Finance and State Administration of Taxation on 9 December 2008. This policy is released after 11 November 2011, but this VAT reduction policy is taken into account in the assessment, this is conservative. Secondly, considering the VAT refund, 8.5% was directly adopted as the VAT rate in the FSR, but while calculating the IRR, 17% was taken as the VAT firstly, and then 8.5% of the VAT was considered in the cash inflow, this is more conservative.

b) Value Added Tax recovery on investment: The “Notice about implementation of VAT reform in the whole country” (Cai Shui[2008]170) allows for the VAT from the investment in wind projects to be recouped. The possibility to recover the VAT on the investment for wind farms was introduced after 11 November 2001. However, this VAT reduction policy is taken into account in the assessment. This is conservative.

c) Income Tax: According to People's Republic of China Enterprise Income Tax Provisional Regulations issued in March 2007, State Council No. 63, the income tax was approved as 25%[15].

d) Education Tax: According to the Interim Provision on Education Tax Law, the education rate is 3% of VAT[16]. And Jilin province collects 2% local education tax from May 2011[17]. Therefore, the total education tax rate in Jilin is 5%.

e) City Building Tax: According to National City Tax Law, the city building tax rate is 5% of VAT[18].

2) Comparison of the project IRR and the financial benchmark

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13 The currency rate is considered as 8.4 RMB/EURO

14 http://www.chinatax.gov.cn/n8136506/n8136593/n8137537/n8138502/8714515.html

15 http://www.gov.cn/flfg/2007-03/19/content_554243.htm

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

17 http://www.jl.gov.cn/xxgkml2011/zfgkml/auto335/auto347/201110/t20111031_77061.html

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

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

Table B-5 shows the project IRR with and without the income from sales of Certified Emission Reductions (CERs). Without the sales of CERs, the project IRR is 6.49% which is lower than the financial benchmark. Thus the proposed project is not financially acceptable. Taking into account the CDM revenues, the project IRR is 8.71% and higher than the financial benchmark. Therefore, the CDM revenues enable the project to overcome the investment barrier.

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

| Item | Without CDM | Benchmark | With CDM |
|---|---|---|---|
| IRR | 6.49% | 8% | 8.71% |

Sub-step 2d. Sensitivity analysis

For the proposed project, the following four parameters were selected as sensitivity factors to analyse the financial attractiveness.

1) Static Investment

2) Annual O&M cost

3) Tariff (Inc. VAT)

4) Electricity Supply / PLF

Assuming the above four factors vary in the range of -10% to 10%, the project IRR ( without the revenue from CERs sales) varies to different extents as shown in Figure B- 2 below.

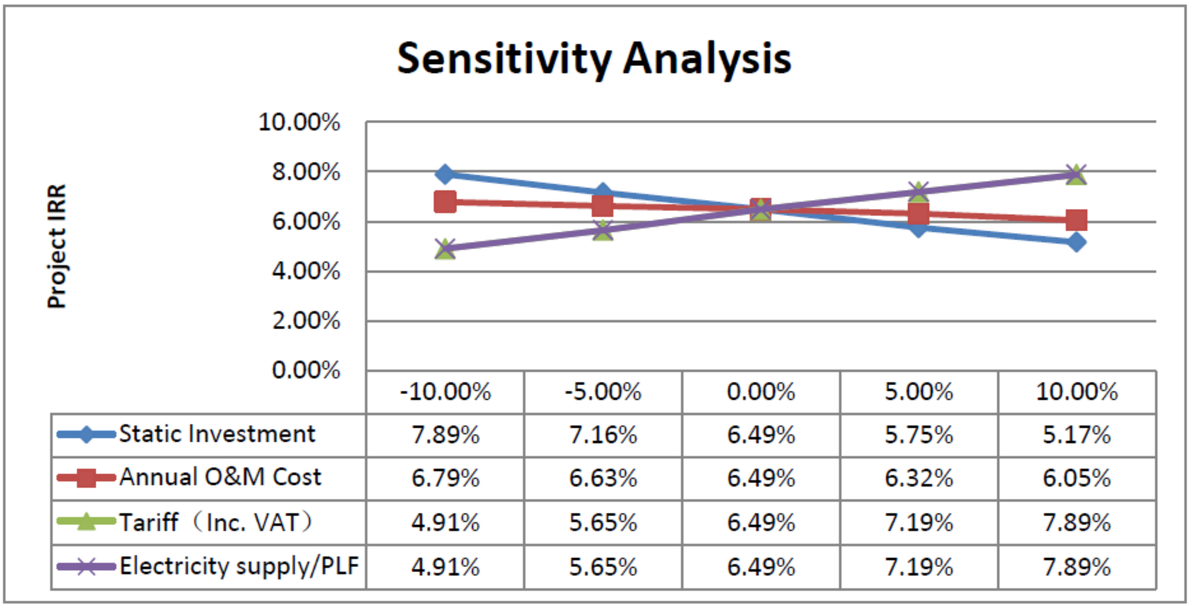


**Figure B- 2 Sensibility analysis of the proposed project**

**Table B-6 the varieties of the parameters when reaching the benchmark IRR**

| | 8.00% |
|---|---|
| Static Investment | -10.65% |
| Annual O&M Cost | -47.79% |
| Tariff（Inc. VAT） | 10.86% |
| Electricity supply/PLF | 10.86% |

Within the reasonable changing range of static investment, annual electricity supply, tariff（Inc. VAT） and annual O&M cost, the IRR is always lower than the investment benchmark 8%, and thus the proposed project is not financially attractive.

**Static investment**

The total investment was estimated by an experienced design institute, taking into account the experience of the developer. The estimated static investment for the proposed project activity is 9621 RMB/kW, falls into the range of the other similar projects in Jilin Province, which is 7,629 (Project reference No.0544) to 11,422 RMB/kW (Project reference No.0771).[19] Therefore, it can be concluded that the estimated static investment in the FSR is reasonable.

For wind farm projects, the costs of turbines, engineering construction and related accessories comprise the main budget of static investment. For the proposed project, the price of the signed contracts for turbine, substation construction and foundation & road construction, which occupied 64.74% of the total static investment, has already raised 2% comparing to the FSR value. For the rest of the 35.26% of the total static investment as designed in the FSR to realize 10.86% decrease of the total static investment, 34.47% decrease of the rest 35.26% of the designed total static investment is required. This 34.47% decrease is very unlikely considering the increase of the labour cost[20] and static investment cost[21]. Therefore, it was not realistic to assume that the investment costs of the proposed project could be 10.86% lower than estimated in the FSR in order to reach the benchmark.

**Table B-7 The investment comparison between FSR and the signed contracts**

| **Items** | **Contract (million)** | **FSR (million)** |
|---|---|---|
| Turbine | 135 | 131.84 |
| Substation construction | 5.12 | 4.61 |
| Foundation construction | 50.5 | 50.39 |
| **Total** | **190.62** | **186.84** |
| | As 2% increase of the FSR value. | 64.74% of the designed static investment) |

**Tariff (Incl. VAT)**

The expected tariff used in the financial analysis in the FSR refers to the latest NDRC tariff notification (Fa Gai Jia Ge [2009]1906) and is utilized by all the recently developed wind farm projects located in the same region. According to the Interim Measures for Renewable Energy Power Tariff and Cost-sharing[22], issued by NDRC, and affective from 1 January 2006, all wind projects will receive the government guiding tariff. The latest NDRC tariff notification (Fa Gai Jia Ge [2009]1906), issued on 20 July 2009, stipulates the regional tariff as 0.58 RMB/kWh for Jilin province, and it also clarified that future projects in these classified regions would automatically be awarded corresponding tariff upon approval of their FSR. As the starting date of the project is after the approval of the FSR, which definitely later than the publication of the NDRC tariff notification, the tariff was fixed at the time of making the decision to go ahead with the project. Therefore, the tariff for the proposed project was fixed at 0.58 RMB/kWh, the same as estimated in the FSR. Any variation from this original assumption, therefore, cannot be considered credible, as the tariff has been fixed prior to the project starting date.

The tariff would need to be 10.86% higher than the assumed level in the FSR, at 0.6430 RMB/kWh, for the proposed project IRR to reach the benchmark. However, as discussed above, the tariff is regulated by the government. It is unlikely to vary over such range. In addition, according to the *Information note on the highest tariffs applied by the Executive Board in its decisions on registration of projects in the People's Republic of China (version 01)*, published on 03 June 2011, the highest historical tariff in Jilin Province is 0.63RMB/kWh (incl VAT). Even using the highest tariff as 0.63 RMB/kWh (incl. VAT) in Jilin Province, the IRR of the proposed project will not reach the benchmark.

