



**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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Nanjing Jinling Grid Connected Natural Gas Combined Cycle Power Plant Project

Version number of the document: 06.4

Date: 21st April 2010

Revision history of this document:

Version Number	Date	Description
01	01/09/2006	PDD submitted for GSP
02	16/03/2007	PDD revised to address DOE's comments based on the document review and on-site interview
03	29/10/2007	Further revised according to DOE's comments
04	14/02/2008	Further revised according to DOE's comments
05	12/05/2009	Updated to AM0029 Version 3
06	29/07/2009	Further revised according to DOE's comments
06.1	21/09/2009	Further revised according to DOE's comments
06.2	28/09/2009	Further revised according to DOE's comments
06.3	02/03/2010	Further revised according to response to Request for Review
06.4	21/04/2010	Further revised according to response to Review

A.2. Description of the project activity:

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Nanjing Jinling Grid Connected Natural Gas Combined Cycle Power Plant Project (hereafter referred to as the "Proposed Project") is a natural gas fired grid-connected electricity generation plant, constructed, owned and operated by Huaneng Nanjing Jinling Power Generation Co. Ltd (hereafter referred to as the 'Project Owner') in Jiangsu Province, China.

The total installed capacity of the Proposed Project is 780MW, and involves the installation of two sets of 390MW gas-steam combined cycle generation system. As a peak-load regulating power plant with an estimated annual operation of 3,500 hours, the Proposed Project will supply approximately 2,716,000 MWh of electricity per annum, to the Jiangsu Power Grid, a sub-grid of the East China Power Grid (ECPG). Each year approximately 576 million m³ of natural gas transmitted from the gas fields of the Chadamu basin of Qinghai, Tarim basin of Xinjiang, and Shanganning region in the west of China will be consumed by the Proposed Project.

As a newly constructed power plant, the scenario existing prior to the start of the Proposed Project was that an equivalent amount of electricity would have been obtained from the East China Power Grid.

As set out in section B.4., the appropriate baseline scenario for the Proposed Project is the construction of a new 600MW sub-critical coal-fired power plant. The Proposed Project activity, therefore, results in significantly lower GHG emissions compared with coal-fired power generation, calculated to be a reduction of approximately 1,044,328 tons of CO₂e each year. During the first 7 year crediting period, the total emission reductions are 7,310,296 t CO₂e.



Not only will the Proposed Project help in meeting the increased electricity demand requirements of Jiangsu Province, it will also contribute to the sustainable development of the local region and host country, as well as the domestic power industry in the following ways:

- reducing GHG emissions and other pollutants, including SO_x, NO_x and Carbon Dioxide, which are directly associated with the coal fired power plants that dominate the ECPG;
- demonstrating state-of-the-art, international natural gas combined cycle technology in the power industry in the PRC;
- improving the peak-load regulating capacity of the ECPG to support the alleviation of power shortages ('brown-outs') for end-users in a region with one of the highest population densities and levels of industrial activity in the PRC;
- creating employment opportunities for local residents; and
- supporting the sustainable development of the power industry in the PRC by promoting the CDM as a viable business opportunity to support investments in low-carbon technologies.

A.3. Project participants:

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Participants to the Project activity are the following:

Table 1: Information of the Project Participants

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 country)	Huaneng Nanjing Jinling Power Generation Co., Ltd	No
United Kingdom of Great Britain and Northern Ireland	Gaisi Peony Carbon Capital s.a.r.l	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.		

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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The People's Republic of China

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

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Nanjing City, Jiangsu Province

A.4.1.3. City/Town/Community etc:
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Xidu Village, Longtan County, Qixia District

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

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The Proposed Project is located at Longtan County, Qixia district of Nanjing City within Jiangsu Province, the geographical coordinates are 119°00'45" east longitude and 32°10'17" north latitude as shown in the Figure 1. Close to the Yangtse River, the Proposed Project lies to the north, approximately 30 km away from the centre of Nanjing City, as shown in the figure below.

