



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

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

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Title of document: China Fujian Putian LNG Generation Project

Version of document: Version 05

The date of the document: 09/11/2008

A.2. Description of the project activity:

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Fujian Putian LNG Power Plant is designed to construct a grid connected natural-gas based combined cycle gas turbine power plant with total installed capacity of 1,528 MW ($4 \times 382\text{MW}$) located on the north of the Meizhou Bay Xiuyu Peninsula Xiuyu District, Putian city, Fujian Province. The proposed project will be connected to East China Power Grid (ECPG). The proposed project consists of four generating blocks, each of which composes of a single-axis gas turbine, a heat recovery steam generator, a steam turbine, a generator with all hydrogen cooling and self-parallel-excitation system, and 500KV transmission lines for power evacuation. The proposed project will use the natural gas imported from Indonesian Tangguh Gas Field. No other start-up fuels or auxiliary fuel will be applied by the project activity.

The proposed project will supply strong and stable electricity to support Fujian power grid, and provide peak regulation function as the project activity. The annual output of the proposed project is expected at 6,112GWh when all the generating units putting into operation, which can mitigate the high pressure of Fujian power grid regarding to power shortage incurred by the greatly increased power demand and balance the grid peak loads. As a clean fuel power project, the proposed project can reduce Green House Gases emissions compared with conventional thermal power plants, thus be considered as an environmental-friendly project, which will substitute part of thermal power in ECPG. Thus, the proposed project provides a combination of positive environmental, economic, and sustainable development benefits. The specific sustainable development benefits of this proposed project are described as follows:

- Supply reliable power to Fujian province, help satisfy the increasing demand for electricity;
- Provide better service for smoother balancing of grid peak loads;
- Consist with Fujian's energy policy aiming at optimisation of energy structure, and diversification of energy mix;
- Contribute to environment protection of Fujian Province by improving electricity efficiency and mitigating GHG emission;
- Encourage and promote the technique (combined cycle gas turbine) progress.
- Create 180 permanent staff positions during the operation period.

In terms of environmental and power benefits, the proposed project is in line with the choice of China's energy industry's prior area and support China's policy of harnessing zero-impact energy resource. The social, economic and environmental benefits contribute to sustainable development of the country and region.

**A.3. Project participants:**

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Please list <u>project participants</u> 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)
People's Republic of China (Host)	CNOOC Fujian Gas Power Co., Ltd	No
Japan	Mitsubishi Corporation	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 <u>approval</u> . 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 (form CDM-NM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:**

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A.4.1.1. Host Party(ies):

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People's Republic of China

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

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Fujian Province

A.4.1.3. City/Town/Community etc:

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Dongzhuang Town, Xiuyu District of Putian City, Fujian Province, China.

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

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The proposed project is located on Qianyun Village, Dongzhuang Town, Xiuyu District, Putian City, Fujian Province, P. R, China, where Putian City has the geographical coordinates of 118°27'--119°56'' east longitude, 25°2'--25°46'' north latitude. Geographically, the project is situated on the Xiuyu Peninsula, close to the Meizhou Bay in the north. It's 35km away from the downtown of Putian city and 130KM away from Fuzhou city the capital of Fujian Province. The figure 1, 2 and 3 below show the location of Fujian Province, Putian City and the proposed project site.



Figure 1 Location of Fujian Province



Figure 2 Location of Putian City

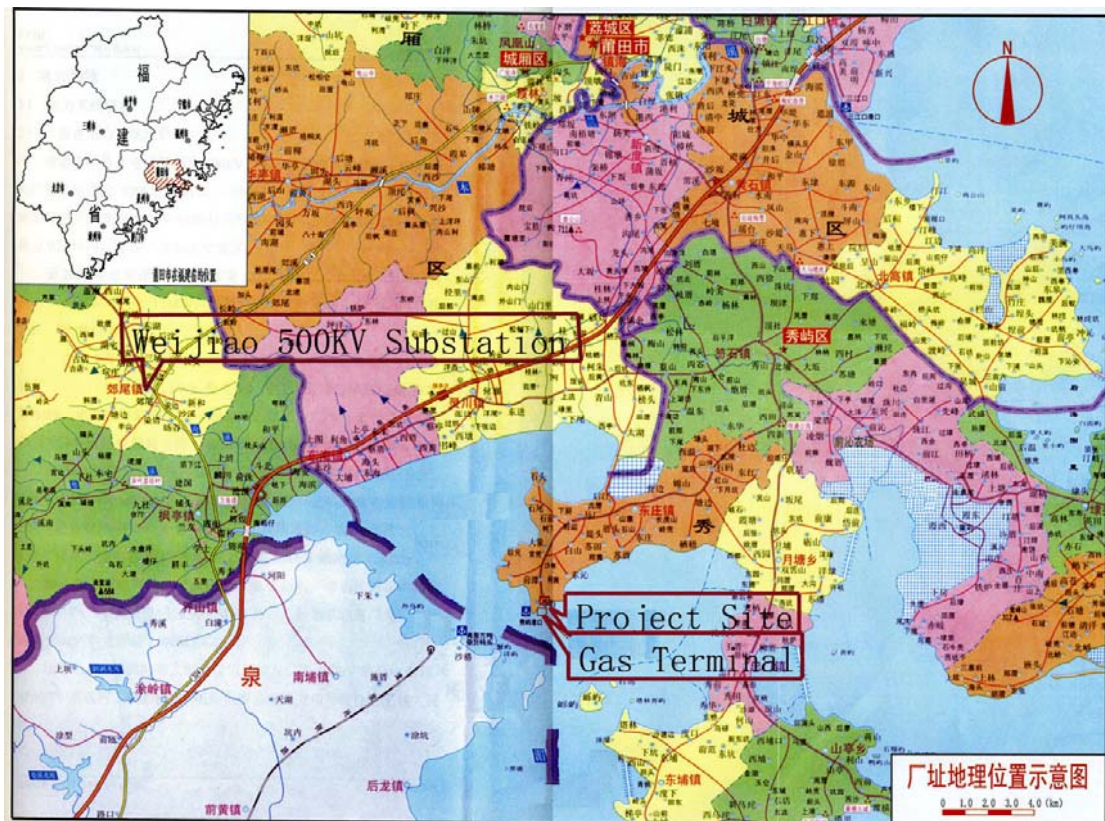


Figure 3 Location of the project site

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

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The proposed project falls into:

Sectoral Scope Number: 1. Energy industries: grid-connected electricity generating project using non-renewable fuel

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

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The proposed project is a grid-connected natural gas based combined cycle power plant, which is proposed to construct 4 single-axis M701F combined cycle blocks. The project with total installed capacity of 1,528 MW (4×382 MW) will be under operation 4,000 hours and provide electricity of 6,112 GWh annually. Based on the preliminary design, the main equipments of each configuration comprises as the following:

- One combined cycle;
- One gas turbine;
- One matching triple pressure heat recovery steam generator;
- One steam turbine; and
- One common generator.

The gas turbine and the steam turbine are on the same axis. Both of them are consolidated to drive the generator. The specific details for the main equipments are as the following:

**Table 1 Technique Index of The Main Equipments**

Equipments	Key Index		Type	Manufacture
Combined Cycle	Rated Power (MW)	385.88	MPCP1	DFSTW/MHI (Dong Fang Steam turbine Works and MITSUBISHI Heavy Industry)
	Rated Speed (r/min)	3,000		
Gas turbine	Concentration of NO _x emission (ppmV)	< 25	M701F	DFSTW/MHI (Dong Fang Steam turbine Works and MITSUBISHI Heavy Industry)
Heat recovery steam generator	Outlet flow of high-pressure steam (t/h)	276.9	To be determined	To be determined
Steam turbine	Rated Power (MW)	138.7	TC2F-30	DFSTW (Dong Fang Steam turbine Works)
	Rated Speed (r/min)	3,000		
Power generator	Rated Power (MW)	409.7	QFR-400-2-20	DFSTW (Dong Fang Steam turbine Works)
	Rated Speed (r/min)	3,000		

The main process of power generation within the project includes:

- The first phrase of the process takes place in the gas turbine. The natural gas would be fired in gas combustion chamber and expanded in gas turbine that drives on the power generator to convert heat energy into electricity energy. The proposed chooses dry low NO_x type burner in gas turbine, which will significantly reduce the emission of NO_x. The gas turbine also drives the axial compressor to supply the compressed ambient air to the combustor;
- Then, the hot exhaust gas passes through the gas turbine to the matching triple pressure heat recover system generator to be utilized to produce steam. The steam turbine generator is designed to operate with steam at 10Mpa in the high pressure cylinder, then at 2.21Mpa in the medium pressure cylinder, at 0.33Mpa in the low pressure cylinder at last.
- The steam will be introduced to and expanded in steam turbine to drive the power generator for generating electricity. The generator applies hydrogen cooling and self-parallel-excitation System.

The proposed project operates at around 75% of capacity throughout the year. The efficiency of the project can reach 57% on average. Because the temperature of the local place may severely affect on the rating of the gas turbine unite, the average output is estimated to 382 MW of each generator.

The auxiliary system of the proposed project includes water supply system, water treatment and demineralisation plant condensing equipment, compressed air system, air conditioning system, effluent treatment system, and etc.

The electricity generated by the project is will be stepped up to 550KV and be connected to Putian substation by using two sets of 4×LGj-400 transmission lines, and then supplied to the Fujian Grid, an integrated part of the ECPG.

In addition, the project is not designed to use other fuels or auxiliary fuel for start-up, shutdown or power generation. The relevant technology is explained as following:



- The 4 gas turbine units employed by the project activity are M701F type manufactured by Dong Fang Electric Group introducing the Japanese MHI technology. The four units are single-fuel units using the natural gas as fuel;
- The requisite steam when the M701F units start comes from two 30t/h actuating boilers. The boilers are single-fuel combustion machines using the fuel of natural gas; and
- The requisite power when the M701F units start is electric power, which depends on the power supply of the grid to control and drive the generators to speed up.

In order to maintain the daily operation of the power plant, all the stuff will get technical trainings for safe and smooth operation before getting into work. Technical trainings were designed into three stages.

First stage: the power plant signed a training agreement with Fujian Electric Power Training Center on safety education of operation. This training began from 08/2006 lasted for 15 days, 18 relevant employees took part in it.

Second stage: in 10/2006, 10 employees were sent to Huizhou Power Plant to get a four-month training on Gas Turbine Operation theoretically and practically. After the training, all 10 employees got the certification.

Third Stage: In 05/2008, a 15-day practical training of Gas Turbine operation was implemented in Fujian Electric Power Training Center, which was participated by 9 relevant employees, and all of the 9 employees got the training certification.

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

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The project chooses renewable crediting period, the emission reductions for the first 7-year crediting period are as following:

Years	Annual estimation of emission reductions in metric tonnes of CO₂ e
2008 (Oct. ~ Dec.)	188,377
2009	1,883,765
2010	3,014,024
2011	3,014,024
2012	3,014,024
2013	3,014,024
2014	3,014,024
2015 (Jan. ~ Sep.)	2,260,518
Total estimated reductions (metric tonnes of CO₂e)	19,402,780
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (metric tonnes of CO₂e)	2,771,826



A.4.5. Public funding of the project activity:

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No public funding from Annex I countries is provided for this project.

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

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Methodology and tool applied by the Project are as the following:

Version 01 of approved baseline and monitoring methodology AM0029 – “Grid Connected Electricity Generation Plants using Natural Gas.” (Sectoral Scope 01, 19/05/2006)¹;

Version 06 of approved baseline methodology ACM0002 – “Consolidated Methodology For Grid-Connected Electricity Generation From Renewable Sources.” (Sectoral Scope 01, 19/05/2006)²

Version 04 of the “Tool For Demonstration And Assessment Of Additionality”³.

For the above methodologies please refer to website:

<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:

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The project activity meets all the applicability conditions defined in the approved methodology AM0029 (Version 01) as the following reasons:

- The project activity is the construction and operation of a new natural gas fired grid-connect electricity generation plant;
- Fujian Province is covered by ECPG, the geographical/physical boundaries of the baseline grid (ECPG) can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available;
- Natural gas is sufficiently available in the region where the project is located, which can be demonstrated as the following:

1. Data of the exploitable amount in the Indonesia Tangguh Gas Field

The natural gas for the proposed project will be supplied via Fujian LNG Terminal, which will import natural gas from the Tangguh gas field. The Tangguh Liquefied Natural Gas (LNG) Project is a major greenfield development to extract natural gas from gas fields in the Berau and Bintuni bay area of Papua, Indonesia, and to liquefy it into LNG for shipping to export markets. Tangguh gas field has proven reserves of 14.4 trillion cubic feet (tcf), and together with probable and possible reserves, Tangguh has the potential to yield a total of 23.7 tcf of gas, and to support more than the two trains in the current plan and the Project may be expanded in the future.

¹ <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

² ibid

³ http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf



Initial development of the Project will comprise two LNG trains (equipment units that purify and liquefy gas), with the capacity to produce a total of 7.6 million tons annually (mtpa) of LNG. In addition to LNG, the Project is expected to produce condensate at the rate of 9,000 barrels per day (bpd), representing more than 3 million barrels per year. So the natural gas supply for Fujian Province is abundant. A commitment to supply 2.6 mtpa of LNG to Fujian, People's Republic of China, was signed in 2002⁴.

2. Illustration of the use of natural gas in Fujian Province

China National Offshore Oil Corp Fujian Natural Gas Co., Ltd. is responsible for construction of Fujian LNG Terminal with the capacity to provide 2.6 mtpa natural gas in Fujian Province in the first stage for 25 years. In September 2004 and August 2005, China National Offshore Oil Corp Fujian Natural Gas Co., Ltd. with five urban gas companies (including Fuzhou, Putian, Quanzhou, Xiamen and Zhangzhou) and three gas power plants (including Putian, Jinjiang and Xiamen) signed the long-term "Take or pay" natural gas purchase and sales contract⁵ respectively to ensure the LNG supply to the five consumers. The distribution of the contract gas is listed in the following tables:

2.1 The total urban gas consumption: 0.51 mtpa.

The Urban Gas Customers	Fuzhou	Putian	Quanzhou	Xiamen	Zhangzhou
Annual Gas Consumption (million tons)	0.14	0.05	0.2	0.08	0.04

2.2 The total power plants gas consumption: 2.02 mtpa.

Gas Power Plants	Putian	Jinjiang	East of Xiamen
Installed Capacity (MWh)	4×350	4×350	2×350
Owner	CNOOC Fujian Gas Power Co., Ltd	Fujian Jinjiang Gas Power Generation Co., Ltd.	East Asia Power Xiamen Co., Ltd.
Annual Gas Consumption (million tons)	0.81	0.81	0.4

⁴ The evidence has been provided to DOE.

⁵ <http://www.china5e.com/news/oil/200409/200409200306.html>



In the near future, the LNG Terminal will be expanded capacity to supply 7 mtpa natural gas to Fujian Province⁶. And the natural gas consumed by the proposed project just accounts for small part of the total natural gas supply. Therefore, the project activity doesn't constrain the future capacity additions of other LNG power plants comparable in size to the project activity.

Based on above data, the natural gas source is sufficient to satisfy the natural gas consumption requirement of the project activity⁷; meanwhile, the project will not cause any impact on other LNG customers⁸.

To conclude, as a new grid-connected power generation using natural gas, the project applies the methodology AM0029 (Version 01) to determine the project baseline and calculate GHG emission reductions resulting from the project activity.

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

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According to AM0029 (Version 01), the spatial extent of the project boundary includes the project site and all power plants connected physically to the baseline grid as defined in ACM0002 (Version 06). The greenhouse gases included in or excluded from the project boundary are listed as follows:

	Source	Gas	Included?	Justification / Explanation
Baseline	Power generation in baseline grid (East China Power Grid)	CO ₂	Yes	Main emission source.
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.
Project Activity	On-site natural gas combustion due to the project activity	CO ₂	Yes	Main emission source.
		CH ₄	No	Excluded for simplification.
		N ₂ O	No	Excluded for simplification.

The Project is located in Fujian Province and will be connected to ECPG. Thus, ECPG is justified as project boundary of the Project, which covers the provinces of Jiangsu, Zhejiang, Anhui, and Fujian and Shanghai City. There is clearly defined spatial and geographical extent of the power plants and transmission system within ECPG, all electricity can be dispatched without significant transmission constraints. Moreover, ECPG is also defined as a regional grid in accordance with the "Explain of confirming baseline emission factors of regional power grid in China" issued by China's DNA. Therefore, the ECPG is considered as the grid boundary for determining the build margin (BM) and operating margin (OM) emission factors. Figure 4 below shows the project boundary of the proposed project.

⁶ Page 47, Volume 1, General Report, Feasibility Study of Putian LNG Power Plant

⁷ The Reply of the Letter regarding the Request to Supply Official Data and Information of the Natural Gas Source and Consumption in the Fujian LNG Project. The evidence has been provided to DOE.

⁸ Clarification of LNG supply and sequence in Fujian Province. The evidence has been provided to DOE.