[19] Statistics of all registered wind farm CDM projects in Jilin Province has been provided to DOE.

[20] http://www.stats.gov.cn/tjsj/ndsj/2011/indexch.htm

[21] Although there was a slight decrease in 2009, the decrease is less than 3% and the FSR of the proposed project has been completed in later 2011.

[22] Fa Gai Jia Ge [2006] No. 7 (1 Jan 2006)

The tariff is regulated by the government. It is unlikely to vary over such range. In addition, according to the Information note on the highest tariffs applied by the Executive Board in its decisions on registration of projects in the People's Republic of China (version 01), published on 03 June 2011, the highest historical tariff in Jilin Province is 0.63RMB/kWh (incl VAT). Even using the highest tariff as 0.63 RMB/kWh (incl. VAT) in Jilin Province, the IRR of the proposed project will not reach the benchmark.

**Electricity supply / PLF**
According to the FSR, the expected annual operation is 2,113 hours (the plant load factor is 24.1%) and the annual electricity supplied to the NECPG is 63,391.1MWh. The expected power generation of the proposed project from the FSR is calculated by an independent qualified design institute with the highest grade (Grade A) in the report.

As per the FSR (Chapter 5), the estimated net supplied power is calculated from the turbine availability, grid availability and the wind resource based on 20-year wind assessment record. The calculations for the proposed project are carried out using professional software designed for the wind energy industry. The generation and plant load factor determination are, therefore, in line with both options of the EB Guidelines for the reporting and validation of plant load factors (EB 48 Annex 11): (a) provided to the government while applying the project activity for implementation approval, and (b) determined by a third party contracted by the developer. The output is maximized through selection of the most suitable turbines, optimal turbine distribution in the wind farm, and considering the specific turbine characteristics, and the grid connection. The volume of annual generation therefore represents the long-term average power supply during the lifetime of the wind farm, taking into account yearly variations in power generation. As a result, the net grid-connected electricity/load factor is reasonable and should not vary a lot in long term.

The net electricity output calculations, based on the modelling result, account for issues such as air density corrections, turbine efficiency, planned maintenance, contaminated rotors, and auxiliary power use, etc. The reduction factor for calculating the net supplied electricity from the modelling result is 30% by considering the above affects. According to the "Explanation of Wind Farm Electricity Generation in China" published by NDRC on June 2nd, 2009, the reasonable range of the reduction factor is 20%-45%. Therefore, the reduction factor of the proposed project is in this range, the net supplied electricity is reasonable.

Therefore, it is not credible to assume that supply from the proposed project would increase by more than 10.86% each year on average over the lifetime of the project in order to reach the benchmark of 8%.

**Annual O&M Cost**
The O&M costs were estimated by an experienced design institute which has been awarded the highest certificate (grade A), taking into account the experience of Developer, who have been involved in several projects. The estimated average annual O&M costs is 2.8% of total static investment, and falls into the range of from 1.2% to 3.7%[23] which is the costs of other registered wind projects in Jilin province. Therefore, it can be concluded that the estimated average annual O&M costs in the FSR are reasonable.

The O&M costs in the approved FSR were derived from the extensive experience of the design institute. Past trends show that costs have been rising as the same as prices, including those of the required equipment and commodities, in recent years, a significant reduction in the level of O&M costs is unlikely[24]. Therefore, it is not credible to assume 47.79% reduce of the Annual O&M Cost.

**Outcomes of step 2:**
Based on the investment analysis above, the proposed project is not financially attractive without the

[23] Statistics of all registered wind farm CDM projects in Jilin Province has been provided to DOE
[24] *The Development of Wind Power*, People's Daily, http://energy.people.com.cn/GB/5720709.html, as above.

revenues generated from CER sales. Thus, alternative a) of the proposed project is not feasible unless it is registered as a CDM project activity.

**Step 4 Common practice analysis**

In line with the "Tool for the demonstration and assessment of additionality" (version 06.0.0), four types of measures are currently covered in the framework:

(a) Fuel and feedstock switch;

(b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);

(c) Methane destruction;

(d) Methane formation avoidance.

As a newly-built wind farm project, the proposed project belongs to the type (b) of the measures listed above. Therefore, the existing common practice is identified and discussed through the following 4 steps:

***Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity:***

The total installed capacity of the proposed project is 30 MW. So the applicable capacity range as +/-50% of the design capacity is identified as 15~45 MW.

***Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number $N_{all}$. Registered CDM project activities and projects activities undergoing validation shall not be included in this step;***

In China, the regulatory framework and investment climate for wind power plants are only similar and comparable for projects connected to the same grid and located in the same Province/Autonomous Region. Therefore, the applicable geographical area is identified as Jilin Province. The proposed project was approved by the Jilin DRC and the project company was registered in Jilin as well.

According to the above analysis and considering the requirements, $N_{all}$ is identified as:

1. With capacity range in 15~45 MW in Jilin province.
2. Started commercial operation before 08/11/2011 (the project starting date);
3. Excluded registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process

According to the available data, $N_{all}$ is listed as following:

**Table B-8 List of $N_{all}$[25]**

| Type | Number |
| --- | --- |
| Coal/oil/gas fired power | 0[26] |
| Waste gas/heat/pressure recovery | 0[27] |

[25] China Electric Power Yearbook 2011 and Water Resource Year Book 2006

[26] *Notice on Strictly Prohibiting the Illegal Installation of coal-fired Generators with the Capacity of 135MW or below* issued by the General Office of the State Council, Guo Ban Fa Ming Dian decree No. 2002-6; and "*The State Council approves the notice for accelerating closures of small thermal power units by the NDRC, Energy Office*", Guofa [2007] Nr.2, issued by the State Council, the coal and oil turbine generator units with a capacity lower than 50MW should be shut down during the 11th five-year plan. Therefore, the number of coal/gas/oil fired projects belonging to $N_{all}$ is 0.

[27] According to *China Electric Year Book 2009, 2010 and 2011* which have identified the new capacity separately for fossil-fuel fired power plant. In 2008, other than coal/gas/oil fired power, 10MW other fossil fuel fired power was installed in Jilin; in 2009, 42MW solid waste power was installed and 30 MW biomass power; in 2010, 60.5MW waste heat/gas/pressure power projects, 30MW solid waste power and 8.9MW biomass power were installed. From 2009 to 2010, the waste heat/gas/pressure projects, in jilin, listed under UNFCCC have reached capacity of 118 MW.

| Type | Number |
|---|---|
| Solid waste power | 1[28] |
| Biomass power | 0[29] |
| Wind farm | 0[30] |
| Hydropower | 5 |
| Solar power | 0 |
| Geothermal power | 0 |
| Nuclear power | 0 |

**Table B-9 List of Hydropower projects in $N_{all}$**

| No. | Project Name | Reference |
|---|---|---|
| 1 | Jiang koudong Hydropower (33MW) | http://wenku.baidu.com/view/e235f342336c1eb91a375d43.html |
| 2 | Shenbu Hydropower (26.5MW) | |
| 3 | Huangshanpo Hydropower (30MW) | |
| 4 | Xijingou Hydropower (30MW) | |
| 5 | Huilongfeng Hydropower (17.5MW) | |

Therefore, $N_{all}$ = 6.

***Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number $N_{diff}$.***
As listed above, obviously the identified projects are using the different technologies. Thus, $N_{diff}$ =6;

***Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.***
The proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:
(a) The factor F is greater than 0.2, and
(b) $N_{all}$-$N_{diff}$ is greater than 3.

For the proposed project activity:
*F=1-1*=0<0.2, and $N_{all}$ - $N_{diff}$ =0<3
Therefore, the proposed project activity is not a common practice regarding the applicable capacity range in the applicable geographical area.

