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

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Guangdong Taishan Shangchuandao Island Phase II Wind Farm Project
PDD version: 1.1
Date: 24/10/2008

A.2. Description of the project activity:

>>
Guangdong Taishan Shangchuandao Island Phase II Wind Farm Project (hereinafter referred as to "the project") is located in the Shangchuandao Island, Chuandao Town, Jiangmen City, Guangdong Province, China. The objective of the project is to generate renewable electricity from wind and the generated power will be accessed to the South China Power Grid (SCPG).

Based on the conditions of the project site, the developer is planning to install 43 wind turbines, each with a capacity of 850kW. The total installed capacity is 36.55MW. The expected net generation of the project activity is 70,460MWh per year. The expected of emission reductions is 68,332 tCO_2e per year once fully operational.

The project will assist China in stimulating and accelerating the commercialisation of grid-connected wind power technologies and markets which are an important objective of the Chinese government. The project will therefore help reduce GHG emissions versus the high-growth, coal-dominated business-as-usual scenario. Furthermore, the project will improve air quality and local livelihoods, promote sustainable renewable energy industry development.

The baseline scenario, therefore, is the same as the scenario existing prior to the implementation of the project activity, i.e. generation of electricity by grid connected power plants.

The project activity will promote the local and national sustainable development powerfully in the following aspects:

- Reduce greenhouse gas emissions in China compared to a business-as-usual scenario;
- Help to stimulate the growth of the wind power industry in China;
- Create local employment opportunity during the assembly and installation of wind turbines, and for operation of the wind farm;
- Reduce other pollutants resulting from the power generation industry, compared to a business-as-usual approach, such as SO_2, NO_x and soot.

A.3. Project participants:

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Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Party involved wishes to be considered as project participant (Yes/No)
P.R. China (host)	CGN Taishanchuandao Wind Power Co., Ltd.	No
United Kingdom of Great	Carbon Resource Management Ltd.	No

Britain and Northern Ireland		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

>>
People's Republic of China

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

>>
Guangdong Province

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

>>
Jiangmen City/ Chuandao Town/ Shangchuandao Island

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

>>
The project activity lies in the Shangchuandao Island, Chuandao Town, Jiangmen City, Guangdong Province, China. The coordination of the wind farm is as follow:
Latitude: 21°34′ (N) ~21°39′ (N)
Longitude 112°46′ (E)~ 112°47′(E)
Figure 1 shows the location of the project.

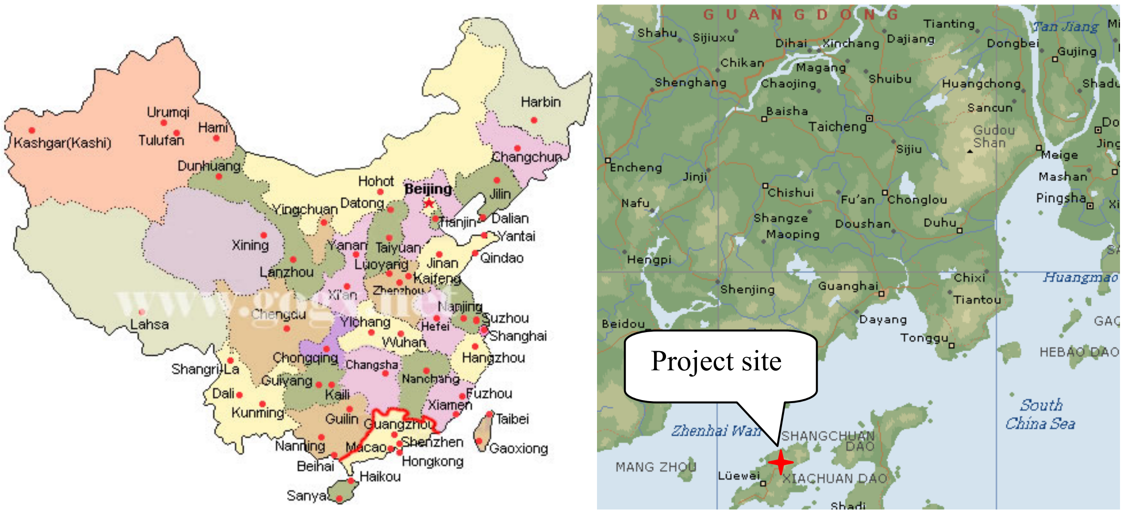

Figure 1: The location of the wind farm

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

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Sectoral Scope: 1. Energy Industries (Renewable sources).

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

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The project developer adopts advanced commercial wind-power technology for the construction of this proposed project activity. A total of 43 turbines with a capacity 850kW will be installed with the total installed capacity of 36.55MW. Net generation is expected to be 70,460MWh per year, once the project is fully operational, which is exported to the SCPG. The project activity is expected to be operational for 20 years.

The turbine manufacturers will provide on-the-job-training for staff of the proposed wind farm before the start of operation. The project developer already has successful experience on similar wind turbines and has trained staff.

The main technical specifications of the wind turbines are provided in Table 1.

Table 1 Main technical specifications of the installed wind turbines

Item	Value
Rated capacity (kW)	850kw
Rotor diameter (m)	52
Sweep-wind area (m^2)	2124
Cut-in speed (m/s)	4
Rated wind speed (m/s)	19
Cut-out speed (m/s)	25
Rated voltage of generator (V)	690

The project scenario is the installation of 43 wind turbines with an aggregate capacity of 36.55MW. The annual net electricity generation is estimated to be 70,460MWh once fully operational. The power generation is monitored by the electronic control and monitoring system in the onsite office, as well as through the electricity meter at the 110kV transformer station is planed at the project site, to connect the project with the 110kV grid.

Prior to the implementation of the project activity, the electricity was generated by grid-connected power plants. Without the implementation of the project, this scenario would have continued and is considered the baseline scenario.

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

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The project will achieve an ex-ante estimated average emission reduction of 68,332tCO_2 per year over the chosen 7-year renewable crediting period, as presented in Table 3 below.

The baseline emissions factor has been fixed for the first crediting period. In each year the amount of CERs actually generated by the project will depend on the metered electricity supplied by the project to the grid.

Table 2 Estimated emission reductions of the project in the first crediting period

Period	Annual estimation of emission reductions (tCO_2e)
01/07/2009-30/06/2010	68,332
01/07/2010-30/06/2011	68,332
01/07/2011-30/06/2012	68,332
01/07/2012-30/06/2013	68,332
01/07/2013-30/06/2014	68,332
01/07/2014-30/06/2015	68,332
01/07/2015-30/06/2016	68,332
Total estimated reductions (tCO_2e)	478,324
Total number of crediting years	7
Annual average of estimated reductions over the crediting period (tCO_2 e)	68,332

The baseline emissions factor has been fixed for the first crediting period. In each year the amount of CERs actually generated by the project will depend on the metered electricity supplied by the project to the grid.

A.4.5. Public funding of the project activity:

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No public funding from any of the UNFCCC Annex I country governments has been secured for the project.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of the approved methodology: *ACM0002 Consolidated methodology for grid-connected electricity generation from renewable sources* (Version 7, valid from 14 Dec 07 onwards)

Tools referenced in this methodology:
AM_Tool_01 "Tool for the demonstration and assessment of additionality"
Version 05.2 (EB 39)
AM_Tool_07 "Tool to calculate the emission factor for an electricity system"
Version 01.1 (EB 35)

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

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The approved methodology ACM0002 is applicable to the project activities, because:

- The project involves electricity capacity additions to the grid from wind power resources; and
- The project does not involve switching from fossil fuels to renewable energy at the site of the project activity; and
- The geographic and system boundaries of the SCPG can be clearly identified and information on the characteristics of the grid is public available.[1]

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

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Emission sources:

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

Spatial boundary:

The spatial extend of the project boundary includes the project site and all power plants connected to SCPG. SCPG is an electricity system which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains.

