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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Fujian Dongshan Damaoshan Wind Power Project

Document version number: 3.0

Document version date: 05/08/2010

A.2. Description of the project activity:

Fujian Dongshan Damaoshan Wind Power Project (hereinafter referred to as the proposed project) is to build and operate a 49.5 MW grid connected wind farm, located on Damao mountain, Shitou mountain and Huzai mountain, which are in Chencheng town Dongshan County, Zhangzhou City, Fujian Province, China. The existing scenario prior to the implementation of the proposed project activity is that the East China Power Grid (ECPG) would provide the electricity supply. The baseline scenario is the same with the prior scenario. The proposed project involves the installation of 33 sets of 1,500kW wind turbines, for a total installation capacity of 49.5 MW. It is estimated that the annual generated output will be 119,760 MWh. The expected annual GHG emission reductions are 99,700 tCO2e.

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

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

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A.3. Project participants:

Name of Party involved (*) ((host)	Private and/or public entity(ies) project participants (*) (as	Kindly indicate if the Party involved wishes to be considered as

indicates a host Party)	applicable)	project participant (Yes/No)
China (host)	Fujian Dongshan Aozaishan Wind Power Development Co.Ltd.	Yes
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

China

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

Fujian Province

A.4.1.3. City/Town/Community etc:

Chencheng town Dongshan County Zhangzhou City

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

The project is to build and operate a 49.5 MW grid connected wind farm, located in the top of Damao mountain, Shitou mountain and Huzai mountain, Which are in Chencheng town Dongshan County, Zhangzhou City, Fujian Province, China. The geographical co-ordinates are: East longitude 117°23′7″-117°24′49″, and northern latitude 23°35′4″-23°36′26″. Figure 1 gives an illustration of the location.

Figure 1 Location of Fujian Dongshan Damaoshan Wind Power Project

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

Category: Renewable Energy in grid connected applications

Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

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

The purpose of the proposed project is to generate zero-emission wind power and supply it to East China Power Grid. For the proposed project,

(a) The scenario existing prior to the start of the implementation of the project activity is that East China Power Grid providing the same electricity supply as the proposed project. The baseline scenario is the same with the prior scenario.

(b) The project scenario is the implementation of the proposed project (with CDM as an indispensible consideration), i.e., the installation and operation of 33 1500kW(EN15B) wind turbines which will supply an average annual generation of 119,760MWh to East China Power Grid and replace the same amount of electricity generated by fossil fuel fired power plants connected into East China Power Grid; Specifically,

The proposed project will install 33 sets of 1.5MW wind turbines. All wind turbines are produced by Envision Energy in China. The development of the proposed project will contribute to promoting application of such type of wind turbine, accelerating the accumulation of experiences and advancement of domestic wind power technology. The main technical specifications are as follows (Shown in table1):

Tabel 1: Technical Parameters for Wind Turbines

Preliminary design data	
Cut-in wind speed:	4m/s
Rated wind speed:	11.5m/s
Cut-out wind speed:	25m/s
Life time	20 year
Rotor	
Diameter:	70.9m
Number of blades:	3
Material:	Fiberglas
Blades End Speed:	82 m/s
Gearbox	
Type:	1 stage planetary / 2 stage parallel axis helical gear
Rated torque:	High-speed axle 8276Nm low-speed 834000Nm
Transmission ratio:	94.74
Electrical system	
Rated power:	1500kW
Generator type:	Double-fed
Protection class:	IP54
Speed range:	1000～2000rpm
Voltage:	690V
Tower	
Tower Height:	64.7m

Source: the wind turbines purchasing contract

Each turbine will have a 690V-to-35kV transformer, from which a 35kV line will link into 110kV transformer in the wind farm, and finally link into 110KV Chencheng substation.[1] Two meters, Main meter and back up meter, will be installed at the outlet of the 110KV transformer in the wind farm. All the meters are the multifunctional electricity meters (accuracy degree is no less than 0.5, bidirectional). In order to measure electricity when the main meter is out of order, the backup meter will be for usage.

The load factor for the proposed project is 27.6%, which is determined by a qualified independent third party contracted with the project owner.

The auxiliary electric system of the proposed project includes control, protection, measure, signalling and surveillance in central control room. The electricity generated by the wind farm will be dispatched by regional dispatch centre and wind turbines could be controlled and signalled remotely.

[1] This grid-connection method comes from the document No.205(2008) Min Power Letter, which is issued by the Fujian Province Grid Company.

No technology from abroad is transferred for the proposed CDM project.
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A.4.4. Estimated amount of emission reductions over the chosen crediting period:

A renewable crediting period is selected for the proposed project activity. A reduction of approximately 697,900 tCO_2e (from 01/01/2011 to 31/12/2017) is forecasted for the first 7-year crediting period in the table below.

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
01/01/2011—31/12/2011	99,700
01/01/2012—31/12/2012	99,700
01/01/2013—31/12/2013	99,700
01/01/2014—31/12/2014	99,700
01/01/2015—31/12/2015	99,700
01/01/2016—31/12/2016	99,700
01/01/2017—31/12/2017	99,700
Total estimated reductions (tonnes of CO_2e)	697,900
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	99,700

A.4.5. Public funding of the project activity:

No public funds from countries in Annex I is involved in the project.

SECTION B. Application of a baseline and monitoring methodology:

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

Methodology:

Version 10 of ACM0002: Consolidated methodology for grid-connected electricity generation from renewable sources

Tools referenced in this methodology:

Version 5.2 of Tool for the demonstration and assessment of additionality

Version02 of Tool to calculate the emission factor for an electricity system

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

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

The above methodology ACM0002 (Version 10) are applicable to the project activities under the following conditions:

- The project is a grid-connected zero-emission renewable electricity from wind source;
- The project is not an activity that involves switching from fossil fuels to renewable energy at the site of the project activity;
- The geographic and system boundaries for the ECPG can be clearly identified and information on the characteristics of the grid is publicly available.

Version 5.2 of Tool for the demonstration and assessment of additionality is applied for the proposed project, because that the additionally tool is included in the approved methodology ACM0002 (Version 10) and its application is mandatory.

Version02 of Tool to calculate the emission factor for an electricity system is applied for the proposed project，because that the proposed project activity supplies electricity to the ECPG.

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

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

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

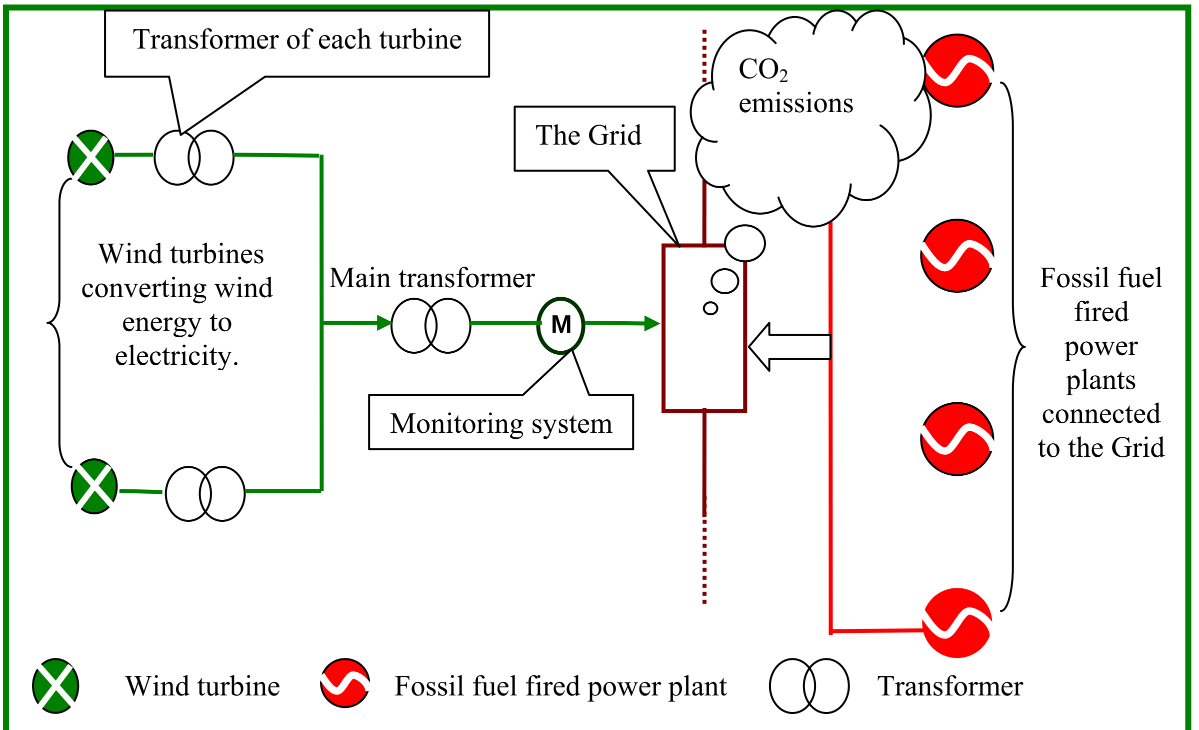
Spatial boundary:

The spatial extent of the project boundary includes the proposed project and all power plants connected to electricity system. The ECPG is the project electricity system, which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains. Using the boundary definitions of the Chinese DNA[2], the East China Power Grid consists of Shanghai, Jiangsu, Zhejiang, Anhui and Fujian power grids.

