CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)[1]

CONTENTS

Annexes

[1] The PDD form Version 02 has been updated according to UNFCCC/CDM-EB 19 report Annex 14: Revised guidelines for completing the project design document (CDM-PDD), the proposed new methodology: baseline (CDM-NMB) and the proposed new methodology: monitoring (CDM-NMM), Version 03, taking into effect on 13 May 2005. See http://cdm.unfccc.int/meetings/019/eb19repan14.pdf.

SECTION A. General description of project activity

A.1 Title of the project activity:

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Guangdong Nan'ao Huaneng 45.05 MW Wind Power Project
Version number of the document: rewritten-01
Date: June, 22nd 2006

A.2. Description of the project activity:

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The objective of Guangdong Nan'ao Huaneng 45.05 MW Wind Power Project (hereafter refered to as the Project), a grid-connected renewable project, is to utilize the wind power for generating electricity which will be sold into the Shantou Power Grid, an integral part of the Southern China Power Grid. The Project activity will achieve greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions from the business-as-usual scenario electricity generation of those fossil fuel-fired power plants connected into the Southern China Power Grid.

The Project is sited in the east of Nan'ao Island, Shantou City, Guangdong Province in southern China. The Project involves the installation of 53 sets of turbines, each of which has a capacity of 850 kW, providing a total installed capacity of 45.05 MW. According to the anemometry data collected during the past years, the Project site has excellent wind resources. It is estimated that the feed-in electricity to the Southern China Power Grid from the 53 sets of turbines of the Project is 100.965 GWh per year.

The Project clearly fits into the development priority of China, and will support China in stimulating and accelerating the commercialization of grid-connected renewable energy technologies and the green-power market development. It will therefore help reduce GHG emissions resulting from the high-growth, coal-dominated business-as-usual scenario.

Being an environment sound project, the proposed project will also play a complementary role in supplying the electricity to the Southern China Power Grid. Moreover, given the fact that turbines are often perceived as aesthetic in China, the site of the Project is expected to become a local attraction so as to promote the development of local tourism industry. Moreover, the proposed project will demonstrate the contribution of large grid connected wind power projects as alternative sustainable energy future in improving energy security, air quality, local livelihoods and the overall sustainable development of the renewable energy industry in China.

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

- reducing greenhouse gas emissions compared to business-as-usual scenario;
- helping to stimulate the growth of the wind power industry in China;
- reducing the emission of other pollutants resulting from the power generation industry in China, compared to business-as-usual scenario;
- creating local employment opportunities during the project construction and operation period;
- promoting the development of local tourism.

A.3. Project participants:

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Participants to the project activity are the following:

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

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host country)	Huaneng New Energy Industrial Co. Ltd. (project owner)	No
Spain	Endesa, S.A.	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

The following are the main Project Participants:

Project Owner: Huaneng New Energy Industrial Co. Ltd. (HNEIC), a subsidiary company solely owned by China Huaneng Group.

Registered in Nov 2002 with a total registered capital of 80 million RMB (US$9.67million), HNEIC has committed itself in the business areas of new energy project development, investment and operation. The main business activities of HNEIC include: new energy project development and investment, OEM, engineering construction and operation for various types of new energy projects including hydro, wind power, LFG power, solar and etc; it also provides services in the areas of sales and marketing of the engineering construction equipment, as well as the related technology development, transference, training and maintenance.

HNEIC believes that the company should supply “green power” to the market, and assumes responsibility in protecting the environment. It has made a full commitment to the sustainable development for the society at large. Translating its commitment into action, HNEIC has developed a large number of renewable energy projects, thus reducing significant amount of GHG emissions in the market of China.

Host Country: The host country is the People’s Republic of China and the Designated National Authority is the National Development and Reform Commission of the government of China. The government of the People’s Republic of China announced its approval of the Kyoto Protocol in August 2002.

Purchasing Party: Endesa, S.A. As one of the world’s largest electric utilities and the only Spanish electricity multinational, Endesa carries out electricity generation, transmission, distribution and supply activities, directly or through its subsidiaries, in Spain, Portugal, Italy, France, Chile, Argentina, Peru, Colombia, Brazil, the Dominican Republic, Morocco, Poland and Turkey.

It is the leader in the Spanish electricity market, the largest private electricity multinational in Latin America, the largest electricity company in Chile, Argentina, Peru and Colombia, and one of the best positioned electricity companies in Southern Europe.

Endesa has an installed capacity of 46,364 MW and 48 billion Euros in total assets. In 2004, it produced 184,951 GWh and supplied 192,519 GWh to 22 million customers.

Other parties involved in the Project but who are not Project Participants include:

Project Developer: Green Capital Consulting Company, a China-registered legal entity specializing in providing solutions for green project development, financing and implementation in the China.

More detailed contact information on the Participants and other Parties are provided in Annex 1

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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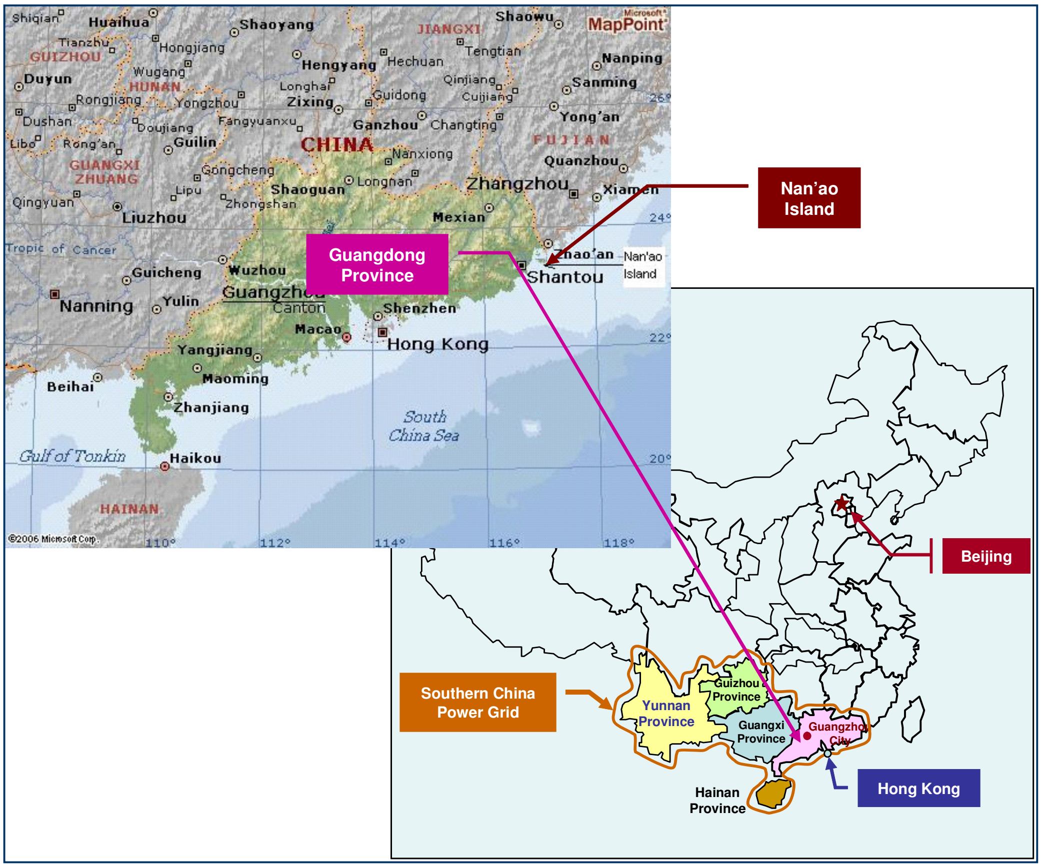
Figure 1. Map showing the location of Nan'ao Island



The Project is sited in the east of Nan'ao Island, Shantou City, Guangdong Province. Nan'ao Island is an island county within Shantou City which is surrounded by the South China Sea, about 450 km and 50 km away east to Guangzhou City and Shantou City respectively, and about 180 sea miles northeast to Hong Kong. Figure 1 shows the location of Nan'ao Island.

A.4.1.1. Host Party(ies):

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The Host Country is the People's Republic of China.

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

>>
Guangdong Province

A.4.1.3. City/Town/Community etc:

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Nan'ao Island, Shantou City

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

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The Project has geographical coordinates with east longitude of 117º06' and north latitude of 23º27'. The area of the site is about 10 km in east-west and 4 km in north-south (L×W), with a 400 m of the elevation. The Project site is faced and closed to the South China Sea in north, east and south, about 450 km and 50 km away from the east of Guangzhou City and Shantou City respectively, about 180 sea miles away from the northeast of Hong Kong. While situated in subtropical zone with monsoon marine climate, the site is also surrounded by mountains within the island, with a varied topography and dense vegetation. Figure 2 shows the location of the Project.