Using the boundary definitions of the Chinese DNA[2], SCPG consists of Guangdong, Guangxi, Yunnan and Guizhou power grids. The electricity transmission between different provinces in SCPG is very large and it is reasonable for the project to regard SCPG as the project boundary.

SCPG connects with Central China Power Grid (CCPG); the electricity transfers are from

[1] The boundary of SCPG is defined by Chinese DNA on 18/07/2008 with the linkage of http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf
[2] Chinese DNA designates it on 18/07/2008 at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf

CCPG to SCPG. Electricity transfers from NEPG and CCPG, therefore, are taken into account.

Table 3 Sources and gases in the project boundary

Source		Gas	Included?	Justification / Explanation
Baseline	Power supplied by SCPG	CO_2	Yes	Following ACM0002
		CH_4	No	Conservative / according to ACM0002
		N_2O	No	Conservative / according to ACM0002
Project activity	Fossil fuel use	CO_2	No	According to ACM0002, the project emission of wind power project activity is not considered.
		CH_4	No	
		N_2O	No	

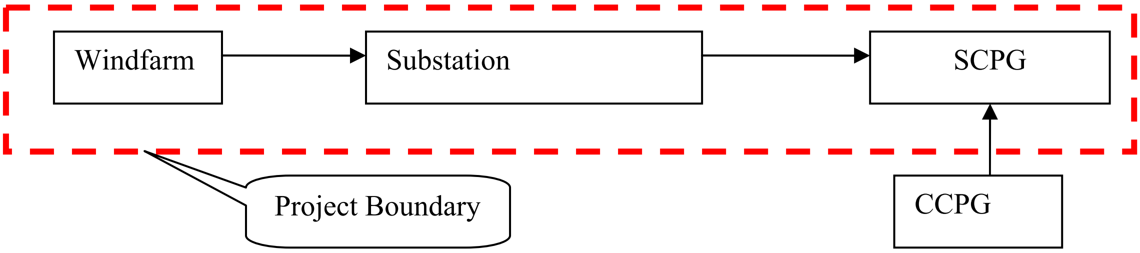

Figure 2 Flow diagram of the project boundary

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

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Because the project activity is the installation of a new grid-connected renewable power plant/unit, and is not a modification/retrofit of an existing plant/unit, the baseline scenario, according to methodology ACM0002, is the following:

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

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

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Prior consideration

As also shown in the common practice analysis below, and based on years of experience since the first approved wind farm CDM project[3], new wind energy investments in China are all considered as CDM projects. Many wind farms have already registered, or are in the process of doing so, in China.

Therefore, the project owner considered CDM revenue from the very beginning of project implementation, as mentioned in feasible study report (FSR), "CDM revenue will help to

[3] Project 0064 Huitengxile Windfarm Project, registered in June 2005

overcome the investment barrier of this project". Also a Directorate Decision is made regarding CDM development before the implementation of this project. In the mean time, project owner started negotiation with Carbon Resource Management (CRM) regarding the CDM development and signed an Emission Reduction Purchase Agreement (ERPA) with CRM. From the description above, we can draw the conclusion that the project owner had decided to apply for CDM registration to overcome the financial barriers before the start date of the project.

Additionality

According to ACM0002, the additionality of the project activity is demonstrated and assessed using the latest version of *AM_Tool_01 "Tool for the demonstration and assessment of additionality"*. The tool uses the following steps:

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

Realistic and credible alternatives to the project activity are defined through the following sub-steps:

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

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

a) *The proposed project activity undertaken without being registered as a CDM project activity.*
The alternative (a) is fully in accordance with current Chinese law and regulations. The proposed project is financially less attractive than alternatives, as demonstrated below, and the proposed project activity undertaken without being registered as a CDM project activity is not a realistic alternative.

b) *Thermal power plant with comparable capacity or electricity generation.*
This is not realistic alternative in line with current laws and regulations as explained in sub-step 1b.

c) *Renewable energy plant with comparable capacity or electricity generation.*
Besides wind energy, solar PV, geothermal, biomass and hydro are the possible grid-connected renewable energy technologies that could be applied in China. Due to the technology development status and the high cost for power generation, solar PV, geothermal and biomass of the similar installed capacity as the proposed project are alternatives far from being attractive investment in the grid in China[4]. Only hydropower projects have the investment return rate that can compete over that of wind power projects in China[5]. However, there is no exploitable hydro power resource to develop in the region of the proposed project activity. Therefore, the hydro and other kinds of renewable energy power plant are also not realistic alternative.

[4] http://finance.21cn.com/news/cydt/2007/06/28/3319602.shtml, http://finance.people.com.cn/GB/1038/59942/59949/6294546.html.
[5] http://www.chinaenergy.gov.cn/news.php?id=15688.

d) *Continuation of the current situation: 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. Comparable capacity or electricity generation addition provided by Sourth China Power Grid.*
To meet the increasing electricity demand, the power grid company can increase the generation from operating units as well as from and rely on some new built (thermal) power plants connected to the grid. Indeed, this is the current route followed by the industry to meet demand, as reflected in the baseline calculations data presented: more than 99% of recently added capacity is thermal power. Therefore, continuation of the current situation, with the electricity generated by the operation of grid-connected power plants and by the addition of new generation sources. Therefore, comparable capacity or electricity generation addition provided by Northeast China Power Grid can be taken as a realistic alternative for the project activity and comply with the applicable laws and regulations.

From the above mentioned we know that the alternative (d) is the baseline scenario of the project, in line with the methodology.

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

According to Chinese regulations, coal-fired power plants of less than 135MW are prohibited from being built in areas covered by the large grids such as provincial grids[6]. Therefore, a fossil fuel fired power plant delivering a comparable volume of electricity generation, which would be 12.51MW[7], as described in alternative (b1) in sub-step 1a, conflicts with Chinese regulations and practice. So, alternative (b1) is not a realistic alternative.

The other alternatives described in sub-step 1a are all in compliance with applicable legal and regulatory requirements. However, only alternative (c) continuation of the current situation, with the electricity generated by the operation of grid-connected power plants and by the addition of new generation sources on SCPG is a realistic alternative consistent with current laws and regulations. Indeed, it is very common in the power grid to increase the generation output of some operating units to satisfy the load demand.

Step 2. Investment analysis

The purpose of this step is to determine whether the project activity is economically or financially less attractive than the alternatives, or economically or financially not feasible, without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, the following sub-steps are used:

Sub-step 2a. Determine appropriate analysis method

This step determines whether to apply the simple cost analysis, investment comparison analysis

[6] Notice on Strictly Prohibiting the Installation of Fuel fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Decree No. 2002-6.