The connected electricity system includes Center China Power Grid and Yangcheng Power Plant which

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

are connected by transmission lines to the project electricity system, and the ECPG imports from the Center China Power Grid and Yangcheng Power Plant.



The flow diagram of the project boundary

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.

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

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity	CO_2	Yes	Major emission sources
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	Wind power	CO_2	No	According to ACM0002, the project emission of wind power project activity is not considered.
		CH_4	No	According to ACM0002, the project emission of wind power project activity is not considered.
		N_2O	No	According to ACM0002, the project emission of renewable wind power activity is not considered.

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

According to the description in the approved consolidated baseline and monitoring methodology ACM0002 (Version 10), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

The proposed project connected to Fujian Grid, which is a part of ECPG. According to ACM0002, baseline emissions are equal to power generated by the project that delivered to the ECPG, multiplied by the baseline emission factor. The baseline emission factor is calculated as Combined Margin (CM) emission factor 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):

The implementation timeline of the proposed project activity

No.	Date	Description
1	11/11/2007	The EIA of the proposed project has been finished.

2	11/2007	The feasibility study report of the proposed project
3	05/12/2007	The stakeholders conference was hold by the project owner.
4	06/12/2007	The EIA approval letter by Environmental Protection Bureau of Fujian Province
5	10/12/2007	The board meeting on CDM development decision.
6	09/2008	The Signing date of Consultation contract between Longyuan(Beijing) Carbon Asset Management Technology Co.,LTD. and the project owner
7	08/10/2008	The project owner signed the substation construction contract with the construction company.
8	10/10/2008	The project owner informed China DNA the commencement of the project activity.
9	25/10/2008	Road construction date
10	27/10/2008	Substation construction date
11	31/10/2008	The specific validation contract between prior DOE (CQC) and the project owner was signed.
12	08/11/2008	The wind turbines purchasing agreement was signed.
13	1/12/2008	The confirmation for the notification from China DNA was obtained.
14	13/02/2009	The CDM approval from National Development and Reform Commission.
15	31/08/2009	All the wind turbines have been put into operation.
16	20/11/2009	Terminate the contract signed between the project owner and CQC.

In the feasibility study report (FSR), the IRR for the total investment is lower than the benchmark 8%. And at the same time the FSR points out that, the project needs capital support to improve the financial benefits and advices PP to apply for the support of CDM. From the website: http://cdm.ccchina.gov.cn/web/index.asp, the project owner has known a lot about CDM for wind power projects. Considering that the proposed project is additional and meets the CDM application requests, the project owner began to contact with the CDM consultation company. On 5 December 2007, with the help by the consultation company, the project owner held the stakeholders conference successfully. And on 10 December 2007, the board held a meeting discussing the CDM development for the project and reached the same result that the CDM revenue would help the project overcome financial barrier and the project should be applied for CDM registration. On September 2008, the project owner signed the consultation contract with Longyuan(Beijing) Carbon Asset Management Technology Co.,LTD., and signed the validation contract with China Quality Certification Center on 31 October 2008. The project owner signed the 110KV substation construction contract on 08 October 2008 and began to construct the substation in the wind farm from 27 October 2008.

The project uses the *Tool for the Demonstration and Assessment of Additionality (version 5.2)* to demonstrate the additionality .It includes the steps as follows:

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

Define realistic and credible alternatives to the project activity(s) through the following Sub-steps:

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

To provide the same electricity comparable with the proposed CDM project activity, these alternatives include:

a) The proposed project not undertaken as a CDM project activity but as a commercial project;
b) The fossil fuel power plant with the same annual electricity output as the proposed project;
c) Other power plants using other sources of renewable energy with the same annual electricity output as the proposed project;
d) The East China Power Grid as the provider for the same amount electricity output as the proposed project.

In the ECPG, other renewable energies including hydropower, solar PV, biomass and geothermal are the possible power generation technologies. 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. Only hydropower projects have an investment return that can compete over that of wind power projects in China. However, there exists no hydropower exploitable nearby or at the proposed project site that it isn't suit for development of hydropower projects in Dongshan County. Moreover, the proposed project owner is only dedicated to wind power development in Fujian Province, and has no experience and ability to develop other renewable energy power plants. So the scenario c) couldn't be considered as an alternative scenario.

Sub-step1b. Consistency of mandatory laws and regulations

Based on the latest national power statistic data, the operational hour of a fossil fuel plant (5612 hours) [3]is about 2.32 times more than that of the proposed project (2419 hours)[4] with the same capacity. Therefore, a fossil fuel power plant which provides equivalent annual electricity generation would require an installed capacity lower than 50MW. According to China power regulations, fossil fuel power plants of

[3] *China Electric Power Yearbook2007, page626*

[4] The feasibility study report of the proposed project

less than 135MW are prohibited for construction in the areas covered by large grids[5]. Alternative b) is not in compliance with China regulations. Therefore, b) is not a realistic and credible alternative.

Outcome of Step 1: as illustrated above, the alternatives b) and c) were unrealistic and should be eliminated from the four alternatives.

Step2. Investment analysis

This step will determine whether the project is the economically or financially less attractive without the revenue from the sale of CERs.

Sub-step 2a. Determine appropriate analysis method

Tool for the Demonstration and Assessment of Additionality (version 5.2) provides three analysis methods to apply for the investment analysis: the simple cost analysis (option I), the investment comparison analysis (option II) and the benchmark analysis (option III).

For the proposed project, the simple cost analysis method is not applicable because the project activity will generate economic benefit (from electricity sale) other than CDM related income. The investment comparison analysis method is also not applicable because the scenario d) is the ECPG rather than a new investment project.

In conclusion, the proposed project should use the benchmark analysis method based on total investment IRR to determine whether the proposed project financial is viable.

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

According to *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects* (version 1) issued by former State Power Corporation of China in 2002 the project internal rate of return (IRR) as benchmark in China's power generation industry is 8%(after tax), considering economic assessments, especially the interest rate of commercial loans over five years. Nowadays China's existing wind power projects have also applied it as the benchmark IRR.

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

(1) Basic parameters for calculation of financial indicators

According to the feasibility study report of the proposed project, the parameters for calculation of financial indicators are shown in Table 2.

Table 2 Main parameters for calculation of financial indicators

Items	Unit	Amount	Data source

[5] *On Prohibition of 135MW and Smaller-scale Coal-fired Power Plants, General Office of State Council(*http://www.gov.cn/gongbao/content/2002/content_61480.htm*)*

Capacity	MW	49.5	FSR
Static Total Investment	Million RMB	453.46	FSR
Annually net electricity supply	MWh/year	119,760	FSR
O& M	Million RMB	337.55	FSR
Electricity Tariff (Including VAT)	RMB /kWh	0.627/0.45	0.627 is implemented within 30000 operating hours，0.45 is implemented in the rest of operating hours. From FSR.
Value Added Tax (VAT)	%	8.5	FSR
Income tax rate	%	25	FSR
Rate of residual	%	0	FSR
Depreciable period	year	8	FSR
Rate of loan	%	7.05	FSR
Project life time	Year	20	FSR
CERs crediting period	Year	7×3	Section C

(2) Comparison of IRR for the proposed project and the financial benchmark

According to the benchmark analysis method, the proposed project should not be considered as financially attractive if its financial indicators (such as IRR) are lower than the benchmark. Without CERs revenue, the IRR on the total investment in the Excel spreadsheet is 7.44%, lower than the benchmark rate 8%. While CERs revenue is considered, the IRR will reach 10.71%. Thus the proposed project is not considered as financially attractive without CERs revenue. The IRR with and without CERs revenue are listed in the following table.

Table 3 Comparison of IRR with and without CERs revenue

Item	Without CERs revenue	Benchmark	With CERs revenue
IRR	7.44%	8%	10.71

Sub-step 2d. Sensitivity analysis

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. Four factors are considered in following sensitivity analysis:

1) Total investment
2) Annual operation and maintenance cost(O&M cost)
3) Tariff(Excluding VAT)
4) Annual electricity supplied

The four financial parameters were identified as the main variable factors for sensitive analysis of financial attractiveness. Their impacts on IRR of total investment were analyzed in the below tables (Table4 –Table7).