Figure 1: Geography Location of the Project

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

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The Proposed Project applies to the following category:

Sectoral Scope 01: Energy Industries (renewable / non-renewable sources).

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

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As a newly constructed power plant, the scenario existing prior to the start of the Proposed Project was that an equivalent amount of electricity would have been obtained from the East China Power Grid.



The Proposed Project activity involves the installation of two sets of 390MW gas-steam combined cycle generation system which can supply approximately 2,716,000MWh of electricity per annum to the ECPG to improve the peak regulating capacity of the grid.

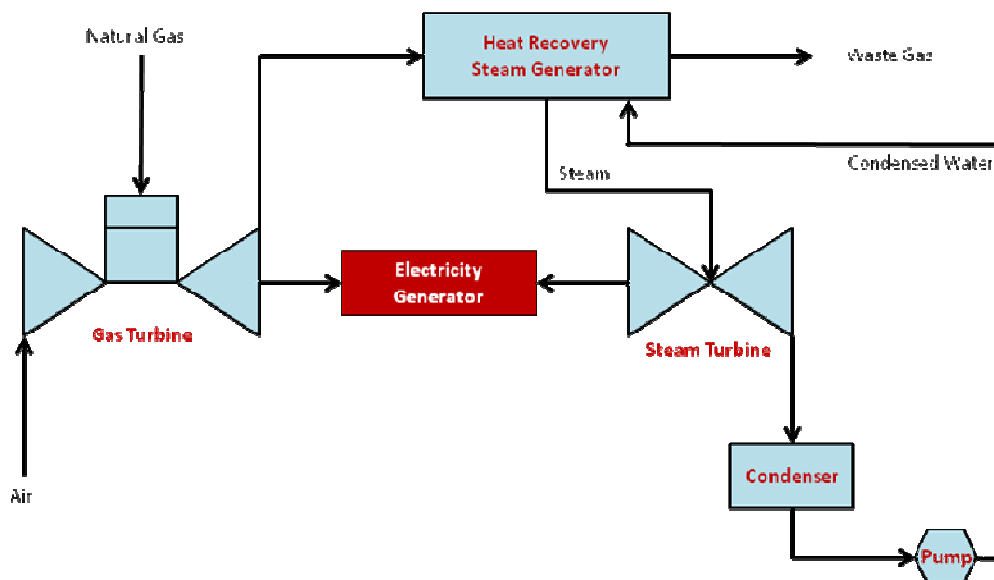
The NGCC technology (unit code GE-109FA) applied by the Proposed Project is supplied by the US manufacturer General Electric. The average lifetime of the equipments is 25 years, the designed load factor of the plant is 0.4 and the designed thermal efficiency is 57.71%. Each set (of which there are 2) contains the following main pieces of equipment:

Equipment	Specifications	Manufacturer	Source
Gas turbine	Model: PG9351FA Capacity: 255.6MW; Firing temperature: 1326.7°C Rotational speed:3000r/min	GE-Harbin Power Equipment Company	Manufacturer Specification
Heat Recovery Steam Generator (HRSG)	High pressure steam volume: 286.1 t/h Reheated steam volume: 314.2 t/h Low pressure steam volume: 42.7 t/h	NEM-Wuhan Boiler Works	Manufacturer Specification
Steam turbine	Model: D10 Capacity: 141MW; Rotational speed: 3000r/min	GE-Harbin Power Equipment Company	Manufacturer Specification
Electricity Generator	Model: 390H Capacity: 397.8MW Rated voltage:19000V Power factor: 0.85	GE-Harbin Power Equipment Company	Manufacturer Specification

The combustor is fired with natural gas and produces hot, high pressure, low NO_x gases, which expand in the gas turbine. The gas turbine drives the generator at one end, and an axial compressor at the other end, which supplies compressed ambient air to the combustor. The thermal energy contained in the high temperature exit gases of the gas turbine is recovered in the HRSG, which is designed to maximize the heat recovery of gases and allows a minimum stack temperature of the exhaust gases. The steam generated from the HRSG will be introduced to and expand in the steam turbine to drive the generator.