Figure 2. Location of the Project

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

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This category would fall within sectoral scope 1: energy industries.

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

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The Project involves the installation of 53 sets of turbines with a unit capacity of 850 kW.

The turbines will be arranged according to the wind resource conditions as well as the geographical characteristics of the island. The hub height is 65 m. The estimated electricity output to the grid is 100.965 GWh per year, the annual average operational hour is 2138 h, and the capacity factor is 0.256.

The Project will adopt a mode in one-turbine-one-transformer unit for grid connection. Each turbine will has a 690V-to-35kV transformer, from which a tri-circuit 35 kV current collection line will be linked into the newly constructed 110 kV switchgear at the substation, then a 45.7 km long 110 kV line will be linked into the 220 kV Su'nan Substation.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

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Compared to those typical grid-connected fossil fuel-fired power plants connected into the Southern China Power Grid, the grid-connected wind power project has obvious disadvantages, including much higher cost in per kW installation and initial capital investment, and much shorter annual operational hours. Since the key part of the turbines were imported from abroad and the construction cost on islands is higher than that on mainland, even with preferential bus-bar tariff (0.528 RMB/kWh)[2], the IRR of the total investment of the Project is only 7.54% and the IRR of equity of the Project is only 8.26%. The Project is unfeasible in terms of economic and commercial considerations. Therefore it is not attractive to investors.

The Project is additional and therefore not the baseline scenario as it faces key financial barriers. In the absence of additional revenues, possibly those from the CDM project activity, the Project will have difficulties in construction and operation and the GHG emission reductions generated by the Project is unlikely to occur.

Based on CDM project, financial indicators of the Project can be improved with CER sales revenue, which guarantees the successful implementation of the Project. Therefore the Project activity can achieve greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions from the electricity generation of those fossil fuel-fired power plants connected into the Southern China Power Grid.

2. From October 1, 2004, the bus-bar tariff of new incremental coal-fired unit (including co-generation unit) is 0.405 RMB (without desulphurization equipment, including tax) and 0.420 RMB (with desulphurization equipment, including tax). New incremental oil-fired unit is 0.4716 RMB (including tax). (Source: Notice of related issues on bus-bar tariff adjustment and management issued by the Pricing Bureau of Guangdong Province)

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

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It is expected that the Project activities will generate emission reductions, within the Southern China Power Grid, in a total annual amount of 82,428 tCO_2e over a 21-year renewable crediting period (7 yrs×3) from the Oct., 2006 to Sep., 2027. Estimated emission reductions are achieved by avoiding CO_2 emissions from electricity generation of those fossil fuel-fired power plants connected into the Southern China Power Grid.

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emission reductions shall be in indicated using the following tabular format.

Years	Annual estimation of emission reductions in tonnes of CO_2e
Oct. to Dec., 2006	20,607
2007	82,428
2008	82,428
2009	82,428
2010	82,428
2011	82,428
2012	82,428
2013	82,428
2014	82,428
2015	82,428
2016	82,428
2017	82,428
2018	82,428
2019	82,428
2020	82,428
2021	82,428
2022	82,428
2023	82,428
2024	82,428
2025	82,428
2026	82,428
Jan. to Sep., 2027	61,821
Total estimated reductions (tonnes of CO_2e)	**1,730,988**
Total number of crediting years	**21**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**82,428**

Please note that the emission reduction calculation is only a estimation and the actual emission reductions will be calculated every year according to the actual electricity output of the Project, and the baseline will be renewed every seven years.

A.4.5. Public funding of the project activity:

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There is no public funding from Annex I Parties for this Project.

SECTION B. Application of a baseline methodology

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

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ACM0002.ver 06 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." For more information regarding the methodology please refer to http://cdm.unfccc.int/methodologies/approved.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

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Wind power generation technology is a renewable electricity generation technology to displace fossil fuel-fired power generation technology to supply electricity to the grid. Therefore the Project applies the consolidated baseline methodology ACM0002 approved by CDM EB to determine the project baseline and calculate GHG emission reductions achieved by wind power generation.

The Project meets all applicability conditions of the consolidated baseline methodology ACM0002 as follows:

1） The Project involves the electricity capacity additions from wind power.

2） The Project does not involve switching from fossil fuels to renewable energy at the site of the Project activity.

3） The geographic and system boundaries for the Southern China Power Grid can be clearly identified and information on the characteristics of the Southern China Power Grid is available.

B.2. Description of how the methodology is applied in the context of the project activity:

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GHG emission reductions of the Project were calculated based on the consolidated baseline methodology ACM0002.

Baseline emission factors of operating margin ($EF_{OM,y}$) and build margin ($EF_{BM,y}$) were calculated based on the data of the Southern China Power Grid, which include installed capacity, electricity output and consumption of different types of fuels of all plants. The baseline emission factor (EF_y) is calculated as a combined margin (CM) of $EF_{OM,y}$ and $EF_{BM,y}$, according to the following three steps:

STEP 1. Calculate the Operating Margin Emission Factor(s) ($EF_{OM,y}$**)** based on one of the four following methods:

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

Each method is analyzed as below.

<u>Method (a) Simple OM</u>

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount of grid generating output 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. Among the total electricity generations in 2004 of the Southern China Power Grid which the Project is connected into, the electricity output of low-cost/must run resources accounts for about 30%, less than 50%. Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin ($EF_{OM,y}$) for the Project.

Method (b) Simple adjusted OM

The application of simple adjusted OM method requires annual load duration curve of the grid. The power sector in China is in a transitional period of "separating the plant operation from the grid operation", resulting in the detailed data of dispatch and fuel consumption are often taken as confidential business information by the grid company and the power plants. Therefore those data are not publicly available. In most cases, it is difficult for the CDM projects in China to adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$). Similarly, the Project can not adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$) due to unavailability of the dispatch data of the Southern China Power Grid.

Method (c) Dispatch data analysis OM

Dispatch data analysis OM method should be the first choice if the dispatch data are available, because the method can truly reflect the substitutable relationship between the amount of electricity output from power plants of the baseline grid and that from the Project activity and the emission reductions generated. However, Method (c) cannot be adopted for the Project because of unavailability of the dispatch data of the Southern China Power Grid, similar reason as method (b).

Method (d) Average OM

Method (d) can only be used when 1) low-cost/must run resources constitute more than 50% of total amount of grid electricity output and 2) detailed data required by applying method (b) and method (c) is unavailable. Among the total amount of electricity output in 2004 of the Southern China Power Grid where the Project is connected into, the electricity output of low-cost/must run resources accounts for about 30%, less than 50%, so method (d) cannot be applied to the Project.

In conclusion, Method (a) Simple OM is the only reasonable and feasible method among the four methods for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the Project.

In accordance with the consolidated baseline methodology ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2e/MWh) of all generating sources serving the system, excluding those low-operating cost and must-run power plants. The formula of $EF_{OM,simple,y}$ calculation is

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (1)$$

where:

$F_{i,j,y}$ is the total amount of fuel i (in a mass or volume unit) consumed by all the relevant power sources j in year(s) y, j refers to the power sources serving the grid, excluding those low-operating cost and must-run power plants, and including imports to the grid,

$COEF_{i,j,y}$ is the total amount the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the oxidation rate of the fuel in year(s) y, and

$GEN_{j,y}$ is the electricity output (MWh) supplied to the grid by the sources j.

The CO_2 emission coefficient $COEF_i$ is then obtained from equation (2) as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad (2)$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of fuel i,

$OXID_i$ is the oxidation factor of the fuel i (see page 1.29 in the 1996 Revised IPCC Guidelines for Default Values), and

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The net calorific values of the fuels adopted are data obtained from the *China Energy Statistical Yearbook* 2005 Edition and IPCC default, and the oxidation factors of the fuels adopted are obtained from IPCC default.

The Simple OM emission factor ($EF_{OM,y}$) of the Project is calculated based on the electricity generation mix of the Southern China Power Grid, excluding those low-operating cost and must-run power plants, such as wind power and hydropower etc[3]. These data, the Simple OM emission factor ($EF_{OM,y}$) of the Southern China Power Grid is calculated as 0.9222 tCO_2e/MWh (see Annex 3 for details).