Table 4 Sensitivity of total investment IRR to Total investment

IRR / Range / Parameter	-10%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.0%	7.5%	10.0%	-2.75%
Total investment	9.59%	9.03%	8.48%	7.95%	7.44%	6.95%	6.47%	6.01%	5.57%	8.00%

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

IRR / Range / Parameter	-10%%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.0%	7.5%	10.0%	-11.4%
O&M cost	7.93%	7.81%	7.69%	7.56%	7.44%	7.31%	7.19%	7.06%	6.93%	8.00%

Table 6 Sensitivity of total investment IRR to Tariff

IRR / Range / Parameters	-10%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.0%	7.5%	10%	2.65%
Tariff	5.24%	5.8%	6.36%	6.9%	7.44%	7.97%	8.49%	9%	9.51%	8.00%

Table 7 Sensitivity of total investment IRR to Annual electricity supplied

IRR / Range / Parameters	-10%	-7.5%	-5.0%	-2.5%	0%	2.5%	5.0%	7.5%	10%	3%
electricity supplied	5.53%	6.02%	6.5%	6.97%	7.44%	7.91%	8.37%	8.82%	9.28%	8.00%

As shown in the above tables, the tariff is the most important factor affecting the financial attractiveness of the proposed project. In the case that the tariff increases by 2.65%, the IRR of the proposed project begins to exceed the benchmark. The tariff 0.627 RMB/kWh(Include VAT) is just an optimistic expected tariff. And the final tariff should implement the approval guided tariff by NDRC[6]. Before the FSR

[6] http://www.sdpc.gov.cn/nyjt/nyzywx/t20050810_41378.htm

finished, the only tariff notification public available was 0.585 RMB/kWh for its first 30000 operation hours, and down to the local average tariff after 30,000 operation hours, issued by NDRC on 09/06/2007. Furthermore, according to the latest tariff notification issued by NDRC on 20/07/2009 (Fa Gai Jia Ge [2009]1906), China wind power projects are classified to 4 categories (I, II, III, IV). According to their regional wind resource and construction status, Fujian Province belongs to category IV, thus the tariff of wind power projects in Fujian Province is 0.61 RMB/ kWh (Incl. VAT). Since the tariff in the FSR is an optimistic expected tariff, which is higher than the public tariff in Fujian province. It is very conservative that this tariff has been applied in the IRR analysis. In Fujian province, the local average tariff is 0.36505 RMB/Kwh[7], and is also lower than the expected tariff 0.45RMB/Kwh for the electricity over 30000 hours. Therefore, it is impossible that the future approval guided tariff would increase by 2.65% than the estimated tariff.
Furthermore, in the Fujian province, the applied tariff of the proposed project is higher than the highest tariff of 0.626RMB/kWh (incl. VAT) published by EB in 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". Therefore, with the highest tariff published by EB, the project IRR does not cross the benchmark.

The next important factor for financial attractiveness is the total investment. In the case that total investment decreases by about 2.75%, the IRR of the proposed project begins to exceed the benchmark. Since most of the investment contracts have been signed[8], the signed contracts amount reaches 451.07 million RMB, 99.47% of the static total investment. Hence, it is impossible to lower the expected total investment of the proposed project in the Feasibility Study Report. Within the reasonable range of total investment, the proposed project is always lack of financial attractiveness.

In the case that annual electricity supplied increases by 3%, the IRR of the proposed project begins to exceed the benchmark. Project capacity multiplied by operation hours in a year equals to annual electricity. So the sensitivity around annual electricity supplied is the same as the sensitivity around annual operation hours. According to the Chinese Renewable Energy Law enacted on January 1st 2006, wind power generation should be purchased fully by the grid[9]. Therefore, annual operation hours of the proposed project depend on the average wind speed at the project site for a specific wind turbine. According to the feasibility study report of the proposed project, annual operation hours is estimated based on 52-year wind data provided by local meteorological station (1955-2006) and 1-year wind

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7 http://www.serc.gov.cn/zwgk/jggg/200809/W020080912334874610579.doc

8 The contracts have already been provided to DOE for validation.

9 http://www.gov.cn/ziliao/flfg/2005-06/21/content_8275.htm

resources measurement (from October 2006 to September 2007), which first using professional software WAsP to select the rich wind source area, then using software WindFarmer to optimize the location of each turbine for maximize power generation. Annual operation hours are positive correlation with the wind speed. The average wind speed 5.4 m/s (from October 2006 to September 2007) is a representative value, which is very close to the average wind speed 5.43m/s in the last ten years. And annual average wind speed of the project site tends to decrease and gradually be stable over the past 52 years[10] as shown in Figure 2. The similar CDM project (Registered No. 0995) *Fujian Dongshan Wujiaobay 30MW Wind Power Project*[11], which is also in Dongshan county and the nearest to the proposed project, has about 2179 operation hours one year. The estimated annual operation hours for the proposed project are 2419 hours, 11% higher than the similar project in Dongshan county. Therefore, the probability that annual electricity supplied increased by 3% than the estimated value is very small.

Furthermore, since all the wind turbines have been put into operation on 31 August 2009, the operation data from 31 August 2009 to 27 August 2010 shows that the electricity delivered to the grid are 117,347.372MWh, that is, it will reach 118,647.6 MWh (=117,347.372*365/361) yearly. [12], Which is lower than the value 119,760 MWh applied in the IRR calculation.

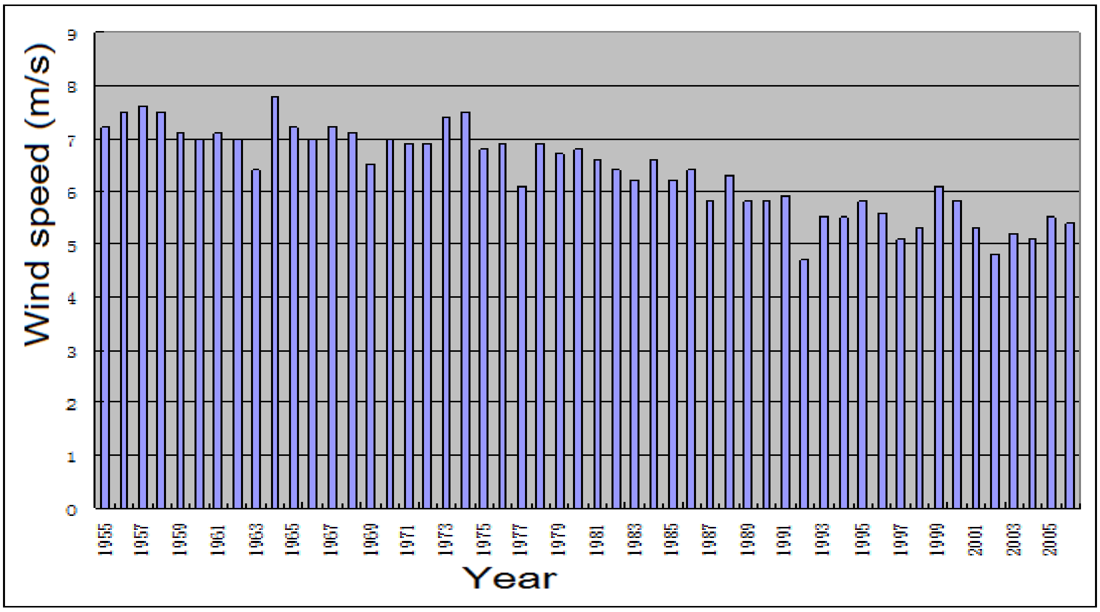

Figure 2 the Average Wind speed provided by local meteorological station

[10] from the feasibility study report of the proposed project.

[11] http://cdm.unfccc.int/Projects/DB/DNV-CUK1173696354.85/view

[12] The sales receipts have been provided to DOE for validation.

The impact of the annual O&M cost is the slightest. The IRR of the proposed project could reach the benchmark when the annual O&M cost decreases by 11.4%. However, according to the Feasibility Study Report of the proposed project, the detailed O&M costs is composed of four kinds of costs - maintenance costs, annual salaries for the employees, insurance premium of fixed assets and other costs. Moreover, the price of material and salaries of the employees are gradually increasing in China, which leads annual O&M cost gradually increasing[13].

Furthermore, the average annual O&M cost for the proposed project is 16.88 Million RMB (about 0.14 RMB/kWh). According to the "Wind Energy – the Facts" implemented by European Wind Energy Association (EWEA) published in Mar. 2009, the O&M costs are generally estimated to be around 1.2 to 1.5 eurocents (c€) per kWh (that is, 0.12 RMB/kWh to 0.15 RMB/kWh) of wind power produced, the annually average O&M cost 0.14 RMB/kWh of the project was within the reasonable range.

Therefore, it is impossible that the annual O&M cost could decrease11.4%, so the proposed project is always lack of financial attractiveness within the reasonable range of annual O&M cost.

Outcome of Step 2: as illustrated above, under the reasonable variations in the critical assumptions, the conclusion regarding the financial additionality is robust and supported by sensitivity analysis. So the proposed project activity is unlikely to be financially attractive.

Step 3. Barrier analysis

Investment analysis has showed that the project is the economically less attractive than other alternatives without the revenue from the sale of CERs. According to "*Tool for the Demonstration and Assessment of Additionality (version 5.2)*", barrier analysis skips.

Step 4. Common practice analysis

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

In China, provincial governments are authorized to regulate wind power projects in the province by the NDRC.[14] So the investment climate, tariff, land policy, regulations etc. are usually similar for wind power projects in the same province. The location of the proposed project belongs to Fujian province. Fujian province is selected as the geographical scope for the common practice analysis of the project. Following the clarification made in the EB38 meeting report (paragraph 60), project activities which have been registered or validated as CDM projects on the UNFCCC CDM website are not

[13] http://www.ic37.com/htm_news/2008-1/15834_66520.htm
http://www.chinadaily.com.cn/hqcj/2007-09/03/content_6075777.htm

[14] http://www.sdpc.gov.cn/nyjt/nyzywx/t20050810_41378.htm

identified as similar activities to the Project thus not listed in below table. The following table lists all wind power projects which not applied for CDM inFujian Province.

In 2006, wind power accounted for only 0.4% of the total installed capacity and 0.18% of actual supply in Fujian province[15], it is clearly that wind power project is very few in Fujian province.