The process flow diagram of the Proposed Project is shown below, in Figure 2:

Figure 2: Process Flow Diagram of the Project



A 220kV double circuit transmission line connects the project site to the 500kV Longtan sub-station, which is used to connect to the Jiangsu Power Grid, a sub-grid of the ECPG.

As the Proposed Project involves the transfer of international, state-of-the-art natural gas combined cycle (NGCC) technology, the Project Owner has been working with various related professional institutions (including GE) to provide technical trainings during the project development so as to maximise the technical know-how of the staff for successful operation and performance of the equipment.

The Proposed Project followed the implementation schedule set out below:

Milestone	Date
Civil construction completed	28 Mar 2006
Generators in place	30 June 2006
Gas Turbines in place	23 July 2006
HRSGs in place	8 Nov 2006
Steam Turbines in place	10 Nov 2006
First Turbine in operation	31 Dec 2006
Second Turbine in operation	5 Mar 2007

In comparison to the Proposed Project scenario, the baseline scenario, as identified in section B.4, is the construction of a new 600MW sub-critical coal fired power plant.

The greenhouse gases emission sources with both the Proposed Project scenario and the baseline scenario are shown in the following table:

	Baseline scenario	Project scenario
Emission sources and greenhouse gases	CO ₂ ;	CO ₂ ;

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

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The crediting period selected for the proposed project is 7x3 years, and the estimated annual emission reductions due to the Proposed Project activity for the first crediting period, with an estimated starting date from the 01/01/2010, could be calculated accordingly as provided at the table below:

Years	Annual estimated emission reductions in tones of CO₂e
1 Jan 2010-31 Dec 2010	1,044,328
1 Jan 2011 -31 Dec 2011	1,044,328
1 Jan 2012 -31 Dec 2012	1,044,328
1 Jan 2013 -31 Dec 2013	1,044,328
1 Jan 2014 -31 Dec 2014	1,044,328
1 Jan 2015 -31 Dec 2015	1,044,328
1 Jan 2016 -31 Dec 2016	1,044,328
Total number of crediting years (First crediting period)	7
Total estimated reductions over the first crediting period of (tones of CO₂e)	7,310,296

A.4.5. Public funding of the project activity:

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There is no public funding involved in the Proposed 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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Version 03 of Approved baseline methodology AM0029: “Baseline Methodology for Grid Connected Electricity Generation project using Natural Gas” and “Monitoring methodology for grid connected generation plants using non-renewable and less GHG intensive fuel”. (Version 03; 16th May 2008).

References:

1. Version 01 of the: “Tool to calculate the emission factor for an electricity system” (Version 01.1, 29th July 2008)
2. Version 05 of the “Tool for the demonstration and assessment of additionality” (Version 05.2, 25th July 2008)

The above mentioned methodologies and tools are all available at:

<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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According to baseline methodology AM0029 (version 03), applicable projects must satisfy the following criteria:

- (1) The project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant;*
- (2) The geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available;*
- (3) Natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity.*

The Proposed Project satisfies these applicability criteria for the following reasons.

- The Proposed Project involves the construction and operation of a new natural gas fired grid-connected electricity generation plant according to the Approval released by Chinese NDRC on 16th September 2005¹. No other startup or auxiliary fuels will be used in this project.
- The Proposed Project supplies electricity to the Jiangsu Power Grid, a sub grid of the East China Power Grid, which includes Jiangsu, Zhejiang, Fujian, Anhui and Shanghai Grids. The

¹ Approval for the proposed project by NDRC dated 16 Sep 2005.



geographical/physical boundaries of this grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available²; and

- As set out in more detail below, natural gas is sufficiently available in the region and country; the Proposed Project will not constrain the use of natural gas by other comparable users.