Project Boundary

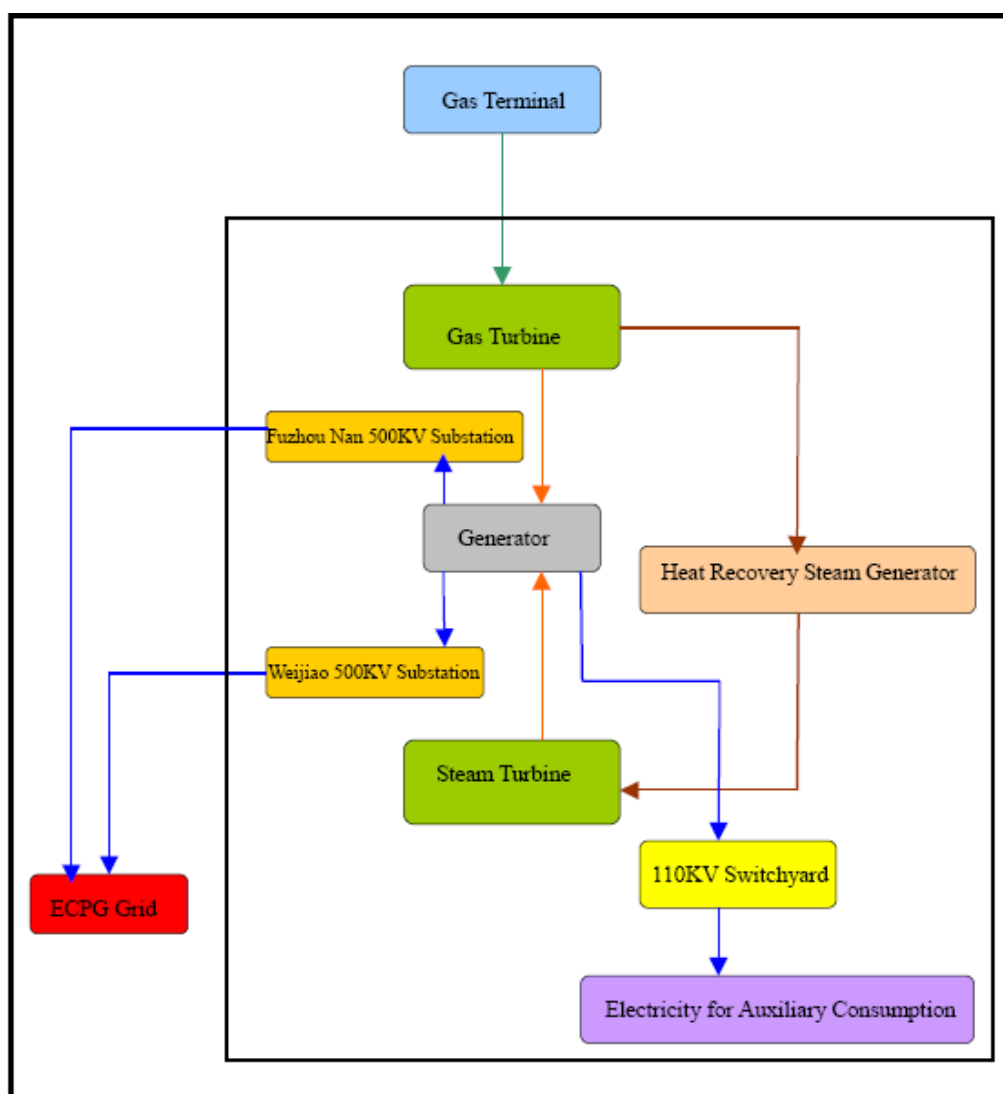


Figure 4 Project Boundary

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

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According to AM0029 (Version 01), the following steps shall be used to define the baseline scenario:

1. Identify plausible baseline scenarios

The identification of alternative baseline scenarios should include all possible realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity (including the proposed project activity without CDM benefits).

According to AM0029 (Version 01), alternatives to be analyzed should include, inter alia:

- The project activity not implemented as a CDM project;
- Power generation using natural gas, but technologies other than the project activity;
- Power generation technologies using energy sources other than natural gas;
- Import of electricity from connected grids, including the possibility of new interconnections.



Based on the above, the plausible baseline scenarios are identified as the following Table 2:

Table 2 Plausible Baseline Scenario

No.	Plausible Baseline Scenario	Technique
1	The project activity not implemented as a CDM project	Gas-steam combined cycle
2	Natural gas power generation using gas turbine single cycle technology.	Single cycle gas turbine
3	Power generation using hydropower	Hydropower
4	Power generation using wind power	Wind power
5	Power generation using nuclear power	Nuclear power
6	Power generation using coal-fired power	Sub critical coal-fired power plant with installed capacity of 4×300 MW
		Sub critical coal-fired power plant with installed capacity of 2×600 MW
		Super critical coal-fired power plant with installed capacity of 2×600 MW
7	Import of electricity from connected grids	

Currently, there is no large-scale single cycle natural gas turbine power generation project operated or under construction in China. Furthermore, this technology is rarely used now due to its lower heat efficiency level around 38%⁹. Thus, alternative 1 is not a feasible baseline scenario.

Fujian Province is abundant in water resources with potential installed capacity of 10,930MW available to be developed¹⁰. However, as its hydropower development has experienced long history since 1920's¹¹, hydropower resources with good potential and economical conditions have been almost developed already. Until the end of 2004, 8,890 MW of hydropower resources has been exploited¹² accounting for 81% of total capacity. Almost all the large or middle scale hydropower resources have already been finalized the development¹³. As the remained hydropower resource is only fit for development of small hydropower projects, the development of new hydropower cannot provide outputs or services comparable with the project activity. Therefore, alternative 3 is not a realistic and credible baseline scenario.

In China, development of wind power is just start-up. There are few wind power plants built in Fujian Province with little installed capacity. Moreover, wind power is of seasonal nature with low load, which cannot deliver outputs or services comparable to the project activity. Thus, alternative 4 is not a feasible baseline scenario.

The proposed project is designed to provide electricity and full-year peak regulation services. Whereas, for the purpose of operation safety, the nuclear power plant shall be under the base load operation in

⁹ <http://www.hdrqw.com/news/20060505-31.htm>

¹⁰ <http://www.hwcc.com.cn/newsdisplay/newsdisplay.asp?Id=146835>

¹¹ http://engine.cqvip.com/content/f/81012a/2004/000/006/jj31_f4_9906963.pdf

¹² <http://www.hwcc.com.cn/newsdisplay/newsdisplay.asp?Id=146835>

¹³ <http://www.hwcc.com.cn/newsdisplay/newsdisplay.asp?Id=146835>



China¹⁴. Therefore, alternative 5 cannot provide outputs or services comparable with the project activity, and is not a realistic and credible baseline scenario.

According to the report of China Electricity Council, the operational cost of domestic oil based power plants is higher than bus-bar tariff, which makes them running under deficit¹⁵. Therefore, alternative 6 cannot be considered as a business-as-usual practice, neither a realistic and credible baseline scenario to the proposed project.

According to the Feasibility Study of the proposed project, import of electricity from connected grids cannot provide peak regulation function as the project activity¹⁶. Therefore, alternative 7 is not a realistic and credible baseline scenario.

To be concluded, the feasible alternatives that provide outputs or services comparable with the project activity include the following, and all the alternatives are consistent with the current laws and regulations:

- Alternative 1: The project activity not implemented as a CDM project;
- Alternative 6a: Power generation using sub critical coal-fired power technology with installed capacity of 4×300 MW;
- Alternative 6b: Power generation using sub critical coal-fired power technology with installed capacity of 2×600 MW;
- Alternative 6c: Power generation using super critical coal-fired power technology with installed capacity of 2×600 MW.

2. Identify the economically most attractive baseline scenario alternative

According to AM0029 (Version 01), the economically most attractive baseline scenario alternative is identified from all alternatives remaining after step 1 by using investment analysis. The levelized cost of electricity production should be used as financial indicator for investment analysis.

The levelized cost formula used in this PDD was drawn from the *Appendix 5 Cost Estimation Methodology of Projected Costs of Generating Electricity. Update 2005 (OECD 2005)* as the following:

$$EGC = \Sigma [(I_t + M_t + F_t) (1+r)^{-t}] / \Sigma [E_t (1+r)^{-t}] \quad (1)$$

Where:

- EGC: Average lifetime levelized electricity generation cost per kWh
- I_t: Capital expenditures in the year t
- M_t: Operation and maintenance expenditures in the year t
- F_t: Fuel expenditures in the year t
- E_t: Electricity generation in the year t
- R: Discount rate

¹⁴ “According to the Twelfth-five Year Plan in Fujian Province, newly additional nuclear power of 4,000MW will be built until 2015. For the purpose of operation safety, the nuclear power plant shall be under the base load operation.” Page 12, Volume 2, *Special report on the status and function of Gas Power plant in Fujian Grid, Feasibility Study of Putian LNG Power Plant*

¹⁵ [Wang](#) Yonggan. *The Analysis and Forecast of Countrywide electricity supply and demand and Economic Operation Situation in 2005~2006*. China Electric Power Yearbook 2006: 47~55

¹⁶ Page 11, Volume 2, *Special report on the status and function of Gas Power plant in Fujian Grid, Feasibility Study of Putian LNG Power Plant*



The main parameters and assumptions for levelized cost analysis of Alternative 1 and Alternative 6a~c are shown as the following Table 3 and Table 4:

Table 3 Parameters of Alternative 1

Construction Investment (10,000 RMB)	502,351
Project Lifetime (Year)	23 (including 2 years of construction)
Annual Operation and Maintenance Expenditure (10,000 RMB)	The 3 rd year: 6,411 The 4 th year: 20,786 The 5 th ~22 nd year: 27,626 The 23 rd : 15,126
Fuel Expenditure (10,000 RMB)	The 3 rd year: 9,244 The 4 th year: 92,441 The 5 th ~22 nd year: 147,906 The 23 rd : 80,116
Annual electricity generation (GWh)	The 3 rd year: 382 The 4 th year: 3,820 The 5 th ~22 nd year: 6,112 The 23 rd : 3,311

* Feasibility Study of the project

Table 4 Parameters of Alternative 6a~c

	Alternative 6a ¹⁷	Alternative 6b ¹⁸	Alternative 6c ¹⁹
Installed Capacity (MWh)	4×300MWh	2×600	2×600
Annual Operation Hours	5,000	5,000	5,000
Discount Rate (%)	8%	8%	8%
Unit Investment (RMB/KW)	4,139	3,725 ²⁰	4,037
Material Expenditure (RMB/MWh)	6	5	5
Water Expenditure (RMB/MWh)	1	1	1
Desulfuration Expenditure (RMB/tce)	3.64	3.64	3.64
Employee Num. (Person)	295	247	247
Human resource cost per capita (RMB/year)	50,000	50,000	50,000
Welfare Rate (%)	60%	60%	60%
Maintenance cost (%)	2.5%	2.5%	2.5%
Pollutant Discharge Fee (RMB/a)	12,520,000	11,360,000	11,360,000

¹⁷ Referenced Cost Index of thermal power engineering and design (2005 level), China Institute of Power Planning and Design

¹⁸ ibid

¹⁹ ibid

²⁰ The unit investment of 600 MW sub critical coal-fired power technology is 10~15% lower than that of 300MW sub critical coal-fired power technology. Thus, the above data 3,725 is calculated as $4,139 \times (1 - 10\%)$ for conservative reason. *Prospect of Controlled Circulation Boilers*, Vol. 16 No. 3 1999, Modern Electric Power



Coal Consumption for Power Generation (tce)	1,890,000	1,884,000	1,794,000
Coal Price (RMB/tce)	430	430	430
Other Expenditure (RMB/MWh)	12	10	10
Construction Period (Month)	39	44	44
Operation Period (Year)	21	21	21

Based on the calculation, the results of levelized cost analysis are shown as follows:

Table 5 Result Of Levelized Cost Analysis

	Alternative 1	Alternative 6a	Alternative 6b	Alternative 6c
Levelized Cost (RMB/KWh)	0.3810	0.2787	0.2627	0.2650

As shown in Table 5, Alternative 6b has the lowest levelized cost. Then, the sensitivity analysis is employed to confirm that the conclusion regarding the financial attractiveness is robust to reasonable in the critical assumptions. Fuel cost and load factor are taken as the variations for the sensitivity analysis. Table 6 below demonstrates the results.

Table 6 Sensitivity Analysis Of The Levelized Cost (RMB/KWh)

Variables	Fluctuation Range	Alternative 1	Alternative 6a	Alternative 6b	Alternative 6c
Fuel Cost	+10%	0.4052	0.2922	0.2762	0.2779
	+5%	0.3931	0.2855	0.2695	0.2715
	0%	0.3810	0.2787	0.2627	0.2650
	-5%	0.3689	0.2719	0.2560	0.2586
	-10%	0.3568	0.2652	0.2492	0.2522
Load Factor	+10%	0.3700	0.2675	0.2527	0.2542
	+5%	0.3753	0.2728	0.2575	0.2594
	0%	0.3810	0.2787	0.2627	0.2650
	-5%	0.3877	0.2852	0.2687	0.2713
	-10%	0.3950	0.2924	0.2752	0.2783

The sensitivity analysis confirms that Alternative 6b always has the lowest levelized cost within reasonable variations in the critical assumptions. According to AM0029 (Version 01), the most economically attractive alternative can be considered as the most plausible baseline scenario. Therefore, Alternative 6b “Power generation using sub critical coal-fired power technology with installed capacity of 2×600 MW” is selected as the most plausible baseline scenario.

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

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Prior Consideration of CDM

The project owner was in an early stage aware about the potential of CDM to support its project activities. It is clear that the project owner has fully considered the revenues from CDM when making the decision to



implement the project activity. The detailed schedule of events relating to the project is as follows:

Time	Milestone
25/06/2004	Third director work meeting of the Construction Office on CDM study research;
11/2004	FSR finished;
16/05/2005	Commissioned Fujian Electric Power Survey & Design Institute to do the CDM consultation;
10/2005	The <i>Special Report on the Economic Appraisal of Introducing the CDM to LNG Power Plant</i> finished;
20/12/2005	FSR approved by NDRC;
24/01/2006	Resolution of Board of Directors that start the CDM project and designate the person and apartment in charge;
20/02/2006	Signed the Consulting Contract on CDM Development with CRIH;
14/03/2006	The order to commence of the project;
15/03/2006	The project started;
31/08/2006	Equipment Purchase Contract;
10/01/2007	ERPA signed;
26/04/2007	Adopted by the Audit Council of NDRC;
28/04/2007	Singed the Validation Proposal with SGS;
01/05/2007~30/05/2007	On EB website for public comments;
07/06/2007	On-site visit was performed by SGS;
16/07/2007	Got the LoA from China government;
27/07/2007	Got the LoA from Japan government.

As of 2003, a large scale of training activity on CDM has been done by Ministry of Science and Technology of China, which introduced abundant information. And the Construction Office of Putian project held a meeting about CDM study research on 25/06/2004.

In November 2004, the FSR of the project has been finished by the qualified third party –Electric Power Survey & Design Institute of Fujian Province and was approved on December 20th 2005 by the NDRC. According to the result of the FSR, without the support of CDM, the IRR of the project was 6.39% only (with the income tax of 33%), which made the project financially unattractive. Therefore, on May 16th 2005, the project owner submitted the Electric Power Survey & Design Institute of Fujian Province to do the CDM consultation and compile the Special Report on the Economic Appraisal of Introducing the CDM to LNG Power Plant to evaluate the IRR of the project with the CDM revenue.

In October 2005, the Special Report on the Economic Appraisal of Introducing the CDM to LNG Power Plant was finished, According to which, the IRR of the project could reach 8.98% (with the income tax of 33%), when the CERs price was US\$10/T. On January 24th 2006, in accordance with the result of preceding study, the board of the company decided to contract a professional CDM development entity to prepare the PDD and to seek potential CERs buyer.

On February 20th 2006, the CDM Cooperation Framework Agreement was signed with the CDM Project Entity, Beijing Changjiang River International Holding.



On March 15th 2006, the land formation on the site was begun. And on August 31st 2006, the Major Equipment Purchase Contract with the Dongfang Electric Corporation was signed.

On January 10th 2007, the formal signing of the ERPA with Japan Mitsubishi Corporation was done.

On April 26th 2007, the project was approved by the NDRC CDM verification council.

On April 28th 2007, the Validation Agreement was signed with the SGS. From May 1st ~ 30th 2007, the PDD was on the website of EB for public comments. Then SGS finished the on-site verification on June 7th 2007.

On July 16th 2007, the LOA from Chinese government was obtained. And on July 27th 2007, the LOA from Japanese government was obtained.

It can be concluded that CDM was seriously considered and played a key role at the time the project owner decided to proceed the project.

The following steps are used to demonstrate the additionality of the proposed project based on the latest version of the “Tool for the demonstration and assessment of additionality” agreed by the Executive Board.

According to the version 01 of AM0029 (Version 01), the assessment of additionality comprises the following steps:

Step 1: Benchmark investment analysis

Substep 2b. Option III - Apply benchmark analysis

According to the “*Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*”, the financial benchmark IRR (after tax) of total investment in China power sector should be at 8%²¹, which indicates that the benchmark is applicable to newly build or retrofit power generation projects including natural gas power generation projects in China. In addition, the Interim Rules states that the benchmark refers to the version 2 of the “*Methodology and Parameters for Financial Evaluation of Construction projects*” issued by former State Planning Commission and the Ministry of Construction (MOC)²².

The Interim Rules was issued by the former State Power Corporation of China in 2003 and endorsed by the former State Planning Commission (now this function is under National Development and Reform Commission (NDRC) and MOC. The former State Power Corporation of China was responsible for the implementation of government policies and guidelines relating to power production, purchase and sales in China. Following re-structuring, the State Power Corporation ceased to exist and its functions relating to issuance of guidelines and rules (such as IRR benchmark setting) were transferred to the NDRC. However, the Interim Rules is still valid after the structure reform. The benchmark of 8% has been widely used for financial appraisal of all kinds of electricity generation projects in China.

²¹ Page 2, Section 1.11, *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*, the former State Power Corporation of China, 2003.

²² Page 1, Section 1.1, *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*, the former State Power Corporation of China, 2003.



Therefore, the benchmark of 8% settled in “*Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project*” is considered as conservative parameter and chosen as the benchmark for the financial analysis of the proposed project.

Substep 2c. Calculation and comparison of financial indicators

Except for the income tax, other basic parameters for financial appraisal of the proposed project are derived from the approved feasibility study report (FSR) as the following. The FSR was compiled by Electric Power Survey & Design Institute of Fujian Province²³ in October of 2004 and approved by NDRC on 20/12/2005²⁴.

(1)

Installed Capacity	(MW)	1,528
Annual electricity generation	(GWh)	382 (01/10/2008) 3,820 (2009) 6,112 (2010~2027) 3,310.67 (2028)
Project Lifetime	(Year)	23(including 2 years of construction. And, each generator has 21-year operational period ²⁵ .)
Total Investment	(Million RMB)	5,420.92
Prospective Bus-bar tariff	(excluding VAT, RMB / MWh)	391.20
VAT		17%
Income Tax		25% ²⁶
Crediting Period	(Year)	21 (7×3)
Estimated Price Of Natural Gas	(including VAT, RMB/ m ³)	1.411

²³ Electric Power Survey & Design Institute of Fujian Province was established in 1958. It involves design in electricity industry and construction, survey and consultation of construction with Grade A qualification approved by Ministry of Construction. The related certificates have been provided to DOE.