Table 8 all the wind farms which not applied for CDM in Fujian province

Project Title	**Commissioning Date**	**Capacity (MW)**	**On-grid Tariff (RMB RMB/kWh, incl.VAT)**	**Note**
Fujian Dongshan Aozaishan Wind Power Phase I Project	september 2000	6MW	0.75[16]	Demonstration project
Fujian Pingtan Changjiang'ao Wind Power Phase I Project	september 2000	6MW	0.75[17]	Demonstration project

Sources:
http://www.cwea.org.cn/upload/200612391640820.doc

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

Before 2002, two wind power plants mentioned above were demonstration projects and enjoyed higher price than the proposed project. After the reform that enforced the separation of power plants from grids since 2002, it is impossible for the wind farm to receive such high tariffs.
To conclude, the existence of these projects in Table 8 does not contradict the claim that the proposed project activity is financially unattractive.

As described above, the proposed project is lack of common practices in Fujian province. As described above, the proposed project activity meets all criteria of "Tool for the demonstration and assessment of additionality" (*version 5.2*).

Therefore, the proposed project is additional.

B.6. Emission reductions:

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[15] China Electric Power Yearbook 2007, p636,638

[16] http://www.fjjg.gov.cn/fjwjj/jgfw/qsjgzc/webinfo/2000/12/1187774408406219.htm

[17] http://bbs.godeyes.cn/showtopic-212107.aspx

B.6.1. Explanation of methodological choices:

Project emissions

For wind power generation project activities, $PE_y=0$.

Baseline emissions

Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all electricity generation by the proposed project would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline emissions in year y (tCO2/yr)

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

$EF_{grid,CM,y}$ = Combined margin CO2 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" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

Greenfield renewable energy power plants

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

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

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

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

The methodological tool "Tool to calculate the emission factor for an electricity system" (version 02) determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity.

The methodological tool "Tool to calculate the emission factor for an electricity system (version 02)" provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	**tCO2/MWh**	**Combined margin CO2 emission factor for project electricity system in year y**

$EF_{grid,BM,y}$	**tCO2/MWh**	**Build margin CO2 emission factor for project electricity system in year y**
$EF_{grid,OM,y}$	**tCO2/MWh**	**Operating margin CO2 emission factor for project electricity system in year y**

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

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: Identify the group of power units to be included in the build margin (BM).
STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

Step1: Identify the relevant electricity system.

Using the boundary definitions of the Chinese NDRC[18], The spatial extent of the project boundary includes the proposed project and all power plants connected physically to the East China Power Grid that the CDM project power plant is connected to. The East China Power Grid is defined as the **project electricity system**, which consists of independent province-level electricity systems including Shanghai, Jiangsu, Zhejiang, Anhui and Fujian province that can be dispatched without significant transmission constraints. The **connected electricity system** is Center China Power Grid and Yangcheng Power Plant, which is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

Electricity transfers from connected electricity systems to the project electricity system are defined as **electricity imports** and electricity transfers to connected electricity systems are defined as **electricity exports**. The East China Power Grid has the electricity **imports** from the Center China Power Grid and Yangcheng Power Plant.

For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system (East China Power Grid), since the electricity **imports** from Center China Power Grid and Yangcheng Power Plant account for a very small percentage.

(c). The simple operating margin emission rate of the exporting grid has been applied for the electricity imports emission calculation.

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

Step2: 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:

[18] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf

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

The proposed project calculation only included grid power plants. Therefore, Option I is selected.

Step3: Select a method to determine an operating margin (OM)

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

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

The simple OM method (option a) can only be used if low-cost/must-run resources [19] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

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

- Ex ante option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

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

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

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

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

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

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

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

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

Considering the low-cost/ must run resources only constitute 4.5～12%[20] of total generation of East China Power Grid from the year 2003 to 2007(China Electric Power Yearbooks 2004-2008). Therefore, method (a) is chosen to calculate OM emission factor for the proposed project.

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

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- ◆Based on net electricity generation and a CO_2 emission factor of each power unit;[21], (Option A), or
- ◆ 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)

[20] China Power Yearbook 2004-2008

[21] Power units should be considered if some of the power units at the site of the power plant are low-cost/must-run units and some are not. Power plants can be considered if *all* power units at the site of the power plant belong to the group of low-cost/must-run units or if *all* power units at the site of the power plant do *not* belong to the group of low-cost/must-run units.

For the purpose of calculating the simple OM, Option B should only be used if the necessary data for option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost / must-run power sources and if the quantity of electricity supplied to the grid by these sources is known.

For the proposed project, the data on fuel consumption, net electricity generation and the average efficiency of each power unit are unavailable, thus option A cannot be used. Nevertheless, the data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system are available, and, nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known, therefore, Option B can be used.
On Option B, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

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

Where:

$EF_{grid,OMsimple,y}$ = 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 = The relevant year as per the data vintage chosen in Step 3.

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

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. The Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2008. Emission factors ($EF_{CO2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

As chosen in step 3, the simple OM emission factor is calculated by using Ex-ante option of data vintages, i.e. a 3-year generation-weighted average, based on the most recent data available at the time of

submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

The data of installed capacity, electricity generation and fuel consumptions are all from China Energy Statistical Yearbooks 2006-2008 and China Electric Power Yearbooks 2006-2008.

Given the above, the simple operating margin CO2 emission factor ($EF_{grid,OMsimple,y}$) of East China Power Grid is 0.8825tCO_2**/MWh.** The detailed calculations and data are listed in the annex 3 (The baseline emission factor OM is same as the one provided by Chinese NDRC, the website is http://cdm.ccchina.gov.cn/web/index.asp).

Step 5: Identify the group of power units to be included in the build margin

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

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

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[22].

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

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

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

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

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

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

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

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

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

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

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

Step 6: Calculate the build margin emission factor

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

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

Where:

$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year y (tCO2/MWh)

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

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year y (tCO2/MWh)

m = Power units included in the build margin

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

For the proposed project, option 1 in step 5 was chosen to determine the vintage of data.

No matter which options for calculating BM factor mentioned in step 5 was adopted for the proposed project; the same issue on data availability must be addressed. Currently, it is very difficult to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity generated and delivered to the grid and fuel consumption data in power unit m are regarded as commercial secrets or only for internal usage. Then the following deviation was adopted to calculate the Build Margin emission factor. According to the guidance from the CDM Executive Board for a deviation of the baseline methodology of AM0005, which had combined into the baseline methodology of ACM0002, the following deviation was adopted to calculate the Build Margin emission factor.
(http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ)

♦ Use of capacity additions during last 1 - 3 years for estimating the build margin emission factor for grid electricity.

♦ Use of weights estimated using installed capacity in place of annual electricity generation.

♦Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

Following the EB's guidance the build margin is calculated as follows:

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

2. The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.
   Since the power plant capacity additions in the electricity system from 2005 to 2007 comprise 24.99% of the system generation (in MWh), so the sample group *m* consists of the power plants that have been built from 2005 to 2007. (See Annex 3 for detailed calculation)

3. To be conservative, zero emission factors were selected for hydropower capacity and other capacity. Moreover, since specific data on coal fired capacity, oil fired capacity, and gas fired capacity could not be separated from current statistical data on fossil fuel fired capacity, the following approach was adopted for calculating the emission factor of fossil fuel fired capacity addition:

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

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}} \quad (4)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}} \quad (5)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{co_2,i,j,y}} \quad (6)$$

Where:

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

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

$EF_{CO_2,i,j,y}$ = CO_2 emission factor of fossil fuel type i by province *j* in year *y* (tCO2/GJ)

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

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

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

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are the emission factors for the best commercially available technology of coal fired power generation, oil fired power generation, and gas fired power generation, respectively (See Annex 3 for detailed calculation).

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

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

Where:

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

Following the four steps above, the build margin emission factor $EF_{grid,BM,y}$ of the East China Power Grid is calculated to be 0.6826tCO_2/**MWh.** The detailed calculations and data are listed in the annex 3 (The build margin emission factor BM is same as that provided by Chinese NDRC, the website is http://cdm.ccchina.gov.cn/web/index.asp.)

Step 7: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

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

Where:
$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$ =Operating margin CO2 emission factor in year y (tCO2/MWh)
w_{OM} =Weighting of operating margin emissions factor (%)
w_{BM} =Weighting of build margin emissions factor (%)

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

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} = 0.8325\text{t}\mathbf{CO_2/MWh}$$

Leakage

No leakage emissions are considered. 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 and upstream emissions from fossil fuel use (e.g. extraction, processing and transport). These emissions sources are neglected.

Emission reductions

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

$$ER_y = BE_y - PE_y \quad (10)$$

Where:

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

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

PE_y = Project emissions in year y (t CO2/yr).

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

Data / Parameter:	$FC_{i,y}$, $F_{i,j,y}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type i (in a mass or volume unit) consumed by power plant/unit (or in the project electricity system in case of $FC_{i,y}$) in year y, or the amount of fuel type i (in a mass or volume unit) consumed by province j
Source of data used:	China Energy Statistical Yearbook 2006-2008
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$NCV_{i,y}$
Data unit:	kJ/kg or kJ/m3
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	China Energy Statistical Yearbook 2008

Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of fossil fuel type i in year y
Source of data used:	2006 IPCC default values
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	Applied for calculating OM and BM

Data / Parameter:	$\eta_{coal,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for coal fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	38．10
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value
Any comment:	Applied for calculating BM

Data / Parameter:	$\eta_{oil,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for oil fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	49.99
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value
Any comment:	Applied for calculating BM

Data / Parameter:	$\eta_{gas,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for gas fired plant

Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	49.99
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic value
Any comment:	Applied for calculating BM

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO2/MWh
Description:	Combined margin CO2 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 used:	http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm
Value applied:	0.8325
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to calculate the emission factor for an electricity system" (version02)
Any comment:	Applied for calculating emission reduction.