Natural gas is sufficiently available to the Proposed Project:

The Project Owner has secured a sufficient supply of natural gas for the Proposed Project through the signing of a 20 year fuel supply agreement with the China National Petroleum Corporation (PetroChina), the owner of the 'West-East Gas Pipeline'.

Natural gas is sufficiently available to the Yangtze Delta of China, including Jiangsu, Shanghai, and Zhejiang:

For the gas supply capacity:

- (1) China has large domestic natural gas reserves³ that comprise about 1.1% of proven global reserves. These gas reserves are located primarily in China's north-west and Sichuan Province. A large infrastructure project, known as the West-East Gas Pipeline, was constructed beginning in 2001. This pipeline is capable of transferring a stable supply of gas from the gas fields of the Chadamu basin of Qinghai, Tarim basin of Xinjiang, and Shangganning region in the west of China to the East China region, including Jiangsu. It commenced operation in October 2004 and has a planned operating period of an expected 30 years. The pipeline is being continually upgraded by the installation of imported compressors, and the overall capacity has increased from 12 billion m³ to 17 billion m³ when the upgrade was completed in 2007⁴. In 2008, the gas supplied to Jiangsu by Line 1 of West-East Gas Pipeline was 5.7 billion⁵ m³ and 2.37⁶ billion m³ for Shanghai. Further, additional pipelines are being constructed, including a second West-East line and a line from the Puguang gas field in Sichuan Province, which will increase the available supply to Jiangsu to a total of 9.65 billion m³ by 2010⁷. The Sichuan-East Pipeline sourced from Puguang Gas Field in Sichuan Province was started in August 2008 and is expected to supply gas from 2010 with the total capacity of 12 billion m³ to the Yangtze Delta region, of which 2.35 billion m³ is allocated for Jiangsu⁸.
- (2) Besides the West-East Gas Pipeline and other domestic sources mentioned above, there are also other gas sources that will be available from the international markets available for the Yangtze Delta region as follows:

² Notification on Determining Baseline Emission Factor of China's Grid, issued by China's DNA on August 9th, 2007 <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf>

³ BP Statistical Review of World Energy; June 2008

⁴ <http://www.earthtimes.org/articles/show/ge-oil-and-gas-sets-installation-record-in-china,634054.shtml>

⁵ http://big5.ce.cn/cysc/ny/trq/200802/26/t20080226_14646680.shtml

⁶ <http://www.cnpy.com/Html/IndustryNews/2004-2/14/200421493342653.htm>

⁷ http://cn.chinagate.cn/economics/2007-05/31/content_2377642.htm

⁸ Data source: same as footnote 8



The two-phase Jiangsu Rudong LNG Program is currently under construction and is expected to be commissioned in April 2011. Phase I will supply 4.8 billion m³ per annum, while Phase II will provide a further 8.7 billion m³ of natural gas to Jiangsu province⁹. Overall, a total of 13.5 billion m³ of natural gas will be supplied each year to Jiangsu Province through the Rudong terminal.

Shanghai LNG Program Phase 1 will start operation in 2010 and will supply 4.0 billion m³ to Shanghai City¹⁰.

East Sea Oil Field is supplying about 0.6 billion m³ of natural gas per year to Shanghai City from 2005¹¹.

For Zhejiang Province, the annual gas supply capacity is estimated to be more than 6 billion m³ in 2012¹².

For the Gas Demand in Yangtze Delta:

The NG consumption for Shanghai, Jiangsu and Zhejiang in 2005 was 1.872 billion m³, 1.362 billion m³, and 0.225 billion m³ respectively¹³, resulting in a total actual consumption as 3.46 billion m³. According to a Report published in Urban Gas¹⁴, the gas demand in the Yangtze Delta including Shanghai, Zhejiang and Jiangsu region is predicted as 20.1 billion m³ in 2010 and 35.8 billion m³ in 2015.