**Outcomes of step 4:**
From the above analysis and discussion, the proposed project is not a common practice.

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[28] http://wenku.baidu.com/view/8adb4b610b1c59eef8c7b4fc.html
[29] According to *China Electric Year Book 2009, 2010 and 2011* which have identified the new capacity separately for fossil-fuel fired power plant. In 2008, other than coal/gas/oil fired power, 10MW other fossil fuel fired power was installed in Jilin; in 2009, 42MW solid waste power was installed and 30 MW biomass power; in 2010, 60.5MW waste heat/gas/pressure power projects, 30MW solid waste power and 8.9MW biomass power were installed. From 2009 to 2010, the biomass power projects, in Jilin, listed under UNFCCC have reached capacity of 130 MW.
[30] https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp
"Statistics of domestic wind farm installation capacity in 2007", Shi Pengfei, see http://www.cwea.org.cn/download/display_info.asp?id=25. And "Statistics of domestic wind farm installation capacity in 2008", Shi Pengfei and "Statistics of domestic wind farm installation capacity in 2009", Shi Pengfei;

In conclusion, the proposed project activity is additional.

## B.6. Estimation of emission reductions

### B.6.1. Explanation of methodological choices

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ACM0002 and *2011 Baseline Emission Factors for Regional Power Grids in China* are applied as the following steps, and the data are from *China Electric Power Yearbook* and *China Energy Statistics Yearbook.*

I. Calculating the Baseline Emission ($BE_y$);

II. Calculating the Project Emission ($PE_y$);

III. Calculating the Leakage Emission ( $L_y$);

IV. Calculating the Emission Reduction ($ER_y$).

**I. Calculating the Baseline Emission**

The baseline emission factor is calculated as a Combined Margin, which consists of the weighted average of Operating Margin emission factor and Build Margin emission factor by utilizing the latest data vintage for NECPG, then the baseline emission ($BE_y$) is the product of the baseline emission factor ($EF_y$) times the electricity supplied by the project activity to the grid ($EG_y$) .

According to Tool to calculate the emission factor for an electricity system (Version 02.2.1), seven steps are applied to calculate the baseline emission factor:

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

**Step 1. Identify the relevant electricity systems**

The power generated by the project will be supplied to the NECPG. According to "2011 Baseline Emission Factors for Regional Power Grids in China" which is renewed by the Office of the National Coordination Committee on Climate Change of the National Development and Reform Commission (NDRC) of China (the Chinese DNA) in 20th October 2011, the NECPG is a regional grid, which covers Heilongjiang Province, Jilin Province and Liaoning Province.

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

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

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

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

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

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

Because the detailed dispatch data of NECPG is unavailable, method (c) and method (b) are not applicable.

According to the total electricity generated in 2005-2009 by NECPG, the low-cost/must run resources

constitute less than 50% of total amount of grid generating output. Therefore, the Average OM method is not applicable.
The Simple OM method can be used to calculate the OM emission factor.
For the simple OM method, the emission factor can be calculated using either of the two following data vintage:
Ex ante option: A three year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

Ex post option: The year in which the project activity displace grid electricity, requiring the emission factor to be updated annually during monitoring.

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

**Step 4. Calculate the operating margin emission factor according to the selected method**
According to the Tool, the simple OM emission factor in y year ($EF_{grid, OMsimple,y}$) is calculated as generation-weighted average $CO_2$ emissions per unit net electricity generation ($tCO_2e/MWh$) of all generating power plants serving the system, not including low-cost / must-run power plants. It may be calculated:

Option A: Based on the net electricity generation and a $CO_2$ emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

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

In China, there is no available data for the detailed net electricity generation and CO2 emission factor of each power unit; only nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and off-grid power plants are not included in the calculation. Therefore option B is selected for calculating the OM emission factor. The formula of $EF_{grid,OM,simple,y}$ is

$$EF_{grid,OM,simple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad (1)$$

Where:
$FC_{,j,y}$ = Amount of fossil fuel type *i* consumed in NECPG in year *y* (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y*(GJ/mass or volume unit)
$EF_{CO2,i,y}$ = $CO_2$ emission factor of fossil fuel type in year y(t $CO_2$/GJ)
$EG_y$ = Net electricity generated and delivered to NECPG 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 NECPG in year y
*y* = the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option)

**Step 5. Calculate the build margin (BM) emission factor**
According to *Tool to calculate the emission factor for an electricity system*, the sample group of power units *m* used to calculate the build margin consists of either:

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

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

The Tool emphasizes that project participants should use the set of power units that comprises the larger annual generation, so we choose (b) to calculate.
In terms of vintage of data, project participants can choose between one of the following two options:
Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based

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

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

The proposed project applies option 1 to calculate the build margin emission factor ex-ante. But recently in China, the power plants see the build margin as the vital business data, so it is very difficult to find the available data about the power units consists of either the set of five power units that have been built most recently, or the set of power capacity additions in the electricity system generation (in MWh) and that have been built most recently. To resolve this problem, the Executive Board (EB) has approved the project participants to use the methodological deviation [31]as follows:
(1) Use of capacity additions during the last 1-3 years for estimating the build margin emission factor for grid electricity.
(2) Use of weights estimated using installed capacity in place of annual electricity generation. And it is suggested that the project participants use the efficiency level of the best technology commercially available in the provincial, regional or national grid of China, as a conservative proxy.

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (2)$$

Where:
$EF_{grid,BM,y}$ = Build Margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)
EGm,y = Net Quantity of electricity generated and delivered to NECPG by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = $CO_2$ emission factor of power unit *m* in year *y* ($tCO_2/MWh$)
*m* = Power units included in the build margin

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

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

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

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

Where:

$Fi_{,m,y}$ = Amount of fossil fuel type *i* consumed by power unit *m* in year *y*(Mass or volume unit), while *m* refers to the power resource delivering electricity to NECPG not including low-operating and must-run power plants and including imports to the grid

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

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

*m* = Power units included in the build margin

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

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

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total fuel-fired installed capacity, according to the permitted deviation by CDM EB, the Build Margin emission factor ($EF_{grid,BM,y}$ ) will be calculated as :

1) Based on the most recent year's energy balance of NECPG, calculating the percentages of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired $CO_2$ emissions;

2) based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the fuel-fired emission factor of NECPG;

3) calculating the Build Margin emission factor ($EF_{grid,BM,y}$) through fuel-fired emission factor times the weighted-average of fuel-fired installed capacity which is more close to 20% in the new capacity additions. The detailed calculation is as follows:

***Sub-Step 5a. Calculating the percentages of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired $CO_2$ emissions.***

$$\lambda_{coal} = \frac{\sum_{i \in coal,m} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}} \quad (4)$$

$$\lambda_{oil} = \frac{\sum_{i \in oil,m} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}} \quad (5)$$

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

Where:
$F_{i,j,y}$ = the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*
$COEF_{i,j,y}$ = the $CO_2$ emission coefficient of fuel *i* ($tCO_2e$/ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*
$\lambda_{Coal}$ = the percentage of $CO_2$ emissions from the coal-fired power plants in total fuel-fired $CO_2$ emissions;
$\lambda_{Oil}$ = the percentage of $CO_2$ emissions from the oil-fired power plants in total fuel-fired $CO_2$ emissions;
$\lambda_{Gas}$ = the percentage of $CO_2$ emissions from the gas-fired power plants in total fuel-fired $CO_2$ emissions;

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

**Sub-Step 5b. Calculating the fuel-fired emission factor**

$$EF_{thermal} = \lambda_{coal} \times EF_{coal,ADV} + \lambda_{oil} \times EF_{oil,ADV} + \lambda_{gas} \times EF_{gas,ADV} \quad (7)$$

Where:
$EF_{Thermal}$ = the fuel-fired emission factor;
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas.Adv}$ are corresponding to the emission factors of coal, oil and gas fired power plants which are applied by the most advanced commercialized technologies:
The weighted average of coal consumption per kWh supplied of 30 new built 600MW sub critical units in 2009 is adopted to determine the emission factor of the best advanced coal fired generation technology, which is 311.5 gce/kWh. In other words, the efficiency of best advanced coal fired generation technology is 39.45%.
The maximum electricity supplied efficiency of oil and gas fired generation plants are regarded as approximate estimation of commercially optimal efficiency technology. Similarly, the fuel consumption per kWh supplied of best advanced oil and gas fired generation technology is determined to be 237. 4 gce/kWh, which means a generation efficiency of 51.77%.
The installation capacity, generation data, and average self-consumption rate data are from the China Electric Power Yearbooks 2008- 2010. The data of fuel consumption per electricity generated and low calorific values of fuels are from the China Energy Statistics Yearbooks 2007- 2009. The $EF_{CO2,i}$ and $OXID_i$ data by fuels are from Table 1-2 in P.1.6 and Table 1-4 in P.1.8 in first chapter of "2006 IPCC Guidelines for National Greenhouse Gas Inventories".