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

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

Baseline emissions

Operating Margin emission factor（$EF_{OM,y}$）（tCO_2/MWh）：0.8825

Build Margin emission factor（$EF_{BM,y}$）（tCO_2/MWh）：0.6826

Baseline Emission factor（EF_y）（tCO_2/MWh）：0.8325

Project emissions

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

$$PE_y = 0$$

Leakage

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

$$L_y = 0$$

Project Emission Reductions

The emission reduction (*ERy)* by the project activity during a given year y is the difference between

baseline emissions (*BEy*), project emissions (*PEy*) and emissions due to leakage (*Ly*), as follows:

$$ER_y = BE_y - PE_y - L_y$$

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

$$ER_y=BE_y= EG_{PJ,y} \times EF_y = EG_{facility,y} \times EF_y$$

Annual generation is estimated as 119,760MWh. Using the approach above, the annual emission reductions are estimated to be 99,700 tCO2 .the proposed project activity is expected to achieve 697,900 tCO2 of net emission reductions during the first 7-year crediting period. (details in Annex3).

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
01/01/2011—31/12/2011	0	99,700	0	99,700
01/01/2012—31/12/2012	0	99,700	0	99,700
01/01/2013—31/12/2013	0	99,700	0	99,700
01/01/2014—31/12/2014	0	99,700	0	99,700
01/01/2015—31/12/2015	0	99,700	0	99,700
01/01/2016—31/12/2016	0	99,700	0	99,700
01/01/2017—31/12/2017	0	99,700	0	99,700
Total (tonnes of CO_2e)	0	697,900	0	697,900

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

B.7.1. Data and parameters monitored:

Data / Parameter:	$\mathbf{EG}_{export}$
Data unit:	MWh
Description:	The quantity of power electricity supplied to ECPG in year y
Source of data to be used:	Measured from the on-site monitoring meters and verified against sales data
Value of data applied for the purpose of calculating	119,760

expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuously measurement and monthly recording
QA/QC procedures to be applied:	Two meters are the multifunctional electricity meters (accuracy degree is no less than 0.5, bidirectional). The electricity supplied to the grid is measured according to the main meter. In order to measure electricity when the main meter is out of order, the backup meter is for usage. Both meters will be calibrated as per China electric industry regulation DL/T448-2000. The electricity supplied by the project activity to the grid should be double checked by Electricity Transaction Receipts.
Any comment:	

Data / Parameter:	$\mathbf{EG}_{import}$
Data unit:	MWh
Description:	The quantity of power electricity imported from ECPG in year y
Source of data to be used:	Measured from the on-site monitoring meters and verified against sales data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Continuously measurement and monthly recording
QA/QC procedures to be applied:	Two meters are the multifunctional electricity meters (accuracy degree is no less than 0.5, bidirectional). The electricity supplied to the grid is measured according to the main meter. In order to measure electricity when the main meter is out of order, the backup meter is for usage. Both meters will be calibrated as per China electric industry regulation DL/T448-2000. The electricity supplied by the project activity to the grid should be double checked by Electricity Transaction Receipts.
Any comment:	

Data / Parameter:	$\mathbf{EG}_{facility}$
Data unit:	MWh
Description:	The net quantity of power electricity supplied to ECPG in year y
Source of data to be used:	Calculated by $\mathbf{EG}_{export}$ minus $\mathbf{EG}_{import}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5	119,760
Description of measurement methods and procedures to be	Continuously measurement and monthly recording

applied:	
QA/QC procedures to be applied:	Two meters are the multifunctional electricity meters (accuracy degree is no less than 0.5, bidirectional). The electricity supplied to the grid is measured according to the main meter. In order to measure electricity when the main meter is out of order, the backup meter is for usage. Both meters will be calibrated as per China electric industry regulation DL/T448-2000. The electricity supplied by the project activity to the grid should be double checked by receipt of sales or Electricity Transaction Receipts.
Any comment:	

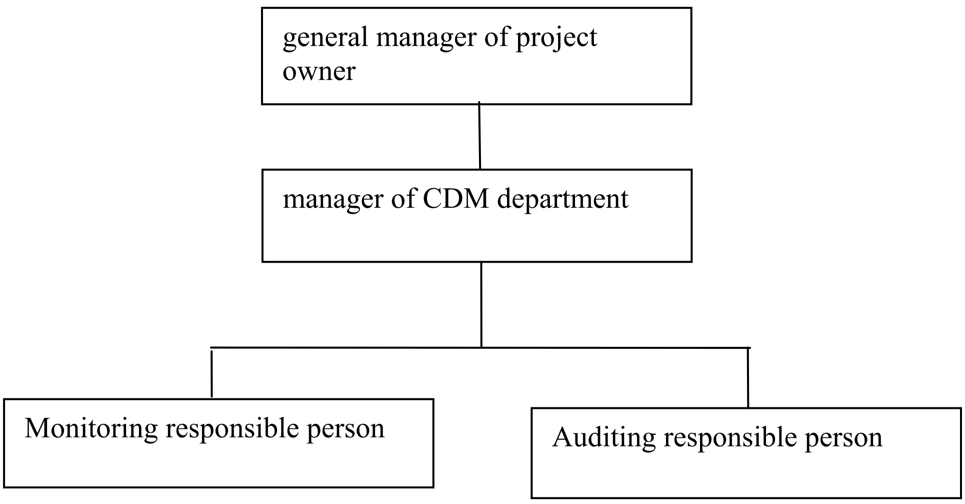
B.7.2. Description of the monitoring plan:

1. Introduction

The project adopts the approved consolidated baseline and monitoring methodology ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (Version 10) to determine the emission reductions from the net electricity generation from the wind farm. This plan describes the process in more detail.

2. Responsibility

Fujian Dongshan Aozaishan Wind Power Development Co.Ltd. is overall responsible for monitoring and carrying out this monitoring plan. The management structure is illustrated as follows:



Title	Responsibility
general manager of project owner	Appoint persons according to the management structure chart
manager of CDM	1. Cooperate with the DOE and the consultancy company to complete

department	validation and verification; 2. Collect the project completion report, power purchase agreement, calibration organization qualification and meter calibration report; 3. Communicate and coordinate with the meter calibration organization when the meter is out of order 4. Organize the training of the relative persons.
Auditing responsible person	1. Collect the copy of sales receipts for each month; 2. Check the records provided by the grid monthly with the records from the wind farm. If any data errors are detected, inform the monitoring responsible person and correct the data immediately.
Monitoring responsible person	1. Carry out operational rules and regulations made for the wind farm; 2. Organize and dispatch workers 3. Ensure the equipment run normally. Report the abnormal to the CDM manager. 4. Input the daily reading of the meter in the wind farm into Excel spreadsheet. Be responsible for the monthly electricity statistics. And send the result to the auditing responsible person. 5. Record the readings of the meters 6. Check the records with the readings recorded by the wind turbine system. If any data errors are detected, correct the data immediately.

3. Training

The monitoring staff should be trained by professional CDM consulting company before the registration. Daily training will be arranged according to the requirements by operation and management in different phase of wind farm construction. During construction period, Engineering management training should be planned. The workers should be trained by the wind turbine manufacturer. Before the project putting into operation, the workers should be trained on dispatching knowledge by the local grid company.

4. Calibration

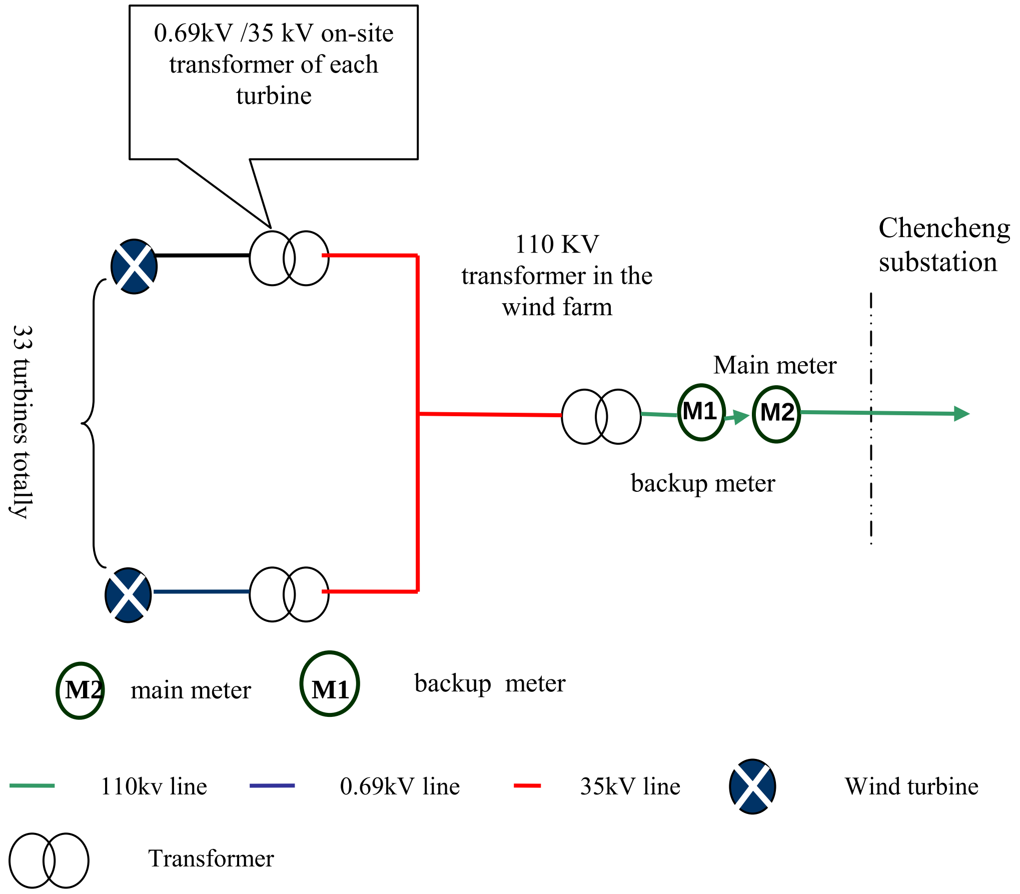
The monitoring meters should be tested before installation by qualified third party. During the operation period, the metering equipments are calibrated once a year by qualified third party. For accuracy according to the requirements from *Technical Administrative code of Electric Energy Metering (DL/T448*