[7] Using the average loadfactor of thermal plant connected to SCPG, as reported in the *China Electric Power Yearbook* (2007 Edition), of 5633 hours per year, a fossil fuel-fired plant of 12.51MW would generate 70,460 MWh per year.

or benchmark analysis (sub-step 2b):

The proposed project activity generates financial benefits by the sales of electricity, so the simple cost analysis can not be applied. The alternative to the project activity is the supply of electricity from a grid, which is not considered an investment, and a benchmark approach is considered appropriate, according to EB Guidance.[8] The investment comparison analysis (Option II), therefore, is not suitable, and the benchmark analysis (Option III) is adopted. The investment comparison analysis is suitable for a project which has a similar type alternative project. The alternative of the proposed project is comparable capacity or electricity generation addition provided by the SCPG, not a concrete project, so this is not a suitable analysis method either. Therefore, in line with EB Guidance, the benchmark analysis is adopted.

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

Identify the relevant benchmark value which represents standard returns in the market, and compare the financial indicators of the proposed CDM project with the benchmark value.

According to the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*[9], the benchmark of total investment financial internal rate of return (IRR) of electric power industry is 8%, and only if the total investment IRR of the project is higher than or equivalent to this benchmark, the project is financially feasible. This benchmark is widely used in assessment and approval of Chinese electricity power industrial, especially new projects, and is applied by many Chinese projects under the CDM. Therefore, the project activity uses the benchmark of 8% in the financial analysis.

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

The investment estimation in the Feasibility Study Report (FSR) is based on national regulation, material and equipment price levels and was carried out by an independent design institute regulated by national regulation. The relevant data is listed in Table 4 and included in the annex to the PDD.

Table 4 Relevant indicators for financial assessment

Item	Value
Net supplied power to the grid	70,460 MWh/y
Fixed investment	360.72 million RMB Yuan
Annual O&M costs	9.34 million RMB Yuan
Expected operational lifetime	20 Years
On-grid tariff (including VAT)	0.689 RMB / kWh
Value added tax rate	8.5%
Income tax rate	25%
Expected CER price	12EUR

[8] EB 41 Annex 45 (paragraph 15).

[9] Issued by State Power Corporation of China in 2002

Table 5 IRR with and without the CERs income

Parameter	Benchmark IRR	IRR without CERs	IRR with CERs
Value	8%	6.64%	9.67%

It can be seen in the IRR calculation spreadsheet (in the annex to the PDD) that the IRR without CER revenue is below the benchmark 8%. The proposed project activity without registration as a CDM project, therefore, is not financially attractive to the project developer.

Sub-step 2d. Sensitivity analysis

According to the rules and regulations, the sensitivity analysis that was carried out in the FSR used total investment, tariff, O & M costs and net supplied power as the critical variables.

The result of the sensitivity analysis is shown in Figure 3 below. This sensitivity analysis shows that the conclusion of sub-step 2c that the project is not attractive without CDM registration is robust to reasonable variations in the critical assumptions.

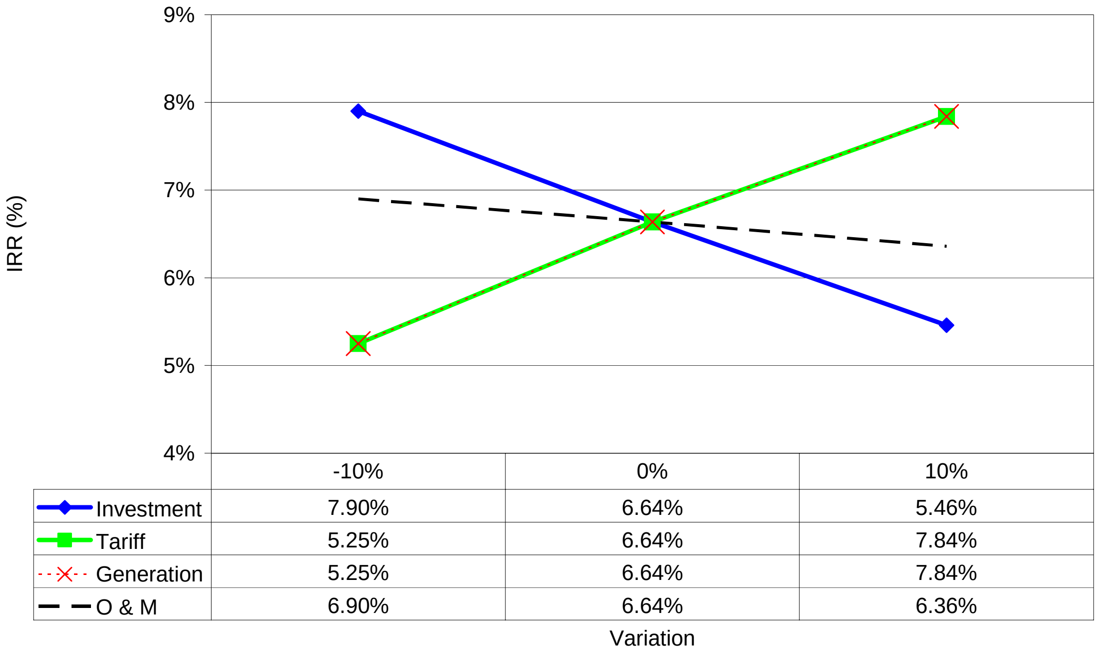

Figure 3 IRR sensitivity analysis for the proposed project

Variations of +10% to -10% from the original assumptions for each of the critical variables are used in line with the regulations.

→ If after the sensitivity analysis it is concluded that the proposed CDM project activity is unlikely to be the most financially attractive (as per step 2c para 8a) or is unlikely to be financially attractive (as per step 2c para 8b), then proceed to Step 3 (Barrier analysis) or Step 4 (Common practice analysis).

The financial analysis shows that the project is not the most financially attractive alternative, and the sensitivity analysis shows that it is unlikely to be financially attractive under reasonable variations in the assumptions.

Step 4. Common practice analysis

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

In line with the guidance from the additionality tool the common practice analysis is carried out on the basis of similar projects in the same region and take place in a comparable environment with regards to regulatory framework, investment climate etc.

Using the statistics of installed capacity of wind power in China in 2007, by Professor Shi Pengfei[10], the wind farm projects connected to the same grid (SCPG) and of similar scale (between 30MW and 60MW) are all CDM projects. CDM project activities should not be included in this analysis. Therefore, it can be concluded that there are no similar activities to the proposed project activity, and that the project is not common practice.

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

As already described in the statement above, currently there are no wind farm projects with similar capacity connected to the SCPG that are not CDM projects. Therefore it can be concluded that the proposed project is not common practice in SCPG.

→ If Sub-steps 4a and 4b are satisfied, i.e. similar activities cannot be observed or similar activities are observed, but essential distinctions between the project activity and similar activities can reasonably be explained, then the project activity is additional.

In conclusion, all the steps above are satisfied, the proposed CDM project is not the baseline scenario, and the project activity is additional.

B.6.	**Emission reductions:**

	B.6.1.	**Explanation of methodological choices:**

>>
Project emissions (PE_y)

According to the ACM0002, the project emission of the windfarm project is zero.

Baseline emissions (BE_y)

Following the methodology, the baseline emissions (BE_y) are the CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The emissions are calculated from the net electricity delivered to the grid by the project activity (EG) and the combined margin emissions factor (EF) as described in the “Tool to calculate the emission factor for an electricity system”:

$$BE_y = (EG_y - EG_{baseline}) * EF_y$$

[10] http://www.cwea.org.cn/download/display_info.asp?cid=&sid=&id=19

Where:
BE_y is the baseline emissions in year y
EG_y is the net electricity supplied by the project activity to the grid in year y
$EG_{baselin}$e is the baseline electricity supplied to the grid. For new power plants this value is zero.
EF_y is the combined margin emission coefficient calculated using the 'Tool to calculate the emission factor for an electricity system'

As $EG_{baseline}$ is zero, this is simplified to:

$$BE_y = EG_y * EF_y$$

Using the 'Tool to calculate the emission factor for an electricity system' EF_y is calculated in the following 6 steps:

1. Identify the relevant electric power system.
2. Select an operating margin (OM) method.
3. Calculate the operating margin emission factor according to the selected method.
4. Identify the cohort of power units to be included in the build margin (BM).
5. Calculate the build margin emission factor.
6. Calculate the combined margin (CM) emissions factor.