STEP 2. Calculate the Build Margin Emission Factor ($EF_{BM,y}$ **)** according to the consolidated baseline methodology ACM0002 using equation (3):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (3)$$

where:

$F_{i,m,y}$ is the total amount of fuel i (in a mass or volume unit) consumed by all the sample power sources m in year(s) y, m refers to the sample power plants serving the grid, excluding those low-operating cost and must-run power plants, and including imports to the grid,

$COEF_{i,m,y}$ is the total amount the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by sample power sources m and the

3 The data on installed capacity and electricity output of different power generation technology options are obtained from the *China Electric Power Yearbook* (published annually) 2003, 2004 and 2005 editions. The data on different fuel consumptions for power generation in the China Southern Power Grid are obtained from the provincial *Energy Balance Table* (of year 2002 to 2004) from the *China Energy Statistical Yearbook (2000~2002)* and the *China Energy Statistical Yearbook* 2004 and 2005 Edition (published annually after 2003). The *China Energy Statistical Yearbook* 2005 Edition is published in June, 2006.

oxidation rate of the fuel in year(s) y, and

$GEN_{m,y}$ is the electricity output (MWh) supplied to the grid by the sources m.

The consolidated baseline methodology ACM0002 provides two options for sample group m:
(1) The five power plants built most recently, or
(2) The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently.

It is suggested that the sample group that comprises the larger annual generation should be used.

In China, it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently because these data are considered as confidential business information by the plants owners. Taking notice of this situation, EB accepts the following deviation in methodology application:

1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

In this PDD, as required, capacity additions of the Southern China Power Grid during 2002~2004[4] were calculated and the 600 MW sub-critical coal-fired power plant was used as the proxy of efficiency level of the best technology in China[5] for estimating the $EF_{BM,y}$. Based on these data, the build margin emission factor ($EF_{BM,y}$) of the Southern China Power Grid is calculated as 0.4990 tCO_2e/MWh (see Annex 3 for details).

STEP3. Calculate the baseline emission factor (EF_y)

Based on the consolidated baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated as the weighted average of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$), as

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \tag{4}$$

According to the consolidated baseline methodology ACM0002, the weight w_{OM} is 0.75 and the weight w_{BM} is 0.25 for wind power projects. Therefore the combined baseline emission factor

EF_y =0.75×0.9222+0.25×0.4990=0.8164 (tCO_2e/MWh).

Baseline emissions

4 Capacity addition during 2002~2004 are most close to 20%. Calculation details are available for DNA and DOE.
5 http://www.ccchina.gov.cn/source/fa/fa2002082803.html

Baseline emissions are calculated with combined baseline emission factor and electricity output of the Project as follows:

$$BE_y = EG_y \times EF_y \quad (5)$$

According to the consolidated baseline methodology ACM0002, the main indirect emissions potentially giving rise to leakage in the context of electric sector projects result from activities such as power plant construction, fuel handling(mining, processing, and transportation), and land inundation (for hydroelectric projects). The project developer does not need to consider such indirect emissions when applying the methodology. So the Project can take no account of such leakages, $L_y = 0$.

The Project activity will generate greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions from electricity generation by fossil fuel power plants. The emission reduction (ER_y) during a given year y is calculated as follows:

$$ER_y = BE_y - PE_y - L_y \quad (6)$$

Since the project emission for wind power (PE_y) and the linkage (L_y) is considered as zero, the emission reduction is equal to baseline emission (BE_y), i.e.:

$$ER_y = BE_y = EG_y \cdot EF_y \quad (7)$$

B.3. 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:

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The additionality of the Project is demonstrated and assessed by using the *Tool for the Demonstration and Assessment of Additionality* approved in the sixteenth meeting of the Executive Board (EB16). It includes the following steps:

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

The objective of the Step 1 is to define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

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

Plausible and credible alternatives available to the Project that provide outputs or services comparable to the proposed CDM project activity include:

Alternative I: Construction of a fuel-fired power plant with equivalent amount of annual electricity generation;

Alternative II: The proposed project activity not undertaken as a CDM project activity;

Alternative III: Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation; and

Alternative IV: Provision of equivalent amount of annual power output by the grid where the Project is connected (excluding those low cost/must run plants).

Based on Step 2: Investment Analysis, the Project is not financially attractive without consideration of CDM sales revenues. Alternative II is not feasible.

Since there are no economically exploitable technology options of grid-connected renewable energy power projects on Nan'ao Island, Alternative III is not feasible.

Sub-step 1b. Enforcement of applicable laws and regulations:

For Alternative I, considering the same annual electricity generation, the alternative baseline scenario for the proposed project should be a fuel-fired power plant with installed capacity of 25 MW or lower. Further, as the proposed project is a grid-connected wind power generation project, the alternative baseline scenario must be a grid-connected fuel-fired power generation project. However, according to China's regulations, construction of coal-fired power plants with capacity of less than 135 MW are prohibited in the areas which can be covered by large grids such as provincial grids[6], and the fossil fuel-fired power units with capacity of less than 100 MW is strictly limited for installation[7]. For these reasons, the possible alternative baseline scenario of building a 25 MW fuel-fired power plant conflicts with China's current regulations. Therefore, Alternative I is not feasible.

For Alternative IV, the installed capacity of the Southern China Power Grid for both the existing power plants and the power plants to be built in a foreseeable future satisfies China's regulations, which is also economically feasible. Therefore, Alternative IV is feasible.

In conclusion, the practical and feasible baseline scenario is Alternative IV, the provision of equivalent amount of annual power output by the Southern China Power Grid.

Step 2. Investment Analysis

The purpose of this step is to determine whether the Project activity is economically or financially less attractive than other alternatives without an additional revenue/funding, possibly from the sale of certified emission reductions (CERs). The investment analysis was conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

Tools for the Demonstration and Assessment of Additionality suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn the revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The alternative baseline scenario of the Project is the Southern China Power Grid rather than new investment projects. Therefore Option II is not appropriate. The Project will use benchmark analysis method (Option III) based on the consideration that benchmark IRR of the power sector is available.

Sub-step 2b. Benchmark Analysis Method (Option III)

With reference to the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects,* the financial benchmark rate of return (after tax) of China's power industries is 8% for the IRR of total investment or 10% for the IRR of equity. Presently, the financial benchmark rate of return is used in the

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

7 Interim Rules on the Installation and Management of Small-scale Fuel-fired Generators(issued in Aug., 1997)

analysis of wind power projects in China. On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

The requirements of the "Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45 (e) of the CDM Modalities and Procedures) in determining a baseline scenario" issued by EB16 was also considered in analysis, such as preferential tax for wind power project.

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

(1) Basic parameters for calculation of financial indicators

Basic parameters for calculation of financial indicators of the Project are as follows:

Installed capacity:	45.05 MW
Estimated annual output:	100.965 GWh
Project lifetime:	21 years
Total investment:	417 million RMB (equity/debt ratio: 33/67)
Loan period:	15 years
Interests of the loan:	6.12%
Expected bus-bar tariff:	0.528 RMB/kWh (including VAT)
Tax:	8.5% (VAT); 15% (income tax, exempted for the first 5 years).
Operation cost:	5.97 million RMB
Expected CERs price:	Euro 7/tCO_2e (rate of exchange: Euro 1 = 9 RMB)
Crediting period:	7 yrs×3 (renewable)

(2) Comparison of the financial benchmark of IRR and NPV for the Project

In accordance with the benchmark analysis (Option III), if the financial indicators (such as IRR and NPV) of the Project are lower than the benchmark, the Project is not considered as financially attractive.

Table 1 shows the IRR and NPV of the Project without CER sales revenues. Without CER sales revenues, the IRR of total investment is lower than the benchmark (8%) and the IRR of equity is lower than the benchmark (10%). Thus the Project is not financially attractive. Considering of the fluctuation of bus-bar tariff, exchange rate or others which may increase the risk of the Project, the Project is not financially attractive to investors.

Table 1. Financial indicators of the Project (without CER sales revenues)

	NPV (total investment, ic=8%) (million RMB)	NPV (equity. ic=10%) (million RMB)	IRR (total investment) benchmark=8%	IRR (equity) benchmark=10%
Without CER sales revenues	-11.54	-18.27	7.54	8.26

Sub-step 2d. Sensitivity analysis

The objective of sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive.

For the Project, following financial parameters were taken as uncertain factors for sensitive analysis of financial attractiveness:

- Total investment
- Bus-bar tariff (not including VAT)
- Annual O&M cost

The impacts of total investment, bus-bar tariff (not including VAT)and annual O&M cost of the Project on IRR of total investment were analyzed. The results of sensitive analysis of three indicators are shown in Table 2 and Figure 3.