Therefore, a comparison between supply capacity and the demand of Yangtze Delta is conducted as follows:

Unit: million m ³	2005	2010	2015
Natural gas supply capacity	8,670	22,400	40,000
Natural gas demand	3,460	20,100	35,800

Based on the data set out above, the project's demand only accounts for 2.5% of natural gas availability currently and 1.4% in 2015, it can be concluded that the gas supply in Yangtze Delta will be sufficient in the future and further expansion of NGCC plants will not be constrained by the gas supply.

⁹ http://www.jiangsu.gov.cn/shouye/rdgz/jjrd/200903/t20090317_315696.html

¹⁰ http://www.sinopecnews.com.cn/shnews/2006-07/31/content_395882.htm

¹¹ http://www.cctv.com/program/zgzq_new/20050804/100220.shtml

¹² <http://news.sohu.com/20090115/n261763086.shtml>

¹³ *Energy Year Book of China, 2007*

¹⁴ <http://www.sxrql.com/shows.asp?id=279&clas=%BB%E1%BF%AF>

**The project activity will not displace natural gas that would otherwise be used elsewhere:**

According to the NDRC's *Policy on Utilization of Natural Gas*¹⁵ (NDRC-Energy[2007]2155) published in Aug 2007, there are four categories of users for natural gas: priority, permitted, restricted and forbidden. In major electricity load centres and areas with adequate supplies of natural gas (as is the case for the region in which the Proposed Project is located), the construction of only peak-load balancing plants natural gas-fired power plants fall within the 'permitted' category, placing them below 'priority' users, which ranges from residential users, for cooking and hot water, through public service facilities, such as airports, government departments, schools, hotels and office buildings, natural gas vehicles, to combined heat and power (CHP) plants and tri-generation plants. Therefore, as a 'permitted' user ranked below these 'priority' users, in the event of scarcity of gas, the Proposed Project gas supply would be suspended in favor of priority users¹⁶, so as to ensure that the project activity will not displace natural gas that would otherwise be used elsewhere.

Future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity:

At the same time, a number of new natural gas power plants have been planned and are currently approved for the Jiangsu region, and these are expected to be constructed in the foreseeable future¹⁷.

Based on all of the above, it can be concluded that the supply of natural gas will be more than sufficient for the Proposed Project and the Yangtze Delta.

In sum, the approved Methodology AM0029 Version 03 is applicable to the Proposed Project.

Further clarification on the applicability of Methodology AM0029 to the proposed project:

In the PDD submitted for request for registration (version 06.2), the applicability of the methodology for the project activity was already described. However, in response to EB Request for Review on "Further clarifications are requested on the applicability of the methodology, in particular that the implementation of the project activity will not limit natural gas (NG) based power capacity additions in region and that there is no diversion of NG from other projects in the region," more detailed information is provided. The response to the Request for Review is therefore incorporated in this revised PDD (version 06.3) for further clarification as follows:

According to the baseline methodology AM0029 (version 03), applicable projects must satisfy the following three criteria:

- a) the project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant;
- b) the geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available;

¹⁵ http://www.ndrc.gov.cn/zcfb/zcfbtz/2007tongzhi/t20070904_157244.htm

¹⁶ *Gas Supply Agreement with PetroChina (Paragraph 20.5).*

¹⁷ http://www.sbfz.gov.cn/fzgh/fzgh_yhkf.htm



- c) Natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity.