²⁴ The approval document has been provided to DOE.

²⁵ The 20-year operational period is determined by FSR in accordance with “*the Methodology and Parameters for Financial Evaluation of Construction projects*” (Page 62, 2nd Edition). This Methodology is used as a national standard for financial evaluation of all construction projects in China.

²⁶ Originally, the income tax in the FSR of the project is 33%. The FSR was completed in Nov 2004. As at that time, the income tax rate applicable to enterprises in China was established as 33% in accordance with *Provisional Regulations Of The Peoples Republic Of China On Enterprise Income Tax* promulgated by the State Council on 13/12/1993.

On 16/03/2007, the *Enterprise Income Tax Law of the People’s Republic of China* has been adopted by the Fifth Session of the Tenth National People’s Congress and is hereby promulgated for effect as of 01/01/2008. This regulation prescribes 25% as income tax rate for enterprises and meanwhile abolishes the *Provisional Regulations of the People’s Republic of China on Enterprise Income Tax*. Therefore, the income tax rate of the project is adjusted to 25% for financial analysis.



- (2) Based on benchmark analysis (Option III), if the financial indicator (such as IRR) of the proposed project is less than the benchmark, the proposed project is not attractive.

The IRR on total investment of the proposed project without CDM revenues are shown in Table 7 below. Without CDM, the IRR of total investment is 6.69% obviously lower than the benchmark of 8%, and the NPV on total investment is negative. Therefore, the proposed project is not financially attractive.

Table 7 Financial Indicators of the Proposed Project (Total Investment)
(Without CDM Revenue)

IRR	NPV (ic=8%) (Million Yuan)
(BENCHMARK=8%) 6.69%	-458

Sub-step 2d. Sensitivity analysis

The objective of sensitivity analysis is to conclude that whether the proposed project is unlikely to be financially attractive or be financially attractive.

Three parameters are used for sensitivity analysis of financial attractiveness:

- Total investment
- Price of natural gas
- Bus-bar tariff

Provided that total investment, price of natural gas and Bus-bar tariff change with fluctuation ranging from -10% ~ +10%, the impacts of these indicators on IRR of total investment are analysed. The results are shown in Table 8 and Figure 5.

Table 8 IRR (Total Investment) Sensitivity To Different Financial Parameters (Without CDM)

Range Parameter	-10%	-7.5%	-5%	-2.5%	0	+2.5%	+5%	+7.5%	+10%
Total investment	7.82%	7.53%	7.26%	7.00%	6.69%	6.52%	6.28%	6.06%	5.85%
Price Of Natural Gas	9.27%	8.67%	8.04%	7.41%	6.69%	6.08%	5.39%	4.64%	3.85%
Bus-bar tariff	1.85%	3.24%	4.53%	5.69%	6.69%	7.78%	8.76%	9.71%	10.63%

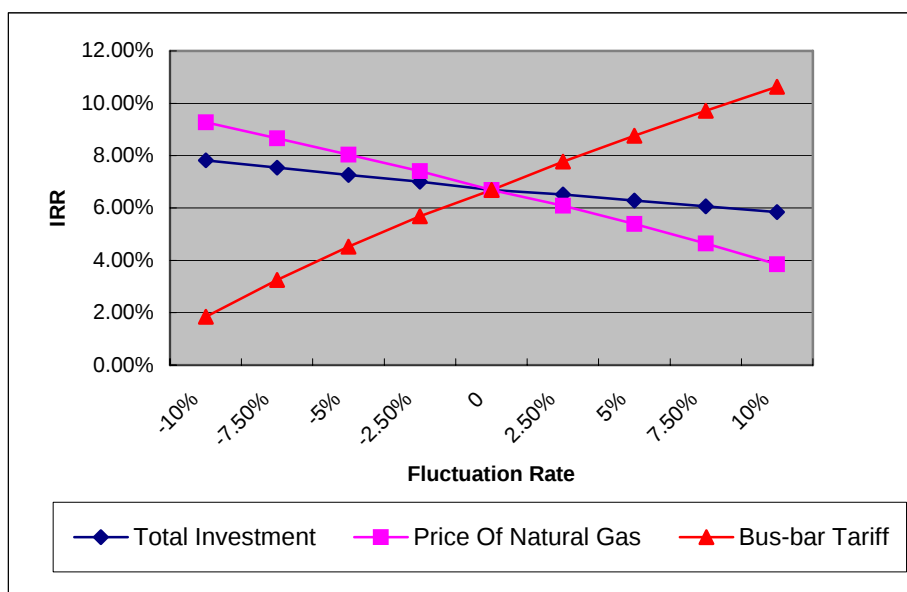


Figure 5 IRR (Total Investment) Sensitivity To Different Financial Parameters (Without CDM)

It can be concluded that the impact of bus-bar tariff on IRR is the most sensitive, following by the price of natural gas. The impact of total investment on IRR is minimal.

Bus-bar tariff

According to the feasibility study, the surveyor's pole bus-bar tariff for fossil-fired power in Fujian Grid is at RMB362Yuan/MWh (including VAT). The prospective bus-bar tariff of the proposed project is expected at RMB 457.71 Yuan/MWh (including VAT) that is already higher than the surveyor's pole bus-bar tariff so far.

According to *Tentative Management Rules on Bus-bar Tariff*²⁷ issued by the National Development and Reform Commission (NDRC) in 2005, the coal-fired, oil-fired and gas-fired electricity-generation enterprises should participate in on-grid bidding on power market. That means the proposed project needs to compete on equal footing with other thermal power plants under the open market situation and cannot enjoy preferential price. Before that, ECPG has already taken the pilot operation of such bidding²⁸. The result shows that the on-grid bidding can restrain the tariff, which leads to the decrease on surveyor's pole bus-bar tariff and lower bidding price than it and increase the competition²⁹. Therefore, under the current price system, the proposed project has already been less advantageous to compete with coal-fired power plants and participate in on-grid bidding³⁰. The increase in bus-bar tariff certainly will cause the proposed project loses competitiveness more seriously comparing with other thermal power enterprises. Thus, the bus-bar tariff of the proposed project cannot be increased further.

²⁷ http://www.ndrc.gov.cn/zcfb/zcfbtz/zcfbtz2005/t20050613_6670.htm

²⁸ http://www.sdpc.gov.cn/xwfb/t20050628_27678.htm

²⁹ Meng Yuming, *Analyses on the Operation Risk and the Corresponding Policy for the Thermal Power Enterprises*, Energy of China, Vol. 28 No. 4 Apr. 2006: 18

³⁰ Page 10, Investment Estimation and Economic Appraisal, Volume. 10, Feasibility Study of Putian LNG Generation Project



Therefore, it is hard for the proposed project to turn a profit as a result of the limitation on the bus-bar tariff. Without CDM revenue, it would be a barrier for the implementation of the proposed project.

Price of natural gas

Based on the feasibility study, the natural gas price sold by China National Offshore Oil Corp Fujian Natural Gas Co., Ltd. to the project owner is RMB 1.411 Yuan/m³ which was based on the striking price of 25 U.S. dollars per barrel negotiated between China National Offshore Oil Corp Fujian Natural Gas Co., Ltd. and the owner of Indonesian Tangguh Gas Field. Recently, a report announced by NDRC indicates that the striking price has already risen to 38 U.S. dollars per barrel in June 2006³¹. Thus, the natural gas price will be higher than the expected price in feasibility study. Also, the long-term trend is that international gas prices are continuously rising.³² Therefore, the proposed project is less financially attractive resulting from the increasing price according to the sensitive analysis above. The natural gas price is a barrier affecting the feasibility and implementation of the proposed project.

Total Investment

As shown in Table 8 above, when the total investment is decreased by 10%, the IRR still cannot reach the benchmark.

Based on the above financial analysis the proposed project is obviously less financial attractive if it cannot implement CDM. Whereas, given that the project gets CERs revenues for the first 7-year crediting period, its IRR of total investment could be improved to 9.14% exceeding the benchmark (seeing Table 9 below). Thus, the proposed project will be financial attractive, if it gets CDM income.

**Table 9 Comparison of Financial Indicators of the Proposed Project With CDM Revenue
And Without CDM Revenue (Total Investment)**

	IRR (BENCHMARK=8%)	NPV (ic=8%) (Million Yuan)
Without CDM	6.69%	-458
With CDM	9.14%	402

Step 2 Common practice analyses

Sub-step 2a. Analyze other activities similar to the proposed project activity:

At the present, the power plants using natural gas just accounts for very small share of China's power market at 2.1%³³ of the total power generation in China, most of which are of small scale.

Currently, the natural gas power generation projects similar to the proposed project in ECPG are identified in the Table 10 below:

Table 10: Similar LNG power projects in ECPG

No.	Project	Location	Installed capacity (MW)	Annual output (GWh)	Investment (RMB/KW)	Starting time	Remark
1	Yuyao electricity	Yuyao City,	780	2,662	2,970	2007	Under the CDM

³¹ http://www.ndrc.gov.cn/nyjt/gjdt/t20070312_120697.htm

³² <http://www.eia.doe.gov/emeu/international/ngasprie.html>

³³ <http://www.gs-n-tax.gov.cn/shownews.asp?newsid=7861>



	generation project using natural gas ³⁴	Zhejiang Province					development
2	Zhenhai Natural Gas Power Generation Co., Ltd ³⁵	Ningbo City, Zhejiang Province	2×370	2,590	3,529	2007	Under the CDM development
3	Xiaoshan Power Plant's Natural Gas Power Generation Project ³⁶	Hangzhou City, Zhejiang Province	2×370	2,590	3,501	2007	Under the CDM development
4	Hangzhou Hadian Banshan Power Generation Co., Ltd's Nature Gas Power Generation Project ³⁷	Hangzhou City, Zhejiang Province	3×390	3,700	3,395	2007	Under the CDM development
5	Nanjing Grid Connected Natural Gas Combined Cycle Power Plant ³⁸	Nanjing City, Jiangsu Province	2×400	2,716	4,860	2007	Under the CDM development
6	Huaneng Shanghai Baoshan Grid Connected Natural Gas Combined Cycle Power Plant ³⁹	Shanghai City	3×400	3,990	2,961	2007	Under the CDM development
7	Fujian Jinjiang LNG Power Plant ⁴⁰	Jinjiang City	4×390	6,064	3,046	2008	Under the CDM development
8	Xiamen Eastern LNG Power Plant ⁴¹	Xiamen City, Fujian Province	2×350	3,000	4,042	2009	Wholly foreign-owned

Sub-step 2b. Discuss any similar options that are occurring:

Xiamen eastern LNG power plant (No. 8) is totally invested by a Singapore invested enterprise —RGM International. According to the *Measures for the Management of CDM Project Activities*⁴² issued by China DNA, only China-affiliated enterprise and China-controlled enterprise are eligible to develop CDM projects in China. As the project is exclusively foreign-owned, it cannot be considered as a CDM project.

³⁴ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1536.pdf>

³⁵ *ibid*

³⁶ *ibid*

³⁷ *ibid*

³⁸ *ibid*

³⁹ *ibid*

⁴⁰ *ibid*

⁴¹ <http://ctixm.smexm.gov.cn/2006-12/2006122313041.htm>

“Xiamen Eastern LNG Power Plant” also can be translated to “Xiamen Dongbu LNG Power Plant” for Chinese pronunciation.

⁴² <http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=458>



In addition, as a wholly foreign invested project, the power plant can be developed without CDM by enjoying favourable policies as incentives described below which the proposed project cannot benefit from:

- The enterprises invested by a multinational corporation with a production nature scheduled to operate for a period more than 10 years shall, from the year beginning to make profit, be exempted from income tax in the first and second years and allowed a 50% reduction from the third to fifth years⁴³;
- Such enterprises can enjoy the returned VAT which has been paid when purchasing domestic equipments according to the preferential back VAT policy⁴⁴; and
- The imported equipments purchased by such enterprises can be exempted from tariff and VAT relating to importation⁴⁵.

Other projects face similar financial barrier as the proposed project and are currently applying for CDM to conquer the barrier⁴⁶.

The proposed project will be the first natural gas based combined cycle power plant constructed in Fujian Province. However, it cannot enjoy the favourable policies as Xiamen Eastern LNG Power Plant, and faces low bus-bar tariff and increased natural gas price, and bears higher investment risk. Therefore, the Project is not a common practice within ECPG.

Taking account of the barriers and obstacles mentioned above, the Preparatory Work Office of Fujian Putian LNG Power Plant seriously considered the incentives from the CDM in the decision to proceed with the project activity:

On 25/06/2004, the Preparatory Work Office called a board meeting to discuss the issue of developing the planned Fujian Putian LNG Power Plant Project as a CDM project activity. All the members agreed that the company should quicken the research of Kyoto protocol, get hold of the CDM operational procedures and develop the Project in accordance to CDM rules to combat the potential financial barriers.

In conclusion, the project is additional, and the project owner is unlikely to undertake the Project without CDM incentives.

Step 3 Impact of CDM Registration

If the proposed project is registered as a CDM project, it can bring the following benefits:

- (1) The CDM revenues can improve the poor IRR and NPV of total investment of the proposed project, thus make the project more financial attractive.
- (2) The CDM revenue will increase the total revenues of the proposed project, which can help the project cover the high cost of maintenance, and alleviate the risks regarding to the low and uncertain pool purchase price and high natural gas price;

⁴³ <http://www.xm-n-tax.gov.cn/LlfxServlet?nwbz=2&lmbh=008&errpage=/jsp/internet/index/errPage.jsp&url=/publish/internet/bszn/FB0000000008.shtml>

⁴⁴ *ibid*

⁴⁵ *ibid*

⁴⁶ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1536.pdf>



- (3) The CDM revenue can reduce the pressure from high investment and cash flow risks, and can improve the repayment capability of the project owner to pay back the loan;
- (4) If the project is registered as CDM project, it will attract and encourage new local players to invest in natural gas based electricity generation plants, which contribute to low emission and bring stable power supply.

In conclusion, the proposed project is additional, not (part of) the baseline scenario.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

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In accordance with the Methodology AM0029 (Version 01), the following steps are employed to calculate the emission reductions generated by the proposed project.

Step 1 Calculation of Project emissions

The project activity is on-site combustion of natural gas to generate electricity. The CO₂ emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = \sum_f FC_{f,y} \times COEF_{f,y} \quad (2)$$

Where:

FC_{f,y}: is the total volume of natural gas or other fuel 'f' combusted in the project plant or other startup fuel (m³ or similar) in year(s) 'y'

COEF_{f,y}: is the CO₂ emission coefficient (tCO₂/m³ or similar) in year(s) for each fuel and is obtained as:

$$COEF_{f,y} = \sum NCV_y \times EF_{CO_2,f,y} \times OXID_f \quad (3)$$

Where:

NCV_{f,y}: is the net calorific value (energy content) per volume unit of natural gas in year 'y' (GJ/m³) as determined from the fuel supplier, wherever possible, otherwise from local or national data;

EF_{CO₂,f,y}: is the CO₂ emission factor per unit of energy of natural gas in year 'y' (tCO₂/GJ) as determined from the fuel supplier, wherever possible, otherwise from local or national data;

OXID_f: is the oxidation factor of natural gas.

According to the feasibility study, Putian LNG project is not designed to apply other startup fuels or auxiliary fuel for electricity generation. Thus, the project emission from electricity generation is only resulted from the natural gas consumption.

According to the feasibility study, the natural gas consumption rate of the proposed project is at 0.1938 m³/KWh. Based on the annual electricity generated by the proposed project (EG_{PJ,y}), the amount of annual



natural gas combustion ($FC_{NG,y}$) by the proposed project can be calculated. The net fuel calorific value ($NCV_{\text{Natural gas}}$) of natural gas used by the project is at $34,402 \text{ KJ/m}^3$ ⁴⁷.

The carbon emission factor of natural gas ($EF_{\text{co2, natural gas, y}}$) is taken the default value of 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006) as 15.30 tC/TJ . And the $OXID_{\text{Natural gas}}$ is taken as 1.00, which is also taken from IPCC 2006.

The proposed project consists of 4 generator units. The first unit will put into operation from Oct 1st 2008, and the rest will start generating power in 2009 successively. The annual output (exclude the last operation year 2028) of the proposed project is expected at 6,112GWh when all the generating units putting into operation. The specific annual power generation are calculated as the following:

	Time of Starting Operation	Annual Electricity Generation (EG) (KWh)			
		2008 (Oct.~Dec.)	2009	2010~2027	2028 (Jan.~Sep.)
No.1 Unit	01/10/2008	382,000,000	1,528,000,000	1,528,000,000	620,750,006
No.2 Unit	01/03/2009	-	1,273,333,333	1,528,000,000	620,750,006
No.3 Unit	01/07/2009	-	764,000,000	1,528,000,000	620,750,006
No.4 Unit	01/11/2009	-	254,666,667	1,528,000,000	620,750,006
Annual Electricity Generation (EG) (KWh)		382,000,000	3,820,000,000	6,112,000,000	2,483,000,025

Step 2 Calculation of Baseline Emissions

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline CO_2 emission factor ($EF_{BL,\text{CO}_2,y}$), as follows:

$$BE_y = EG_{PJ,y} \times EF_{BL,\text{CO}_2,y} \quad (4)$$

Sub-step 2a: Determination of the baseline CO_2 emission factor

According Methodology AM0029 (Version 01), in order to address the uncertainty relating to which type of other power generation is substituted by the power generation of the proposed project in a conservative manner, project participants shall use for $EF_{BL,\text{CO}_2,y}$ the lowest emission factor among the following three options:

For the first crediting period:

Option 1: The build margin, calculated according to ACM0002 (Version 06);

Option 2: The combined margin, calculated according to ACM0002 (Version 06), using a 50/50 OM/BM weight; and

Option 3: The emission factor of the technology (and fuel) identified as the most likely baseline scenario under “Identification of the baseline scenario” above, and calculated as follows:

⁴⁷ Data source from Togguh Gas Field of Indonesia, provided by the Executive office of Fujian LNG Terminal Station.



$$BE_{BL, CO_2}(tco2 / MWh) = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6GJ / MWh \quad (5)$$

Where:

$COEF_{BL}$: the fuel emission coefficient (tCO₂e/GJ), based on national average fuel data, if available, otherwise IPCC defaults can be used;

η_{BL} : the energy efficiency of the technology, as estimated in the baseline scenario analysis above.