—*2000)*. The meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

5. Monitoring system

Two meters, Main meter and back up meter, will be installed at the outlet of the 110KV substation in the wind farm. Both meters are the multifunctional electricity meters (accuracy degree is no less than 0.5, bidirectional). The electricity supplied to the grid and the electricity imported from the grid will be measured through the main meter. In order to measure electricity when the main meter is out of order, the backup meter will be for usage.

Chencheng substation is the local dispatching center of ECPG.



6. Monitoring data

According to the meters system mentioned above, the net electricity supplied by the proposed project activity is calculated based on the recording measured by the meter installed at the outlet of the 110KV substation in the wind farm, recording exports to the grid (supply) and imports from the grid (consumption). Net electricity supplied to the grid is calculated by exports minus imports. The recording

frequency will be continuously measured and monthly recorded.

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1.EG_{export}	Electricity supplied to the grid by the project	Electricity meter	MWh	*m*	continuously measured and monthly recorded	100%	electronic	During the crediting period and two years after	Rechecked by sales receipt
2.EG_{import}	Electricity imported from the grid by the project	Electricity meter	MWh	*m*	continuously measured and monthly recorded	100%	electronic	During the crediting period and two years after	Rechecked by sales receipt
3.$EG_{facility}$	Net Electricity imported from the grid by the project	calculate	MWh	*c*		100%	electronic	During the crediting period and two years after	

The meter reading will be readily available for DOE. Calibration records will be maintained for verification.

Overall responsibility for monitoring greenhouse gas emissions reductions will rest with the CDM monitoring staff of the proposed project. Monitoring responsible person will record the readings of the meters and check the recorded data with the data from the wind turbine system. Auditing responsible person will check the records with Electricity transaction Receipts issued by the grid company. If any data errors are detected, the monitoring responsible person should be informed and the data should be corrected immediately. All paper-based information will be stored by auditing responsible person of Fujian Dongshan Aozaishan Wind Power Development Co.Ltd. and the electronic copy will be kept by manager of CDM department and auditing responsible person. And all data including calibration records are kept until 2 years after the end of the total crediting period of the CDM project.

The table below outlines the key documents relevant to monitoring and verification of the emission reductions from the proposed project.

Table9 List of the key documents relevant to monitoring and verification

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

7. Error disposal

● If any errors are detected, the project owner owning the meter should organize repairing, recalibration or replacement the meter, and all these activities should be done in the presence of the representative of the local grid company.

● Should reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the electricity supplied to the grid by the proposed project shall be determined by:

a) First, by reading the backup meter, unless a test by either party reveals it is inaccurate;
b) if the backup meter is not with acceptable limits of accuracy or are otherwise performing improperly, the readings from self-carried meters of wind turbines should be accepted, unless a test by either party reveals they are inaccurate;
c) if the self-carried meters of wind turbines are not with acceptable limits of accuracy or are otherwise performing improperly, the project owner and the local grid shall jointly prepare an estimate of the correct reading; and
d) If the project owner and Zhangzhou Power Supply Bureau fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to No. 19 in the Relevant Regulation on Renewable Energy made by NDRC.[23]

[23] Notice of the National Development and Reform Commission on Printing The Mangement Regulation of Renewable Energy Power Generation, code: Fa Gai Neng Yuan [2006] No.13

8. Quality assurance and Quality control

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity. This is an on-going process that will be ensured through the CDM in terms of the need for verification of the emissions.

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

Date of completion of baseline: 04/12/2009

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

(Not the project participants listed in Annex 1)

- Ms. Feng Tianfeng

  Entity: Longyuan (Beijing) Carbon Asset Management Technology Co.,LTD.

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

  Telephone/fax: +8610-66091327/66091396

  E-mail: tffeng@163.com

SECTION C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

>>

C.1.1. Starting date of the project activity:

08/10/2008 (Substation construction contract was signed.)

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

20years 0 month

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

C.2.1. Renewable crediting period

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

01/01/2011 or the registered date whichever is later.

C.2.1.2. Length of the first crediting period:

7 years 0 month

C.2.2. Fixed crediting period:

N/A

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Environmental impacts

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

In accordance with relevant environmental law and regulations, an environmental impact assessment (EIA) of the project was completed in November.2007. The project is likely to cause the following environmental impacts:

- **Main Potential Environmental Impacts Associated with the project**
  - Impacts from the construction of the wind farm include construction noise, dust as well as water and soil loss etc;
  - Impacts from noise pollutions of the turbines during the exploitation of the wind farm;
  - Impacts on native vegetation and environment as a result of construction activities for windmill towers, transformers, and access roads;
  - Impacts on Socio-Economy from the construction and operation of the project
  - Impacts on Electromagnetic Environment from the substation
- **Impacts on Air Environment**

Wind Power plants are known to contribute to zero atmospheric pollution as no fuel combustion is involved during any stage of the operation. However, the sources of air pollution are mainly due to the construction activities including the transportation of construction material, road construction and Improvement and cadre construction etc. The impacts on air environment are temporarily that the impact will be ended when the construction is completed. It is suggested that several measures shall be taken into account, such as the construction under strong wind weather is prohibited, reducing as much as possible the area of construction, spraying water when undertaking construction, and reducing the speed of vehicles in the field. Hence, air pollution caused by the project is not significant to the surrounding environment.

- **Impacts on Noise Environment**

The noise of the project in construction phase is from vehicles and machines on-site. According to the monitoring data from the construction site, the noise is at a level between 91-102 dB. Based on the

formula of declining of sound emitted from a non-directional source, it is estimated that the maximum noise effective distance of the project is 50m in daytime and 300m at night. Moreover, the magnitude of the impacts during construction phase exists for a temporary period of time till the end of construction phase. However, operational noise from the rotating blades is expected to be minimal due to the higher background noise caused by strong winds. The closest residential area to the site of the Project is over 5km away. Therefore, the noise of the project will not have impact on nearby residents.

- **Impacts on Water and Solid Waste**

The wind-farm does not consume any water, nor does it generate any wastewater in the operation phase. The possible negative impacts are the household wastewater and solid waste produced by builders and staff, and the waste earth from digging of the foundation in the construction phase. Under normal conditions with highly automated monitoring and control system, the household wastewater will be first treated in a septic tank, and then be disinfected to discharge for circumjacent virescence. Moreover, the amount of household solid waste will be very little, which will not have impact on the environment. Besides, the solid waste will be collected and moved to the landfill site of the nearest city. The waste earth from the digging should be firstly used for refilling. The rest of the waste earth should be placed in the low area of the site and replanted with grass. Following the suggestion, the water and solid waste should have no significant impact on the environment.

- **Impacts on Ecosystem Environment**

A serious potential concern for wind farms is their impact on vegetation, animals and migrating birds. The land on which the project activity takes place is barren and unfertile. Prior to the project activity the land had no beneficial use. The vegetation in the project area was substituted by grassland for livestock use and land for cultivation. So the minor quantity of solid / liquid discharge, likely to be generated during the construction phase has no noticeable impact on soil use and the project proponent has made arrangements to dispose them in an environmentally acceptable manner. Moreover, there are no migratory birds / endangered species in the region of project activity. Therefore, the activities to be carried out will not generate any negative impact on the ecological environment.

- **Socio-Economic Impacts**

The preliminary appraisal assumed a larger installed capacity and higher coal displacement in the project. The project is estimated to supply 119760MWh of power to the Fujian Power Grid, which is estimated that 41916tce coal will be saved. So the project generates eco-friendly, GHG free power that contributes to sustainable development of the region. Moreover, the locals have benefited economically through land sales and revenues. The project activity not only helps the uplift of skilled and unskilled manpower in the region, but also improves employment rate and livelihood of local populace in the vicinity of the project.

- **Impacts on Electromagnetic Environment**

The proposed substation is located on Damaoshan mountain. There is no resident in 1.8 km away from

the substation. The electromagnetic intensity of the substation is far lower than the limited value 4000V/m for electric intensity and lower than the limited value 100uT for magnetic intensity, which are recommended in *Technical regulations on environmental impact assessment of electromagnetic radiation produced by 500 KV ultrahigh voltage transmission and transfer power engineering*[24]. And wireless interference value is also lower than the limited value 46BuV/m (0.5MHz), which is regulated by the country.