Details of the calculations and data follow the published data from the Chinese DNA and official national statistics (China Energy Statistical Yearbook and China Electric Power Yearbook), and are also given in Annex 3 of the PDD.

STEP 1. Identify the relevant electric power system.

As described in section B.3 the spatial extend of the project boundary includes the project site and all power plants connected to SCPG. SCPG is an electricity system which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains.

Using the boundary definitions of the Chinese DNA[11], SCPG consists of Guangdong, Guangxi Zhuang Autonomous Region, Yunnan and Guizhou power grids. The electricity transmission between different provinces in SCPG is very large and it is reasonable for the project to regard SCPG as the project boundary.

Imports

SCPG connects with Central China Power Grid (CCPG); the electricity transfer is from CCPG to SCPG. Electricity transfers from CCPG, therefore, are taken into account, as follows:

- For the purpose of determining the operating margin emission factor, use one of the following options to determine the CO_2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from a connected electricity system within the same host country(ies):
  - (a) 0 tCO_2/MWh, or
  - (b) The weighted average operating margin (OM) emission rate of the exporting grid,

[11] Chinese DNA designates it on 18/07/2008 at
http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf

determined as described in step 3 (d) below; or

(c) The simple operating margin emission rate of the exporting grid, determined as described in step 3 (a), if the conditions for this method, as described in step 2 below, apply to the exporting grid; or

(d) The simple adjusted operating margin emission rate of the exporting grid, determined as described in step 3 (b) below.

☑ *For the purpose of determining the operating margin emission factor the simple operating margin emission rate of the exporting grid is used (option (c)), as the conditions for this method apply to the exporting grid.*

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

☑ *For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system, as it is unlikely that recent or likely future additions to transmission capacity enable significant increases in imported electricity.*

o For imports from connected electricity systems located in another host country (ies), the emission factor is 0 tons CO_2 per MWh. Electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the electricity emission factors.

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

According to the tool, four various methods are provided for calculating the operating margin emission factor ($EF_{OM,y}$), including:

a) Simple OM;
b) Simple Adjusted OM;
c) Dispatch data analysis OM;
d) Average OM

The Simple OM method can only be used where low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normal data for hydroelectricity production. Low-cost/must-run resources do indeed constitute less than 50% of SCPG during 2003 to 2007 (see Annex 3), so, following the publication of the EF by the Chinese DNA, the project participants have chosen to use the Simple OM method (option a) for calculating the operating margin emission factor.

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

o (ex-ante option) the full generation-weighted average for the most recent 3 years for which data are 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 if or,

o (ex-post option) the year in which project generation occurs, if EF_{OM}, y is updated based on ex-post monitoring.

The project participants choose the ex-ante option, fixing the emission factor in the PDD for the first crediting period. The three most recent years for which data is available are 2005-2007.

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

The Simple OM emission factor $EF_{OM,y}$ is defined as the generation-weighted average emissions per unit net electricity generation (in tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. Three options can be selected to calculate the Simple OM:

A. Based on data on fuel consumption and net electricity generation of each power plant / unit; or
B. Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit; or
C. Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option C can be used if the necessary data for using options A and B is not available, and if only nuclear and renewable power generation are considered low-cost/must-run sources. Data for using options A and B is not available. And nuclear and renewables are considered the only low-cost/must-run power generation sources. Therefore, option C is chosen to calculate the OM emission factor.

For Option C, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, and including electricity imports[12], as follows:

$$EF_{OM,y} = \sum i\ (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}) / EG_y$$

Where

$EF_{OM,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	(Using the ex-ante option) The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

On the basis of the data available, the three-year generation-weighted average operating margin emission factor is calculated by the DNA (see Annex 3) as:

EF_{OM} = 1.0608 tCO_2/MWh

[12] As described above, import from a connected electricity system is considered as one power source.

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

According to tool, the sample group of power units m used to calculate the build margin consists of the set of power units that comprise the larger annual generation 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.[13]

The set of power units as identified by option (b) would comprise the larger annual generation and is therefore chosen.

However, due to the limited publicly available data, it is not possible to identify the exact new-built plants which comprise the 20% of the system generation. Therefore, the project participants follow the method of calculations of the Chinese DNA, which uses the deviation accepted by EB to calculate EF_{BM}[14]: Using the latest statistical data available (from the China Power Yearbook), the most recent year from which the added generation capacity is equal to or just exceeds 20% of the latest year is determined. This added generation capacity is the sample group of power units m used to calculate the build margin.

In terms of vintage of data, the project participants can choose between ex-ante and ex-post data vintages. The project participants choose the ex-ante option, fixing the emission factor in the PDD for the first crediting period:

- 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.

STEP 5. Calculate the build margin emission factor (EF_{BM})

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

$$EF_{BM,y} = \sum_m (EG_{m,y} \times EF_{EL,m,y}) / \sum_m EG_{m,y}$$

Where

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

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

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

---

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

[14] http://cdm.unfccc.int/Projects/Deviations: Application of approved methodology AM0005 (DNV, 07 Oct 05).

m = Power units included in the build margin
y = Most recent historical year for which data is available

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in step 3 (a) for the Simple OM, using options B1, B2 or B3, using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin. However, data on fuel consumption, fuel types and electricity generation from each of the units m is not available. Therefore, following the calculations of the Chinese DNA, the deviation mentioned above is used, using the following sub-steps:

Sub-step 1: Calculate the CO_2 emission share of thermal generation by fuel type

- Using the latest statistical data available from the China Energy Statistical Yearbook calculate the CO_2 emission percentages (λ_i) of solid, liquid and gas fossil fuels in the total emissions from thermal power generation in the project electricity system.

Sub-step 2: Calculate the weighted emission factor of thermal power

- Based the fuel shares (λ_i) and the corresponding emission factor (EF_i) according to the best technology commercially available in the China, calculate the weighted emission factor of thermal power ($EF_{thermal}$).

Sub-step 3: Calculate the build margin emission factor

- Using the identified cohort of power units (step 4) and the emission factor of thermal power, calculate the build margin emission factor.

On the basis of the data available, the build margin emission factor is calculated by the DNA (see Annex 3) as:

$EF_{BM} = 0.6968\ tCO_2/MWh$

STEP 6. Calculate the combined margin emissions factor (EF)

The combined margin emission factor is calculated as follows:

$$EFy = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

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

For hydro projects the default weights w_{OM} and w_{BM} are 75% and 25% respectively.

With both EF_{OM} and EF_{BM} fixed in this PDD for the first crediting period, EF is also fixed for the first crediting period. The emission factor will be revised at the renewal of the crediting period.

$EF = 0.9698\ tCO_2/MWh$

Having determined the combined margin emission fact, the baseline emissions (BE_y) can now be calculated as the emission factor multiplied by the annual net generation of the project as described above.

Leakage emissions (L_y)

The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects – see applicability conditions above). In line with the methodology, the project participants do not need consider these emission sources as leakage in applying this methodology.