**Sub-Step5c. Calculating the Build Margin Emission Factor**

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

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

**Step 6. Calculation of the combined margin (CM) emission factor**

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

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

$EF_{grid,OM,,y}$ =Operating margin $CO_2$ emission factor in year *y* ($tCO_2$/MWh)
$\omega_{OM}$ =Weighting of operating margin emissions factor (%)
$\omega_{BM}$ =Weighting of build margin emissions factor (%)
According to Methodological Tool, the default weights of wind farm project are follows:
$\omega_{OM}$ =0.75, $\omega_{BM}$ = 0.25.

Therefore, baseline emission can be calculated as below:

$$BE_y = EF_{grid,CM,y} \times EG_y \quad (10)$$

Where:
$BE_y$=Baseline emission in year *y* ($tCO_2$/year) y BE
$EG_y$=Electricity supplied by the project activity to NECPG in year *y* (MWh/year)
$EF_{grid,CM,y}$=Combined margin $CO_2$ emission factor of NECPG in year *y* ($tCO_2$/MWh)

**II. Project Emission**
According to the methodology, there are no expected project emissions for a wind farm project. Therefore, $PE_y = 0$

**III. Leakage Emission**
According to the methodology, the leakage of the project need not be considered. Therefore, $L_y$=0.

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

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

**B.6.2. Data and parameters fixed ex ante**

| **Data/Parameter** | *EGy* |
|---|---|
| Data unit | MWh |
| Description | Net electricity generated and delivered to NECPG in year y |
| Source of data | China Electric Power Yearbook 2008-2010 |
| Value(s) applied | Refer to Appendix 4 for details |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | *FCi, y* |
|---|---|
| Data unit | Mt, $Mm^3$ |
| Description | Amount of fossil fuel type *i* ( in a mass or volume unit) consumed in NECPG in year *y* |
| Source of data | China Energy Statistics Yearbook 2008-2010 |
| Value(s) applied | Refer to Appendix 4 for details |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | $EF_{CO2,i,y}$ |
|---|---|
| Data unit | $tCO_2/GJ$ |
| Description | $CO_2$ emission factor of fossil fuel type *i* in year *y* |
| Source of data | 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value(s) applied | Refer to Appendix 4 for details |
| Choice of data or measurement methods and procedures | Data that is collected from the IPCC because the local data is not available. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | $NCV_{i,y}$ |
|---|---|
| Data unit | GJ/mass or volume unit |
| Description | Net calorific value (energy content) of fossil fuel type *i* in year *y* |
| Source of data | China Energy Statistics Yearbook 2010 |
| Value(s) applied | Refer to Appendix 4 for details |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | CAP |
|---|---|
| Data unit | MW |
| Description | Installed capacities of NECPG |
| Source of data | China Energy Statistics Yearbook 2018~2010 |
| Value(s) applied | Refer to Appendix 4 for details |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | *Auxiliary Power Ratio* |
|---|---|
| Data unit | % |
| Description | The auxiliary power ratio of source *j* in NECPG |
| Source of data | China Energy Statistics Yearbook 2018~2010 |
| Value(s) applied | Refer to Appendix 4 for details |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | $EF_{Coal,, Adv}$ |
|---|---|
| Data unit | % |
| Description | The fuel consumption rate of Coal-fired power plants which are applied by the most advanced commercialized technologies |
| Source of data | From Chinese DNA |
| Value(s) applied | 39.45% |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | $EF_{Oil,, Adv}$ |
|---|---|
| Data unit | % |
| Description | The fuel consumption rate of Oil-fired power plants which are applied by the most advanced commercialized technologies |
| Source of data | From Chinese DNA |
| Value(s) applied | 51.77% |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | $EF_{Gas,, Adv}$ |
|---|---|
| Data unit | % |
| Description | The fuel consumption rate of Gas-fired power plants which are applied by the most advanced commercialized technologies |
| Source of data | From Chinese DNA |
| Value(s) applied | 51.77% |
| Choice of data or measurement methods and procedures | Data that is collected from the Chinese official statistics. |
| Purpose of data | Official data, used for OM and BM calculation |
| Additional comment | |

| **Data/Parameter** | $EF_{OM,y}$ |
|---|---|
| Data unit | tCO2/MWh |
| Description | Operating Margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Source of data | http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2706.xls |
| Value(s) applied | 1.0852 |
| Choice of data or measurement methods and procedures | As per the "Tool to calculate the emission factor for an electricity system" (version 02.1.1) |
| Purpose of data | |
| Additional comment | |

| **Data/Parameter** | $EF_{BM,y}$ |
|---|---|
| Data unit | $tCO_2/MWh$ |
| Description | Build Margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Source of data | http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf |
| Value(s) applied | 0.5987 |
| Choice of data or measurement methods and procedures | As per the "Tool to calculate the emission factor for an electricity system" (version 02.1.1) |
| Purpose of data | |
| Additional comment | |

| **Data/Parameter** | $EF_{grid,CM,y}$ |
|---|---|
| Data unit | $tCO_2/MWh$ |
| Description | Combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Source of data | http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf |
| Value(s) applied | 0.9635 |
| Choice of data or measurement methods and procedures | As per the "Tool to calculate the emission factor for an electricity system" (version 02.1.1) |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | The value is fixed ex-ante |

### B.6.3. Ex ante calculation of emission reductions

>>

**I. Baseline Emission**

Therefore, the Operating Margin emission factor ($EF_{grid,OM,simple,y}$) is the weighted emission factors of 2007-2009:

$EF_{grid,OM,simple,y}$ = 1.0852 $tCO_2e/MWh$

The Build Margin emission factor can be calculated by formula (2)-(8):

$EF_{grid,BM,y}$ =0.5987 $tCO_2e/MWh$

The baseline emission factor $EF_{,grid,CM,,y}$ is calculated as formula (9). Thus,

$EF_{,grid,CM,,y}$ = 0.9635 $tCO_2e/MWh$

The baseline emission $BE_y$ is calculated as formula (10):

$BE_y$ = 0.9635× 63,391.1＝ 61,077 $tCO_2e$ /year

Refer to Appendix 4 for details.

**II. Project Emission**

$PE_y$ = 0.

**III. Leakage Emission**

$L_y$= 0.

**IV. Emission Reduction**

The Emission Reductions ($ER_y$) for the proposed project activity could be calculated as the formula (14):

$ER_y$ = 61,077 - 0 - 0 = 61,077 $tCO_2e$/year

### B.6.4. Summary of ex ante estimates of emission reductions

| Year | Baseline emissions ($t CO_2e$) | Project emissions ($t CO_2e$) | Leakage ($t CO_2e$) | Emission reductions ($t CO_2e$) |
|---|---|---|---|---|
| 01/09/2013~31/12/2013 | 20,359[32] | 0 | 0 | 20,359 |
| 01/01/2014~31/12/2014 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2015~31/12/2015 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2016~31/12/2016 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2017~31/12/2017 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2018~31/12/2018 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2019~31/12/2019 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2020~31/12/2020 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2021~31/12/2021 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2022~31/12/2022 | 61,077 | 0 | 0 | 61,077 |
| 01/01/2023~31/08/2023 | 40,718[33] | 0 | 0 | 40,718 |
| **Total** | 610, 770 | 0 | 0 | 20,359 |
| **Total number of crediting years** | 10years | | | |
| **Annual average over the crediting period** | 61,077 | 0 | 0 | 61,077 |

## B.7. Monitoring plan

### B.7.1. Data and parameters to be monitored

| **Data/Parameter** | $EG_{export,y}$ |
|---|---|
| Data unit | MWh |
| Description | Electricity supplied to NECPG by the proposed project in year *y*. |
| Source of data | Measured by power meter(M1)[34] |
| Value(s) applied | 63,391.1 |
| Measurement methods and procedures | Measured by multi-function electronic energy meter |
| Monitoring frequency | Measured continuously and recorded on a monthly basis. |