Table 2. IRR of total investment sensitivity to different financial parameters (without CER sales revenues)

Range / Parameter	-10%	-7.5%	-5%	-2.5%	0	+2.5%	+5%	+7.5%	+10%
Total investment (%)	8.98	8.60	8.17	7.88	7.54	7.22	6.90	6.60	6.31
Bus-bar tariff (including VAT) (%)	6.18	6.53	6.87	7.21	7.54	7.87	8.20	8.52	8.84
Annual O&M cost (%)	7.74	7.69	7.64	7.59	7.54	7.49	7.44	7.39	7.34

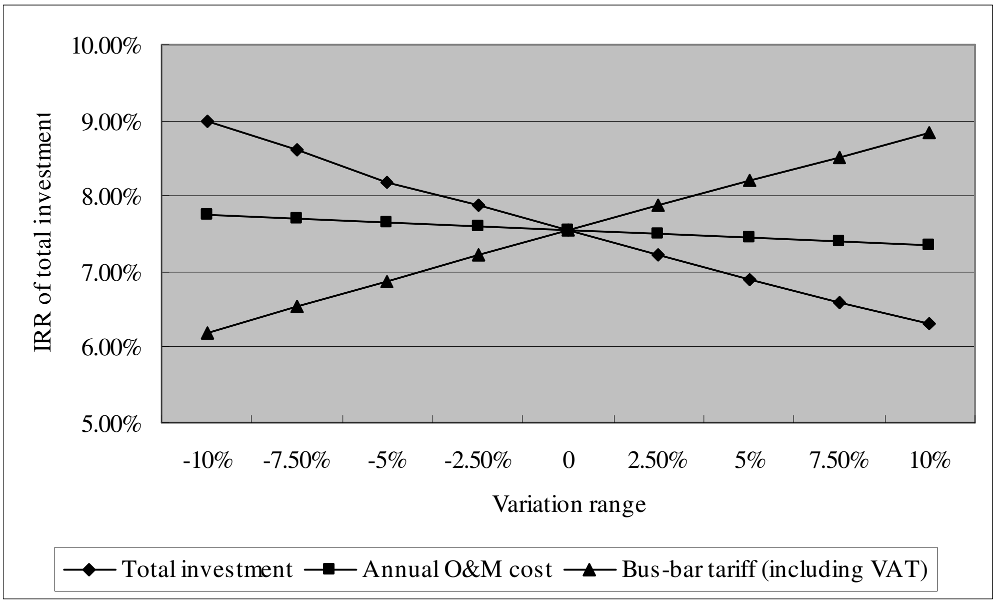


Figure 3. IRR of total investment sensitivity to different financial parameters (without CER sales revenues)

Among the three financial indicators, the impact of the total investment on IRR is the most significant. When total investment decreases by 3.4%, the IRR of total investment exceeds the benchmark. The next one is the impact of bus-bar tariff. When the bus-bar tariff increases by 3.5%, the IRR of total investment exceeds the benchmark. The impact of annual O&M cost on IRR is minimal. When the annual O&M cost decreases by 23%, the IRR of total investment exceeds the benchmark.

Step 4 Common practice analysis

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

Guangdong Province is one of the pioneers of wind power development in China and the Nan'ao County, especially, is one of the most active regions for wind investments. Up to date, six enterprises, from overseas and domestic, developed wind power projects in the Nan'ao Island, resulting in a total installation of 132 sets of wind turbines with a total amount of installation capacity of 54 MW.

Wind power developments in Guangdong Province (including Nan'ao Island) have historically been supported by government preferential policies and financial incentives, including the income tax exemptions and/or reductions, bus-bar tariff and favorable mixed loan of credit. Bus-bar tariff for those existing wind power projects was much higher than that of the Project, as shown in Table 3.

Table 3[8]. Bus-bar tariff for existing wind power projects in Guangdong Province

Name	Bus-bar tariff (RMB/kWh)	Average bus-bar tariff of the Guangdong Power Grid
Guangdong Shanwei Honghaiwan Wind farm	0.743	
Guangdong Huilai Wind farm	0.74	0.39 RMB/kWh [9]
Guangdong Huilai Haiwanshi Wind farm	0.65	
Guangdong Nan'ao Zhenneng Wind farm	0.62	

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

The Guangdong Power Grid bears the price difference between the higher bus-bar tariff of wind power and the average bus-bar tariff within the Guangdong Power Grid. At present, the average bus-bar tariff for the Guangdong Power Grid is 0.39 RMB/kWh, which means Guangdong Power Grid must pay the differences in a total amount of 13~50 million RMB per year for wind power generated from the existing wind power projects in the Nan'ao County. Although Guangdong Province is a relatively rich province in China, it is still be a burden for the Guangdong Power Grid to bear without difficulties. As a result, the Guangdong provincial government stipulated, in year 2001, that "bus-bar tariff for the wind power should not be higher than the average amount of power sales price within the Guangdong Power Grid".[10] The current bus-bar tariff for the newly built wind power projects is therefore caped to a price of 0.528 RMB/kWh[11] (VAT included). Such a price will also be applied to the Project. It is obvious that the price adopted by the Project will be lower than those bus-bar tariffs of the existing wind power projects in Guangdong Province. The existing projects could not demonstrate that wind power projects are commercially and financially viable.

Step 5 Impact of CDM Registration

In the absence of the anticipated CER sales revenues, the Project owner may slow down the implementation of the Project in order to find ways to reduce risks. Taking this into account, the Project owner has been actively looking for international cooperation based on CDM for a long time.

If the Project fails to be approved and registered, the absence of the CER sales revenues may weaken the loan repayment capability and equipment maintenance capacity of the Project, which may lead to cash flow crisis and failure of the Project.

8 http://www.newenergy.org.cn/energy/wind/read.asp?id=605
9 www.gxzx.gov.cn
10 http://www.gd.xinhuanet.com/newscenter/2003-12/04/content_1290343.htm
11 Document No.[2004]110, Guangdong Provincial Pricing Bureau

If the Project can be successfully registered as a CDM project, the CER sales revenue will supplement the tariff of the Project, allowing the Project owner to gain the investment return equivalent to that of the baseline scenario and to offset some risks associated with the uncertainty of the bus-bar tariff. Furthermore, the CER sales revenues, which will be in foreign currency, can reduce foreign exchange risk associated with the purchase of foreign equipment and relieve some of the pressures on the Project owner to repay project loan. In addition, the CER sales revenues can be one of the sources for the technical maintenance reserve for the 850 kW turbine which helps guarantee successful implementation of the Project.

Considering of the CER sales revenues (calculated with Euro 7/tCO_2e, 7yrs×3 crediting period), the IRR of the Project will be significantly improved to meet the financial benchmark requirements of the power sector in China.

Table 4. Financial indicators of the Project (with CER sales revenues)

	NPV (total investment, ic=8%) (million RMB)	NPV (equity. ic=10%) (million RMB)	IRR (total investment) benchmark=8%	IRR (equity) benchmark=10%
With CER sales revenues	33.05	19.18	9.28	11.84

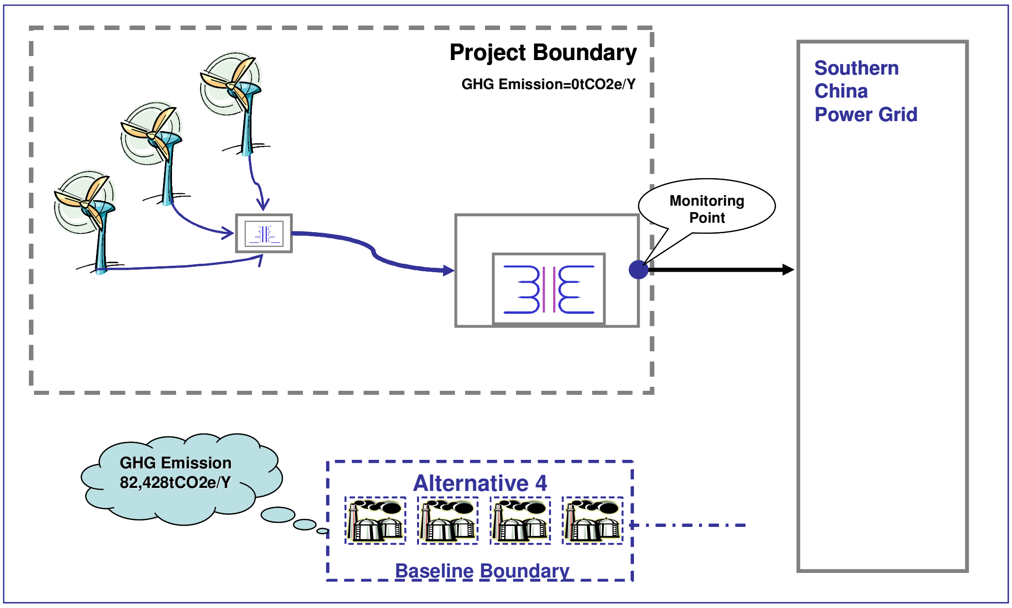
B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

>>

The electricity displaced by the Project activity should be the electricity generated by the Southern China Power Grid. Therefore, the boundary when calculating the baseline operating margin emission factor and build margin emission factor is set within the Southern China Power Grid. The spatial scope of the Project boundary covers those fossil fuel-fired power plants physically connected into the Southern China Power Grid that are influenced by the Project activity.