$L_y = 0$

Emission reductions (ER_y)

Emission reductions are calculated as the baseline emissions minus project and leakage emissions. With leakage emissions equal to zero, emission reductions therefore are equivalent to the baseline emissions, as follows:

$ER_y = BE_y – L_y – P_y = BE_y – 0\text{-}0$

Therefore:

$ER_y = BE_y = EG_y \times EF_y$

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

Data / Parameter:	$NCV_{i,y}$
Data unit:	kJ/kg or kJ/m^3
Description:	The net calorific value (energy content) per mass or volume unit of fuel i
Source of data used:	China Energy Statistical Yearbook 2007
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$OXID_i$
Data unit:	
Description:	Oxidation factor of the fuel i
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	100%
Justification of the	The IPCC default value is adopted in the calculations by the DNA

choice of data or description of measurement methods and procedures actually applied:	
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$F_{i,j,y}$
Data unit:	Tones or m^3
Description:	The quantity of fuel i (in a mass or volume unit) consumed by power plants in provinces j in year(s) y
Source of data used:	China Energy Statistical Yearbook 2005-2007
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	The gross electricity generated in province j in year y
Source of data used:	China Electric Power Yearbook 2005-2007
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	Internal power use rate of power plant
Data unit:	%
Description:	The internal power consumption rate of power plants in province j in year y
Source of data used:	China Electric Power Yearbook 2005-2007
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually	Data used are from Chinese authorities

applied:	
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/TJ
Description:	The CO2 emission factor per unit of fuel i
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied:	The IPCC default value is adopted in the calculations by the DNA
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$CAP_{i,j,y}$
Data unit:	MW
Description:	Installed capacities of power plant category i of province j in years y
Source of data used:	China Electric Power Yearbook 2005-2007
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$EF_{coal,bat}$
Data unit:	
Description:	The power supply efficiency of coal-fired power plants with best commercially available technology
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	37.28%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$EF_{oil,bat}$

Data unit:	
Description:	The power supply efficiency of oil-fired power plants with best commercially available technologies
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	48.81%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$EF_{gas,bat}$
Data unit:	
Description:	The power supply efficiency of gas-fired power plants with best commercially available technologies
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	48.81%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor

Data / Parameter:	$Import_{CCPG,y}$
Data unit:	MWh
Description:	The electricity import from CCPG in year y
Source of data used:	China Electric Power Yearbook 2005-2007
Value applied:	2004: 10,951,240 2005: 20,264,000 2006: 21,730,840 (see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor due to imports from CCPG

Data / Parameter:	$EF_{average\_CCPG,y}$
Data unit:	tCO_2e/MWh

Description:	Average grid emission factor for CCPG in year y
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	2004: 0.82732 2005: 0.77216 2006: 0.77134 (see Annex 3 for details)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Data used are from Chinese authorities
Any comment:	Used for calculation of power grid emission factor due to imports from CCPG

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

>>

The Baseline Emissions (*BEy*, in tCO_2), for each year y, are calculated by multiplying the baseline emissions factor (*EF*, in tCO_2/MWh) by the net supplied power of the project (*EGy*, in MWh), as follows:

$BEy = EGy \bullet EF$

The baseline emissions factor (*EF*) is calculated using operating and build margins as described in detail in section B.6.1 above.

According to the Feasibility Study Report the proposed project activity is estimated to supply 70,460 MWh per year, net of own consumption, once fully operational from the third year of operation.

Thus, baseline emissions, once fully operational, are:

$BE = EG \bullet EF = 70{,}460 \times 0.9698 = 68{,}332\ tCO_2/y$

The values obtained are presented in the table in section B.6.4.

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

>>

Table 6 The ex-ante estimation of emission reductions of the project activity (tCO_2e)

Period	Estimation of the project activity emissions (tCO_2e)	Estimation of the baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
01/07/2009-30/06/2010	0	68,332	0	68,332
01/07/2010-30/06/2011	0	68,332	0	68,332
01/07/2011-30/06/2012	0	68,332	0	68,332
01/07/2012-30/06/2013	0	68,332	0	68,332
01/07/2013-30/06/2014	0	68,332	0	68,332
01/07/2014-30/06/2015	0	68,332	0	68,332
01/07/2015-30/06/2016	0	68,332	0	68,332
Total (tCO_2e)	0	478,324	0	478,324

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

All data collected as part of the monitoring are archived electronically and kept at least for 2 years after the end of the last crediting period. 100% of the data are monitored as indicated in the table below. All measurements are conducted with calibrated measurement equipment according to relevant industry standards.

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net electricity supplied to the grid by the project in period y
Source of data to be used:	Electricity meters (bi-directional, i.e. recording generation and consumption)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	70,460 (once fully operational)
Description of measurement methods and procedures to be applied:	Main meter is installed at connection point to the grid to monitor the power output generated with the accuracy of 0.5. The power output after the main transformers and the net power output supplied to the grid are measured continuously and are recorded automatically. The meters at the turbines are recorded manually every day. Designated person from the grid company and the project company jointly record the readings of the meters at the connection point to the grid at the beginning of each month.
QA/QC procedures to be applied:	1. The net electricity supply to the grid is checked by receipt. 2. When the main meter fails to work normally, the readings of the back-up meter will be adopted. 3. The data will be kept during the crediting period and two years after. 4. The main meter and back-up meter will be calibrated once per year by a qualified calibration organization.
Any comment:	The uncertainty of the data is very low.

B.7.2. Description of the monitoring plan:

>>

The aim of the monitoring plan is to make sure that the net electricity generation delivered to the grid is monitored completely, consistently, reliably and precisely. The details are summarized as follows:

1. Monitoring subject

The data required for the calculation of emission reductions are the export electricity supply to the power grid and the import electricity supply from the power grid, the difference of which is the net electricity generation.

2. Monitoring management structure

In order to obtain reliable monitoring data, the project developer will establish a monitoring management framework prior to the starting of the crediting period. Clear responsibilities will be assigned to all staff involved in the CDM project. A monitoring director will be appointed who has the overall responsibilities for the monitoring of the project, other staff will be responsible for the data recording, data collecting, data archiving and emission reductions calculation. The detailed structure is as follows:

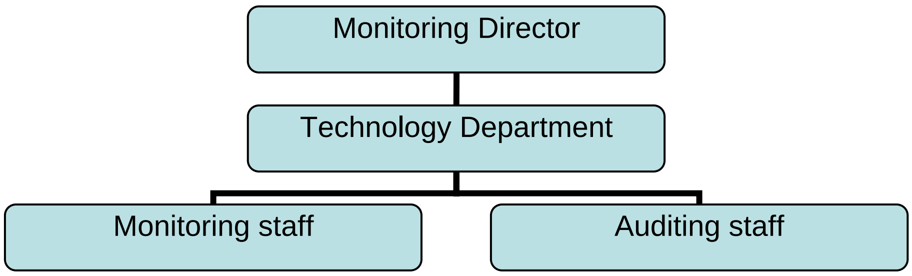

Figure 3 The CDM management structure of the project

3. Monitoring apparatus and installation:

The meters will be installed in accordance with "Technology & Management Regulations for Power Metering Devices" (DL/T448-2000). The accuracy of the meters is 0.5. The main meter and back-up meter will be installed at the connection point to the grid. The main meter and backup meter will be checked and accepted by the grid and the project developer before the project operation. All of the installed meters are sealed after installation or calibration.