- **Conclusion**

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

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

The construction and operation of the proposed project have no significant environmental impacts. The Environmental Assessment Report of the project has been approved by the Environmental Protection Bureau of Fujian Province on 6 Dec. 2007.

SECTION E. Stakeholders' comments

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

According to the requirement by the *Measures for Operation and Management of Clean Development Mechanism Projects in China* and PDD, the project owner held an open public survey and a stakeholders conference in Dongshan county during December 2007-March 2008. In the public survey and conference, the stakeholder representatives were respectively from the local government and the nearby village where the proposed project is located.

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

1) Respondent's basic information and education level;
2) The influences on their surrounding environment and livelihoods during construction and operation of the project;
3) The suggestions to the proposed project;
4) Whether or not agree with the construction of this project.

[24] http://www.zhb.gov.cn/tech/hjbz/bzwb/other/pjjsdz/199902/t19990201_71406.htm

The survey had a 100%response rate (20 questionnaires returned out of 20, education level of the respondents: primary level (40%); middle level above (60%)) and the statistical result was shown in table 8.

- Stakeholder conference: the meeting was held on 5 December 2007 in Dongshan county to explain CDM，better understand the stakeholders' interests and obtain their comments. In the meeting, the presentations were followed by Q &A and further discussion. Present at the conference were totally 10 representatives and experts, mainly from the local Development and Reform Bureau, the local Environmental Protection Bureau, the local Power Supply Corporation, and the nearby village.

E.2. Summary of the comments received:

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

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

Table 10 Statistic of the comments in the survey

No.	Discussional items	Options	Percentage（%）
1	Will the project improve the local development or increase job opportunities?	Yes	100
		No	0
2	Will the project have positive impacts on local economy/environment/society/others?(multi-options)	economy	95
		environment	35
		society	5
		others	0
3	Are they satisfied with their life conditions and surrounding	Yes	100

	environment?	No	0
4	What the impacts on environment should be considered? (Muti-options)	Ecological environment	60
		Noise pollution	30
		Water pollution	0
		Solid waste	10
		Air pollution	0
5	Will they support the construction of the project?	Yes	100
		No	0

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

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Entity:

Organization:	Fujian Dongshan Aozaishan Wind Power Development Co.Ltd.
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Represented by:	Sun Cuihua
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First Name:	Cuihua
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Direct FAX:	+86-10-68502358
Direct tel:	+86-10-68502963
Personal E-Mail:	suncuihua@yahoo.com.cn

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I countries is involved in the proposed project.

Annex 3
BASELINE INFORMATION

The Annex 3 provides the basic data and results of the baseline emission factor of East China Power Grid.

The key parameters for the emission factors calculation

The key parameters in OM and BM calculation include the net caloric values (NCVs) and CO_2 emission factor per unit of energy (EF_{co2}s) of various types of fuels, and power supply efficiency of various power generation technologies.

Fuel	NCVs (kJ/kg)	Emission Factor (kgCO_2/TJ)
Coal	20908	87,300
Washed coal	26344	87,300
Other washed coal	8363	87,300
Moulded coal	20908	87,300
Coke	28435	95,700
Crude oil	41816	71,100
Gasoline	43070	67,500
Diesel	42652	72,600
Fuel oil	41816	75,500
Other petroleum products	41816	75,500
Natural gas	38931	54,300
Coke oven gas	16726	37,300
Other gas	5227	37,300
LPG	50179	61,600
Refinery gas	46055	48,200

Data sources:

NCVs are from *China Energy Statistical Yearbook 2008, P283.*

EFco2 are from *2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy, Chapter 1, P1.21-1.22, Table 1-3, and Table 1-4.*

1.Calculation of the Operating Margin Emission Factor ($EF_{OM,y}$)

Table A-1 Electricity Generation of Thermal Power of East China Power Grid in 2005

Province	Electricity Generation (MWh)	Self-service Power Consumption Rate (%)	Electricity Delivered to the Grid (MWh)
Shanghai	74,606,000	5.05	70,838,397
Jiangsu	211,429,000	5.96	198,827,832
Zhejiang	108,110,000	5.59	102,066,651
Anhui	62,918,000	5.9	59,205,838
Fujian	48,600,000	4.57	47,425,257
Total			477,317,698

Data source: *China Electric Power Yearbook 2006*

Table A-2 Electricity Generation of Thermal Power of East China Power Grid in 2006

Province	Electricity Generation (MWh)	Self-service Power Consumption Rate (%)	Electricity Delivered to the Grid (MWh)
Shanghai	72,033,000	5.06	68,388,130
Jiangsu	251,258,000	5.69	236,961,420
Zhejiang	140,349,000	5.62	132,461,386
Anhui	71,867,000	6.05	67,519,047
Fujian	55,580,000	4.51	53,073,342
Total			558,403,325

Data source: *China Electric Power Yearbook 2007*

Table A-3 Electricity Generation of Thermal Power of East China Power Grid in 2007

Province	Electricity Generation (MWh)	Self-service Power Consumption Rate (%)	Electricity Delivered to the Grid (MWh)
Shanghai	72,600,000	4.72	69,173,280
Jiangsu	270,900,000	5.55	255,865,050
Zhejiang	172,300,000	5.83	162,254,910
Anhui	84,800,000	5.92	79,779,840
Fujian	72,300,000	5.59	68,258,430
Total			635,331,510

Data source: *China Electric Power Yearbook 2008*

Table A-4 Fuel Consumption and Emissions of East China Power Grid in 2005

Fuel	Unit	Shanghai A	Jiangsu B	Zhejiang C	Anhui D	Fujian E	Sub-Total F=A+B+C+D+E	Carbon Content (tc/TJ) G	EF_{CO2} ($kgCO_2$/TJ) I	NCV (MJ/t,km^3) J
Coal	10^4t	2847.31	9888.06	4801.52	3082.9	2107.69	**22727.48**	25.8	87,300	20,908
Washed Coal	10^4t						**0**	25.8	87,300	26,344
Other washed coal	10^4t						**0**	25.8	87,300	8,363
Coke	10^4t			0.03			**0.03**	29.2	95,700	28,435
Coke oven gas	10^8m^3	1.68	1.38		1.71		**4.77**	12.1	37,300	16,726
Other gas	10^8m^3	83.72	24.97	0.06	30		**138.75**	12.1	37,300	5,227
Crude oil	10^4t			27.01			**27.01**	20	71,100	41,816
Gasoline	10^4t						**0**	18.9	67,500	43,070
Diesel	10^4t	1.25	16	4.52		1.67	**23.44**	20.2	72,600	42,652
Fuel oil	10^4t	59.39	13.22	153.22		7.45	**233.28**	21.1	75,500	41,816
LPG	10^4t						**0**	17.2	61,600	50,179
Refinery gas	10^4t	0.57	0.83				**1.4**	15.7	48,200	46,055
Natural gas	10^8m^3	1.09	1.85	0.62			**3.56**	15.3	54,300	38,931
Other petroleum products	10^4t	21	8.38	34.8			**64.18**	20	75,500	41,816
Other coking products	10^4t						**0**	25.8	95,700	28,435
Other energy	10^4tce	12.36		15.29			**27.65**	0	0	0

	Imported Generation (MWh)	Emission Factor (tCO2e/MWh)	CO2 Emission (tCO2e)
Electricity Delivered by East China Power Grid	477,317,698		429,544,732
Generation Imported from Central China Power	27,039,000	1.16148	31,405,359.93

Generation Imported from Yangcheng Power Plant	11,282,000	1.06604	12,027,087.3
OM	**0.91726tCO_2e/MWh**		

Table A-5 Fuel Consumption and Emissions of East China Power Grid in 2006

Fuel	Unit	Shanghai A	Jiangsu B	Zhejiang C	Anhui D	Fujian E	Sub-Total F=A+B+C+D+E	Carbon Content (tc/TJ) G	EF_{CO2} ($kgCO_2$/TJ) I	NCV (MJ/t,km^3) J
Coal	10^4t	2744.45	10945.42	6065	3455.2	2369.63	**25579.7**	25.8	87,300	20,908
Washed Coal	10^4t						**0**	25.8	87,300	26,344
Other washed coal	10^4t		150.54		23.06		**173.6**	25.8	87,300	8,363
Coke	10^4t			39.07			**39.07**	29.2	95,700	28,435
Coke oven gas	10^8m^3	1.71	3.13	0.23	0.71		**5.78**	12.1	37,300	16,726
Other gas	10^8m^3	84.64	106.54	3.28	25.12		**219.58**	12.1	37,300	5,227
Crude oil	10^4t			20.3			**20.3**	20	71,100	41,816
Gasoline	10^4t						**0**	18.9	67,500	43,070
Diesel	10^4t	2.13	3.7	4.11	1.21	1.11	**12.26**	20.2	72,600	42,652
Fuel oil	10^4t	44.51	3.77	71.98	0.02	4.5	**124.78**	21.1	75,500	41,816
LPG	10^4t						**0**	17.2	61,600	50,179
Refinery gas	10^4t	0.29	0.4		2.95		**3.64**	15.7	48,200	46,055
Natural gas	10^8m^3	3.2	13.5	9.18			**25.88**	15.3	54,300	38,931
Other petroleum products	10^4t	18.82	3.57				**22.39**	20	75,500	41,816
Other coking products	10^4t						**0**	25.8	95,700	28,435
Other energy	10^4tce	6.66	2.8	27.45	3.21		**40.12**	0	0	0
								Imported	Emission Factor	CO2 Emission