According to introductions on the website of Southern China Power Grid Co., Ltd. (http://www.csg.net.cn/), the Southern China Power Grid is composed of Guangdong Power Grid, Guangxi Power Grid, Yunnan Power Grid, Guizhou Power Grid and Hainan Power Grid. Therefore the spatial scope of the Southern China Power Grid covers grids of these five provinces.

Figure 4. The project boundary and baseline boundary of the Project



B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

>>

The baseline study of the Project was completed on June 2006 by following key individuals:

1. **Mr. Zheng Zhaoning**, zhaoning.zheng@tuttle-international.com.
2. **Ms. Pan Tao**, tao.pan@tuttle-international.com.
3. **Ms. Xia Xiaoshu**, xiaoshu@co2-china.com, Green Capital Consulting Company, Suit 2001, Building 7, Jianwai SOHO, Beijing 100022, China.

The person/entity is not project participant listed in Annex 1.

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:

>>
29/07/2005 (construction starting date)

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

>>
21y-0m.

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:

>>
01/10/2006.

C.2.1.2.Length of the first crediting period:

>>
7y-0m

C.2.2. Fixed crediting period:

C.2.2.1.Starting date:

>>
Not applicable.

C.2.2.2.Length:

>>
Not applicable.

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>>
ACM0002 ver.06 – "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources." For more information regarding the methodology please refer to http://cdm.unfccc.int/methodologies/approved.

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

>>
Applying the consolidated monitoring methodology ACM0002 to the Project is justified because:

- This monitoring methodology shall be used in conjunction with the consolidated baseline methodology ACM0002, and the Project has adopted the consolidated baseline methodology ACM0002.
- The Project involves an electricity capacity addition of a renewable source (wind energy) providing power to the grid.
- The Project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- The geographic and system boundaries for the Southern China Power Grid can be clearly identified and information on the characteristics of the Southern China Power Grid is available.

In line with the consolidated monitoring methodology ACM0002, Option 1 is chosen as the monitoring method.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

>>

Being a wind power project, no emissions from the Project Activity were identified. There are therefore no entries in the following.

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

Being a wind power project, no emissions from the Project activity were identified. There are therefore no formulae included here.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

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)	Comment
1.EG_y	Electricity supplied to the grid	ammeter	MWh	m	continuously	100%	Electronic and paper	Double Checked against receipts of electricity sales.

All the monitoring data will be archived during and at least two years after the crediting period.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

The combined emission factor of the Southern China Power Grid is calculated ex-ante by the following formula.

In accordance with the consolidated baseline methodology ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2e/MWh) of all generating sources serving the system, excluding those low-operating cost and must-run power plants. The formula of $EF_{OM,simple,y}$ calculation is

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (1)$$

where:

$F_{i,j,y}$ is the total amount of fuel i (in a mass or volume unit) consumed by all the relevant power sources j in year(s) y, j refers to the power sources serving the grid, excluding those low-operating cost and must-run power plants, and including imports to the grid,

$COEF_{i,j,y}$ is the total amount the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the oxidation rate of the fuel in year(s) y, and

$GEN_{j,y}$ is the electricity output (MWh) supplied to the grid by the sources j.

The CO_2 emission coefficient $COEF_i$ is then obtained from equation (2) as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad (2)$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of fuel i,

$OXID_i$ is the oxidation factor of the fuel i (see page 1.29 in the 1996 Revised IPCC Guidelines for Default Values), and

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The net calorific values of the fuels adopted are obtained from the *China Energy Statistical Yearbook* 2005 Edition and IPCC default, and the oxidation factors of the fuels adopted are obtained from IPCC default.

The Simple OM emission factor ($EF_{OM,y}$) of the Project is calculated based on the electricity generation mix of the Southern China Power Grid, excluding those low-operating cost and must-run power plants, such as wind power and hydropower etc[12]. These data, the Simple OM emission factor ($EF_{OM,y}$) of the Southern China Power Grid is calculated as 0.9222 tCO_2e/MWh (see Annex 3 for details).

STEP 2. Calculate the Build Margin Emission Factor ($EF_{BM,y}$) according to the consolidated baseline methodology ACM0002 using equation (3):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (3)$$

where:

$F_{i,m,y}$ is the total amount of fuel i (in a mass or volume unit) consumed by all the sample power sources m in year(s) y, m refers to the sample power plants serving the grid, excluding those low-operating cost and must-run power plants, and including imports to the grid,

$COEF_{i,m,y}$ is the total amount the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by sample power sources m and the oxidation rate of the fuel in year(s) y, and

$GEN_{m,y}$ is the electricity output (MWh) supplied to the grid by the sources m.

The consolidated baseline methodology ACM0002 provides two options for sample group m:

(3) The five power plants built most recently, or

(4) The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently.

It is suggested that the sample group that comprises the larger annual generation should be used.

In China, it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently because these data are considered as confidential business information by the plants owners. Taking notice of this situation, EB accepts the following deviation in methodology application:

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

---

12 The data on installed capacity and electricity output of different power generation technology options are obtained from the *China Electric Power Yearbook* (published annually) 2003, 2004 and 2005 editions. The data on different fuel consumptions for power generation in the China Southern Power Grid are obtained from the provincial *Energy Balance Table* (of year 2002 to 2004) from the *China Energy Statistical Yearbook (2000~2002)* and the *China Energy Statistical Yearbook* 2004 and 2005 Edition (published annually after 2003).

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

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

In this PDD, as required, capacity additions of the Southern China Power Grid during 2002~2004[13] were calculated and the 600 MW sub-critical coal-fired power plant was used as the proxy of efficiency level of the best technology in China[14] for estimating the $EF_{BM,y}$. Based on these data, the build margin emission factor ($EF_{BM,y}$) of the Southern China Power Grid is calculated as 0.4990 tCO_2e/MWh (see Annex 3 for details).

STEP3. Calculate the baseline emission factor (EF_y)

Based on the consolidated baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated as the weighted average of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$), as

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \qquad (4)$$

According to the consolidated baseline methodology ACM0002, the weight w_{OM} is 0.75 and the weight w_{BM} is 0.25 for wind power projects. Therefore the combined baseline emission factor

EF_y =0.75×0.9222+0.25×0.4990=0.8164 (tCO_2e/MWh).

Baseline emissions

Baseline emissions are calculated with combined baseline emission factor and electricity output of the Project as follows:

$$BE_y = EG_y \times EF_y \qquad (5)$$

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

>>

13 Capacity addition during 2002~2004 are most close to 20%. Calculation details are available for DNA and DOE.
14 http://www.ccchina.gov.cn/source/fa/fa2002082803.html

Option 2 is not selected as it is not appropriate to the Project activity.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

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)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

According to the consolidated baseline methodology ACM0002, the main indirect emissions potentially giving rise to leakage in the context of electric sector projects result from activities such as power plant construction, fuel handling(mining, processing, and transportation), and land inundation (for hydroelectric projects). The project developer does not need to consider such indirect emissions when applying the methodology. So the Project can take no account of such leakages, $L_y = 0$.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

The Project activity will generate greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions from electricity generation by fossil fuel power plants. The emission reduction (ER_y) during a given year y is calculated as follows:

$$ER_y = BE_y - PE_y - L_y \tag{6}$$

Since the project emission for wind power (PE_y) and the linkage (L_y) is considered as zero, the emission reduction is equal to baseline emission (BE_y), i.e.:

$$ER_y = BE_y = EG_y \cdot EF_y \tag{7}$$

BE_y is (in the absence of the Project activity) the GHG emission of the part of electricity generation, which is equivalent to that of the Project, of the Southern China Power Grid, i.e. annual emission reductions of the Project.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.3-1	*low*	The grid-connected electricity generation will be monitored by ammeter in compliance with relevant standards in China. Electricity sales receipts from the Southern China Power Grid will also be obtained for cross-check.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>>

Detailed monitoring arrangements of emission reductions will be determined according to Section D and Annex 4 of this PDD.

D.5 Name of person/entity determining the monitoring methodology:

>>
The monitoring plan of the Project was completed on June 2006 by following key individuals:

1. **Mr. Zheng Zhaoning**, zhaoning.zheng@tuttle-international.com.
2. **Ms. Pan Tao**, tao.pan@tuttle-international.com.
3. **Ms. Xia Xiaoshu**, xiaoshu@co2-china.com, Green Capital Consulting Company, Suit 2001, Building 7, Jianwai SOHO, Beijing 100022, China.

The person/entity is not project participant listed in Annex 1.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>
As per section D.2.1.2, based on the assumption that the leakage at the construction phase of the Project is neglected, the GHG emission of the Project within the Project boundary is zero, *i.e.* PE_y =0.