4. Data monitoring

The readings of the main meter are used for calculating the emission reductions when the main meter is in normal operation state. The monitoring processes are as follows:

(1) The meter readings from the turbines and onsite transformer station are recorded daily;
(2) The designated persons from the grid company and the project company jointly record the main and backup meter readings of the power to/from the grid monthly;
(3) The project developer provides the power grid company with a settling accounts sheet about the net electricity supplied to the grid monthly;
(4) The project developer provides the power grid company with a sale receipt after the power grid company has confirmed the settling accounts sheet, and archives a copy of the sale receipt.
(5) The project developer provides the DOE with the readings of the main and backup meters at the connection point and/or the settling accounts sheets and the copy of sale receipt.

5. Quality control

1) Calibration of meters

The calibration of meters is conducted by a qualified organization in compliance with the national standard and sectional regulations to ensure the accuracy. The main meter and back-up meter at the connection point to the grid will be calibrated once per year, other meters will be calibrated once per year. The meters must be sealed after calibration. The calibration records must be archived together with other monitoring records. When the main meter or back-up meter have a breakdown, the party finding the breakdown should tell another party and inform the qualified calibration organization to check, calibrate, test and treat the meter so as to recover the normal monitoring state.

2) Emergency treatment

When the main meter or back-up meter have a breakdown, the electricity generation difference will be treated as follows:
(1) When one of the two meters has a breakdown, the readings of the other meter will be adopted;
(2) If both the main meter and back-up meter have breakdowns, the net electricity supplied to the grid will be calculated from the readings of other meters and deducting the line losses.

6. Data management

All monitoring data and records will be archived in electronic format as well as on paper. The electronic documents will be backed up on compact disc or hard disc. The project developer will also keep copies of sale receipts and prepare a monitoring report at the end of each year, which includes the net electricity generation, the monitoring data summary, the calibration records, and the emission reductions calculation.

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

7. Training program

The project developer will train all related staff before the start of the crediting period. The training contains CDM knowledge, operational regulations, quality control (QC), data monitoring requirements and data management regulations, etc.

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

>>
Date of completion of the baseline study and monitoring methodology: 24/10/2008.

Contact information of the entity and persons responsible:

- Carbon Resource Management (CRM) prepared the PDD. CRM is a project participant. Contact information is given in Annex 1.
- The persons preparing the documentation were:
  - Ms. Zhu Qiyan, Mr. Shi Xiangfeng, and Ms. Qian Yiwen, zqy@carbonresource.com, Tel: +86 10 8447 5246/8
  - Mr. Christiaan Vrolijk, cv@carbonresource.com, Tel: +44 20 7016 1420.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
04/06/2008 (Date of the Equipment Purchase Agreement)

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

>>
20years

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

C.2.1. Renewable crediting period:

A renewable crediting period is chosen.

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

>>
01/07/2009 or the date of registration whichever is later

C.2.1.2. Length of the first crediting period:

>>
7years and 0 month

C.2.2. Fixed crediting period:

Not applicable.

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

SECTION D. Environmental impacts

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

>>

The Environment Impact Assessment is prepared in March 2006 and approved by Environment Protection Bureau of Guangdong Province in May 2006.

According to the Environmental Impact Assessment (EIA), the environment impacts of the project are summarised below:

1. The analysis of the environment impact during the construction period

The environmental impacts during the construction period are as follows:

Noise: the project will meet the restrictive construction boundary noise values during the construction stage. Therefore, the noise is not considered to negatively impact local residential areas.

Dust: the dust will be produced during the construction period by the machines. The impact of dust can be erased by sprinkling and covering the materials in the windy days.

Solid waste: the main solid wastes produced during the construction period are construction waste and garbage from the construction workers. Garbage will be collected and will be sent to landfill. The construction wastes will be used for backfilling, foundations and road construction.

Waste water: waste water will be treated and reused.

2. The analysis of the environment impact during operation period

The environment impacts during the construction period are as follows:

Waste water: a small quantity of waste water will be produced by the project management staff during operation. The waste water will be treated and will be used for sprinkling the vegetation.

Noise: the noise from the wind turbines is expected to be 53~33DB (A) at a distance of 50~150 meters, meeting the "Industry Enterprise Factory Boundary Noise Standard". Therefore, the noise of the wind farm is not considered to have a negative impact on local residents during the operational period.

Solid waste: the main solid waste during the operational period is generated by the project management staff. All the waste produced will be collected and sent to landfill.

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

>>

Environmental impacts are not considered significant.The Environmental Protection Bureau of Guangdong Province approved the EIA.

SECTION E. Stakeholders' comments

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

>>

The project developer has sent out a questionnaire to the stakeholders in the directly affected area, requesting comments on the proposed project construction. 40 copies of questionnaire were distributed, and 40 copies of questionnaire were returned. The age of the participating stakeholders was in the range of 26 to 70 years old.

E.2. Summary of the comments received:

>>

All stakeholders gave a positive opinion to the project, and supported the construction of the project.

The results of the questionnaires are as follows:

- 100% agreed to the construction of the project;
- 100% thought the project would be helpful to the local economy;
- 95% thought the project would not influence the surrounding area, the other people were unconcerned about the problem;
- 97.5% thought the project would not influence the natural scenery; the others were unconcerned about the problem;
- 92.5% thought the project would not influence the ecosystem; the other people were unconcerned about the problem.

All of the stakeholders thought the project would have many advantages such as alleviating the local power shortage, promoting the economic development and increasing the income of the local residents. In addition, they also put forward the following issues and suggestions:

- The project owner should establish a good relationship with local municipal and township.
- The vegetation destroyed during the construction should be re-established quickly.
- Work opportunities should provide work for local people.

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

>>

Following the consultation and taking the comments of the stakeholders into account, the project owner will take the following measures:

1. Implement the measures described in the EIA strictly. The project owner will protect and re-establish the vegetation when the construction is finished.
2. The project owner will establish good relationship with local municipal and township. Good communication channels will be set up between the local people and the project owner.
3. More work opportunities will be provided for the local people.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the proposed project activity.

Annex 3

BASELINE INFORMATION

Step 1. Identify the relevant electric power system

Following the DNA delineation, the project electricity system is the North China Power Grid (SCPG), consisting of four provincial grids: Guangdong, Guangxi, Guizhou and Yunnan Power Grid.

The connected electricity system is Central China Power Grid (CCPG), consisting of six provincial grids: Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan.

Step 2. Select an operating margin (OM) method

According to Tool to calculate the emission factor for an electricity system, the Simple OM method is applicable to the project if the low-cost resources constitute less than 50% of total grid generation on average in the five most recent years or based on long-term average hydroelectric production. The Simple OM method, therefore, is applicable to the proposed project as the share of low-cost/must-run generation does not exceed 30% in the most recent last 5 years.