[32] 61,077/12*4=20,359

[33] 61,077/12*8=40,718

[34] As shown in Figure A-2

| | |
|---|---|
| QA/QC procedures | The accuracy of the power meter is 0.2S. The measurement will be in compliance with the national guidelines and requirements of the grid company for accuracy and reliability. The meter was periodically checked according to the national standard by authorized organisation. Cross checked by recorders or sales receipts from local grid company. |
| Purpose of data | Baseline calculation |
| Additional comment | - |

| **Data/Parameter** | $EG_{import,y}$ |
|---|---|
| Data unit | MWh |
| Description | Electricity imported from NECPG by the proposed project in year *y.* |
| Source of data | Measured by power meter (M1[35]) |
| Value(s) applied | |
| Measurement methods and procedures | Measured by multi-function electronic energy meter |
| Monitoring frequency | Measured continuously and recorded on a monthly basis. |
| QA/QC procedures | The accuracy of the power meter is 0.2S. The measurement will be in compliance with the national guidelines and requirements of the grid company for accuracy and reliability. The meter was periodically checked according to the national standard by authorized organisation. Cross checked by recorders or sales receipts from local grid company. |
| Purpose of data | Baseline calculation |
| Additional comment | - |

| **Data/Parameter** | $EG_{facility,y}$ |
|---|---|
| Data unit | MWh |
| Description | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data | Calculated based on monitored data $EG_{export,y}$ & $EG_{import,y}$ <br> $EG_{facility,y}=EG_{export,y}-EG_{import,y}$ |
| Value(s) applied | 63,391.1 |
| Measurement methods and procedures | - |
| Monitoring frequency | Measured continuously and recorded on a monthly basis. |
| QA/QC procedures | $EG_{facility,y}$ is calculated as $EG_{export,y}$ minus $EG_{import,y}$, both of which are continuously measured by the main meter M1 installed at the high voltage side of onsite Substation. The accuracy of the power meter is 0.2S. The measurement will be in compliance with the national guidelines and requirements of the grid company for accuracy and reliability. The meter was periodically checked according to the national standard by authorized organisation. Cross checked by recorders or sales receipts from local grid company |
| Purpose of data | Emission reduction calculation |
| Additional comment | |

### B.7.2. Sampling plan

>>

No sampling required as the all parameter will be monitored directly.

### B.7.3. Other elements of monitoring plan

>>

The monitoring plan is to serve as a guideline for the project owner to monitor the emission reduction of the proposed project. A more detailed Monitoring and Management Manual of the proposed

[35] As shown in Figure A-2

project will be completed before the date of operating the first wind turbine.

**1. Monitoring management structure**

In order to obtain effective monitored data, the project owner will establish a CDM Monitoring Office and designate qualified staffs responsible for all relevant matters, including monitoring, data collection and archiving, QC/QA, and verification. The structure of the CDM Monitoring Office is outlined in Figure B1.-2.

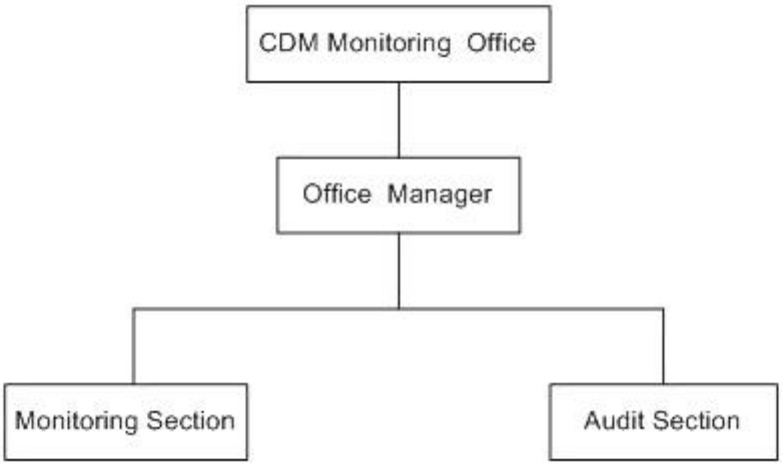


Figure B1.-2 Organization Chart of the CDM Project Management Office

The responsibilities of the sections are briefly described as following:

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

**2. Monitoring parameter**

The main parameters to be monitored are $EG_{export,y}$, and $EG_{import,y}$ , $EG_{facility,y}$ used to calculate the emission reduction is calculated as $EG_{export,y}$,- $EG_{import,y}$. The calibration procedure, QA/QC and data management of the project has been implemented.

**3. Meters and Metering**

As showed in Figure A.1-2, the bi-directional meter $M_1$ will be installed to monitor $EG_{export,y}$ and $EG_{import,y}$. The $M_1$ has been used to monitor electricity imported and exported from the project. The accuracy of the meters is 0.2s.

The power has been measured and recorded electronically. The detailed information has been written in the Monitoring and Management Manual and updated in accordance with PPA.

**4. Calibration of Meters**

The metering system has beenchecked and calibrated by the qualified checking institute in compliance with the requirements of Checking Regulation of Electronic Power Meters (JJG 596-1999) or Technical Management Regulation of Power Metering Device (DLT448-2000). The frequency of calibration is once a year, and the validated periods of all calibration reports should be successive.

**5. Data management system**

The data management system has been established to save data and information during the monitoring process. All the monitoring and calculated records should be archived in electric

documents and paper documents. The paper documents, such as maps, diagrams and Environmental Impact Assessment (EIA) Report, should be kept at the fixed location together with the monitoring plan.

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

**6. Training**

Monitoring training is critical to ensure that all members of the CDM Monitoring Team has a thorough understanding of the monitoring procedure, maintenance knowledge and are able to carry out the monitoring and maintenance tasks strictly in line with the CDM requirements. The team leader is responsible for evaluating training outcome. Only qualified staffs can work on duty. The training is including:

- Training on operation and monitoring system of the wind farm. This is the type of training which are routinely carried out by the wind farm itself for new staffs.
- Training on CDM basics with focus on monitoring. It has been carried out by the CDM consultancy company before the project is implemented. The CDM monitoring manual has been used as the primary training materials.
- Learning basic maintenance knowledge. This is also a type of training for all new staffs.
- Training on operation and maintenance of the wind farm.

## SECTION C. Start date, crediting period type and duration

### C.1. Start date of project activity

>>

8th November 2011 (the signing date of construction contract of the on-site substation and office building)

The wind turbine purchasing contract and the loan agreement were signed after. Therefore, the earliest date as mentioned above is determined as the starting date of the project activity.

### C.2. Expected operational lifetime of project activity

>>

20years

### C.3. Crediting period of project activity

#### C.3.1. Type of crediting period

>>

10years fixed crediting period

#### C.3.2. Start date of crediting period

>>

01/09/2013

#### C.3.3. Duration of crediting period

>>

01/09/2013~31/08/2023

## SECTION D. Environmental impacts

### D.1. Analysis of environmental impacts

>>

The EIA of the proposed project was completed by Jilin Environmental Protection Science and Technology Co., Ltd. in November 2010, and approved by Jilin Environmental Protection Administration on 3rd December 2010. The summary of this assessment is as following:

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

**Ambient air:** The air pollution in the construction period is mainly due to the dust emitted from the construction activities including the earth excavation, loading/uploading of construction materials, vehicle transportation, and etc.. Measures recommended include onsite sprinkling for dust control, and stopping construction during windy days.

**Acoustic environment:** Noise during the construction period mainly comes from the construction machinery and transportation vehicles. Measures include strict construction management and forbidding construction activities within 600m around residential area at night.

**Water environment:** Wastewater during construction mainly includes a little domestic wastewater and construction wastewater. Measures recommended include: collecting construction wastewater and reusing after settling; setting temporary WC, and using the residues as fertilizer.

**Solid waste:** Construction wastes (e.g. waste packing materials, construction scrap, and etc.) and excavated materials will be dumped and covered with grass planting on the top. Domestic solid waste will be collected regularly and deposited in landfilled area of the county and treated by the local sanitary department.

**Ecological Environment:** the construction equipment will be strictly maintained, preventing from leaking any oil or dust discharged into the water; no resource, like earth, stone and wood could be taken within 100 m to the protection area; no water in the lakes could be used; toxic construction materials, as cement, is prohibited to be put near the lakes and the staffs are forbidden to fishing and hurting birds.

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

**Acoustic environment:** The operation of wind turbines constitutes the major source of noise during the operational period. According to the noise attenuation calculation, the noise protection distance is 300 m from the proposed site. The nearest resident area is farther than 350 m, and therefore the noise impact of the proposed project on the surrounding residents is negligible.
**Ambient air:** The operation of wind farm will not impact the air quality. And the heat will be generated from electricity during winter time.

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

**Solid Waste:** Domestic solid waste generated from the staff activities during the operation period of the proposed project will be collected and deposited in landfilled area of the county and treated by the local sanitary department.