The Proposed Project satisfies these applicability criteria as follows:

- a) The Proposed Project involves the construction and operation of a new natural gas fired grid-connected electricity generation plant according to the Approval released by Chinese NDRC on 16th September 2005. No other startup or auxiliary fuels will be used in this project,
- b) The Proposed Project supplies electricity to the Jiangsu Power Grid, a sub grid of the East China Power Grid, which includes Jiangsu, Zhejiang, Fujian, Anhui and Shanghai Grids. The geographical/physical boundaries of this grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available; and,
- c) as shown below, natural gas supply is sufficiently available in the Yangtse Delta region of China due to large national and trans-national infrastructure projects (some of which came into operation after completion of version 06.2 of the PDD). Several NGCC power plants similar to the Project in the region are already operational, and a number of new projects are also currently under construction or in the planning approval process in the region. Data supporting the sufficiency of gas supply in China and the Yangtse Delta is set out in three sections below:
- (1) infrastructure build, which summarises the initiatives recently completed to expand China's capacity to transport natural gas around the country, and to import natural gas via sea and overland;
 - (2) the balance of supply and demand in the Yangtse Delta region where the Project is located; and,
 - (3) plans to construct further natural gas fired power stations similar to the Project.

(1) Infrastructure Build

China's 11th Five Year National Plan included the objective of increasing the national share of total primary energy of natural gas to 10% by 2020, compared with approximately 3.5% in 2007¹⁸. In order to achieve this objective, very large additions to the natural gas infrastructure are being put in place in the three key areas of:

- domestic natural gas pipeline networks to interconnect gas producing and gas consuming regions,
- LNG terminals for importation of gas by ship, and
- trans-national gas pipelines connecting China to Central Asia.

¹⁸ IEA Working Paper, *Natural Gas in China*, June 2009, page 9
http://www.iea.org/Papers/2009/nat_gas_china.pdf.



These additions to the natural gas supply infrastructure across China demonstrate that at the macro level, China has considerably increased its access to natural gas and has improved its capacity to transfer large volumes of gas around China.

The sections below describe large new additions to the natural gas infrastructure being built by the three main Chinese oil and gas companies, Petrochina, Sinopec and CNOOC. Some of this additional capacity came on line in recent months and is now available to supply gas to the Yangtse Delta Region, which is located mid-way along the coast of China and includes Shanghai, Zhejiang and Jiangsu Province where the Project is located.

Domestic Natural Gas Pipeline Networks: in 2007, the IEA¹⁹ estimated that China's reserves from identified gas fields amounted to around 5,000 bcm, which means that the reserve/production ratio is approximately 47²⁰. These gas reserves are concentrated in three areas in the interior of China far from the more densely populated coastal regions. The three principle gas producing areas are:

- Sichuan (in the South-west),
- Tarim (in the extreme North-West region of Xinjiang) and,
- Ordos (across the northern Chinese provinces of Shaanxi, Shanxi and Inner Mongolia).

Until the late 1990s, the use of natural gas was limited in China due to the lack of infrastructure but since then, several large gas pipelines have been put in place between the Ordos field and Beijing (Shaan-Jing pipeline operational from 1997, and upgraded with a second line of 12 bcm capacity in 2005) and the Tarim Basin and the Yangtse Delta Region (the West-East pipeline, which was completed in 2004 with a capacity of 12 bcm).

This infrastructure has been upgraded recently with significant additional capacity as follows²¹:

- in 2008/9, the West-East pipeline was upgraded from 12 bcm capacity to 17 bcm capacity by the installation of a number of pressure boosting stations²²,
- on 31st December 2009,²³ the western section of the second West-East gas pipeline became operational. Petrochina started to build this pipeline in February 2008 and its total length of 4,843 km will connect the Yangtse Delta and Southern China to the Tarim gas field in China's north-west. Its planned total capacity is 30 bcm. As further described below, this pipeline is significant for China because it was recently connected to the Central Asia – China pipeline and has started to deliver natural gas from Turkmenistan to the Yangtse Delta.
- Sinopec is also building another two inter-regional pipelines from Sichuan to the Yangtse Delta and to Guangdong. (The Sichuan-East pipeline is discussed in more detail in the following section.)