	Generation (MWh)	(tCO2e/MWh)	(tCO2e)
Electricity Delivered by East China Power Grid	558,403,325		485,051,699
Generation Imported from Central China Power	24,029,150	1.12157	26,950,312.38
Generation Imported from Yangcheng Power Plant	11,150,820	0.997020	11,117,588.2
OM	**0.88129tCO_2e/MWh**		

Table A-6 Fuel Consumption and Emissions of East China Power Grid in 2007

Fuel	Unit	Shanghai A	Jiangsu B	Zhejiang C	Anhui D	Fujian E	Sub-Total F=A+B+C+D+E	Carbon Content (tc/TJ) G	EF_{CO2} (kgCO_2/TJ) I	NCV (MJ/t,km^3) J
Coal	10^4t	2754.04	11060.78	7350	3929.9	3097.87	**28192.59**	25.8	87,300	20,908
Washed Coal	10^4t						**0**	25.8	87,300	26,344
Other washed coal	10^4t		459.17		29.32		**488.49**	25.8	87,300	8,363
Coke	10^4t			35.06			**35.06**	29.2	95,700	28,435
Coke oven gas	10^8m^3	0.89	9.73	0.22	1.56	0.75	**13.15**	12.1	37,300	16,726
Other gas	10^8m^3	98.92	70.45	3.41	36.3	1.71	**210.79**	12.1	37,300	5,227
Crude oil	10^4t			15.15			**15.15**	20	71,100	41,816
Gasoline	10^4t						**0**	18.9	67,500	43,070
Diesel	10^4t	1.23	5.37	2.76		1.01	**10.37**	20.2	72,600	42,652
Fuel oil	10^4t	40.76	1.55	29.52		2.04	**73.87**	21.1	75,500	41,816
LPG	10^4t						**0**	17.2	61,600	50,179
Refinery gas	10^4t	0.2	0.63		2.55		**3.38**	15.7	48,200	46,055
Natural gas	10^8m^3	4.61	19.17	11.01			**34.79**	15.3	54,300	38,931
Other petroleum products	10^4t	20.39	2.78				**23.17**	20	75,500	41,816

Other coking products	10^4t						**0**	25.8	95,700	28,435
Other energy	10^4tce	6.89	28.88	44.93	7.52	9.43	**97.65**	0	0	0

	Imported Generation (MWh)	Emission Factor (tCO2e/MWh)	CO2 Emission (tCO2e)
Electricity Delivered by East China Power Grid	635,331,510		535,305,699
Generation Imported from Central China Power	31,823,310	1.10197	35,068,444.7
Generation Imported from Yangcheng Power Plant	12,773,620	0.972544	12,422,903.2
OM	**0.85714tCO_2e/MWh**		

Data source: *China Energy Statistical Yearbook 2008*

Table A-7 Operating Margin Emission Factor of East China Power Grid

OM Emission Factor (tCO_2e/MWh)			Weighted Average OM Emission Factor (tCO_2e/MWh)
2005	2006	2007	**0.8825**
0.91726	**088129**	**0.85714**	

Notes:
The average OM emission factor is the weighted average of OM emission factors in previous three years.
Weight = Every Year's Electricity Delivered by East China Power Grid (including imported electricity) / Three Years' Total Electricity Delivered by East China Power Grid (including imported electricity)

2. Calculation of the Build Margin Emission Factor （$EF_{BM,y}$）

Table A-16 Installed Capacity of East China Power Grid in 2007

Installed Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal Power	MW	14,150	53,340	39,490	17,760	13,910	138,650
Hydropower	MW	0	140	8,520	1,510	9,800	19,970
Nuclear	MW	0	2,000	3,070	0	0	5,070
Wind power and others	MW	268.8	517.8	40	0	269	1,096
Total	MW	14,418.80	55,997.80	51,120.00	19,270.00	23,979.00	164,786

Data source: *China Electric Power Yearbook 2008*

Table A-14 Installed Capacity of East China Power Grid in 2006

Installed Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal Power	MW	14526	51776	35391	14134	13001	128828
Hydropower	MW	0	136	8369	1001	8957	18463
Nuclear	MW	0	0	3066	0	0	3066
Wind power and others	MW	253	162	43	0	89	547
Total	MW	14779	52074	46869	15135	22047	150904

Data source: *China Electric Power Yearbook 2007*

Table A-15 Installed Capacity of East China Power Grid in 2005

Installed Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Thermal Power	MW	13113.5	42506.4	27688.1	11423.2	9345.4	104076.6
Hydropower	MW	0	142.6	6952.1	749.8	8224.9	16069.4
Nuclear	MW	0	0	3066	0	0	3066
Wind power and others	MW	253.3	58.8	37.2	0	52	401.3
Total	MW	13366.8	42707.8	37743.4	12173	176223	123613.3

Data source: *China Electric Power Yearbook 2006*

Table A-17 Calculation of New Installed Capacity of East China Power Grid

	Installed Capacity in 2005 (MW)	Installed Capacity in 2006 (MW)	Installed Capacity in 2007 (MW)	Additional Capacity from 2005to 2007 (MW)	Proportion of Additional Capacity (%)
	A	B	C	D=C-A	E
Thermal Power	104,076.60	128,828	138,650	34,573.4	83.97
Hydropower	16,069.40	18,463	19,970	3,900.6	9.47
Nuclear	3,066	3,066	5,070	2004	4.87
Wind power	401.3	547	1,095.60	694.3	1.69
Total	123,613.3	150,904	164,785.6	41,172.3	100
Share of Installed Capacity in 2006	75.01%	91.58%	100.00%		

Table A-18 CO_2 Emission Factor of Additional Fossil Fuel Fired Power Project

	Variable	Supply Efficiency	Fuel Emission Factor (tc/TJ)	EF_{CO2} (tCO_2/MWh)
		A	B	$C=3.6/A/10^6*B$
Coal-fired Power Plant	$EF_{Coal,Adv}$	38.10%	87,300	0.8249
Gas Power Plant	$EF_{Gas,Adv}$	49.99%	75,500	0.5437
Oil-fired Power Plant	$EF_{Oil,Adv}$	49.99%	54,300	0.3910

Table A-19 Calculation of Emission Weight of Solid Fuel, Liquid Fuel and Gas Fuel in Overall Fuel Emission

Fuel	Unit	Shanghai	Zhejiang	Jiangsu	Anhui	Fujian	Total	NCV (MJ/t,km^3,tce)	Emission Factor ($kgCO_2$/TJ)	CO Emissions (tCO_2e)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I=F*G*H*44/12/100
Coal	10^4t	2,754.04	11,060.80	7,350	3,929.90	3,097.87	28,192.59	20,908	87,300	514,590,436
Washed coal	10^4t	0	0	0	0	0	0	26,344	87,300	0
Other washed coal	10^4t	0	459.17	0	29.32	0	488.49	8,363	87,300	3,566,416
Coke	10^4t	0	0	0	0	0	0	20,908	87,300	0
Total		0	0	35.06	0	0	35.06	28,435	95,700	954,063
Crude oil	10^4t									519,110,916
Gasoline	10^4t	0	0	15.15	0	0	15.15	41,816	71,100	450,427
Diesel	10^4t	1.23	5.37	2.76	0	1.01	10.37	42,652	72,600	321,111
Fuel oil	10^4t	40.76	1.55	29.52	0	2.04	73.87	41,816	75,500	2,332,156
Other petroleum products	10^4t	20.39	2.78	0	0	0	23.17	41,816	75,500	731,502
Total										3,835,196
Natural gas	10^7m^3	46.1	191.7	110.1	0	0	347.9	38,931	54,300	7,354,444
Coke oven gas	10^7m^3	8.9	97.3	2.2	15.6	7.5	131.5	16,726	37,300	820,402
Other gas	10^7m^3	989.2	704.5	34.1	363	17.1	2,107.90	5,227	37,300	4,109,712
LPG	10^4t	0	0	0	0	0	0	50,179	61,600	0
Refinery gas	10^4t	0.2	0.63	0	2.55	0	3.38	46,055	48,200	75,031
Total										12,359,588

Data source: *China Energy Statistical Yearbook 2008*

From the above table and formulae (4), (5) and (6) in B.6, the weights are as follows:
$\lambda_{Coal,y}$=96.97%， $\lambda_{Oil,y}$=0.72%， $\lambda_{Gas,y}$=2.31%。

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

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.8129 \ tCO_2e/MWh$$

$$EF_{BM,y} = EF_{Thermal,Adv} \times CAP_{Thermal,addition} / CAP_{Total,,addition} = 0.8129 \times 83.97\% = 0.6826 \ tCO_2e/MWh$$

3. Calculation of Baseline Emission Factor (EF_y)

Table A-20 Baseline Emission Factor (EF_y) of East China Power Grid

Calculation of the Key Factors

Operating Margin Emission Factor ($EF_{OM,y}$) (tCO_2/MWh) : 0.8825

Build Margin Emission Factor ($EF_{BM,y}$) (tCO_2/MWh): 0.6826

Baseline Emission Factor (EF_y) (tCO_2/MWh): 0.8825*0.75+0.6826*0.25=0.8325

Annex 4

MONITORING INFORMATION

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