**Ecological Environment:** The nearest turbine is over 5.63 km away from the central protection area, over the 5.5 km wind farm impact scope. And according to the local investigation, no rare species

inhabits in the near area. Construction of the proposed project will only change the inhabit area of same local species a little, no species disappearance or biodiversity reduce will be caused. According to the bird experts, since most of the birds in the protection area are big size birds, the turbines will not impact their fly, especially the project site is far from the protection area and only will influent a little to the migration of some kinds of the birds.

**Conclusion**

As described above, there is no negative impacts were found. Furthermore, as a renewable power project, the proposed project can reduce the consumption of fossil fuel sources and GHG emission. In addition, the operation of the proposed project will improve the development of the local tourism.

## D.2. Environmental impact assessment

>>

According to EIA, no negative environmental impacts are discovered by the project participants or the host party. Jilin Environmental Protection Administration has approved the EIA on 3rd December 2010.

## SECTION E. Local stakeholder consultation

### E.1. Modalities for local stakeholder consultation

>>
To ensure the proposed project meet the requirements of CDM project development procedures and really contribute to local sustainable development, the project owner has, then, carried out a one month investigation on the public's comments in October of 2011, by the formats of questionnaires, meeting and notification.

1. Collecting suggestions through notification

On 11th October 2011, project notifications were put up in the neighboring areas of the project site and the company site. The notification contained the introduction of the project and CDM, and comments can be accessed through e-mail or telephone to the project owner. Also an invitation for stakeholder meeting on 30th October 2011 was published in the notification.

2. Investigating stakeholders through meeting and questionnaires

After inviting the stakeholders through notification and individually, on 30th October 2011, a public consultation meeting was held in the meeting room of the Baliang Town Government, at 1:00 pm.. The project overview and the CDM procedures were introduced in detail to the public in this meeting, and 44 questionnaires were distributed and all of the distributed questionnaires had been returned. The meeting participants includes: residents in the neighboring area, governmental officials, staff from the project owner company, and other related persons.
The basic information of the attendants who attended the meeting and filled the questionnaires is:

Table E-1 Basic information of the attendants:

| Item | Type | Number | Percentage |
|---|---|---|---|
| Sexual | Male | 43 | 97.73% |
| | Female | 1 | 2.27% |
| Age | Below 20 | 0 | 0 |
| | 21~30 | 5 | 11.36% |
| | 31~40 | 20 | 45.45% |
| | Above 41 | 19 | 43.18% |
| Education Background | Primary school or lower | 5 | 11.36% |
| | High School | 39 | 88.64% |
| | Junior college or above | 0 | 0% |

The questions in the questionnaires distributed in the meeting including:

- Do you support the construction of the proposed project?
- What do you think is there any air pollution/water pollution /noise/electromagnetic interference? If any, what's the extent?
- What do you think the influence on the conditions of the local ecosystem?
- What do you think the influence on your life and income?
- What do you think the influence on local employment?
- What do you think the influence on local power distribution?
- What do you think the influence on the local economic development?
- From the perspective of environmental protection and residents' interest, do you have any suggestions about the project construction and operation?

### E.2. Summary of comments received

>>
Comments were received from EIA, the consultation meeting and also from the questionnaires received. No further comments were received.

1. Comments from the stakeholder consultation meeting on 30th October 2011.

Meeting participants generally support the proposed project and none of them opposite it as far as sustainable development is concerned. The proposed project is a renewable power project and in accords with the demands of establishing Songyuan as a sustainable developing city. The proposed project not only protects the local ecosystem efficiently and reduces the emission of GHG, but also promotes the local economic development and provides job opportunities.

2. Comments from questionnaires

During the stakeholder consultation meeting, 44 questionnaires had been delivered and all of them had been collected, 100% support the construction of the proposed project, and 100% think positive influences will be brought to the local economic, social, and cultural development, and promote incomes of the local people. No negative influence was thought can be produced.

3. Comments from the phone or fax

No comments were received by fax or by telephone.

### E.3. Consideration of comments received

>>

The residents and local government are all very supportive to the proposed project. No negative comments have been received on the proposed project.

## SECTION F. Approval and authorization

>>
The China LOA was received on Oct19th, 2012.

The Finland LOA was received on Nov 12th, 2012.

# Appendix 1. Contact information of project participants

| | |
|---|---|
| **Organization name** | Qianguo Gorlos Mongolian Autonomous County Daixu Wind Energy Co., Ltd. |
| **Country** | China |
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| **Website** | |
| **Contact person** | Mr. Dong Han |

| | |
|---|---|
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| | |
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| | |
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# Appendix 2. Affirmation regarding public funding

There will be no public funding or ODA used by project activity

## Appendix 3. Applicability of methodologies and standardized baselines

Please refer relevant section

# Appendix 4. Further background information on ex ante calculation of emission reductions

## BASELINE INFORMATION

### 1. Calculation of the simple Operating Margin (*OM*) Emission Factor

**Table A1. Operating margin data for the Northeast China Power Grid（2007）**

| Fuel types | Unit | **Liaoning** | **Jilin** | **Heilongjiang** | **Subtotal** | **Emission factor （tc/TJ）** | **Oxidation rate （%）** | **Emission factor (kg$CO_2$/TJ)** | **Low Caloric Value （MJ/t,km3）** | **$CO_2$ Emission (tCO2e) I=D*G*H/100000(t)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D=A+B+C** | **E** | **F** | **G** | **H** | **I=D*G*H/10000 (m3)** |
| Raw coal | $10^4$t | 4869.32 | 2873.45 | 3736.11 | **11478.88** | 25.8 | 100 | 87,300 | 20,908 | 209,520,369.31 |
| Cleaned coal | $10^4$t | | | | **0** | 25.8 | 100 | 87,300 | 26,344 | 0.00 |
| Other washed coal | $10^4$t | 747.85 | 16.52 | 106.81 | **871.18** | 25.8 | 100 | 87,300 | 8,363 | 6,360,397.19 |
| Cellular coal | $10^4$t | | | | **0** | 26.6 | 100 | 87,300 | 20,908 | 0.00 |
| Coke | $10^8m^3$ | 4.99 | | | **4.99** | 29.2 | 100 | 95,700 | 28,435 | 135,789.35 |
| Coke oven gas | $10^8m^3$ | 5.53 | 1.44 | 1.89 | **8.86** | 12.1 | 100 | 37,300 | 16,726 | 552,757.50 |
| Other coal gas | $10^4$t | 68.38 | 9.06 | | **77.44** | 12.1 | 100 | 37,300 | 5,227 | 1,509,825.22 |
| Crude oil | $10^4$t | 0.24 | | | **0.24** | 20 | 100 | 71,100 | 41,816 | 7,135.48 |
| Gasoline | $10^4$t | | | | **0** | 18.9 | 100 | 67,500 | 43,070 | 0.00 |
| Diesel | $10^4$t | 0.96 | 0.39 | 0.47 | **1.82** | 20.2 | 100 | 72,600 | 42,652 | 56,356.94 |
| Fuel oil | $10^4$t | 8.43 | 0.45 | 1.48 | **10.36** | 21.1 | 100 | 75,500 | 41,816 | 327,076.39 |
| LPG | $10^4$t | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0.00 |
| Refinery gas | $10^8m^3$ | 7.33 | | 1.99 | **9.32** | 15.7 | 100 | 48,200 | 46,055 | 206,890.11 |
| Natural gas | $10^4$t | | 0.02 | 2.03 | **2.05** | 15.3 | 100 | 54,300 | 38,931 | 433,360.43 |
| Other oil products | $10^4$t | 0.01 | | | **0.01** | 20 | 100 | 72,200 | 41,816 | 301.91 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Other coal chemicals | $10^4$t ce | 0.46 | | | **0.46** | 25.8 | 100 | 95,700 | 28,435 | 12,517.66 |
| Other energy | | 12.41 | 2.43 | 51.35 | **66.19** | 0 | 0 | 0 | 0 | 0.00 |
| | | | | | | | | | Total | 219,122,778 |

Data sources: China Energy Statistical Yearbook 2008

**Table A2. Fire power generation of Northeast China Power Grid (2007)**

| Name of the province | Generation | Rate of electricity used by factory | Power Supply | | |
|---|---|---|---|---|---|
| | (MWh) | (%) | (MWh) | | |
| Liaoning | 106,500,000 | 7 | 99,045,000 | Total emission amount tCO2 | 219,122,778 |
| Jilin | 43,700,000 | 7.68 | 40,343,840 | Total power supply MWh | 202,542,560 |
| Heilongjiang | 68,400,000 | 7.67 | 63,153,720 | Emission factor in 2006 | 1.08186 |
| Total | | | 202,542,560 | | |