E.2. Estimated leakage:

>>
As above mentioned, the leakage of the Project is not considered, i.e. L_y =0.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>>
The emission of the Project is zero, i.e.E.1+E.2= $PE_y + L_y$ =0.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

>>
According to the Feasibility Study Report of the Project, the annual power generation is estimated to be 100.965 GWh.

As per the calculation formula of baseline combined emission factor in section D.2.1.4, the baseline emission factor for is 0.8164 tCO_2e/MWh.

As per the calculation formula of baseline emission, the annual baseline emission of the Project is 82,428 tCO_2e. (See Annex 3 for details)

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>>
With the emissions from the Project being zero, the emission reductions of the Project activity are equivalent to the emissions of the baseline. The annual reductions are estimated to be 82,428 tCO_2e. (See Annex 3 for detail)

E.6. Table providing values obtained when applying formulae above:

>>
It is expected that the Project activities will generate emission reductions, within Southern China Power Grid, in an annual amount of 82,428 tCO_2e over a 21-year renewable crediting period (7 yrs×3) from the Oct 2006 to Sept 2027. Estimated emission reductions are achieved by avoiding CO_2 emissions from electricity generation of those fossil fuel-fired power plants connected into the Southern China Power Grid.

The ex post calculation of baseline emission rates may only be used if proper justification is provided. Notwithstanding, the baseline emission rates shall also be calculated ex ante and reported in the CDM-PDD. The result of the application of the formulae above shall be indicated using the following tabular format.

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2e)	Estimation of Emission reductions (tonnes of CO2 e)
Oct. to Dec., 2006	20,607	Oct. to Dec., 2006	20,607	Oct. to Dec., 2006
2007	82,428	2007	82,428	2007
2008	82,428	2008	82,428	2008
2009	82,428	2009	82,428	2009
2010	82,428	2010	82,428	2010
2011	82,428	2011	82,428	2011
2012	82,428	2012	82,428	2012
2013	82,428	2013	82,428	2013
2014	82,428	2014	82,428	2014
2015	82,428	2015	82,428	2015
2016	82,428	2016	82,428	2016
2017	82,428	2017	82,428	2017
2018	82,428	2018	82,428	2018
2019	82,428	2019	82,428	2019
2020	82,428	2020	82,428	2020
2021	82,428	2021	82,428	2021
2022	82,428	2022	82,428	2022
2023	82,428	2023	82,428	2023
2024	82,428	2024	82,428	2024
2025	82,428	2025	82,428	2025
2026	82,428	2026	82,428	2026
Jan. to Sep., 2027	61,821	Jan. to Sep., 2027	61,821	Jan. to Sep., 2027
Total (tCO_2e)	**1,730,988**	**0**	**0**	**1,730,988**

Please note that the emission reduction calculation is only an estimate. The actual emission reductions will be calculated every year according to the actual electricity output of the Project, and the baseline will be renewed every 7 years.

SECTION F. Environmental impacts

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

>>
The Environmental Impact Assessment of the Project was completed by Environment Protection Institute of Shantou City, and approved by the Environment Protection Bureau of Shantou City in September, 2004 (Document No. [2004]126). Main contents of The Environmental Impacts Assessments are summarized as follows:

Construction Phase

Air Quality
The air pollutants during the construction of the Project will be primarily dusts from open sources such as construction sites, unfinished roads and exhaust gases emitted from the operation of construction equipments and vehicles. The impacts of exhaust gases such as NO_x, CO and THC will be significantly lower in comparison with those of dusts. Therefore, air pollution mitigation measures will be aimed at reducing the generation of dusts. Frequent watering of exposed area or worksite of excavation to maintain surface wet, provision of vehicle washing to remove any dusting materials at the worksite, using closed and semi-closed vehicles to transport construction materials, regular maintenance of construction equipments and transportation vehicles as well as adoption of other good site practices are all such effective practices.

Wastewater
The wastewater discharged during the construction of the Project will be primarily water containing silt and sand as well as oil-containing sewage. The amount of domestic wastewater is little therefore causing minimum impact on the environment. To mitigate water pollution, pollution sources will be controlled for the reduction of pollutants. Moreover, various treatment methods will be used to mitigate the impacts of pollutants that are already generated for instance the use of a wastewater sedimentation tank placed near the excavation area. By taking these mitigating measures into account, the impact of wastewater is minimal.

Noise
The noise pollution mainly originates from the construction equipments and vehicles. Since there are no large residential areas located near the wind farm, the noise impact is very limited. However, the noise level will still be strictly monitored to ensure compliance with relevant guidelines set out in the *Noise Limits for Construction Site* (GB 12523-90). Further mitigation measures will also be taken to reduce the noise pollution on personnel at the construction site.

Solid Waste
The main solid waste generated from the site will be construction waste as well as the household waste from the personnel at the site. The overall impact of solid waste on the environment is considered to be insignificant.

Ecological Impact
Attributed to abundant rainfall and ample sunshine, the vegetation coverage rate of the area where the Project will be sited reaches 90%. Removal of some vegetation as a result of construction activities will

increase the likelihood of surface runoff, which indirectly has a negative impact on agricultural ecosystems. However, as there is no rare and extinct species existing in the region, such impact is quite limited. The avoidance of the ecological impacts can be achieved through some measures for instance, use of natural mountainous environment for the construction of the turbine platform. With regard to the ecological impacts unlikely to be avoided, measures will also be taken to mitigate such impacts. Tree seeds will be planted all over the affected area as an effort to maintain the vegetation coverage rate.

Operation Phase

Impacts of Electromagnetic Radiation
Electromagnetic radiation of high intensity could have a significant impact on human health. As the Project is located well away from residential areas and the radiation emitted from operating turbines is low in intensity, such radiation will do little harm to local residents. Moreover, based on the survey of residents residing close to the existing wind farm, there is no reported case of electromagnetic wave interfering with television and radio broadcasting as well as other electrical appliances. There is no impact on radar stations on Yunshen Mountain either because all these stations are located over 600 m from the wind turbine. It can be concluded that impacts of electromagnetic radiation on human health and communications are both considered to be insignificant.

Noise
Since there are no residents living near the Project, noise impacts on the well-beings of local residents will be minimal. Moreover, as the Project will use computer operational system and the operating room has quite a distance to the wind turbines, noise impact on operators will be minimal as well.

Impacts on birds
Birds are rarely seen around the site because the site has been selected with due consideration for avoiding migratory bird routes. The probability of birds colliding with the turbine is very low. Therefore the impacts on birds are considered negligible.

In conclusion, environmental impacts arising from the Project are considered insignificant.

F.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:

>>
Impacts are not considered significant.

SECTION G. Stakeholders' comments

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

>>

In July 2005, staff from the Project owner carried out a survey of the local residents in the Nan'ao County where the Project will be sited. Comments received through the survey are summarized as follows. The government of Nan'ao County issued a support letter for the Project. Refer to G.2 for details.

G.2. Summary of the comments received:

>>

The survey was conducted through distributing and collecting responses to a questionnaire. Totally 29 questionnaires returned out of 30 with 97% response rate. The basic constitutes of the respondents are shown with Figure 5.

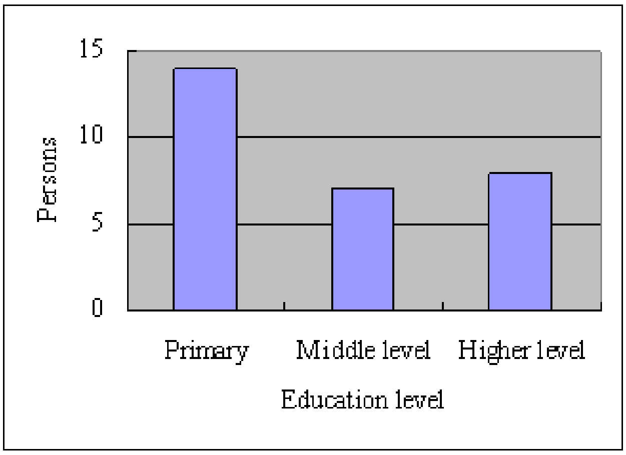


Figure 5. Education level

The following is a summary of the key findings based on returned questionnaires.

- 1(3%) person of the respondents knows well about wind power and 28 (97%) persons know a little.
- 26 (90%) persons of the respondents support the local constructed wind farm, 2 (7%) persons show carelessness and nobody opposes.
- The respondents consider construction and operation of the Project may decrease local electricity price (52%), increase employment opportunities (48%), mitigate air pollution (38%), improve living level (24%) and increase income (21%).
- 10 persons (35%) of the respondents think the construction of the Project will have direct positive impacts, 19 persons (65%) leave blank.
- The respondents worry that the construction and operation of the Project may have negative impacts on natural environment (100%), interferences with TV and other communication systems (60%) and noise (50%). Two respondents raise their concerns on the increasing amount of waste and wastewater discharged at the construction period of the wind farm. Land use impacts are widely considered not important or negligible.
- 3 persons (10%) of the respondents believed that good engineering designs and management practices can effectively mitigate negative impacts of the Project.