¹⁹ IEA Working Paper, *Natural Gas in China*, June 2009, page 6, please refer to footnote 18

²⁰ IEA Working Paper, *Natural Gas in China*, June 2009, page 16, please refer to footnote 18

²¹ IEA Working Paper, *Natural Gas in China*, June 2009, page 7 & 8, please refer to footnote 18.

²² IEA Working Paper, *Natural Gas in China*, June 2009, page 7, please refer to footnote 18.

²³ <http://www.gulfoilandgas.com/webpro1/MAIN/Mainnews.asp?id=10299>



LNG Terminals for Importation of Gas by Ship: in 2006, China took its first step into the international markets with the completion of its first re-gasification terminal in Guangdong in the southern region of the Pearl River Delta.²⁴ As shown in the table below, China's main oil and gas companies have embarked on a program to construct a series of LNG terminals along the coast of China. The LNG terminal in Shanghai, which is located close to the Project, became operational on 20th September 2009²⁵ and has a capacity of 4.12 bcm.

	<u>Year of Operation</u>	<u>Location</u>	<u>Capacity (mt)</u>	<u>Capacity (bcm)²⁶</u>
Existing	2006	Guangdong	3.7	5.0
	2008	Fujian	2.6	3.5
	2009	Shanghai	3.0	4.1
	Total Existing		9.3	12.6
Under Construction	2011	Jiangsu Rudong	3.5	4.8
	2011	Dalian	3.5	4.8
	2011	Guangdong ²⁷	2.0	2.7
	Total Under Construction		9.0	12.3
Approved	N/A	Zhejiang Ningbo	3.0	4.1
	N/A	Qingdao	3.0	4.1
Planned	N/A	Zhuhai	3.5	4.8
	N/A	Shenzhen	3.5	4.8
	N/A	Caofeidian	3.5	4.8
	N/A	Hainan	N/A	
	Total Existing and Planned		34.8	47.5

Source: IEA Working Paper, Natural Gas in China, June 2009, page 9

At the same time as constructing the LNG terminals, China's major oil and gas companies have also entered into agreements to purchase LNG from several sources as follows:

²⁴ IEA Working Paper, Natural Gas in China, June 2009, page 8, please refer to footnote 18.

²⁵ <http://www.oilchina.com/sywx/20090909/news2009090909355613172.html>

²⁶ Conversion factor between 'million tons' (mt) of LNG and 'billion cubic metres' (bcm) of Natural Gas is 1.36 – see <http://www.bp.com/extendedsectiongenericarticle.do?categoryId=9023800&contentId=7044894>

²⁷ The second Guangdong project is an extension of existing facilities; IEA Working Paper, Natural Gas in China, June 2009, page 9, please refer to footnote 18.



Supply Source	Volume pa (mt)	Volume pa (bcm)	Term	Signing Date	Buyer	Destination Terminal
Australia NWS	3.3	4.6	25	Dec-03	CNOOC	Guangdong
Malaysia Tiga	3	4.2	25	Jul-06	CNOOC	Shanghai
Indonesia Tangguh	2.6	3.5	25	Sep-06	CNOOC	Fujian
Qatar Gas IV	3	4.2	25	Apr-08	Petrochina	Jiangsu
Qatar Gas II	2	2.7	25	Jun-08	CNOOC	Multiple
Shell	2	2.7	20	Nov-08	Petrochina	Dalian
Totale	1	1.4	15	Jan-09	CNOOC	Multiple
ExxonMobil	2	2.7	20	Mar-09	Petrochina	N/A
Australia QC LNG	3.6	4.9	20	May-09	CNOOC	N/A
ExxonMobil ²⁸	2.25	3.1	20	Aug-09	Petrochina	N/A
ExxonMobil ²⁹	2	2.7	20	Nov-09	SinoPec	Shandong
Qatar Gas ³⁰	3	4.2	N/A	Nov-09	CNOOC	N/A
Total	29.75	40.9				