Option 1

As the proposed project will be connect to Fujian Power Grid, which is a part of ECPG (regional grid). So emission factors of ECPG are used for determining the $EF_{BL, CO_2, y}$.

According to ACM0002 (Version 06), the build margin of ECPG is calculated by the following equation:

$$EF_{BM, y} = \frac{\sum_{i, m} F_{i, m, y} \times COEF_{i, m}}{\sum_m GEN_{m, y}} \quad (6)$$

Where

$F_{i, m, y}$ is the amount of fuel i (tce) consumed by plant m in year y .

$COEF_{i, m, y}$ is the CO₂ emission coefficient (tCO₂/tce) of fuel i , taking into account the carbon content of the fuels used by plant m and the percent oxidation of the fuel in year y .

$GEN_{m, y}$ is the electricity (MWh) delivered to the grid by plant m , equals to generation minus plant self consumption.

In this PDD, the BM ex-ante method is employed. And because it is very difficult to obtain the data of five most recently built power plants as these data are considered as confidential business information in China, the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently is selected as the sample group m . The power plants, which are CDM projects, are not included in sample group m .

However, even for those built most recently power plants that comprise 20% of the system generation, it is also difficult to obtain the specific data regarding to fuel consumption and electricity generation additions by each power sources as confidential reason. Considering this situation, the following clarifications are given by EB for deviation in use of methodology AM0005 in China⁴⁸ when estimating BM emission coefficient:

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

Since methodology AM0005 has been replaced by the consolidated methodology ACM0002, the

⁴⁸ http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ



deviation of AM0005 is also applicable to the consolidated methodology ACM0002.

The sample m of the proposed project makes accumulation to the year 2004 according to the newly increased installed capacity of ECPG of recent 1~3 years. The newly increased installed capacity occupy 21.55% of the total installed capacity in 2005, which is near to 20% of the newly increased installation in the recent 1~3 years. So the calculation by using the data between the years 2004 and 2005 satisfies the requirements of ACM0002 (Version 06).

According to ACM0002 (Version 06) and clarifications by EB, the main steps for BM calculation are as following:

- (I) Calculation of weights of CO₂ emissions by coal-fired, oil-fired and gas-fired plants in total CO₂ emissions of ECPG.

$$\lambda_{coal} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (7)$$

$$\lambda_{oil} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (8)$$

$$\lambda_{Gas} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (9)$$

Where:

$F_{i,j,y}$: is the total amount of fuel i (in a mass or volume unit) consumed by Province j in ECPG for power generation in year y ;

$COEF_{i,j,y}$: is the total amount the CO₂ emission coefficient of fuel i (tCO₂/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 .

This PDD employs the CO₂ emission weights by coal-fired, oil-fired and gas-fired plants of total CO₂ emission of ECPG in 2005.

- (II) Calculation of emission factor of thermal power (EF_{thermal power}) of ECPG.

The EF_{thermal power} is calculated as a weighted emission factor as the following formula:

$$EF_{thermal\ plants} = EF_{Coal,Adv} \times \lambda_c + EF_{Oil,Adv} \times \lambda_f + EF_{Gas, Adv} \times \lambda_n \quad (10)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas, Adv}$ are the emission factors of the best technology for coal, oil, gas fired power plants commercially available in China, which are calculated based on the efficiency level of the best technology for each fuel type commercially available (η_{Adv}) in China.



According to the data issued by China DNA, the efficiency levels of domestic sub-critical 600 MW coal power unit and the efficiency level of 200 MW combined cycle power unit are taken as the efficiency level of the best technology for coal-fired power plants, and oil and gas fired power plants commercially available in China, which are at 35.82% (343.33 gce/KWh) and 47.67% (258 gce/kWh), respectively.

(III) Calculation of Build Margin (BM) emission factor of ECPG.

Finally, weighted average build margin emission factor ($EF_{BM,y}$) are calculated by multiplying the $EF_{thermal\ power}$ with the weight of new capacity addition by thermal power of total capacity addition in ECPG.

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (11)$$

Where:

CAP_{Total} : the total capacity addition of ECPG between 2004~2005;

$CAP_{Thermal}$: the capacity addition by thermal power of ECPG between 2004~2005.

Therefore, the BM of ECPG is calculated as 0.8672 tCO₂/MWh (See details in Table A1 and Table A2 in Annex 3). The method of BM calculation above refers to “the value of China’s Regional Grid Baseline Emission Factors Determination” published by DNA (<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>).

Option 2

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

The ACM0002 (Version 06) provides four options to calculate the operating margin:

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

For the proposed project activity, because the dispatch data of the Grid in China is not available to the public, options (b) and (c) can’t be adopted. Furthermore, since low-cost/must-run power sources constitute 11.50%, 11.86%, 10.96%, 9.75% and 11.94% from 2001~2005⁴⁹, less than 50% of the East China Power Grid, option (a) (simple OM) is the only reasonable and feasible method among the four options.

The Simple OM emission factor ($EF_{OM, simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO₂/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:

$$EF_{OM, simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} \quad (12)$$

Where:

⁴⁹ China Electric Yearbook 2001~2005



$F_{i,j,y}$ 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 CO₂ emission coefficient of fuel i (tCO₂/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 CO₂ emission coefficient $COEF_i$ is then obtained as:

$$COEF_i = NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \quad (13)$$

Where:

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

$EF_{CO_2,i}$: is the CO₂ emission factor per unit of energy of fuel i (tCO₂/GJ), default value of Revised IPCC 2006 is used; $OXID_i$ is the oxidation factor of the fuel, IPCC default value of IPCC 2006 is used.

This PDD calculates the Operating Margin (OM) emission factors of ECPG in 2003, 2004 and 2005, respectively. Then, the OM emission factor of ECPG is calculated as the weighted average of the three years, which is at 0.9421 tCO₂/MWh (See details in Table A1 and Table A3 in Annex 3).

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

As the above calculation in Option 1, the BM of ECPG is 0.8672 tCO₂/MWh.

(III) Calculation of Combined Margin Emission Factor ($EF_{CM,y}$)

The Combined Margin Emission Factor ($EF_{CM,y}$) is calculated as the weighted average of $EF_{OM,y}$ and $EF_{BM,y}$, the weights are 50% and 50%, respectively.

$$\begin{aligned} EF_{CM,y} &= EF_{OM,y} \times 0.5 + EF_{BM,y} \times 0.5 \\ &= 0.9421 \times 0.5 + 0.8672 \times 0.5 \\ &= 0.9046 \text{ tCO}_2/\text{MWh} \end{aligned} \quad (14)$$

The method of OM calculation refers to official website: <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls> issued by China's DNA.

Option 3

The technology (and fuel) that is identified as the most possible baseline scenario of the proposed project is coal.

The carbon emission factor (EF_c) of coal is taken the default value of IPCC 2006 as 25.8 tC/TJ. The OXID of coal is 1.00, which is the default value of IPCC 2006. Thus, the fuel emission coefficient (tCO₂e/GJ) is calculated as 0.0946 tCO₂e/GJ.

According to “the value of China's Regional Grid Baseline Emission Factors Determination” published



by DNA⁵⁰, the most advanced business technology efficiency level of coal- fired plant ($\eta_{\text{coal, adv}}$) in China is used for determine the η_{BL} , which is taken as 343.33 gce/KWh, corresponding to efficiency level of 35.82%.

Therefore, the most possible baseline emission factor is calculated as 0.9508tCO₂/MWh.

According to AM0029 (Version 01), the lowest emission factor among the three options above shall be used as the baseline emission factor, thus option 1 emission factor of Build Margin (0.8672 tCO₂/MWh) is used, and will be ex-post calculated annually.

Sub-step 2a: Baseline CO₂ Emission

Once the baseline emission factor is determined, the baseline emission can be calculated based on the formula 4 above.

Step 3 Calculation of Leakage

Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH₄ emissions and CO₂ emissions from associated fuel combustion and flaring. According AM0029 (Version 01), the following leakage emission sources shall be considered:

- Fugitive CH₄ emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.
- In the case LNG is used in the project plant: CO₂ emissions from fuel combustion/ electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

Thus, leakage emissions are calculated as follows:

$$LE_y = LE_{CH_4, y} + LE_{LNG, CO_2, y} \quad (15)$$

where:

LE_y : Leakage emissions during the year y in tCO_{2e};

$LE_{CH_4, y}$: Leakage emissions due to fugitive upstream CH₄ emissions in the year y in tCO_{2e};

$LE_{LNG, CO_2, y}$: Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in t CO_{2e}.

Sub Step 3a Calculation Of Leakage Emission Due to Fugitive Upstream Methane Emissions

According to Methodology AM0029 (Version 01), the leakage emission due to fugitive upstream CH₄ emissions ($LE_{CH_4, y}$) is calculated by the following formula:

$$LE_{CH_4, y} = [FC_y \times NCV_{NG, y} \times EF_{NG, upstream, CH_4} - EG_{PJ, y} \times EF_{BL, upstream, CH_4}] \times GWP_{CH_4} \quad (16)$$

where:

$LE_{CH_4, y}$: Leakage emissions due to fugitive upstream CH₄ emissions in the year y in tCO_{2e};

⁵⁰ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>



FC_y :	Quantity of natural gas combusted in the project plant during the year y in m ³ ;
$NCV_{NG,y}$:	Average net calorific value of the natural gas combusted during the year y in GJ/m ³ ;
$EF_{NG,upstream,CH_4}$:	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, in t CH ₄ per GJ fuel supplied to final consumers;
$EG_{PJ,y}$:	Electricity generation in the project plant during the year in MWh;
$EF_{BL,upstream,CH_4}$:	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH ₄ per MWh electricity generation in the project plant, as defined below;
GWP_{CH_4} :	Global warming potential of methane valid for the relevant commitment period.

GWP is taken as 21 tCO_{2e}/tCH₄⁵¹. According to AM0029 (Version 01), the natural gas emission factors for the location of the project activity should be used. Thus, $EF_{NG,upstream,CH_4}$ uses IPCC default value of other oil exporting countries / rest of world (296 tCH₄/PJ).

According to AM0029 (Version 01), the emission factor for upstream fugitive CH₄ emissions occurring in the absence of the project activity ($EF_{BL,upstream,CH_4}$) should be calculated consistent with the baseline emission factor (EF_{BL,CO_2}) which is the build margin factor of East China Power Grid. Thus, option 1 is used to calculate this factor as following formula:

$$EF_{BL,upstream,CH_4} = \frac{\sum_j FF_{j,k} \times EF_{k,upstream,CH_4}}{\sum_j EG_j} \quad (17)$$

where:

$EF_{BL,upstream,CH_4}$:	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH ₄ per MWh electricity generation in the project plant j Plants included in the build margin;
$FF_{j,k}$:	Quantity of fuel type k (a coal or oil type) combusted in power plant j included in the build margin;
$EF_{k,upstream,CH_4}$:	Emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or oil type) in t CH ₄ per MJ fuel produced;
EG_j :	Electricity generation in the plant j included in the build margin in MWh/a i Plants included in the operating margin.

Based on the method of calculating BM taken by the Chinese DNA, the $EF_{BL,upstream,CH_4}$ is calculated as the following way:

- (I) Calculation of weights of upstream fugitive methane emissions from production of different kinds of fuel required by coal-fired, oil-fired and gas-fired plants in ECPG.

⁵¹ Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, Table 1.3 and 1.4 on page 1.21-1.24, Chapter 1, Volume 2.



$$\lambda_{Coal} = \frac{\sum_{COAL,j} FF_{j, coal} \times EF_{coal, upstream, CH_4}}{\sum_{j,k} FF_{j, k} \times EF_{k, upstream, CH_4}} \quad (18)$$

$$\lambda_{Oil} = \frac{\sum_{OIL,j} FF_{j, oil} \times EF_{oil, upstream, CH_4}}{\sum_{j,k} FF_{j, k} \times EF_{k, upstream, CH_4}} \quad (19)$$

$$\lambda_{Gas} = \frac{\sum_{GAS,j} FF_{j, gas} \times EF_{gas, upstream, CH_4}}{\sum_{j,k} FF_{j, k} \times EF_{k, upstream, CH_4}} \quad (20)$$

Where:

- $FF_{j,k}$: Quantity of fuel type k (a coal or oil type) combusted in power plant j included in the build margin;
 $EF_{k, upstream, CH_4}$: Emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or oil type) in t CH₄ per MJ fuel produced.

This PDD employs weights of upstream fugitive methane emissions from production of different kinds of fuel required by coal-fired, oil-fired and gas-fired plants in ECPG in 2005.

Because 95%⁵² of the coal production in China are produced by underground mining, so the $EF_{coal, upstream, CH_4}$ is calculated as the weighted average of the default values for underground and surface mining in Table 2 of AM0029 (Version 01).

$$EF_{coal, upstream, CH_4} = 13.4 \times 95\% + 0.8 \times 5\% = 12.77 \text{ t CH}_4 / \text{kt coal}$$

$EF_{oil, upstream, CH_4}$ is taken as the default value in Table 2 of AM0029, which is at 4.1 t CH₄ / PJ. $EF_{gas, upstream, CH_4}$ is 296 t CH₄ / PJ, which is the default value of other oil exporting countries/rest of world defined in Table 2 of AM0029 (Version 01).

Then, the λ_{coal} , λ_{oil} and λ_{gas} are calculated as 99.02%, 0.02% and 0.96%, respectively. (See details in Table A4-2 in Annex 3)

(II) Calculation of emission factor for upstream fugitive methane emissions by thermal power plants ($EF_{thermal power, upstream, CH_4}$) included in the build margin of ECPG.

The $EF_{thermal power, upstream, CH_4}$ is calculated as a weighted emission factor as the following formula:

⁵² <http://taiyuan.mofcom.gov.cn/aarticle/dongtai/200709/20070905102367.html>



$$EF_{\text{Thermal power, upstream, CH}_4} = \lambda_{\text{Coal}} \times EF_{\text{Coal, upstream, CH}_4, \text{Adv}} + \lambda_{\text{Oil}} \times EF_{\text{Oil, upstream, CH}_4, \text{Adv}} + \lambda_{\text{Gas}} \times EF_{\text{Gas, upstream, CH}_4, \text{Adv}} \quad (21)$$

Where:

$EF_{\text{Coal, upstream, CH}_4, \text{Adv}}$, $EF_{\text{Oil, upstream, CH}_4, \text{Adv}}$ and $EF_{\text{Gas, upstream, CH}_4, \text{Adv}}$ are the emission factors of the best technology for coal, oil, gas fired power plants commercially available in China, which are calculated based on the efficiency level of the best technology for each fuel type commercially available (η_{Adv}) in China.

According to the data issued by China DNA, the efficiency levels of domestic sub-critical 600 MW coal power unit and the efficiency level of 200 MW combined cycle power unit are taken as the efficiency level of the best technology for coal-fired power plants, and oil and gas fired power plants commercially available in China, which are at 343.33 gce/KWh and 258 gce/KWh, respectively.

Based on the formula above, the $EF_{\text{thermal power, upstream, CH}_4}$ is calculated at 0.0044 t CH₄ / MWh. (See details in Table A4-1 and Table A4-2 in Annex 3)

(III) Calculation of the $EF_{\text{BL, upstream, CH}_4}$

Finally, $EF_{\text{BL, upstream, CH}_4}$ is calculated by multiplying the $EF_{\text{thermal power, upstream, CH}_4}$ with the weight of new capacity addition by thermal power of total capacity addition in ECPG.

$$EF_{\text{BL, upstream, CH}_4} = \frac{CAP_{\text{Thermal}}}{CAP_{\text{Total}}} \times EF_{\text{thermal power, upstream, CH}_4} \quad (22)$$

Where:

CAP_{Total} : the total capacity addition of ECPG between 2004~2005;

CAP_{Thermal} : the capacity addition by thermal power of ECPG between 2004~2005.

The proportion of thermal power in the recently build installed capacity of ECPG during the year 2004~2005 is at 92.53%. (See details in Table A2-1.2 in Annex 3) Thus, $EF_{\text{BL, upstream, CH}_4}$ is calculated at 0.004037 tCH₄/MWh.

Sub Step 3b Calculation Of CO₂ Leakage Emission From LNG

CO₂ emissions from fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system ($LE_{\text{LNG, CO}_2, y}$) should be estimated by multiplying the quantity of natural gas combusted in the project with an appropriate emission factor, as follows:

$$LE_{\text{LNG, CO}_2, y} = FC_{\text{LNG, y}} \times EF_{\text{CO}_2, \text{upstream, LGN}} \quad (23)$$

where:

$LE_{\text{LNG, CO}_2, y}$: Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in t CO₂e;

FC_y : Quantity of natural gas combusted in the project plant during the year y in m³;

$EF_{\text{CO}_2, \text{upstream, LNG}}$: Emission factor for upstream CO₂ emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system.



According AM0029 (Version 01), $EF_{CO_2, upstream, LNG}$ is taken as $6 \text{ t CO}_2/\text{TJ}$ ⁵³ as a rough approximation. Where total net leakage effects are negative ($LE_y < 0$), LE_y should be assumed at 0.

Step 4: Calculation of Emission Reductions

To calculate the emission reductions the project participant shall apply the following equation:

$$ER_y = BE_y - PE_y - LE_y \quad (24)$$

Where:

ER_y : emissions reductions in year y ($\text{t CO}_2\text{e}$)

BE_y : emissions in the baseline scenario in year y ($\text{t CO}_2\text{e}$)

PE_y : emissions in the project scenario in year y ($\text{t CO}_2\text{e}$)

LE_y : leakage in year y ($\text{t CO}_2\text{e}$)

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

Data / Parameter:	$F_{i,j, 2003-2005}$
Data unit:	Ton or m^3
Description:	The total amount of fuel i (in a mass or volume unit) consumed by Province j in ECPG for power generation in year 2003, 2004 and 2005.
Source of data used:	China Electric Power Yearbook
Value applied:	See A3 in Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data selected comply with the ACM0002 (Version 06).
Any comment:	For OM.

Data / Parameter:	$EG_j 2003-2005$
Data unit:	MWh
Description:	The electricity generation by the Province j in ECPG in year 2003, 2004 and 2005.
Source of data used:	China Electric Power Yearbook
Value applied:	See table A3 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data selected comply with the ACM0002 (Version 06).
Any comment:	For GEN calculation.