- All the persons of the respondents support the construction of the Project.

The survey shows that the Project receives very strong support from local people who believe the Project will have positive impacts in many aspects. This is closely linked to the fact that the majority of local residents have had some familiarity with wind power projects and they hold highly positive attitude towards the existing wind farms in the region. The respondents generally deem that the Project will bring multiple benefits to their livelihoods, particularly hoping that the electricity price can be lower as a result of the Project. Among the negative impacts, the destruction of the natural environment seems to be the prominent issue. However, as the environmental impact assessment demonstrates, negative impacts on the natural environment (such as air, vegetation) primarily occur at the construction phase of the Project. Thus, these impacts will significantly lessen when the construction finishes. The other main issues are noise and interference with communication signals e.g. TV and radio. Since there is no residential area located near the wind farm and the impacts (if any) can be effectively mitigated by some measures, noise and interferences with communication systems are, as a matter of fact, perceived issues rather than real problems.

The translation of support letter from the local government with regard to the Project

To whom it might concern:

We are aware that a 45.05 MW wind power project will be developed by the Huaneng New Energy Industrial Co., Ltd. in our county. Through thorough investigation and discussion, we deem that:

1) Wind power, as a type of clean energy, emits nearly no pollutants compared to those fuel-fired power plants, therefore does no harm to the local ecological environment;
2) As Guangdong Power Grid is facing power shortage, the construction and operation of the Project should be able to relieve this situation in Guangdong Province;
3) The construction and operation of the Project can accelerate the development of transportation, construction material, and construction-related industries in the county driving its economy forward;
4) Since wind turbines are often perceived as attractive, the Project can promote the development of the tourism of the county; and
5) The Project demonstrates that the construction and operation of wind power projects can be facilitated through an international environment cooperation mechanism, known as the clean development mechanism, therefore further promotes the wind power development in the county.

To summarize, we have no doubt that the Project will be conducive to the improvement of energy mix, the improvement of overall environmental quality of Guangdong Province, and benefit the development of wind power industry in Nan'ao County. We fully support the development and implementation of the Project.

The County Government of Nan'ao
Bureau of Finance, Nan'ao County
Bureau of Tourism, Nan'ao County
Bureau of Environmental Protection, Nan'ao County
Bureau of Power Supply, Nan'ao County

(Stamps)

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

The residents and local government are all very supportive of the Project therefore there has been no need to modify the project due to the comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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The following are the contact details for the other Parties involved:

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Annex 2

There is no public funding from Annex I Parties for the Project.

Annex 3

BASELINE INFORMATION

The following tables summarise the numerical results calculated from the equations listed in the consolidated baseline methodology ACM0002 for grid-connected electricity generation from renewable sources. The information provided by the tables includes data, data sources and the underlying computations.

Table A1~A3 listed the basic data of the Southern China Power Grid in the year 2002, 2003 and 2004, including installed capacities, annual electricity generation under various electricity generation technologies.

Table A1. Basic data of the Southern China Power Grid in 2002

		Guangdong	Guangxi	Hainan	Yunnan	Guizhou
Installed capacity (MW)	Hydro power	7775.3	4363.3	547.5	5836.3	2426.1
	Fuel-fired power	25237.8	3156.2	1224.1	2932.7	4642.5
	Other	2866.8	0.0	8.8	0.1	0.0
	Total	35879.9	7519.5	1780.4	8769.1	7068.6
Electricity generation (TWh)	Hydro power	16.913	18.634	1.589	25.062	9.512
	Fuel-fired power	123.081	13.069	3.589	15.787	33.231
	Other	21.014	0.000	0.013	0.000	0.000
	Total	161.008	31.703	5.191	40.849	42.743

Data source: China Electric Power Yearbook 2003, P584-585

Table A2. Basic data of the Southern China Power Grid in 2003

		Guangdong	Guangxi	Hainan	Yunnan	Guizhou
Installed capacity (MW)	Hydro power	8107.2	4525.2	551.4	6543.2	3713.7
	Fuel-fired power	27231.4	3190.1	1199.5	3556.8	6465.8
	Other	3863.4	0.0	8.7	0.0	0.0
	Total	39202.0	7715.3	1759.6	10100.0	10179.5
Electricity generation (TWh)	Hydro power	17.136	19.288	1.451	26.837	8.019
	Fuel-fired power	143.351	17.079	4.479	19.055	43.295
	Other	29.090	0.000	0.012	0.000	0.000
	Total	189.577	36.367	5.942	45.891	51.314

Data source: China Electric Power Yearbook 2004, P709

Table A3. Basic data of the Southern China Power Grid in 2004

		Guangdong	Guangxi	Hainan	Yunnan	Guizhou
Installed capacity (MW)	Hydro power	8584.6	5040.4	562.2	7058.6	6896.5
	Fuel-fired power	30172.9	4378.1	1599.5	4306.9	7801.8
	Other	3863.5	0.0	8.7	0.0	0.0
	Total	42621.0	9418.5	2170.4	11365.5	14698.3
Electricity generation (TWh)	Hydro power	14.114	17.229	1.177	29.350	23.379
	Fuel-fired power	169.389	20.143	5.687	24.322	49.720
	Other	28.630	0.000	0.010	0.000	0.001
	Total	212.133	37.372	6.874	53.672	73.100

Data source: China Electric Power Yearbook 2005, P473-474

According to consolidated baseline methodology ACM0002, the Simple OM emission factors of the Southern China Power Grid in the year 2002, 2003 and 2004 were calculated in A4~A6. The Simple OM emission factor of the Project is the average value of the Simple OM emission factors in the year 2002, 2003 and 2004, i.e. $EF_{OM,simple,y}$ =(0.9159+0.8751+0.9756)/3=0.9222 tCO_2e/MWh.

Table A4. Calculation of simple OM emission factor of the Southern China Power Grid in 2002

Energy	Unit A	Guangdong B	Guangxi C	Hainan D	Yunnan E	Guizhou F	Total Fuel G=sum(B:F)	Emission factor (tC/TJ) H	NCV (GJ/t or 1000m^3) I	Oxidation rate J	Emission[15] (tCO_2e) K=G×H×I×J×44/12
Coal	10^4t	4121.06	711.35	157.40	1144.39	1430.68	7564.88	25.8	20.908	0.98	146633009
Other washed coal	10^4t	0.00	0.00	0.00	13.58	35.26	48.84	25.8	8.363	0.98	378665
Coke	10^4t	0.00	0.00	0.00	6.44	0.00	6.44	29.5	28.435	0.98	194115
Other gas	10^8m^3	2.63	0.00	0.00	0.00	0.00	2.63	13.0	5.227	0.995	65200
Crude oil	10^4t	5.80	0.00	0.00	0.00	0.00	5.80	20.0	41.816	0.99	176079
Gasoline	10^4t	0.01	0.00	0.00	0.00	0.00	0.01	18.9	43.070	0.99	295
Diesel	10^4t	73.07	0.67	0.00	0.50	0.00	74.24	20.2	42.652	0.99	2321856
Fuel oil	10^4t	701.41	0.20	2.43	0.00	0.00	704.04	21.1	41.816	0.99	22549084
LPG	10^4t	0.09	0.00	0.00	0.00	0.00	0.09	17.2	50.179	0.99	2820
Refinery gas	10^4t	1.42	0.00	0.00	0.00	0.00	1.42	18.2	46.055	0.99	43206
Other oil products	10^4t	7.91	0.00	0.00	0.00	0.00	7.91	20.0	40.190	0.99	230798
Nature gas	10^8m^3	0.00	0.00	1.31	0.00	0.00	1.31	15.3	38.931	0.995	285090
Other energy (renewable energy or waste heating)	10^4tCe	79.28	0.00	0.00	0.00	0.00	79.28	0.0	29.2712	1	0

Total emission of the Southern China Power Grid (tCO_2e)	172880216
Fossil power generation of the Southern China Power Grid (TWh)	188.757
OM emission factor of the Southern China Power Grid (tCO_2e/MWh)	0.9159

Data sources: China Energy Statistical Yearbook (2000-2002), P376-403, P432-451; China Electric Power Yearbook 2003, P590; China Energy Statistical Yearbook 2005 Edition, P365; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

15 If the unit of the fuel is 10^4t, then K=G×H×I×J×44/12×10; if the unit of the fuel is 10^8m^3, then K=G×H×I×J×44/12×100. The same about the calculation of K in Table A5 and Table A6.