Data sources: China Electric Power Yearbook 2008

**Table A3. Operating margin data for the Northeast China Power Grid （2008）**

| Fuel types | Unit | Liaoning | Jilin | Heilongjiang | Subtotal | Emission factor | Oxidation rate | Emission factor | Low Caloric Value | $CO_2$ Emission (tCO2e) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | （ tc/TJ ） | （%） | ($kgCO_2$/TJ ) | （ MJ/t,km3 ） | I=D*G*H/100000(t) |
| | | A | B | C | D=A+B+C | E | F | G | H | I=D*G*H/10000 (m3) |
| Raw coal | $10^4$t | 4973.05 | 3289.16 | 3873.45 | **12135.66** | 25.8 | 100 | 87,300 | 20,908 | 221,508,367.11 |
| Cleaned coal | $10^4$t | | | | **0** | 25.8 | 100 | 87,300 | 26,344 | 0.00 |
| Other washed coal | $10^4$t | 791.96 | 15.58 | 112.97 | **920.51** | 25.8 | 100 | 87,300 | 8,363 | 6,720,550.54 |
| Cellular coal | $10^4$t | | | | | | | | | |
| Coke | $10^4$t | 5.77 | | | **5.77** | 29.2 | 100 | 95,700 | 28,435 | 157,014.94 |
| Coke oven gas | $10^8m^3$ | 4.12 | 1.06 | 5.54 | **10.72** | 12.1 | 100 | 37,300 | 16,726 | 668,799.15 |
| Other coal gas | $10^8m^3$ | 61.11 | 7.63 | | **68.74** | 12.1 | 100 | 37,300 | 5,227 | 1,340,203.85 |
| Crude oil | $10^4$t | 0.37 | | | **0.37** | 20 | 100 | 71,100 | 41,816 | 11,000.54 |
| Gasoline | $10^4$t | 0.02 | | | | 18.9 | 100 | 67,500 | 43,070 | 0.00 |
| Diesel | $10^4$t | 0.84 | 1.07 | 0.37 | **2.28** | 20.2 | 100 | 72,600 | 42,652 | 70,601.00 |
| Fuel oil | $10^4$t | 10.64 | 1.06 | 1.29 | **12.99** | 21.1 | 100 | 75,500 | 41,816 | 410,108.33 |
| LPG | $10^4$t | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0.00 |
| Refinery gas | $10^4$t | 7.54 | | 3.77 | **11.31** | 15.7 | 100 | 48,200 | 46,055 | 251,065.15 |
| Natural gas | $10^8m^3$ | | 0.39 | 1.85 | **2.24** | 15.3 | 100 | 54,300 | 38,931 | 473,525.54 |
| Other oil products | $10^4$t | | | | **0** | 20 | 100 | 72,200 | 41,816 | 0.00 |
| Other coal chemicals | $10^4$t | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Other energy | $10^4$t ce | 16.9 | 3.04 | 68.19 | **88.13** | 0 | 0 | 0 | 0 | 0.00 |
| | | | | | | | | | Total | 231,611,236 |

Data sources: China Electric Power Yearbook 2009

**Table A4. Fire power generation of Northeast China Power Grid (2008)**

| Name of the Province | Generation | Rate of electricity used by factory | Power Supply | | |
|---|---|---|---|---|---|
| | (MWh) | (%) | (MWh) | | |
| Liaoning | 108,500,000 | 7.18 | 100,709,700 | Total emission amount tCO2 | 231,611,236 |
| Jilin | 46,400,000 | 7.76 | 42,799,360 | Total power supply MWh | 209,625,110 |
| Heilongjiang | 71,500,000 | 7.53 | 66,116,050 | Emission factor in 2008 | 1.104883 |
| Total | | | 209,625,110 | | |

Data sources: China Electric Power Yearbook 2009

**Table A5. Operating margin data for the Northeast China Power Grid （2009）**

| Fuel types | Unit | Liaoning | Jilin | Heilongjiang | Subtotal | Emission factor | Oxidation rate | Emission factor | Low Caloric Value | $CO_2$ Emission (tCO2e) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | （tc/TJ） | （%） | (kg$CO_2$/TJ) | （MJ/t,km3） | I=D*G*H/100000(t) |
| | | A | B | C | D=A+B+C | E | F | G | H | I=D*G*H/10000 (m3) |
| Raw coal | $10^4$t | 5297.77 | 2999.09 | 3691.92 | **11988.78** | 25.8 | 100 | 87,300 | 20,908 | 218,827,413 |
| Cleaned coal | $10^4$t | | | | **0** | 25.8 | 100 | 87,300 | 26,344 | 0 |
| Other washed coal | $10^4$t | 662.76 | 19.67 | 98.77 | **781.2** | 25.8 | 100 | 87,300 | 8,363 | 5,703,462 |
| Cellular coal | $10^4$t | | | 1.18 | **1.18** | 26.6 | 100 | 87,300 | 20,908 | 21,538 |
| Coke | $10^4$t | 4.19 | | | **4.19** | 29.2 | 100 | 95,700 | 28,435 | 114,020 |
| Coke oven gas | $10^8m^3$ | 4.97 | 1.77 | 2.51 | **9.25** | 12.1 | 100 | 37,300 | 16,726 | 577,089 |
| Other coal gas | $10^8m^3$ | 75.72 | 13.88 | 0.11 | **89.71** | 12.1 | 100 | 37,300 | 5,227 | 1,749,050 |
| Crude oil | $10^4$t | 0.79 | | | **0.79** | 20 | 100 | 71,100 | 41,816 | 23,488 |
| Gasoline | $10^4$t | | | | **0** | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | $10^4$t | 0.44 | 0.42 | 0.43 | **1.29** | 20.2 | 100 | 72,600 | 42,652 | 39,945 |
| Fuel oil | $10^4$t | 3.32 | 0.79 | 1.39 | **5.5** | 21.1 | 100 | 75,500 | 41,816 | 173,641 |
| LPG | $10^4$t | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Refinery gas | $10^4$t | 7.78 | | 3.21 | **10.99** | 15.7 | 100 | 48,200 | 46,055 | 243,962 |
| Natural gas | $10^8m^3$ | | 1.97 | 1.86 | **3.83** | 15.3 | 100 | 54,300 | 38,931 | 809,644 |
| Other oil products | $10^4$t | 0.44 | | | **0.44** | 20 | 100 | 72,200 | 41,816 | 13,284 |
| Other coal chemicals | $10^4$t | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other energy | $10^4$t ce | 18.24 | 15.93 | 107.82 | **141.99** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | Total | 228,296,535 |

Data sources: China Energy Statistical Yearbook 2010

**Table A6. Fire power generation of Northeast China Power Grid (2009)**

| Name of the Province | Generation | Rate of electricity used by factory | Power Supply | | |
|---|---|---|---|---|---|
| | (MWh) | (%) | (MWh) | | |
| Liaoning | 113,500,000 | 6.94 | 105,623,100 | Total emission amount tCO2 | 228,296,535 |
| Jilin | 47,300,000 | 7.89 | 43,568,030 | Total power supply MWh | 213,531,870 |
| Heilongjiang | 69,400,000 | 7.29 | 64,340,740 | Emission factor in 2007 | 1.06915 |
| Total | | | 213,531,870 | | |

Data sources: China Electric Power Yearbook 2010

**$EF_{OM,y}$ =1.0852 $tCO_2e/MWh$**

**2. Calculation of Build Margin (*BM*) Emission Factor**

The calculation of the BM for the Project makes use of aggregated data to identify the 20% most recent capacity addition (sample group). This is identified by direct comparison of the total installed capacity on NECPG in the most recent years for which data is available (for the Project, the year 2009). BM is determined by selecting the year since which the new capacity additions are equal to or greater than 20%.