Data / Parameter:	$CPR_j 2003-2005$
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⁵³ This value has been derived on data published for North American LNG systems. “Barclay, M. and N. Denton, 2005. Selecting offshore LNG process. http://www.fwc.com/publications/tech_papers/files/LNJ091105p34-36.pdf (10th April 2006)”.



Data unit:	%
Description:	The captive power rate by the Province <i>j</i> in ECPG in year 2003, 2004 and 2005.
Source of data used:	China Electric Power Yearbook
Value applied:	See table A3 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data selected comply with the ACM0002 (Version 06).
Any comment:	For GEN calculation.

Data / Parameter:	GEN _{<i>j</i>} 2003–2005
Data unit:	MWh
Description:	The electricity output (MWh) supplied to the grid by the Province <i>j</i> in ECPG in year 2003, 2004 and 2005.
Source of data used:	Official website of China DNA: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls
Value applied:	See table A3 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data selected comply with the ACM0002 (Version 06).
Any comment:	For OM calculation.

Data / Parameter:	NCV _{<i>i</i>}
Data unit:	kJ/Kg or kJ/m ³
Description:	The net calorific value (energy content) per mass or volume unit of a fuel <i>i</i>
Source of data used:	China Energy Statistical Yearbook 2006
Value applied:	See table A3 in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002 (Version 06), the national value is used.
Any comment:	For OM and BM calculation.

Data / Parameter:	EF _{co2, <i>i</i>}
Data unit:	tC/Tj
Description:	CO ₂ emission factor per energy unit of fuel <i>i</i> .
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See table A3 in Annex.
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002 (Version 06), when the national value is unavailable, IPCC default is used.



Any comment:	For OM and BM calculation.
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Data / Parameter:	OXID _i
Data unit:	
Description:	The oxidation factor of the fuel.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See table A3 in Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is based on IPCC default value because the national specific value is unavailable.
Any comment:	

Data / Parameter:	Installed Capacity _j 2003, 2004, 2005
Data unit:	MW
Description:	The installed capacity of Province j in ECPG in year 2003, 2004 and 2005.
Source of data used:	China Electric Power Yearbook
Value applied:	See table A1 in Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data selected comply with ACM0002 (Version 06).
Any comment:	For BM calculation.

Data / Parameter:	$\eta_{Adv, i}$
Data unit:	%
Description:	The efficiency level of the best technology for each fuel type commercially available in China.
Source of data used:	Official website of China DNA: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf
Value applied:	See table A2-1.1 and A4-2 in Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data selected comply with ACM0002 (Version 06).
Any comment:	For BM calculation.

Data / Parameter:	EF _{NG,upstream,CH4}
Data unit:	tCH ₄ /PJ
Description:	Emission factor for upstream fugitive methane emissions of natural gas production
Source of data used:	Volume 3 of the 1996 Revised IPCC Guidelines



Value applied:	296
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value for other oil exporting countries / rest of world is adopted.
Any comment:	

Data / Parameter:	EF _{coal, , underground mining , upstream,CH4}
Data unit:	tCH ₄ /kt
Description:	Emission factor for upstream fugitive methane emissions from production of coal by underground mining.
Source of data used:	Volume 3 of the 1996 Revised IPCC Guidelines
Value applied:	13.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to AM0029 (Version 01), the IPCC default value is applied.
Any comment:f	

Data / Parameter:	EF _{coal, , surfacing mining , upstream,CH4}
Data unit:	tCH ₄ /kt
Description:	Emission factor for upstream fugitive methane emissions from production of coal by surfacing mining.
Source of data used:	Volume 3 of the 1996 Revised IPCC Guidelines
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to AM0029 (Version 01), the IPCC default value is applied.

Data / Parameter:	EF _{oil, upstream,CH4}
Data unit:	tCH ₄ /kt
Description:	Emission factor for upstream fugitive methane emissions from production of oil.
Source of data used:	Volume 3 of the 1996 Revised IPCC Guidelines
Value applied:	4.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF _{CO2,upstream,LNG}
Data unit:	t CO ₂ /TJ



Description:	Emission factor for upstream CO ₂ emission due to energy consumption associated with LNG process.
Source of data used:	This value has been derived on data published for North American LNG systems. "Barclay, M. and N. Denton, 2005. Selecting offshore LNG process. http://www.fwc.com/publications/tech_papers/files/LNJ091105p34-36.pdf (10th April 2006)
Value applied:	6
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since there is no country or local specific value available, the default value recommended by the methodology AM0029 (Version 01) is adopted.
Any comment:	

Data / Parameter:	GWP _{CH₄}
Data unit:	tCO _{2e} /tCH ₄
Description:	Global warming potential of methane valid for the relevant commitment period.
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of 21 is fixed for the first commitment period, and shall be updated for the subsequent commitment periods according to any future COP/MOP decisions.
Any comment:	

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

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Step 1 Calculation of Project emissions

According to step 1 in Section B6.1, the project emissions are calculated as the following:

(1) Natural Gas Combustion By The Proposed Project

Year	Annual Electricity Generation (EG) (KWh)	Natural Gas Consumption Rate (m ³ /KWh)	Annual Natural Gas Consumption (m ³)
2008(Oct.~Dec.)	382,000,000	0.1938	74,031,600.00
2009	3,820,000,000		740,316,000.00
2010~2027	6,112,000,000		1,184,505,600.00
2028(Jan.~Sep.)	2,483,000,025		481,205,404.85

(2) COEF_{Natural gas, y}

NCV (Kj/m ³)	Carbon Emission Factors (tC/Tj)	EF _{CO₂} (tCO ₂ /Tj)	OXID	COEF (tCO ₂ /m ³)
34,402	15.30	56.10	1.00	0.00193

(3) Project Emissions



Year	Annual Natural Gas Consumption (m ³)	COEF (tCO ₂ /m ³)	Annual Project Emission (tCO _{2e})
2008(Oct.~Dec.)	74,031,600.00	0.00193	142,877.45
2009	740,316,000.00		1,428,774.49
2010~2027	1,184,505,600.00		2,286,039.19
2028(Jan.~Sep.)	481,205,404.85		928,703.43

Step 2 Calculation of Baseline Emissions

Based on the formula 4 of step 2 in Section B.6.1, the baseline emissions are calculated as the following:

Year	Annual Electricity Generation (EG) (KWh)	EF _{BL,CO2} (tCO ₂ /MWh)	Baseline Emission (tCO _{2e})
2008(Oct.~Dec.)	382,000,000	0.8672	331,253.95
2009	3,820,000,000		3,312,539.51
2010~2027	6,112,000,000		5,300,063.22
2028(Jan.~Sep.)	2,483,000,025		2,153,150.70

Step 3 Calculation of Leakage

Sub Step 3a Calculation of leakage emission due to fugitive upstream methane emissions

(1) Leakage of natural gas combustion

Year	Annual Natural Gas Combustion (FC) (m ³)	NCV _{NG} (KJ/m ³)	EF _{NG,upstream,CH4} (t CH ₄ /PJ)	Leakage of natural gas combustion (tCH ₄)
2008(Oct.~Dec.)	74,031,600.00	34,402	296	753.86
2009	740,316,000.00			7,538.63
2010~2027	1,184,505,600.00			12,061.81
2028(Jan.~Sep.)	481,205,404.85			4,900.11



(2) Leakage in baseline

Year	Annual Electricity Generation (EG) (MWh)	EF _{BL,upstream,CH₄} (tCH ₄ /MWh)	Leakage in baseline (tCH ₄)
2008(Oct.~Dec.)	382,000,000	0.004037	1,542.11
2009	3,820,000,000		15,421.07
2010~2027	6,112,000,000		24,673.71
2028(Jan.~Sep.)	2,483,000,025		10,023.69

(3) LE_{CH₄,y}

Year	Leakage of natural gas combustion (tCH ₄)	Leakage in baseline (tCH ₄)	GWP (tCO _{2e} /tCH ₄)	LE _{CH₄} (tCO _{2e})
2008(Oct.~Dec.)	753.86	1,542.11	21	-16,553.11
2009	7,538.63	15,421.07		-165,531.15
2010~2027	12,061.81	24,673.71		-264,849.84
2028(Jan.~Sep.)	4,900.11	10,023.69		-107,595.25

Sub Step 3b Calculation of CO₂ Leakage Emission From LNG

Year	Annual Natural Gas Combustion (FC) (m ³)	NCV _{NG} (KJ/m ³)	EF _{LNG,upstream,Co2} (t CO ₂ /TJ)	LE _{LNG,CO2} (tCO ₂)
2008(Oct.~Dec.)	74,031,600.00	34,402	6	15,281.01
2009	740,316,000.00			152,810.11
2010~2027	1,184,505,600.00			244,496.17
2028(Jan.~Sep.)	481,205,404.85			99,326.57

Finally, leakage from the proposed project is calculated as the following:

Year	LE _{CH₄} (tCO _{2e})	LE _{LNG,CO2} (tCO ₂)	Leakage (tCO ₂)
2008(Oct.~Dec.)	-16,553.11	15,281.01	-1,272.10
2009	-165,531.15	152,810.11	-12,721.04
2010~2027	-264,849.84	244,496.17	-20,353.67
2028(Jan.~Sep.)	-107,595.25	99,326.57	-8,268.68

**Step 4: Calculation of Emission Reductions**

Based on the formula 24 above, the emission reductions generated by the proposed project are calculated as:

Year	Baseline Emission (tCO ₂ e)	Annual Project Emission (tCO ₂ e)	Annual Leakage (tCO ₂)	Annual Emission Reductions (tCO ₂ e)
2008(Oct.~Dec.)	331,253.95	142,877.45	0.00	188,376.50
2009	3,312,539.51	1,428,774.49	0.00	1,883,765.02
2010~2027	5,300,063.22	2,286,039.19	0.00	3,014,024.03
2028(Jan.~Sep.)	2,153,150.70	928,703.43	0.00	1,224,447.27

According to AM0029 (Version 01), $EF_{CO_2, upstream, LNG}$ is taken as 6 t CO₂/TJ⁵⁴ as a rough approximation. Where total net leakage effects are negative ($LE_y < 0$), LE_y should be assumed at 0.

Up to the delivery of this version of PDD to DOE, all the parameters and data mentioned in the BM and OM calculating part are updated to the latest records according to China Electric Power Yearbook 2004, 2005, and 2006.

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

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Year	Estimation of project activity emission (tCO ₂ e)	Estimation of baseline emission (tCO ₂ e)	Estimation of leakage (tCO ₂ e)	Estimation of emission reductions (tCO ₂ e)
2008	142,877	331,254	0	188,377
2009	1,428,774	3,312,540	0	1,883,765
2010	2,286,039	5,300,063	0	3,014,024
2011	2,286,039	5,300,063	0	3,014,024
2012	2,286,039	5,300,063	0	3,014,024
2013	2,286,039	5,300,063	0	3,014,024
2014	2,286,039	5,300,063	0	3,014,024
2015	1,714,529	3,975,047	0	2,260,518
Total (tCO ₂ e)	14,716,377	34,119,157	0	19,402,780

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

>>

B.7.1. Data and parameters monitored:

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Data / Parameter:	FC _{NG, y}
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⁵⁴ This value has been derived on data published for North American LNG systems. “Barclay, M. and N. Denton, 2005. Selecting offshore LNG process. http://www.fwc.com/publications/tech_papers/files/LNJ091105p34-36.pdf (10th April 2006)”.



Data unit:	m ³
Description:	Annual quantity of NG consumed in the project activity
Source of data to be used:	NG flow meter reading at the project boundary
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74,031,600 (Oct.~Dec. 2008) 740,316,000 (2009) 1,184,505,600 (2010~2027) 481,205,405 (Jan.~Sep. 2028)
Description of measurement methods and procedures to be applied:	The data will be monitored and recorded monthly both by supplier and the project owner and by checking meter devices with precision according with the National Standards. The LNG consumption will be aggregated automatically and recorded daily.
QA/QC procedures to be applied:	The total NG consumption will be monitored both by the supplier and the project owner for cross-verification. Natural gas supply metering to the project will be subjected to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The reading will be double checked by the gas supply company.
Any comment:	

Data / Parameter:	NCV _{Natural gas}
Data unit:	KJ/m ³
Description:	Net Calorific Value of natural gas consumed by the proposed project.
Source of data to be used:	Fuel supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	34,402
Description of measurement methods and procedures to be applied:	Measure Report of LNG character as determined from the fuel supplier
QA/QC procedures to be applied:	The calorific value of fuel consumed in the Project Activity would be provided by supplier and recorded and verified.
Any comment:	

Data / Parameter:	EF _{CO2, Natural gs, y}
Data unit:	tCO ₂ /GT
Description:	Emission factor of LNG consumed in the project activity
Source of data to be used:	Fuel supplier
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	15.30



Description of measurement methods and procedures to be applied:	Measure Report of NG character as determined from the fuel supplier
QA/QC procedures to be applied:	It is preferential to use the data provided by fuel supplier. Otherwise, the data will be determined from IPCC guideline and will be updated according to its latest version.
Any comment:	

Data / Parameter:	EG_y
Data unit:	GWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	Ammeter reading at project boundary
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	382 (Oct.~Dec. 2008) 3,820 (2009) 6,112 (2010~2027) 2,483 (Jan.~Sep. 2028)
Description of measurement methods and procedures to be applied:	The readings of electricity meter will be hourly measured and monthly recorded. Data will be archived for 2 years following the end of crediting period by the means of electronic and paper backup.
QA/QC procedures to be applied:	The electricity output from each turbine will be monitored and recorded at the on-site control center using a computer system. The project operator will be responsible for recording this set of data. Electricity sales invoice will also be obtained for double check.
Any comment:	Electricity supplied by the project activity to the grid. Double check by the receipts of sales.

Data / Parameter:	$F_{i,j,y}$
Data unit:	Ton or m^3
Description:	The total amount of fuel i (in a mass or volume unit) consumed by Province j in ECPG for power generation in the year y in which actual project generation and associated emissions reductions occur.
Source of data to be used:	China Energy Statistical Yearbook
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Table A3 in Annex 3.
Description of measurement methods and procedures to be applied:	The data is available from the China Energy Statistical Yearbook which will be update annually.
QA/QC procedures to be applied:	The data will be updated annually according to China Energy Statistical Yearbook.
Any comment:	

Data / Parameter:	$EF_{CO_2,i}$
Data unit:	tC/Tj
Description:	CO ₂ emission factor per energy unit of fuel i .



Source of data to be used:	IPCC Guideline for National Greenhouse Gas Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Table A3 in Annex 3.
Description of measurement methods and procedures to be applied:	The data is available from IPCC Guidelines and will be updated with its latest edition.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	NCV _i
Data unit:	kJ/Kg or kJ/m ³
Description:	The net calorific value (energy content) per mass or volume unit of a fuel <i>i</i>
Source of data to be used:	China Energy Statistical Yearbook
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Table A3 in Annex 3.
Description of measurement methods and procedures to be applied:	The data is available from the <i>China Energy Statistical Yearbook</i> which will be update annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	OXID _i
Data unit:	
Description:	The oxidation factor of the fuel.
Source of data to be used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Table A3 in Annex 3.
Description of measurement methods and procedures to be applied:	The data is available from IPCC Guidelines and will be updated with its latest edition.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\eta_{\text{Coal}, \text{Adv}}$
Data unit:	%
Description:	The efficiency level of the best technology for coal fired power plant commercially available in China.
Source of data to be used:	The data is issued by Chinese DNA by website: http://cdm.cchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf
Value of data applied for the	See Table A4-2 in Annex 3.



purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Chinese DNA will issue the latest data annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\eta_{Oil, Adv}$
Data unit:	%
Description:	The efficiency level of the best technology for oil fired power plants commercially available in China.
Source of data to be used:	The data is issued by Chinese DNA by website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<u>See</u> Table A4-2 in Annex 3.
Description of measurement methods and procedures to be applied:	Chinese DNA will issue the latest data annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\eta_{Gas, Adv}$
Data unit:	%
Description:	The efficiency level of the best technology for gas fired power plants commercially available in China.
Source of data to be used:	The data is issued by Chinese DNA by website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<u>See</u> Table A4-2 in Annex 3.
Description of measurement methods and procedures to be applied:	Chinese DNA will issue the latest data annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Installed Capacity thermal power, y
Data unit:	MW
Description:	The installed capacity of thermal power in ECPG in year y in which actual project generation and associated emissions reductions occur.
Source of data to be used:	China Electric Power Yearbook
Value of data applied for the	See Table A1 in Annex 3.



purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The data is available from the China Electric Power Yearbook which will be update annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Installed Capacity _{total, y}
Data unit:	MW
Description:	The total installed capacity of ECPG in year y in which actual project generation and associated emissions reductions occur.
Source of data to be used:	China Electric Power Yearbook
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Table A1 in Annex 3.
Description of measurement methods and procedures to be applied:	The data is available from the China Electric Power Yearbook which will be update annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	GWP _{CH4}
Data unit:	tCO _{2e} /tCH ₄
Description:	Global warming potential of methane valid for the relevant commitment period.
Source of data to be used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	21
Description of measurement methods and procedures to be applied:	The value of 21 is fixed for the first commitment period, and shall be updated for the subsequent commitment periods according to any future COP/MOP decisions.
QA/QC procedures to be applied:	
Any comment:	

B.7.2. Description of the monitoring plan:

>>

Objective Of Monitoring Plan

The project owner is the user of this monitoring plan and will set up a CDM Team responsible for project registration, monitoring and other CDM activities. The project owner must maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to maintain the information



required for an audit of an emission reduction project. These records and monitoring systems are needed to allow the selected DOE to verify project performance as part of the verification and certification process. This process also reinforces that CO₂ reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs).

Emission reductions will be achieved through due to the operation of the proposed project. The grid-connected output and natural gas consumption are therefore defined as the key data to be monitored.

Monitoring Plan

The approved monitoring methodology AM0029 (Version 01) is used for developing the monitoring plan.

Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

1. Monitoring Team and Training

The plant manager of the proposed project will establish the monitoring plan, and hold the overall responsibility for the monitoring process.