Table A1 Power generation in the South China Power Grid from 2002 to 2006

Year	2002	2003	2004	2005	2006
Percentage (%)	27.99	24.19	21.44	22.02	21.22

Data source: China Energy Statistical Year Book, 2003~2007

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

Table A2 Emission Factors of Fuels

Fuel	Low Calorific Value(kJ/kg,m^3)	Emission Factor (tC/TJ)	Oxidation Factor
Raw Coal	20,908	25.8	100%
Cleaned Coal	26,344	25.8	100%
Other Washed Coal	8,363	25.8	100%
Mould Coal	20,908	26.6	100%
Coke	28,435	29.2	100%
Crude Oil	41,816	20.0	100%
Gasoline	43,070	18.9	100%
Diesel Oil	42,652	20.2	100%
Fuel Oil	41,816	21.1	100%
Natural Gas	38,931	15.3	100%
Coke Oven Gas	16,726	12.1	100%
Other Gas	5,227	12.1	100%
LPG	50,179	17.2	100%
Refinery Dry Gas	46,055	15.7	100%
Other Oil Product	38369	20	100%
Other Oven Product	28,435	25.8	100%
Other Energy	0	0	100%

Source: 1) 2006 IPCC Guidelines for National Greenhouse Gas Inventories， Volume 2 Energy；
2)China Power Year Book (2007)；

Fossil fuel consumption

Fuel consumption is taken from the latest China Energy Statistical Yearbook editions. The yearbooks present a range of more than 10 fuels for each province. Data is presented in Table A3 below. The share of emissions from coal consumption is also given in the table.

Table A3 Energy consumption and CO_2 emissions of SCPG in 2004

2004

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	EF (tC/TJ)	Oxidation (%)	NCV (MJ/t,km³)	CO_2 Emission (tCO_2e) K=G*H*I*J*44/12/10000 (for mass unit) K=G*H*I*J *44/12/1000 (for volume unit)
		A	B	C	D	G=A+B+C+D	H	I	J	
Raw Coal	10^4 t	6,017.70	1,305.00	2,643.90	1,751.28	11,717.88	25.8	100	20,908	231,767,573.55
Cleaned Coal	10^4 t	0.21				0.21	25.8	100	26,344	5,233.50
Other Washed Coal	10^4 t					-	25.8	100	8,363	-
Coke	10^4 t					-	29.2	100	28,435	-
Coke Oven Gas	10^8 m³					-	12.1	100	16,726	-
Other Gas	10^8 m³	2.58				2.58	12.1	100	5,227	59,831.38
Crude Oil	10^4 t	16.89				16.89	20.0	100	41,816	517,932.98
Gas oil	10^4 t					-	18.9	100	43,070	-
Diesel Oil	10^4 t	48.88			1.83	50.71	20.2	100	42,652	1,601,975.28
Fuel Oil	10^4 t	957.71				957.71	21.1	100	41,816	30,983,494.25
LPG	10^4 t					-	17.2	100	50,179	-
Refinery Dry Gas	10^4 t	2.86				2.86	15.7	100	46,055	75,825.26
Natural Gas	10^8 m³	0.48				0.48	15.3	100	38,931	104,833.40
Other Oil Produce	10^4 t	1.66				1.66	20.0	100	38,369	46,707.86
Other Oven Product	10^4 t					-	25.8	100	28,435	-
Other Energy	10^4 t	79.42				79.42	-	100	-	-
									Total	**265,163,407**

Source: China Energy Statistical Year Book (2005);

Table A4 Power generation, own consumption and net supply in SCPG (2004)

Province	Electricity Generation (10^8 kWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Guangdong	1,693.89	5.42	160,208,116.20
Guangxi	201.43	8.33	18,465,088.10
Guizhou	497.20	7.06	46,209,768.00
Yunnan	243.22	7.56	22,483,256.80
Total			247,366,229.10

Import electricity from CCPG in 2004	10951240	MWh
Average emission factor of CCPG in 2004	0.82732	tCO_2/MWh

Source: China Power Year Book (2005)

Table A5 Energy consumption and CO_2 emissions of SCPG in 2005

2005

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	EF (tC/TJ)	Oxidation (%)	NCV (MJ/t,km^3)	CO_2 Emission (tCO_2e)
		A	B	C	D	G=A+B+C+D	H	I	J	K=G*H*I*J*44/12/10000 (for mass unit) K=G*H*I*J *44/12/1000 (for volume unit)
Raw Coal	10^4 t	6,696.47	1,435.00	3,212.31	1,975.55	13,319.33	25.8	100	20,908	263,442,601.85
Cleaned Coal	10^4 t				0.15	0.15	25.8	100	26,344	3,738.21
Other Washed Coal	10^4 t			10.39	33.88	44.27	25.8	100	8,363	350,237.59
Coke	10^4 t	4.79			8.05	12.84	29.2	100	28,435	390,906.18
Coke Oven Gas	10^8 m^3				0.79	0.79	12.1	100	16,726	58,624.07
Other Gas	10^8 m^3	1.87			15.96	17.83	12.1	100	5,227	413,485.84
Crude Oil	10^4 t	10.91				10.91	20.0	100	41,816	334,555.88
Gasoline	10^4 t	0.68				0.68	18.9	100	43,070	20,296.31
Diesel Oil	10^4 t	31.96	2.02		1.81	35.79	20.2	100	42,652	1,130,638.84
Fuel Oil	10^4 t	887.21				887.21	21.1	100	41,816	28,702,703.26
LPG	10^4 t					-	17.2	100	50,179	-
Refinery Dry Gas	10^4 t	4.92				4.92	15.7	100	46,055	130,440.66
Natural Gas	10^8 m^3	0.93				0.93	15.3	100	38,931	203,114.71
Other Oil Produce	10^4 t	1.70				1.70	20.0	100	38,369	47,833.35
Other Oven Product	10^4 t					-	25.8	100	28,435	-
Other Energy	10^4 t	104.66	133.15		59.72	297.53	-	100	-	-
									Total	**295,229,176.74**

Source: China Energy Statistical Year Book (2006);

Table A6 Power generation, own consumption and net supply in SCPG (2006)

Province	Electricity Generation (10^8 kWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Guangdong	1,764.5	5.58	166,606,922.60
Guangxi	250.2	7.95	23,033,671.50
Guizhou	584.3	7.34	54,141,238.00
Yunnan	272.8	6.94	25,387,698.60
Total			269,169,530.70

Import electricity from CCPG in 2005	20264000	MWh
Average emission factor of CCPG in 2005	0.77216	tCO_2/MWh

Source: China Power Year Book (2006)

Table A7 Energy consumption and CO_2 emissions of SCPG in 2006

2006

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	EF (tC/TJ)	Oxidation (%)	NCV (MJ/t,km^3)	CO_2 Emission (tCO_2e)
		A	B	C	D	G=A+B+C+D	H	I	J	K=G*H*I*J*44/12/10000 (for mass unit) K=G*H*I*J *44/12/1000 (for volume unit)
Raw Coal	10^4 t	7,303.19	1,490.01	4,001.54	2,735.88	15,530.62	25.8	100	20,908	307,179,636.00
Cleaned Coal	10^4 t					-	25.8	100	26,344	-
Other Washed Coal	10^4 t			19.53	45.80	65.33	25.8	100	8,363	516,851.63
Moule Coal	10^4 t	133.75				133.75	26.6	100	20,908	2,727,466.02
Coke	10^4 t				1.31	1.31	29.2	100	28,435	39,882.17
Coke Oven Gas	10^8 m^3		0.84		2.06	2.90	12.1	100	16,726	215,202.29
Other Gas	10^8 m^3	0.89			19.15	20.04	12.1	100	5,227	464,736.75
Crude Oil	10^4 t	0.87				0.87	20.0	100	41,816	26,678.61
Gas oli	10^4 t					-	18.9	100	43,070	-
Diesel Oil	10^4 t	29.92	1.26		3.00	34.18	20.2	100	42,652	1,079,777.46
Fuel Oil	10^4 t	685.85	0.09			685.94	21.1	100	41,816	22,191,287.60
LPG	10^4 t					-	17.2	100	50,179	-
Refinery Dry Gas	10^4 t					-	15.7	100	46,055	-
Natural Gas	10^8 m^3	7.92				7.92	15.3	100	38,931	1,729,751.05
Other Oil Produce	10^4 t	0.67				0.67	20.0	100	38,369	18,851.97
Other Oven Product	10^4 t					-	25.8	100	28,435	-
Other Energy	10^4 t	93.54	189.68		20.29	303.51	-	100	-	-
									Total	**336,190,121.56**