Table A5. Calculation of simple OM emission factor of the Southern China Power Grid in 2003

Energy	Unit A	Guangdong B	Guangxi C	Hainan D	Yunnan E	Guizhou F	Total Fuel G=sum(B:F)	Emission factor (tC/TJ) H	NCV (GJ/t or 1000m^3) I	Oxidation rate J	Emission (tCO_2e) K=G×H×I×J×44/12
Coal	10^4t	4491.79	831.84	166.88	1405.27	2169.11	9064.89	25.8	20.908	0.98	175708286
Cleaned coal	10^4t	0.05	0.00	0.00	0.00	0.00	0.05	25.8	26.344	0.98	1221
Other washed coal	10^4t	0.00	0.00	0.00	20.37	36.38	56.75	25.8	8.363	0.98	439992
Coke	10^4t	0.00	0.00	0.00	0.50	0.00	0.5	29.5	28.435	0.98	15071
Coke oven gas	10^8m^3	0.00	0.00	0.00	0.04	0.00	0.04	13.0	16.726	0.995	3173
Other gas	10^8m^3	3.21	0.00	0.00	11.27	0.00	14.48	13.0	5.227	0.995	358971
Crude oil	10^4t	6.85	0.00	0.00	0.00	0.00	6.85	20.0	41.816	0.99	207955
Gasoline	10^4t	0.02	0.00	0.00	0.00	0.00	0.02	18.9	43.070	0.99	591
Diesel	10^4t	31.90	0.00	2.80	0.76	0.00	35.46	20.2	42.652	0.99	1109012
Fuel oil	10^4t	627.22	0.30	0.00	0.00	0.00	627.52	21.1	41.816	0.99	20098291
Refinery gas	10^4t	2.85	0.00	0.00	0.00	0.00	2.85	18.2	46.055	0.99	86716
Other oil products	10^4t	11.35	0.00	0.00	0.00	0.00	11.35	20.0	40.190	0.99	331170
Nature gas	10^8m^3	0.00	0.00	2.32	0.00	0.00	2.32	15.3	38.931	0.995	504161
Other energy (renewable energy or waste heating)	10^4tCe	93.21	0.00	0.00	22.35	0.00	115.56	0.0	29.2712	1	0

Total emission of the Southern China Power Grid (tCO_2e)	198864610
Fossil power generation of the Southern China Power Grid (TWh)	227.259
OM emission factor of the Southern China Power Grid (tCO_2e/MWh)	0.8751

Data sources: China Energy Statistical Yearbook 2004 edition, P218-229, P238-245; China Energy Statistical Yearbook 2005 Edition, P365; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

Table A6. Calculation of simple OM emission factor of the Southern China Power Grid in 2004

Energy	Unit A	Guangdong B	Guangxi C	Hainan D	Yunnan E	Guizhou F	Total Fuel G=sum(B:F)	Emission factor (tC/TJ) H	NCV (GJ/t or 1000m^3) I	Oxidation rate J	Emission (tCO_2e) K=G×H×I×J×44/12
Coal	10^4t	6017.70	1305.00	188.61	1751.28	2518.12	11780.71	25.8	20.908	0.98	228350080
Cleaned coal	10^4t	0.21	0.00	0.00	0.00	0.00	0.21	25.8	26.344	0.98	5129
Coke	10^4t	0.00	0.00	0.00	0.50	0.00	0.5	29.5	28.435	0.98	15071
Other gas	10^8m^3	2.58	0.00	0.00	0.00	0.00	2.58	13.0	5.227	0.995	63960
Crude oil	10^4t	16.89	0.00	0.00	0.00	0.00	16.89	20.0	41.816	0.99	512754
Diesel	10^4t	48.88	0.00	0.42	0.00	0.00	49.3	20.2	42.652	0.99	1541858
Fuel oil	10^4t	957.71	0.00	0.00	1.83	2.66	962.2	21.1	41.816	0.99	30817466
Refinery gas	10^4t	2.86	0.00	0.00	0.00	0.00	2.86	18.2	46.055	0.99	87020
Other oil products	10^4t	1.66	0.00	0.00	0.00	0.00	1.66	20.0	40.190	0.99	48435
Nature gas	10^8m^3	0.48	0.00	5.26	0.00	0.00	5.74	15.3	38.931	0.995	1247365
Other energy (renewable energy or waste heating)	10^4tCe	79.42	0.00	0.00	0.00	0.00	79.42	0.0	29.2712	1	0

Total emission of the Southern China Power Grid (tCO_2e)	262689138
Fossil power generation of the Southern China Power Grid (TWh)	269.261
OM emission factor of the Southern China Power Grid (tCO_2e/MWh)	0.9756

Data sources: China Energy Statistical Yearbook 2005 Edition, P274-285, P294-301; China Electric Power Yearbook 2005, P507; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

The conservative calculation of the build margin emission factor of the Southern China Power Grid has been explained in Section B in the PDD. The data, sources and calculation process of the build margin emission factor and combined emission factor of the Southern China Power Grid are shown in Table A7 and Table A8.

Table A7. Selection of Reference Year

Year	Total installed capacity (MW)	Capacity additions Compare to 2004 (MW)	Capacity additions Compare to 2004 (%)	Reference year
2004	80273.7	-	-	-
2003	68956.4	11317.3	14.10%	N
2002	61017.5	19256.2	23.99%	Y (most close to 20% compare to 2001 and 2003)
2001	57452.1	22821.6	28.43%	N

Table A8. Calculation of build margin emission factor and combined emission factor of the Southern China Power Grid

	Change in installed capacity (2004 compared to 2002, MW)	Best commercially available power generation technology in China (600MW sub-critical coal-fired power plant)
Hydro power	7193.8	**Coal consumed by power generation:** 320 gCe/kWh
Fossil fuel-fired power	11065.9	**Emission factor:** 0.8684 tCO_2e/MWh
Other	996.5	(Calculated as:
Total	19256.2	320 gCe/kWh = 0.32 tCe/MWh 0.32 tCe/MWh × 0.02927 TJ/t × 25.8 tC/TJ × 44/12 × 0.98 = 0.8684
Fuel-fried electricity capacity share	0.57467	tCO_2e/MWh)
Build margin emission factor in the Southern China Power Grid (tCO_2e/MWh)		0.4990
Combined emission factor in the Southern China Power Grid (tCO_2e/MWh)		0.8164

Fuel-fried electricity capacity weights 0.57467 of capacity additions during 2002~2004, therefore build margin emission factor in the Southern China Power Grid is calculated as BM=0.8684×0.57467=0.4990 (tCO_2e/MWh).

Annex 4

MONITORING PLAN

Emission factor of the Project is determined ex ante. Therefore the electricity supplied to the Southern China Power Grid by the Project is defined as the key data to be monitored. The monitoring plan is drafted to focus on monitoring of the electricity output of the Project.

1. Monitoring of the Electricity Supplied to the Southern China Power Grid by the Project

Grid-connected electricity generated by the Project will be monitored through metering equipment at the substation (interconnection facility connecting the facility to the grid). And the data should be cross-checked against relevant electricity sales receipts and/or records from the grid.

The Project owner should ensure that the meter readings be readily available for DOE's verification.

2. Calibration of Meters & Metering

Calibration of Meters & Metering should be implemented according to relevant standards and rules of the Southern China Power Grid. And all the records should be documented and maintained by the Project owner for DOE's verification.

3. 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 according to EB rules and real practice in terms of the need for verification of the emission reductions on an annual basis according to this PDD.

4. Data Management System

Specific staff will be appointed by the Project owner to take the overall responsibility for monitoring of greenhouse gas emission reductions and keeping all the data and information for emission reductions verification.

5. Verification

It is expected that the verification of emission reductions generated from the Project will be done annually.

The Table A8 below outlines the key documents relevant to monitoring and verification of the emission reductions from the Project. With all these documents compiled, the Project owner will sign a verification service agreement with specific DOE.

Table A9. List of the key documents relevant to monitoring and verification

I.D. 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	the Project owner, or directly download from UNFCCC website
F-2	Monitoring Quality Control and Quality Assurance Report	Equipments and national and industry standards	the Project owner
F-3	The report on qualifications of the persons responsible for the monitoring and calculation	Major, the title of a technical post, working experience and etc.	the Project owner
F-4	The report on monitoring and checking of electricity supplied to the grid	Record based on monthly meter reading and electricity sale receipts	the Project owner
F-5	Record on maintenance and calibration of metering equipment	Reasons for maintenance and calibration and the precision after maintenance and calibration	the Project owner
F-6	Monitoring report	CO_2 emission reduction calculation	the Project owner
F-7	Letter of confirmation on F-2 to F-6	Confirmation of monitoring and calculation data and procedure from F-2 to F-6	the Project owner
F-8	Project Management Record (including data collection and management system)	Comprehensive and true reflection of the management and the operation of the Project	the Project owner