In the team, shift supervisor is in charge of the measurement of the daily electrical energy supplied to the grid and NG consumption and reporting of daily operation. Then the general shift leader will verify the daily measurement and operation report. And the director of general control is responsible for statistic, analysis and audit the daily and monthly measurement, collection of sales receipts provided by the grid of the power supply, and prepare monitoring report of the project activity including operating periods, power generation, power delivered to the grid, equipment defects, etc. Finally, the plant manager will review the internal audit and monitoring reports.

This plan should be modified according to actual condition and requirements of DOE in order to ensure that the monitoring is credible, transparent and comprehensive.

The personnel involved in the CDM team will receive sufficient training regarding to monitoring before the project operation. The manager of the CDM team is responsible for organizing the training.

2. Electricity metering equipment

A main meter will be installed in the substation connected to ECPG to monitor the grid-connected electricity generated by the project. A backup meter is installed in the same measurement points as the main meter. The main and back-up meters are controlled, operated and maintained by the Fujian Grid.

In addition, project owner will install four meters at each generator site to monitor the electricity generation. Another meter will be installed at the project site to measure the auxiliary use of the electricity by the project. Data from the five meters can be used to cross check the data measured by the main meter.

Calibration

All 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. The metering equipments are calibrated and checked annually for accuracy. The metering equipments shall have sufficient accuracy so that any error resulting from such equipments shall not exceed 0.5% of



full-scale rating. Calibration is carried out by the grid company with the records being supplied to the project owner, and these records will be maintained by the project owner and the appointed third party.

3. NG metering equipment

Consumption of NG can be monitored by the main meter installed at the front of the NG pipe intake. Another meter is also installed at same point for back-up. Both of the meters have the capability of accumulating the consumption of NG. When the main meter is out of order, the readings from the back-up meter will be used for reference.

Calibration

The national authority department of quality and measuring will properly calibrate NG metering equipment annually and issue the certification. Therefore, the uncertainty of the NG metering system shall be out of consideration. The NG supplier should notice the project owner 10 days prior to the calibration in order that the project owner can appoint a delegate for participation. Both parties shall keep all original materials and documents of testing, calibrating, certification, reports and records, etc.

4. 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, which will be ensured through the CDM mechanism in terms of the need for verification of the emission on an annual basis according to the Project Designed Document and the CDM manual.

5. Data Management System

Physical document such as paper-based maps, diagrams and environmental assessments will be collected in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the project, the project material and monitoring results will be indexed. All paper-based information will be kept on the technology department of the project owner and all the material will have a copy for backup. And all data including calibration records is kept until 2 years after the end of the total credit time of the CDM project.

6. Monitoring Result and Verification

The project owner will sign a verification agreement with the specific DOE and agree to a timeframe work set by the EB for carrying out the verification while considering the buyer's schedule. The project owner will make the time arrangement for the verification and will prepare for the audit verification to the best of itself. The project owner will facilitate the verification by providing the DOE with all required necessary information before, during and, in the event of queries, after verification.

If the project owner deems that the requirement from the DOE is not within the verification, they should refer to the CDM developer or other qualified entities to confirm whether the requirements are reasonable. If considered unreasonable, a rejection letter in written form should be provided to the DOE with justifiable reasons. If the project owner and the DOE can not reach an agreement, they can go to the EB or UNFCCC for arbitration.

For the details of the monitoring plan, including the parameters mentioned in the project emission and baseline emission calculations please refer to the Annex 4.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)
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The baseline study and monitoring plan of the proposed project were conducted by the Beijing Changjiang River International Holding on 09/11/2008

Ms. Shunrong LIN, linnet2001@hotmail.com, Beijing Changjiang River International Holding, No.1, Baiguang Road 2nd Alley, Xuanwu District, Beijing 100761, P.R. China.

Mr. Zheng KANG, ponykang@yahoo.com.cn, Beijing Changjiang River International Holding, No.1, Baiguang Road 2nd Alley, Xuanwu District, Beijing 100761, P.R. China.

**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:**

>>

15/03/2006

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

>>

21 years

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:

>>

01/10/2008

C.2.1.2. Length of the first crediting period:

>>

7 years.

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

Not applicable.

C.2.2.2. Length:

>>

Not applicable.

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

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According to the Environmental Protection Law of the People's Republic of China which states that the Environment Impact Assessment (EIA) must be approved by competent department of environmental protection administration before project construction, the project owner delegated China Global Engineering Company to conduct the required EIA. This Company has qualification for EIA consultancy services certified by State Environmental Protection Administration (SEPA) in 2002 and is independent from the project owner. And the State Environmental Protection Administration of China approved the EIA report in Dec. 2004.

According to the EIA report, the impacts rising from the proposed project were identified, and the mitigation measures were suggested and defined in the following two phrases.

Construction Phase**Ecosystem impact**

According to the characteristic of the proposed project, the possible impacts on the vegetation and animals during the construction period will mainly concentrate on the construction area. The area is the first stage engineering of Putian LNG Power Plant. At present, there is mainly wasteland in this area. In addition, neither cultural relics, nor mineral resources were identified during the EIA survey. Even no buildings were found there. Thus the proposed project will not lead to pulling down of the original residence and displacement of local population. So the adverse impact on the vegetation and animals inhabiting there can be considered minimal.

Wastewater

In order to protect the water of sea area from being polluted, the wastewater from vehicles cooling, and washing, concrete mixing and equipments test is not allowed to discharge into Meizhou Bay directly. Instead the wastewater will be retained in the sedimentation tank before discharged. The oil water from vehicles will be collected and delivered to the local oil water treatment site, which will be treated with the specific treatment equipments before recycled. The domestic sewage generated from labour forces must be treated in septic tank and then will be discharged into the sea in accordance with Sea Water Quality Standard (GB3097-1997). The disposed water mentioned above must meet Integrated Wastewater Discharge Standard (GB8978-1996) grade I.

Dust

The major air pollutant is dust during the construction period. Several dustproof measures such as watering, wet operation method and selection and proper conservation of construction equipments and vehicles etc in accordance with Environment Air Quality Standard (GB3095-1996) grade II.

Noise

The noise is mainly generated from construction equipments and vehicles during the construction period will be strictly controlled in accordance with Standard of Noise at Boundary of Industrial Enterprises (GB12348-90) III and Standard of Environmental Noise of Urban Area (GB3096-1993) III using these measures: setting noise barrier around the construction site, arranging the construction time and plan reasonably etc. Thus the impact on local area will be mitigated as possible.

**Solid waste**

The solid waste generated from earth-rock excavation will be collected and delivered to the designated dumpsites or recycled. The domestic garbage from construction and livelihood area will be disposed by the local department of environment and sanitary every day.

Operation phase**Air pollution**

Since the proposed project is a LNG power plant, the emission of SO₂ and TSP is very slight and negligible compared with the conventional coal fired power plant. And its major air pollutant is NO_x. The proposed project will adopt dry-type low NO_x emission combustion system, which could drastically reduce NO_x Emission. The NO_x Emission of the proposed project is expected to 0.0083mg per cubic meter at maximum, which could meet the requirement of Emission Standard of Air pollutants for fossil power plant (GB13223-1996) and Emission Standard of Air pollutants coal-burning oil-burning gas fired boilers (GB13271-2001).

Wastewater

The wastewater generated from the generation progress, which is mainly comprised of acidic and basic wastewater will be disposed in the neutralization tank before discharged into the sea in accordance with Integrated Wastewater Discharge Standard (GB8978-1996) and Sea Water Standard (GB3097-1997). The domestic sewage mainly generated from the permanent staff during the operation period, whose main pollutants are COD and BOD, will be retained in a sedimentation tank and then will be used for virescence or irrigation purpose when it can meet the requirement of Integrated Wastewater Discharge Standard (GB3097-1997). The oil water will be collected and delivered to the local oil water treatment site. The wastewater from the cooling system will be treated before recycled.

Noise

Noise mainly resulted from machines and vehicles during the operation. In accordance with Standard of Noise at boundary of industrial enterprises (GB12348-90), several measures will be taken to mitigate the negative impacts: the pumps, turbines and generators will be installed inside; sound absorption material will be used; sound insulation workroom will be set up; Doors and windows of controlling and office building will avoid to face the residential area; Heat Recovery Turbine will be equipped with 30dB sound insulator; Green Belts will be built between project site and neighbourhood areas to minimize the noise effectively.

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 environmental impacts of the proposed project are not considered to be significant.

**SECTION E. Stakeholders' comments**

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

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To understand the attitudes of local stakeholders toward to the proposed project, the project owner conducted a survey in accordance with the national laws and regulations. The project owner put up notice around project site to invite local people to participate in a project specified survey starting from 18/02/2005. The survey distributing 50 copies of questionnaires to the local residents who might be affected by the project activity (See Table 10 below) to the individuals. The result shows that local stakeholders give their supports to the proposed project.

Table 10 Spot Check Questionnaires for the Public on the Environment Impact Assessment of Putian Natural Gas (LNG) Power Plant Project

Name	Gender	Age	Education
Company	Vocation		
Project Introduction:			
Fujian Putian LNG Power Plant is designed to construct a grid connected natural-gas based combined cycle gas turbine power plant with total installed capacity of 1,528MW (4×382MW) located on the north of the Mayzhou Bay Xuyu Penisular Xiuyu District, Putian city, Fujian Province. The proposed project will be connected to Fujian power Grid, which is a major part of ECPG. The Power Plant will be installed 4 generating blocks, each of which consists of a combine cycle, a single-axis gas turbine, a heat recovery steam generator, a steam turbine, and a common generator. 500KV transmission lines will be constructed for power evacuation. The proposed project will supply strong and stable electricity to support Fujian power grid. The annual output of the proposed project is expected at 6,112GWh when all the generating units putting into operation, which can mitigate the high pressure of Fujian power grid regarding to power shortage incurred by the greatly increased power demand and balance the grid peak loads. As a clean fuel power project, the proposed project can reduce GHGs emission reductions compared with conventional thermal power plants, thus be considered as an environmental-friendly project. Also, the proposed project will contribute more social and economic social benefits to local area such as providing job opportunities, improving standard of living of local people, supporting the construction of local schools and infrastructure, and etc. Thus, the proposed project provides a combination of positive environmental, economic, and sustainable development benefits			
1. Are you familiar with the proposed project?	A. Yes	B. No	C. Indifferent
2. Do you support the construction of the proposed project?	A. YES		B. NO
3. Do you support the proposed project develop CDM?	A. YES		B. NO



4 .How much the proposed project do you think will impact on your daily life?	A. Positive	B. Negative	C. No idea	
5. Which benefits do you think will be brought by the proposed project?	A. More job opportunities	B. Increase of Income	C. Economic development	
	D. Improvement of local infrastructure		E. Others	
6. To what extent the negative impacts could influence on local environment?	A. Severe	B. Partial	C. Little	D. No

E.2. Summary of the comments received:

>>

During the survey, 50 responses have been received at 100% rate of return. The following is a summary of the key findings:

Composing of the respondents:

Item	Gender		Age			Education Level			
	Male	Female	Below 30	30~59	Above 60	Primary school	Junior high school	Senior High school	College
Percentage	50%	50%	12%	78%	10%	20%	56%	16%	8%

- 1) The average age of the sample group is at 42;
- 2) 16% and 56% are at high and middle education level, respectively;
- 3) 100% know the construction of the proposed project;
- 4) 100% agree with its construction;
- 5) 100% agree that the proposed project develops as CDM project;
- 6) 100% deeply believe that the project will bring positive impacts to their daily life.
- 7) Most of the respondents consider the project will contribute to local development. In one way, 80% believe the project can promote local economic development, 70% consider the project can increase the local job opportunities, 74% think it can increase local income, 66% consider the project will contribute to local infrastructure construction.
- 8) 92% of the respondents consider the negative impacts of the project on local environment are little.

Conclusion

The survey shows that the proposed project receives strong support from local people. The respondents generally deemed that the project generate reliable electricity, accelerate the economic development, and induce some other multiple benefits relating to their livelihoods.

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

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The local residents and authorities are all supportive of the proposed project. Therefore, no comments received.

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

Organization:	CNOOC Fujian Gas Power Co., LTd
Street/P.O.Box:	No. 159, Wusi Rd.
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Represented by:	
Title:	Assistant Manager
Salutation:	Mr.
Last Name:	Nishio
Middle Name:	
First Name:	Ryutaro
Department:	New Energy & Environment Business Division
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	



Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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There is no public funding from Annex I countries for the proposed project.

**Annex 3****BASELINE INFORMATION**

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For calculation of OM and BM of ECPG, please refer to:

<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls><http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>**Table A1 Basic Data of the East China Power Grid****Table A1-1. Basic data of the East China Power Grid in 2003**

	Installed capacity （MW）					Electricity generation and supply by thermal power plants			
	Hydro power	Fuel-fired power	Nuclear power	Other	Total	Electricity generation （MWh）		Power self-consumption rate （%）	Power supply to the Grid （MWh）
Shanghai	0.00	11,092.60	0.00	0.00	11,092.60	69,444,000		5.14%	65,874,578.40
Jiangsu	137.80	22,245.00	0.00	0.00	22,382.80	133,277,000		5.90%	125,413,657.00
Zhejiang	6,054.50	15,321.20	2,406.00	39.70	23,821.40	83,089,000		5.31%	78,676,974.10
Anhui	649.10	9,284.90	0.00	0.00	9,934.00	54,156,000		6.06%	50,874,146.40
Fujian	6,761.10	7,092.80	0.00	12.00	13,865.90	42,146,000		5.07%	40,009,197.80
Sum	13,602.50	65,036.50	2,406.00	51.70	81,096.70	382,112,000		—	360,848,553.70
Share	16.77%	80.20%	2.97%	0.06%	—	Electricity Import* (MWh)	24,461,910	Total power supply (MWh)	385,310,463.70

Data source: China Electric Power Yearbook 2004

* Electricity import from Centre China Power Grid and Yangcheng City in Shanxi Province.



Table A1-2. Basic data of the East China Power Grid in 2004

	Installed capacity (MW)					Electricity generation and supply by thermal power plants			
	Hydro power	Fuel-fired power	Nuclear power	Other	Total	Electricity generation (MWh)		Power self-consumption rate (%)	Power supply to the Grid (MWh)
Shanghai	0.00	12,014.90	0.00	3.40	12,018.30	71,127,000		5.22%	67,414,170.60
Jiangsu	126.50	28,289.50	0.00	17.60	28,433.60	163,545,000		5.93%	153,846,781.50
Zhejiang	6,418.40	21,439.80	3,056.00	39.70	30,953.90	95,255,000		5.68%	89,844,516.00
Anhui	692.80	9,364.50	0.00	0.00	10,057.30	59,875,000		6.03%	56,264,537.50
Fujian	7,180.10	8,315.40	0.00	12.00	15,507.50	50,490,000		6.07%	47,425,257.00
Sum	14,417.80	79,424.10	3,056.00	72.70	96,970.60	440,292,000		—	414,795,262.60
Share	14.87%	81.91%	3.15%	0.07%	—	Electricity Import* (MWh)	38,583,460	Total power supply (MWh)	453,378,722.60

Data source: China Electric Power Yearbook 2005

* Electricity import from Centre China Power Grid and Yangcheng City in Shanghai Province.

Table A1-3. Basic data of the East China Power Grid in 2005

	Installed capacity (MW)					Electricity generation and supply by thermal power plants		
	Hydro power	Fuel-fired power	Nuclear power	Other	Total	Electricity generation (MWh)	Power self-consumption rate (%)	Power supply to the Grid (MWh)
Shanghai	0.00	13,113.50	0.00	253.30	13,366.80	74,606,000	5.05%	70,838,397.00
Jiangsu	142.60	42,506.40	0.00	58.80	42,707.80	211,429,000	5.96%	198,827,831.60
Zhejiang	6,952.10	27,688.10	3,066.00	37.20	37,743.40	108,110,000	5.59%	102,066,651.00
Anhui	749.80	11,423.20	0.00	0.00	12,173.00	62,918,000	5.90%	59,205,838.00
Fujian	8,224.90	9,345.40	0.00	52.00	17,622.30	48,600,000	4.57%	46,378,980.00

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Sum	16,069.40	104,076.60	3,066.00	401.30	123,613.30	505,663,000		—	477,317,697.60
Share	13.00%	84.20%	2.48%	0.32%	—	Electricity Import* (MWh)	237,654,000	Total power supply (MWh)	714,971,697.60

Data source: China Electric Power Yearbook 2006

* Electricity import from Centre China Power Grid and Yangcheng City in Shanxi Province.