Source: China Energy Statistical Year Book (2007);

Table A8 Power generation, own consumption and net supply in SCPG (2006)

Province	Electricity Generation (10^8 kWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Guangdong	1,884.29	5.27	178,498,791.70
Guangxi	279.67	4.45	26,722,468.50
Guizhou	760.39	6.06	71,431,036.60
Yunnan	397.91	4.12	38,151,610.80
Total			314,803,907.60

Import electricty generation from CCPG in 2006	21730840	MWh
Average emission factor of NWPG in 2006	0.77134	tCO2e/MWh

Source: China Power Year Book (2007)

Operating Margin Emission Factor calculations

The Operating Margin Emissions Factor is now calculated from the data presented above using the formula below, including adjustment for imports from CCPG and SCPG.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{co_2,i,y}}{EG_y}$$

Based on above data, the simple OM emission factor of SCPG is calculated ex-ante using a 3-year generation-weighed average is 1.0608 tCO_2e/MWh.

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

The sample group of power units m used to calculate the build margin consists of 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. This option is chosen as it comprises larger annual generation than the five units built most recently. Following the deviation, the latest statistical data available (from the China Power Yearbook 2007) is used by the DNA to determine the most recent year from which the added generation capacity is equal to or just exceeds 20% of the latest statistic year 2006. The added generation capacity is the sample group of power units *m* used to calculate the build margin.

Step 5. Calculate the build margin emission factor

As described in step4, because of the limited availability of publicly available data, this proposed project uses a substitute method accepted by EB to calculate $EF_{BM,y}$

Sub-step 1: calculate the thermal emission factor

Calculate the different CO_2 emission percentage of solid, liquid and gas fuel in the total emission of North China Power Grid in 2006 using new latest statistical data available from China Energy Statistical Year Book 2007.

Table A9 Calculation of CO_2 Emission of South China Power Grid in 2006

		Guangdong	Guangxi	Guizhou	Yunnan	Total	Average Low Calorific Value (kJ/kg,m3)	Emission Factor (tC/TJ)	Oxidation (%)	CO_2 Emission (tCO_2e)
		A	B	C	D	G=A+B+C+D	H	I	J	K=G*H*I*J*44/12/10000 (for mass unit) K=G*H*I*J *44/12/1000 (for volume unit)
Raw Coal	10^4 t	7,303.19	1,490.01	4,001.54	2,735.88	15,530.62	20,908.00	25.8	100%	307,179,636.00
Cleaned Coal	10^4 t					-	26,344.00	25.8	100%	-
Other Washed Coal	10^4 t			19.53	45.80	65.33	8,363.00	25.8	100%	516,851.63
Mould Coal	10^4 t	133.75				133.75	20,908.00	26.6	100%	2,727,466.02
Coke	10^4 t				1.31	1.31	28,435.00	29.2	100%	39,882.17
Subtotal										**310,463,835.83**
Crude Oil	10^4 t	0.87				0.87	41,816.00	20.0	100%	26,678.61
Gasoline	10^4 t					-	43,070.00	18.9	100%	-
Diesel Oil	10^4 t	29.92	1.26		3.00	34.18	42,652.00	20.2	100%	1,079,777.46
Fuel Oil	10^4 t	685.85	0.09			685.94	41,816.00	21.1	100%	22,191,287.60
Other Oil Product	10^4 t	0.67				0.67	38,369.00	20.00	100%	18,851.97
Subtotal										**23,316,595.64**
Natural Gas	10^7 m^3	79.20				79.20	38,931.00	15.3	100%	1,729,751.05
Coke Oven Gas	10^7 m^3		8.40		20.60	29.00	16,726.00	12.1	100%	215,202.29
Other Gas	10^7 m^3	8.90			191.50	200.40	5,227.00	12.1	100%	464,736.75
LPG	10^4 t					-	50,179.00	17.2	100%	-
Refinery Dry Gas	10^4 t					-	46,055.00	15.7	100%	-
Subtotal										**2,409,690.09**
Total										**336,190,121.56**

Source: China Energy Statistical Year Book (2007).

λ_{Coal} = 92.35%;

λ_{Oil} = 0.72%;

λ_{Gas} = 6.94%.

Sub-step 2:

Based the emission percentage (λ_i) of different kind fossil fuels and the corresponding emission factor (EF_i) according to the best technology commercially available in the China, the weighted emission factor of thermal power ($EF_{thermal}$) is calculated.

Table A10 Calculation of CO_2 Emission Factor of Coal, Oil and Gas Fuel Power Plant with the Best Commercial Efficiency in China

	Parameter	Efficiency of Power Suppy	Emission Factor of Fuel (tc/TJ)	Oxidation Factor	Emission Factor (tCO2/MWh)	Share of CO2 emissions (λ)
		A	B	C	D=3.6/A/1000*B*C*44/12	
Coal-fired Power Plant	$EF_{Coal,bat}$	37.28%	25.8	100%	0.9135	92.35%
Gas-fired Power Plant	$EF_{Gas,bat}$	48.81%	15.3	100%	0.4138	0.72%
Oil-fired Power Plant	$EF_{Oil,bat}$	48.81%	21.1	100%	0.5706	6.94%
Thermal Power Plant	*EF thermal*				0.8862	

Source: http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=2876

So, emission factor of thermal plant is:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.8862 tCO_2/MWh$$

Sub-step3:

Using the latest statistical data available (from the China Electric Power Yearbook) determine the year from which the added generation capacity is equal to or just exceeds 20% of the latest statistic year 2006.

Table A11 Identify the year from which the added generation capacity is equal to or just exceeds 20% of the latest statistic year 2006

	2004	2005	2006	Added from 2004 to 2006	Newly added fossil fuel-fired
	A	B	C	D=C-B	
Fossil fuel-fired (MW)	46,659.7	54,507.0	68,963.0	14,456.0	78.63%
Hydro (MW)	27,580.1	30,347.1	34,176.0	3,828.9	20.83%
Nuclear (MW)	3,780.0	3,780.0	3,780.0	-	0.00%
Wind & Others (MW)	83.4	83.4	183.0	99.6	0.54%
Total (MW)	78,103.2	88,717.5	107,102.0	18,384.5	100.00%
Newly installed capacity to 2006 (%)	27.08%	17.17%	0.00%		

Source: China Power Year Book (2005, 2006, 2007).

$EF_{BM} = (CAP_{Thermal} / CAP_{Total}) * EF_{Thermal}$

$CAP_{Thermal}$ is the thermal capacity among the new capacity from 2004 to 2006, and CAP_{Total} is the total capacity from 2004 to 2006.

EF_{BM}= 0.8862×78.63% = 0.6968 tCO_2/MWh

Step 6. Calculation of the combined margin emission factor

The combined margin emission factor is calculated as follows:

$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y}$
$= 0.75\times 1.0608 + 0.25\times 0.6968 = 0.9698\ tCO_2/MWh$

Annex 4

MONITORING INFORMATION

No additional information

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