**Table A7. Calculating the proportion of solid fuel, liquid fuel and gas fuel in total thermal power emission**

| Fuel types | Unit | Liaoning | Jilin | Heilongjiang | Total | NCV | Emission factor | Oxidation factor | $CO_2$ emission ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | kj/kg,$m^3$ | kgCO2/TJ | | H=G×D×E×F/100,000 (Mass unit) |
| | | A | B | C | D=A+B+C | E | F | G | H=G×D×E×F/10,000 (Volume unit) |
| Raw coal | $10^4$t | 5,297.77 | 2,999.09 | 3,691.92 | 11,988.78 | 20,908 | 87,300 | 1.00 | 218,827,412.89 |
| Cleaned coal | $10^4$t | 0 | 0 | 0 | 0 | 26,344 | 87,300 | 1.00 | 0.00 |
| Other washed coal | $10^4$t | 662.76 | 19.67 | 98.77 | 781.2 | 8,363 | 87,300 | 1.00 | 5,703,462.30 |
| Cellular coal | $10^4$t | 0 | 0 | 1.18 | 1.18 | 20,908 | 87,300 | 1.00 | 21,538.17 |
| Coke | $10^4$t | 4.19 | 0 | 0 | 4.19 | 28,435 | 95,700 | 1.00 | 114,019.52 |
| Other coke products | $10^4$t | 0 | 0 | 0 | 0 | 28,435 | 95,700 | 1.00 | 0.00 |
| **Total** | | | | | | | | | 224,666,433 |
| Crude oil | $10^4$t | 0.79 | 0 | 0 | 0.79 | 41,816 | 71,100 | 1 | 23,488 |
| Gasoline | $10^4$t | 0 | 0 | 0 | 0 | 43,070 | 67,500 | 1 | 0 |
| Diesel | $10^4$t | 0.44 | 0.42 | 0.43 | 1.29 | 42,652 | 72,600 | 1 | 39,945 |
| Fuel oil | $10^4$t | 3.32 | 0.79 | 1.39 | 5.5 | 41,816 | 75,500 | 1 | 173,641 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Other oil products | $10^4$t | 0.44 | 0 | 0 | 0.44 | 41,816 | 72,200 | 1 | 13,284 |
| **Total** | | | | | | | | | 250,358 |
| Natural gas | $10^8m^3$ | 0 | 19.7 | 18.6 | 38.3 | 38,931 | 54,300 | 1 | 809,644 |
| Coke oven gas | $10^8m^3$ | 49.7 | 17.7 | 25.1 | 92.5 | 16,726 | 37,300 | 1 | 577,089 |
| Other coal gas | $10^8m^3$ | 757.2 | 138.8 | 1.1 | 897.1 | 5,227 | 37,300 | 1 | 1,749,050 |
| LPG | $10^4$t | 0 | 0 | 0 | 0 | 50,179 | 61,600 | 1 | 0 |
| Refinery gas | $10^4$t | 7.78 | 0 | 3.21 | 10.99 | 46,055 | 48,200 | 1 | 243,962 |
| **Total** | | | | | | | | | 3,379,744 |
| | | | | | | | | | 228,296,535 |

Data sources: China Energy Statistical Yearbook 2010

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

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

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

where:

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

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

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

and COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

According to the data and related calculation formula， $\lambda_{Coal}$ =98.41%， $\lambda_{Oil}$ =0.11%， $\lambda_{Gas}$ =1.48%.

It could be obviously concluded from the calculation results above that the amount of gas-fired and oil-fired power is very small in NECPG, in the Project we could neglect the impacts of gas-fired and oil-fired power and it is conservative.

**The best commercially available thermal power plant:**

With reference to the *2011 Baseline Emission Factors for Regional Power Grid In China*, the efficiency level of the best commercially available of thermal power is set as 600MW domestic sub-critical generator sets. The weighted average value of coal consumption of power supply of 30 set of 600MW generator sets newly built in 2009 is taken as the estimation of the efficiency level of the best technology commercially available in the calculation result. The coal consumption of power supply of 600MW domestic sub-critical power plant is estimated to be 311.5gce/kWh, which is equivalent to 39.45% of power supply efficiency.

**Table A8. Emission factor of coal in NECPG**

| Technology | Variable | Efficiency of power supply | Emission Factor (kgCO2/TJ) | Oxidation rate | Emission Factor (tCO2/MWh) |
|---|---|---|---|---|---|
| | | A | B | C | D=3.6/A/1000000*B*C |
| Coal fired plant | $EF_{Coal,Adv}$ | 39.45 % | 87,300 | 1 | 0.7967 |
| Gas fired plant | $EF_{Gas,Adv}$ | 51.77 % | 75,500 | 1 | 0.5250 |
| Oil fired plant | $EF_{Oil,Adv}$ | 51.77 % | 54,300 | 1 | 0.3776 |

Data sources:
Electricity supply efficiency: China Energy Statistical Yearbook 2010;
Default carbon content: IPCC Guideline 2006
$OXID_i$ : IPCC Guideline 2006

$EF_{thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.7902\ tCO_2/MWh$

**Table A9. Installed capacity of the Northeast China Power Grid 2009**

| Installed capacity | Unit | Liaoning | Jilin | Heilongjiang | Total |
|---|---|---|---|---|---|
| Fire power | MW | 22,560 | 10,560 | 16,720 | 49,840 |
| Hydro power | MW | 1,460 | 3,900 | 940 | 6,300 |
| Nuclear power | MW | 0 | 0 | 0 | 0 |
| Wind power and other | MW | 1,740 | 1,480 | 1,200 | 4,420 |
| **Total** | MW | 25,760 | 15,940 | 18,860 | 60,560 |

Data sources: China Electric Power Yearbook 2010

**Table A10. Installed capacity of the Northeast China Power Grid 2008**

| Installed capacity | Unit | Liaoning | Jilin | Heilongjiang | Total |
|---|---|---|---|---|---|
| Fire power | MW | 19,900 | 8,350 | 16,570 | 44,820 |
| Hydro power | MW | 1,430 | 3,890 | 940 | 6,260 |
| Nuclear power | MW | 0 | 0 | 0 | 0 |
| Wind power and other | MW | 859 | 760 | 620 | 2,239 |
| **Total** | MW | 22,189 | 13,000 | 18,130 | 53,319 |

Data sources: China Electric Power Yearbook 2009

**Table A11. Installed capacity of the Northeast China Power Grid 2007**

| Installed capacity | Unit | Liaoning | Jilin | Heilongjiang | Total |
|---|---|---|---|---|---|
| Fire power | MW | 19,720 | 7,580 | 14,080 | 41,380 |
| Hydro power | MW | 1,410 | 3,890 | 870 | 6,170 |
| Nuclear power | MW | 0 | 0 | 0 | 0 |
| Wind power and other | MW | 359 | 514 | 230 | 1,103 |
| **Total** | MW | 21,489 | 11,984 | 15,180 | 48,653 |

Data sources: China Electric Power Yearbook 2008

**TableA12. Capacity additions of the Northeast China Power Grid from 2007 to 2009**

| | Installed capacity in 2007 | Installed capacity in 2008 | Installed capacity in 2009 | New added installed capacity 2007-2009 | New added installed capacity 2008-2009 | The fraction of newly added installed capacity |
|---|---|---|---|---|---|---|
| | A | B | C | | | |
| Thermal power（MW） | 41,380 | 44,820 | 49,840 | 10,772 | 6,646 | 75.76 % |
| Hydro power（MW） | 6,170 | 6,260 | 6,300 | 130.0 | 40.0 | 0.91 % |
| Nuclear power（MW） | 0 | 0 | 0 | 0.0 | 0.0 | 0.00 % |
| Wind power（MW） | 1,103 | 2,239 | 4,420 | 3317.0 | 2181.0 | 23.33 % |
| Total（MW） | 48653.0 | 53319.0 | 60560.0 | 14219.0 | 8867.0 | 100.00 % |
| The fraction of installed capacity compared with 2009 | | | | 23.48 % | 14.64 % | |

Data sources: China Electric Power Yearbook 2008-2010
*Calculated with the consideration of installed, shut-down and pumped storage capacity

**Table A13. Calculation of BM in NECPG**

| **A** | **B** | **F=A*B** |
|---|---|---|
| $EF_{thermal}$ (kg/MWh) | Share of thermal power plants in newly added total capacity | $EF_{BM,y}$ ($tCO_2$/MWh) |
| 0.7902 | 75.76% | 0.5987 |

So, $EF_{BM,y}$ =0.5987 $tCO_2e$/MWh

## Appendix 5. Further background information on monitoring plan

Please refer relevant section

## Appendix 6. Summary report of comments received from local stakeholders

Please refer relevant section

## Appendix 7. Summary of post-registration changes

Please refer relevant section