Table A2 Build Margin Factor of East China Power Grid

Table A2-1.1 Emission Factor of Newly Built Thermal Power Plants of East China Power Grid

	Carbon Emission Factors (tC/Tj)	EF _{CO2} (tCO ₂ /Tj)	OXID _i	Power Supply Efficiency of The Best Power Technology (%)	Emission Factor of Best Technology (tCO ₂ e/MWh)	The mix of CO ₂ emission by thermal power of East China Power Grid in 2004	EF _{new thermal plants} (tCO ₂ e/MWh)
	A	B=A*44/12	C	D	E=3.6/D/1000*B*C	H	I
Standard Coal	25.8	94.60	1.00	35.82%	0.9508	96.71%	0.9372
Fuel Oil/diesel	21.10	77.37	1.00	47.67%	0.5843	2.35%	
Natural Gas	15.30	56.10	1.00	47.67%	0.4237	0.94%	

Table A2-1.2 Build Margin Factor of East China Power Grid

	Installed Capacity 2003 (MW)	Installed Capacity 2004 (MW)	Installed Capacity 2005 (MW)	New Capacity Additions (MW)	Split of Electricity generation from New Capacity	Emission Factor of Newly Built Thermal Power Plants (tCO ₂ e/MWh)	Weighted Average Build Margin Emission Factor EFBM _y (tCO ₂ e/MWh)
	A1	A2	B	C	D	E	F
Source				C=B-A2	D=C/Total C	Table A2-1.1	F=E*D
Hydro Power Plant	13,602.50	14,417.80	16,069.40	1,651.60	6.20%	0.000	0.000
Thermal Power Plant	65,036.50	79,424.10	104,076.60	24,652.50	92.53%	0.9372	0.8672
Nuclear Power	2,406.00	3,056.00	3,066.00	10.00	0.04%	0.000	0.000

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Others	51.70	72.70	401.30	328.60	1.23%	0.000	0.000
Total	81,096.70	96,970.60	123,613.30	26,642.70	100.00%		0.867
Percentage of the Installed Capacity of 2005	65.61%	78.45%	—	21.55%			

Table A 3 Simple OM emission factor of the East China Power Grid

Table A 3-1.1 Calculation of emission of the East China Power Grid in 2003

	Fi						Carbon Emission Factors (tC/Tj) G	EF _{CO2,i} (tCO ₂ /Tj) H=G*44/12	NCV (Kj/Kg) (Kj/m ³) I	OXIDi J	Emission (tCO ₂ e) K=F*H*I*J*10 ⁻²
	Shanghai (10 ⁴ t) (10 ⁸ m ³) A	Jiangsu (10 ⁴ t) (10 ⁸ m ³) B	Zhejiang (10 ⁴ t) (10 ⁸ m ³) C	Anhui (10 ⁴ t) (10 ⁸ m ³) D	Fujian (10 ⁴ t) (10 ⁸ m ³) E	Total (10 ⁴ t) (10 ⁸ m ³) F=A+B+C+D+E					
Raw coal	2618	6417.74	3442.4	2669.67	1754	16,901.81	25.80	94.60	20,908.00	1.00	334,300,359.13
Cleaned coal						0.00	25.80	94.60	26,344.00	1.00	0.00
Other washed coal						0.00	25.80	94.60	8,363.00	1.00	0.00
Coke						0.00	25.80	108.17	28,435.00	1.00	0.00
Coke oven gas	1.99	0.06				2.05	13.00	47.67	16,726.00	1.000	152,125.76
Other gas	66.34					66.34	13.00	47.67	5,227.00	1.000	1,538,454.90
Crude oil						0.00	20.00	73.33	41,816.00	1.00	0.00
Gasoline						0.00	18.90	69.30	43,070.00	1.00	0.00
Diesel	1.26	14.71	13.99			29.96	20.20	74.07	42,652.00	1.00	946,463.80
Fuel oil	95.49	0.76	174.48		18.89	289.62	21.10	77.37	41,816.00	1.00	9,369,683.52
LPG						0.00	17.20	63.07	50,179.00	1.000	0.00
Refinery gas	0.49	0.96				1.45	18.20	66.73	46,055.00	1.000	44,564.35
Natural gas						0.00	15.30	56.10	38,931.00	1.000	0.00
Other petroleum products*	18.91	5.3	15.04			39.25	20.00	73.33	38,369.00	1.00	1,104,387.72



Other coking products					0.00	25.80	94.60	28,435.00	1.00	0.00
Other energy(renewable energy or waste heating)	5.68		7.08		12.76	0.00	0.00	0.00	0.00	0.00
Emission of the East China Power Grid (tco2e)	347,456,039.18									

Data source:

China Energy Statistical Yearbook 2004

2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Table A 3-1.2 Calculation of CO₂ emission factor of the Central China Power Grid in 2003

	Fi							Carbon Emission Factors (tC/Tj)	EF _{CO₂,i} (tCO ₂ /Tj)	NCV (Kj/Kg) (Kj/m ³)	OXIDi	Emission (tCO ₂ e)
	JIAGNXI (10 ⁴ t) (10 ⁸ m ³)	HENAN (10 ⁴ t) (10 ⁸ m ³)	HUBEI (10 ⁴ t) (10 ⁸ m ³)	HUNAN (10 ⁴ t) (10 ⁸ m ³)	CHONGQING (10 ⁴ t) (10 ⁸ m ³)	SICHUAN (10 ⁴ t) (10 ⁸ m ³)	Total (10 ⁴ t) (10 ⁸ m ³)					
	A	B	C	D	E	F	G=Sum(A:F)	H	I=H*44/12	J	K	L=J*I*K*10 ⁻²
Raw coal	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13,851.66	25.80	94.60	20,908.00	1.00	273,971,539.89
Cleaned coal							0.00	25.80	94.60	26,344.00	1.00	0.00
Other washed coal	2.03	39.63			106.12		147.78	25.80	94.60	8,363.00	1.00	1,169,146.40
Coke				1.22			1.22	25.80	108.17	28,435.00	1.00	32,817.40
Coke oven gas			0.93				0.93	13.00	47.67	16,726.00	1.000	69,013.15
Other gas							0.00	13.00	47.67	5,227.00	1.000	0.00
Crude oil		0.5	0.24			1.2	1.94	20.00	73.33	41,816.00	1.00	59,490.23
Gasoline							0.00	18.90	69.30	43,070.00	1.00	0.00
Diesel	0.52	2.54	0.69	1.21	0.77		5.73	20.20	74.07	42,652.00	1.00	181,015.94
Fuel oil	0.42	0.25	2.17	0.54	0.28	1.2	4.86	21.10	77.37	41,816.00	1.00	157,229.00
LPG							0.00	17.20	63.07	50,179.00	1.000	0.00
Refinery gas	1.76	6.53		0.66			8.95	18.20	66.73	46,055.00	1.000	275,069.63
Natural gas					0.04	2.2	2.24	15.30	56.10	38,931.00	1.000	489,222.52
Other petroleum products*							0.00	20.00	73.33	38,369.00	1.00	0.00

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Other coking products							0.00	25.80	94.60	28,435.00	1.00	0.00
Other energy(renewable energy or waste heating)		11.04			16.2		27.24	0.00	0.00	0.00	0.00	0.00
Emission of the Central China Power Grid (tco2e)	276,404,544.15											

Table A3-1.3 Electricity Generation and Supply of Central China Power Grid in 2003

Province	Total Electricity generation (MWh)	Self-consumption rate (%)	Total Power Supply (MWh)
Jiangxi	31029000	6.43	29,033,835
Henan	100975000	7.68	93,220,120
Hubei	78307000	3.81	75,323,503
Hunan	53902000	4.58	51,433,288
Chongqing	20292000	8.97	18,471,808
Sichuan	82782000	4.41	79,131,314
Total (MWh)			346,613,868

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Table A3 -1.4 Average OM of Central China Power Grid in 2003

CO ₂ emission of Central China Power Grid (tCO ₂ e)	276,404,544.15
Power Supply (MWh)	346,613,868.40
Average OM(tCO ₂ e/Mwh)	0.7974

**Table A 3-1.5 Average OM emission factor of the Yangcheng City in Shanxi Province in 2003**

Coal Consumption Rate (gce/kWh)	Carbon Emission Factors (tC/Tj)	NCV (Kj/Kg)	OM (tCO ₂ e/MWh)
343	25.8	29,271	0.9498

Table A3-1.6 Calculation of Simple OM emission factor of the East China Power Grid in 2003

Total power supply by thermal of the East China Power Grid (MWh)	Emission of the East China Power Grid (tCO ₂ e)	Emission of power import (EM _{2003, import}) (tCO ₂ e)	Total Emission (tCO ₂ e)	OM emission factor of the East China Power Grid (tCO ₂ e/Mwh)
385,310,463.70	347,456,039.18	21,137,863.96	368,593,903.14	0.9566

Table A 3-2.1 Calculation of emission of the East China Power Grid in 2004

	Fi						Carbon Emission Factors (tC/Tj)	EF _{CO₂,i} (tCO ₂ /Tj)	NCV (Kj/Kg) (Kj/m ³)	OXID _i	Emission (tCO ₂ e)
	Shanghai (10 ⁴ t) (10 ⁸ m ³)	Jiangsu (10 ⁴ t) (10 ⁸ m ³)	Zhejiang (10 ⁴ t) (10 ⁸ m ³)	Anhui (10 ⁴ t) (10 ⁸ m ³)	Fujian (10 ⁴ t) (10 ⁸ m ³)	Total (10 ⁴ t) (10 ⁸ m ³)					
	A	B	C	D	E	F=A+B+C+D+E	G	H=G*44/12	I	J	K=F*H*I*J*10 ⁻²
Raw coal	2,779.60	7,601.90	4,008.90	2,906.20	2,183.70	19,480.30	25.80	94.60	20,908.00	1.00	385,300,230.33
Cleaned coal						0.00	25.80	94.60	26,344.00	1.00	0.00
Other washed coal		5.46			4.63	10.09	25.80	94.60	8,363.00	1.00	79,826.01
Coke						0.00	25.8	108.17	28,435.00	1.00	0.00
Coke oven gas	2.59					2.59	13.00	47.67	16,726.00	1.000	192,197.91
Other gas	72.46					72.46	13.00	47.67	5,227.00	1.000	1,680,380.49
Crude oil						0.00	20.00	73.33	41,816.00	1.00	0.00
Diesel	2.69	27.17	6.23			36.09	20.20	74.07	42,652.00	1.00	1,140,116.11
Fuel oil	58.52	55.07	202.89		23.26	339.74	21.10	77.37	41,816.00	1.00	10,991,147.99

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LPG						0.00	17.20	63.07	50,179.00	1.000	0.00
Refinery gas	0.77	0.55				1.32	18.20	66.73	46,055.00	1.000	40,568.93
Natural gas		0.14				0.14	15.30	56.10	38,931.00	1.000	30,576.41
Other petroleum products*	21.22	1.37	24.89			47.48	20.00	73.33	38,369.00	1.00	1,335,957.42
Other coking products						0.00	25.80	94.60	28,435.00	1.00	0.00
Other energy (renewable energy Or waste heating)	6.43		15.48			21.91	0.00	0.00	0.00	0.00	0.00
Emission of the East China Power Grid (tco2e)	400,791,001.59										

Data source:

China Energy Statistical Yearbook 2005

2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Table A 3-2.2 Calculation of CO₂ emission factor of the Central China Power Grid in 2004

	Fi							Carbon Emission Factors (tC/Tj)	EF _{CO₂,i} (tCO ₂ /Tj)	NCV (Kj/Kg) (Kj/m ³)	OXID _i	Emission (tCO ₂ e)
	JIAGNXI (10 ⁴ t) (10 ⁸ m ³)	HENAN (10 ⁴ t) (10 ⁸ m ³)	HUBEI (10 ⁴ t) (10 ⁸ m ³)	HUNAN (10 ⁴ t) (10 ⁸ m ³)	CHONGQIN G (10 ⁴ t) (10 ⁸ m ³)	SICHUAN (10 ⁴ t) (10 ⁸ m ³)	Total (10 ⁴ t) (10 ⁸ m ³)					
	A	B	C	D	E	F	G=Sum(A:F)	H	I=H*44/12	J	K	L=J*I*J*K*10 ⁻²
Raw coal	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	17,144.10	25.80	94.60	20,908.00	1.00	339,092,605.29
Cleaned coal		2.34					2.34	25.80	94.60	26,344.00	1.00	58,316.13
Other washed coal	48.93	104.22			89.72		242.87	25.80	94.60	8,363.00	1.00	1,921,441.23
Coke		109.61					109.61	25.8	108.17	28,435.00	1.00	2,948,455.29
Coke oven gas			1.68		0.34		2.02	13.00	47.67	16,726.00	1.000	149,899.53
Other gas					2.61		2.61	13.00	47.67	5,227.00	1.000	60,527.09
Crude oil		0.86	0.22				1.08	20.00	73.33	41,816.00	1.00	33,118.27
Gasoline		0.06			0.01		0.07	18.90	69.30	43,070.00	1.00	2,089.33

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Diesel	0.02	3.86	1.7	1.72	1.14		8.44	20.20	74.07	42,652.00	1.00	266,627.32
Fuel oil	1.09	0.19	9.55	1.38	0.48	1.68	14.37	21.10	77.37	41,816.00	1.00	464,893.14
LPG							0.00	17.20	63.07	50,179.00	1.000	0.00
Refinery gas	3.52	2.27					5.79	18.20	66.73	46,055.00	1.000	177,950.07
Natural gas						2.27	2.27	15.30	56.10	38,931.00	1.000	495,774.61
Other petroleum products*							0.00	20.00	73.33	38,369.00	1.00	0.00
Other coking products							0.00	25.80	94.60	28,435.00	1.00	0.00
Other energy(renewable energy or waste heating)		16.92		15.2	20.95		53.07	0.00	0.00	0.00	0.00	0.00
Emission of the Central China Power Grid (tCO ₂ e)	345,671,697.30											

Table A3-2.3 Electricity generation and supply by Central China Power Grid in 2004

Province	Electricity generation by thermal Power (MWh)	Self-consumption rate (%)	Power Supply (MWh)	Electricity generation by Hydropower (MWh)))	Self-consumption rate (%)	Power Supply (MWh)	Other (MWh)	Total (MWh)
Jiangxi	30,127,000	7.04	28,006,059	3,890,000	1.2	3,843,320		
Henan	109,352,000	8.19	100,396,071	6,884,000	0.43	6,854,398.8		
Hubei	43,034,000	6.58	40,202,363	69,512,000	0.12	69,428,585.6		
Hunan	37,,186,000	7.47	34,408,206	24,236,000	0.51	24,112,396.4		
Chongqing	16,520,000	11.06	14,692,888	5,670,000	2.09	5,551,497	725,000	
Sichuan	3462,7000	9.41	31,368,599	58,902,000	0.39	58,672,282.2		
Total (MWh)			249,074,186			168,462,480	725,000	418,261,666

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**Table A3 -2.4 Average OM of Central China Power Grid in 2004**

CO ₂ emission of Central China Power Grid (tCO ₂ e)	345,671,697.30
Power Supply (MWh)	418,261,666.30
Average OM(tCO ₂ e/Mwh)	0.8264

Table A 3-2.5 Average OM emission factor of the Yangcheng City in Shanxi Provicne in 2004

Coal Consumption Rate (gce/kWh)	Carbon Emission Factors (tC/Tj)	NCV (Kj/Kg)	OM (tCO ₂ e/MWh)
341	25.8	29,271	0.9442

Table A3-2.6 Calculation of Simple OM emission factor of the East China Power Grid in 2004

Total power supply b thermal of the East China Power Grid (MWh)	Emission of the East China Power Grid (tCO ₂ e)	Emission of power import (EM _{2004, import}) (tCO ₂ e)	Total Emission (tCO ₂ e)	OM emission factor of the East China Power Grid (tCO ₂ e/Mwh)
453,378,722.60	400,791,001.59	33,259,483.03	434,050,484.62	0.9574



Table A 3-3.1 Calculation of emission of the East China Power Grid in 2005

	Fi						Carbon Emission Factors (tC/Tj)	EF _{CO₂i} (tCO ₂ /Tj)	NCV (Kj/Kg) (Kj/m ³)	OXID _i	Emission (tCO ₂ e)
	Shanghai (10 ⁴ t) (10 ⁸ m ³)	Jiangsu (10 ⁴ t) (10 ⁸ m ³)	Zhejiang (10 ⁴ t) (10 ⁸ m ³)	Anhui (10 ⁴ t) (10 ⁸ m ³)	Fujian (10 ⁴ t) (10 ⁸ m ³)	Total (10 ⁴ t) (10 ⁸ m ³)					
	A	B	C	D	E	F=A+B+C+D+E	G	H=G*44/12	I	J	K=F*H*I*J*10 ⁻²
Raw coal	2,847.31	9,888.06	4,801.52	3,082.90	2,107.69	22,727.48	25.80	94.60	20,908.00	1.00	449,526,099.64
Cleaned coal						0.00	25.80	94.60	26,344.00	1.00	0.00
Other washed coal						0.00	25.80	94.60	8,363.00	1.00	0.00
Coke			0.03			0.03	25.80	94.60	28,435.00	1.00	806.99
Coke oven gas	1.68	1.38		1.71		4.77	12.10	44.37	16,726.00	1.000	353,970.67
Other gas	83.72	24.97	0.06	30.00		138.75	12.10	44.37	5,227.00	1.000	3,217,675.86
Crude oil			27.01			27.01	20.00	73.33	41,816.00	1.00	828,263.45
Diesel	1.25	16.00	4.52		1.67	23.44	20.20	74.07	42,652.00	1.00	740,491.04
Fuel oil	59.39	13.22	153.22		7.45	233.28	21.10	77.37	41,816.00	1.00	7,546,991.82
LPG						0.00	17.20	63.07	50,179.00	1.000	0.00
Refinery gas	0.57	0.83				1.40	18.20	66.73	46,055.00	1.000	43,027.65
Natural gas	1.09	1.85	0.62			3.56	15.30	56.10	38,931.00	1.000	777,514.36
Other petroleum products*	21.00	8.38	34.80			64.18	20.00	73.33	38,369.00	1.00	1,805,849.77
Other coking products						0.00	25.80	94.60	28,435.00	1.00	0.00
Other energy (renewable energy Or waste heating)	12.36		15.29			27.65	0.00	0.00	0.00	0.00	0.00
Emission of the East China Power Grid (tco2e)	464,840,691.25										



Data source:
China Energy Statistical Yearbook 2006
2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Table A 3-3.2 Calculation of CO₂ emission factor of the Central China Power Grid in 2005

	Fi							Carbon Emission Factors (tC/Tj)	EF _{CO₂i} (tCO ₂ /Tj)	NCV (Kj/Kg) (Kj/m ³)	OXID _i	Emission (tCO ₂ e)
	JIAGNXI (10 ⁴ t) (10 ⁸ m ³)	HENAN (10 ⁴ t) (10 ⁸ m ³)	HUBEI (10 ⁴ t) (10 ⁸ m ³)	HUNAN (10 ⁴ t) (10 ⁸ m ³)	CHONGQIN G (10 ⁴ t) (10 ⁸ m ³)	SICHUAN (10 ⁴ t) (10 ⁸ m ³)	Total (10 ⁴ t) (10 ⁸ m ³)					
	A	B	C	D	E	F	G=Sum(A:F)	H	I=H*44/12	J	K	L=J*I*J*K*10 ⁻²
Raw coal	1,869.29	7,638.87	2,732.1 5	1,712.27	875.40	2,999.77	17,827.75	25.80	94.60	20,908.00	1.00	352,614,496.76
Cleaned coal	0.02						0.02	25.80	94.60	26,344.00	1.00	498.43
Other washed coal		138.12			89.99		228.11	25.80	94.60	8,363.00	1.00	1,804,669.00
Coke		25.95		105.00			130.95	25.80	94.60	28,435.00	1.00	3,522,490.83
Coke oven gas			1.15		0.36		1.51	12.10	44.37	16,726.00	1.000	112,053.61
Other gas		10.20			3.12		13.32	12.10	44.37	5,227.00	1.000	308,896.88
Crude oil		0.82	0.36				1.18	20.00	73.33	41,816.00	1.00	36,184.78
Gasoline		0.02			0.02		0.04	18.90	69.30	43,070.00	1.00	1,193.90
Diesel	1.30	3.03	2.39	1.39	1.38		9.49	20.20	74.07	42,652.00	1.00	299,797.78
Fuel oil	0.64	0.29	3.15	1.68	0.89	2.22	8.87	21.10	77.37	41,816.00	1.00	286,959.09
LPG							0.00	17.20	63.07	50,179.00	1.000	0.00
Refinery gas	0.71	3.41	1.76	0.78			6.66	18.20	66.73	46,055.00	1.000	204,688.68
Natural gas						3.00	3.00	15.30	56.10	38,931.00	1.000	655,208.73
Other petroleum products*							0.00	20.00	73.33	38,369.00	1.00	0.00
Other coking products				1.50			1.50	25.80	94.60	28,435.00	1.00	40,349.27
Other energy(renewable energy or waste heating)		2.88		1.74	32.80		37.42	0.00	0.00	0.00	0.00	0.00

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Emission of the Central China
Power Grid (tCO₂e)

359,887,487.74

Table A3-3.3 Electricity generation and supply by Central China Power Grid in 2005

Province	Total Electricity generation (MWh)	Self-consumption rate (%)	Total Power Supply (MWh)
Jiangxi	35,000,000	6.48	32,732,000
Henan	138,300,000	7.32	128,176,440
Hubei	129,100,000	2.51	125,859,590
Hunan	64,000,000	5	60,800,000
Chongqing	23,620,000	8.05	21,718,590
Sichuan	101,700,000	4.27	97,357,410
Total (MWh)			466,644,030

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Table A3 -3.4 Average OM of Central China Power Grid in 2005

CO ₂ emission of Central China Power Grid (tCO ₂ e)	359,887,487.74
Power Supply (MWh)	466,644,030.00
Average OM(tCO ₂ e/Mwh)	0.7712

**Table A 3-3.5 Average OM emission factor of the Yangcheng City in Shanxi Province in 2005**

Coal Consumption Rate (gce/kWh)	Carbon Emission Factors (tC/Tj)	NCV (Kj/Kg)	OM (tCO ₂ e/MWh)
339	25.8	29,271	0.9387

Table A3-3.6 Calculation of Simple OM emission factor of the East China Power Grid in 2005

Total power supply by thermal of the East China Power Grid (MWh)	Emission of the East China Power Grid (tCO ₂ e)	Emission of power import (EM _{2005, import}) (tCO ₂ e)	Total Emission (tCO ₂ e)	OM emission factor of the East China Power Grid (tCO ₂ e/MWh)
714,971,697.60	464,840,691.25	196,221,389.59	661,062,080.84	0.9246

Table A 3-4 Simple OM of East China Power Grid

CO ₂ Emission of East China Power Grid (tCO ₂ e)			Power Supply of East China Power Grid		
2003	2004	2005	2003	2004	2005
368,593,903	434,050,485	661,062,081	385,310,464	453,378,723	714,971,698
Total	1,463,706,469		Total	1,553,660,884	

EF_{OM} (tCO₂/MWh) 0.9421

Table A4-1 Calculation of Leakage emission of fugitive CH₄ emission of the East China Power Grid in 2005

	Fi						EF _{k,upstream,CH₄}	NCV (Kj/Kg) (Kj/m ³)	Leakage emission of fugitive CH ₄ Emission (tCO ₄)
	Shanghai (10 ³ t) (10 ⁶ m ³)	Jiangsu (10 ³ t) (10 ⁶ m ³)	Zhejiang (10 ³ t) (10 ⁶ m ³)	Anhui (10 ³ t) (10 ⁶ m ³)	Fujian (10 ³ t) (10 ⁶ m ³)	Total (10 ³ t) (10 ⁶ m ³)			
Raw coal	28,473	98,881	48,015	30,829	21,077	227,274.80	12.77 t CH ₄ /kt coal	20, 908	2, 902, 299
Cleaned coal							12.77 t CH ₄ /kt coal	8, 363	0
COKE OVEN			0.3			0.30	12.77	28, 435	4
Coke oven gas	168	138		171		477.00	296 t CH ₄ /PJ	16, 726	2, 362
Other gas	8372	2497	6	3000		13,875.00	296 t CH ₄ /PJ	5, 227	21, 467
Raw oil			270.1			270.10	4.10	41, 816	46
Diesel	12.5	160	45.2		16.7	234.40	4.1 t CH ₄ /PJ	42, 652	41
Fuel oil	593.9	132.2	1532.2		74.5	2,332.80	4.1 t CH ₄ /PJ	41, 816	400
Refinery gas	5.7	8.3				14.00	296 t CH ₄ /PJ	46, 055	191
Natural gas	109	185	62			356.00	296 t CH ₄ /PJ	38, 931	4, 102
Other petroleum products	210	83.8	348			641.80	4.1 t CH ₄ /PJ	38, 369	101
Total	37,944	102,085	50,279	34,000	21,168	245,476.20			2, 931, 013



**Table A4-2 CH₄ Emission Factor for Upstream Fugitive Methane Emissions
by Newly Built Thermal Power Plants of East China Power Grid**

	Power Supply Efficiency of The Best Power Technology	Emission Factors for Fugitive CH ₄ Upstream Emissions	NCV* (Kj/Kg)	Emission Factors for Fugitive CH ₄ Upstream Emissions of Best Technology (tCO ₂ e/MWh)	The mix of fugitive methane emissions by thermal power of East China Power Grid in 2005	EF _{new thermal plants} (tCO ₂ e/MWh)
Standard Coal	35.82%	12.77 t CH ₄ /kt coal	29,271	0.004385	99.02%	0.0044
Fuel Oil/diesel ¹⁾	47.67%	4.10 t CH ₄ /PJ	-	0.000031	0.02%	
Gas ²⁾	47.67%	296.00 t CH ₄ /PJ	-	0.002235	0.96%	

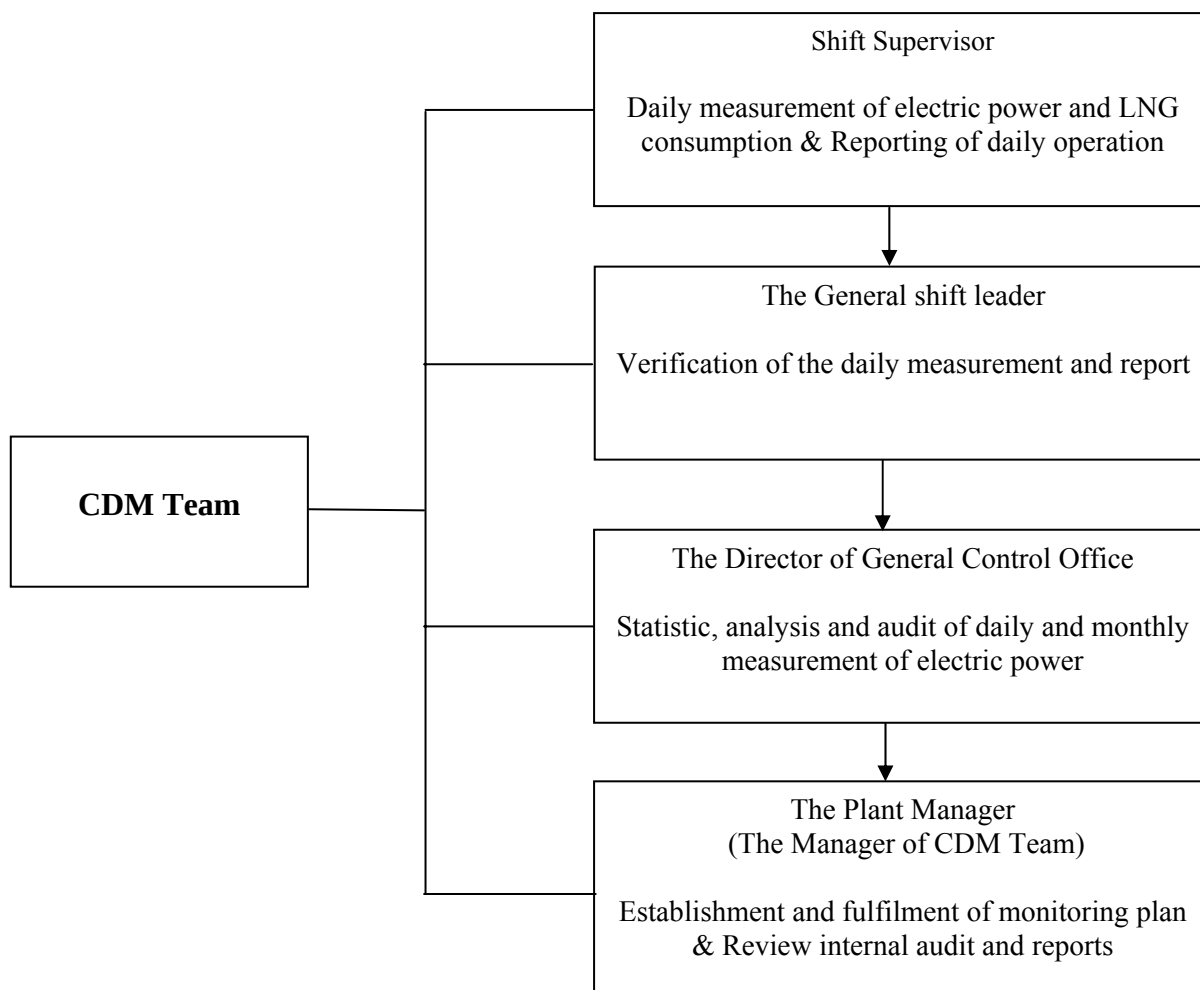
*Data source: China Energy Statistical Yearbook 2006

**Annex 4****MONITORING INFORMATION**

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Operational and Management Structure For Monitoring

The project owner has assigned a CDM Team to carry out the whole monitoring process according to the figure below.

**Monitoring and Management Structure**

The plant manager of the proposed project will establish the monitoring plan, and hold the overall responsibility for the monitoring process. The first step is the measurement of the daily electrical energy supplied to the grid and NG consumption and reporting of daily operation, which will be carried out by shift supervisor. Secondly, the general shift leader will verify the daily measurement and operation report. Then, the data and report will be submitted to the director of general control office who will be responsible for statistic, analysis and audit the daily and monthly measurement, collection of sales receipts provided by the grid of the power supply, and prepare monitoring report of the project activity



including operating periods, power generation, power delivered to the grid, equipment defects, etc. Finally, the plant manager will review the internal audit and monitoring reports.

Monitoring Plan

The approved monitoring methodology AM0029 (Version 01) is used for developing the monitoring plan.

Monitoring plan is a diversion and schedule of a series of monitoring task. Monitoring task must be implemented according to the monitoring plan in order to ensure that the real, measurable, and long-term greenhouse gas emission reduction for the project is monitored and reported.

1. The user of the monitoring plan

The project owner, is the user of this plan and will adhere to the guidelines set out in the monitoring plan. This plan should be modified according to actual condition and requirements of DOE in order to ensure that the monitoring is credible, transparent and comprehensive.

Overall responsibility for daily monitoring and reporting lies with the project owner. A CDM workgroup will be established by the project owner to carry out the monitoring tasks.

2. Personnel training

The personnel involved in the CDM team will receive sufficient training regarding to monitoring before the project operation. The manager of the CDM team is responsible for organizing the training. The training consists of two sections as follows:

- Training on project operation, which includes reading and calibration of meters, recording, adjustment and reporting of the readings, and corresponding solving methods; and
- Training on validation, registration and verification regarding to CDM to ensure the emission reductions generated by the project can be monitored, recorded and reported accurately.

3. Installation of meters

Installation of electricity metering equipment

A main meter will be installed in the substation connected to ECPG to monitor the grid-connected electricity generated by the project. A backup meter is installed in the same measurement points as the main meter. When the main meter is out of order, the readings from the backup meter will be used for reference. The main and back-up meters are controlled, operated and maintained by the Fujian Grid.

In addition, project owner will install four meters at each generator site to monitor the electricity generation. Another meter will be installed at the project site to measure the auxiliary use of the electricity by the project. Data from the five meters can be used to cross check the data measured by the main meter.

Installation of the NG metering equipment

Consumption of NG can be monitored by the main meter installed at the front of the NG pipe intake. Another meter is also installed at same point for back-up. Both of the meters have the capability of accumulating the consumption of NG. When the main meter is out of order, the readings from the back-up meter will be used for reference.

4. Calibration of meters

Calibration of electricity meters

An agreement should be signed between the project owner and the grid company, which defines the arrangements and the required quality control procedures to ensure the accuracy:



- (a) The metering equipment will be properly calibrated and checked annually for accuracy.
- (b) The metering equipment shall have sufficient accuracy so that any error resulting from such equipment shall not exceed 0.5% of full-scale rating.
- (c) Calibration is carried out by the grid company with the records being supplied to the project owner, and these records will be maintained by the project owner and the appointed third party.
- (d) All 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.

All the meters installed shall be tested by a third party within 10 days after:

- (a) Detection of a difference larger than the allowable error in the readings of both meters;
- (b) The repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications.

Calibration of NG metering equipment

The national authority department of quality and measuring will properly calibrate NG metering equipment annually and issue the certification. Therefore, the uncertainty of the NG metering system shall be out of consideration. The NG supplier should notice the project owner 10 days prior to the calibration in order that the project owner can appoint a delegate for participation. Both parties shall keep all original materials and documents of testing, calibrating, certification, reports and records, etc.

5. Monitoring

Data that will be monitored include:

Monitoring of the Grid-connected electricity generated by the Project

The on-grid electricity can be monitored by main meter installed at the substation. The specific steps for data collection and reporting are listed below:

- (a) Grid company, together with the project owner reads the main meter and records data at 24 o'clock on the last day of every month. Then, Grid company supplies readings to the project owner and provides invoice.
- (b) Project owner reads the meters installed in the project site and records data everyday, and prepare monthly data report.

Should any previous months reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the grid-connected electricity generated by the proposed project shall be determined by reading the backup meter, unless a test by either party reveals it is inaccurate:

1. If the backup system is not with acceptable limits of accuracy or is otherwise performing improperly the proposed project owner and grid company shall jointly prepare an estimate of the correct reading; and
2. If the proposed project owner and the grid company fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to agreed procedures.

The monthly on-grid electricity data from the main meter and daily data regarding electricity generation and auxiliary-used electricity measured by on-site meters will be recorded well by project owner by using a computer system at the on-site control center. Project owner will provides meters' readings and photocopies of invoices to DOE for verification.

The data will be archived for 2 years following the end of crediting period by the means of electronic and paper backup. Detailed monitoring procedures will be established in accordance with the Grid Connect



Agreement. The meter reading will be already accessible for the DOE. Calibration tests records will be maintained for verification.

Monitoring of the quantity of the NG combusted

The NG flow rate will be measured by main meter installed at the front of LNG pipe intake. The NG consumption will be aggregated automatically and recorded monthly by both NG supplier and project owner, and will be recorded by a computer system at the on-site control center by the project owner. The recording will be double checked by the gas supply company.

Detail monitoring procedures will be established in accordance with the Purchasing Agreement. The meter reading will be already accessible for the DOE. Calibration tests records will be maintained for verification.

Monitoring of NCV

NCV of the NG was used during the calculation of the CO₂ emission coefficient, so the measure report of NG Character must be obtained from the supplier.

Monitoring of the data needed to calculate the baseline emission factor

The baseline emission factors for the ECG are obtained according to China's Regional Grid Baseline Emission Factors Determined published by DNA. The project owner should check the data and submit the revised ex-post calculation to the DOE on an annual basis. If data for determining the baseline emission factors is no longer or delay provided by the DNA, the project owner should calculate the conservative baseline emission factor of the project boundary by using the available and annually update publications such as China Energy Statistical Yearbook and China Electric Power Yearbook.

The emission reduction of the project is calculated on the basis of AM0029 (Version 01) agreed by EB. The CDM project developer should advise the project owner that when the data is available, the calculation of emission factor should be strictly in accordance with the methodology and be validated by the DOE.

6. 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, which will be ensured through the CDM mechanism in terms of the need for verification of the emission on an annual basis according to the Project Design Document and the CDM manual.

7. Emergency Disposal

The NG Distributed Control System (DSC) will be installed with leakage detector, alarm system and safety shut off valve. In the event of emergency, the detector can immediately check out the leakage point, and the alarm system issues alarm signal and reports to control center. Meanwhile, NG supply can be automatically shut off by safety shut off valve. After receiving the alarm, operators will immediately arrive, and check the reason and make the solution.

The operators responsible for DSC should make daily inspection and repair, record daily operation, and find out and deal with hidden troubles in time. The emergency of leakage will be almost unlikely occur.

8. Data Management System

The CDM manual set out the procedures for checking information from the primary source to the end-data calculation in physical document. If the data and information is from the Internet, the website must



be provided. Moreover, the credibility and reliability of the data and information must be confirmed by the project developer or other qualified entities. The project owner is responsible for providing additional data and information for validation and verification requirements of the DOE.

Physical document such as paper-based maps, diagrams and environmental assessments will be collected in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the project, the project material and monitoring results will be indexed. All paper-based information will be kept on the technology department of the project owner and all the material will have a copy for backup. And all data including calibration records is kept until 2 years after the end of the total credit time of the CDM project.

9. Verification and Monitoring Result

The project owner will sign a verification agreement with the specific DOE and agree to a timeframe work set by the EB for carrying out the verification while considering the buyer's schedule. The project owner will make the time arrangement for the verification and will prepare for the audit verification to the best of itself. The project owner will facilitate the verification by providing the DOE with all required necessary information before, during and, in the event of queries, after verification.

If the project owner deems that the requirement from the DOE is not within the verification, they should refer to the CDM developer or other qualified entities to confirm whether the requirements are reasonable. If considered unreasonable, a rejection letter in written form should be provided to the DOE with justifiable reasons. If the project owner and the DOE cannot reach an agreement, they can go to the EB or UNFCCC for arbitration.