Source: IEA Working Paper, Natural Gas in China, June 2009, page 18

Trans-national Gas Pipelines Connecting China to Central Asia: in addition to the increase in port facilities and domestic pipeline capacity, China is also building a pipeline network to access natural gas across its land borders. The most important of these trans-national pipelines are:

- the Central Asia – China Pipeline: this pipeline first became operational on 14th December, 2009. In July 2007, Petrochina and Turkmenistan signed a 30-year sale and purchase contract for 30 bcm of natural gas per annum, which was subsequently increased to 40 bcm³¹. China also agreed to extend a \$3 billion loan to Turkmenistan to develop the Yolotan gas field and began construction of the Central Asia – China Pipeline, which connects the Turkmenistan gas fields to China's second West-East gas pipeline described above. The Central Asia – China pipeline became operational on 14th December, 2009, and the first section of the second West-East pipeline became operational on 31st December, 2009 and already has been connected to the Shaan-Jing pipeline in the north. In 2009, BP reported proven reserves in Turkmenistan of around 7,940 bcm, ranking Turkmenistan as the fourth largest gas holder in the world following Russia, Iran and Qatar³².

²⁸ http://www.exxonmobil.com/Australia-English/PA/news_release_20080818.aspx;

²⁹ <http://english.peopledaily.com.cn/90001/90778/90861/6804113.html>;

³⁰ http://www.chinadaily.com.cn/bizchina/2009-11/14/content_8971291.htm

³¹ IEA Working Paper, Natural Gas in China, June 2009, pg 18, please refer to footnote 18.

³²

http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2008/STAGING/local_assets/2009_downloads/gas_table_of_proved_natural_gas_reserves_2009.pdf



- Kazakhstan – in November 2008, Petrochina and Kazmunaigaz signed an agreement to construct another gas pipeline from the Aktyubinsk gas fields to the Central Asia – China pipeline³³, and,
- the China – Myanmar Pipeline: in December 2008, China and Myanmar signed a sales and purchase agreement for 10 bcm of natural gas with a planned 1,000 km pipeline³⁴.

As demonstrated by this discussion of the domestic natural gas pipelines, LNG terminals and transnational pipelines, China has already established the infrastructure to access huge reserves of gas and transfer it around China.

The Balance of Supply and Demand in the Yangtse Delta Region where the Project is located:

Set within this wider macro picture of natural gas supply, at the local level it can also be demonstrated that natural gas is sufficiently available in the region where the project activity is located. The gas supply demand balance as set out in version 06.2 of the PDD is as follows:

Unit: million m ³	2005	2010	2015
Natural Gas Supply Capacity	8,670	22,400	40,000
Natural Gas Demand	3,460	20,100	35,800

Since publication of version 06.2 of the PDD additional sources of supply and demand have come on-stream. The following analysis of the balance of supply and demand in the Yangtse Delta region has been conducted based on the most up-to-date published figures. The most recent data supports the conclusions made in version 06.2 of the PDD that there is sufficient supply of natural gas in the region to meet local demands.

³³ IEA Working Paper, *Natural Gas in China*, June 2009, pg19, please refer to footnote 18.

³⁴ IEA Working Paper, *Natural Gas in China*, June 2009, pg19, please refer to footnote 18.

Natural gas supply in the Yangtse Delta Region

Table: Natural Gas Supply in Yangtze Delta Region (Unit: billion Nm ³ /a)													
Province	Natural Gas Source	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Jiangsu	West-East Pipeline I (1)	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	West-East Pipeline II (1)	0	0	0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	West-East Pipeline III (1)	0	0	0	0	0	0	0	0	0	0	0	0
	Sichuan-East Pipeline (2)	0	1.645	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
	Jiangsu Rudong LNG Phase I (3)	0	0	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
	Rudong LNG Phase II (3)	0	0	0	0	0	0	0	0	0	0	0	0
	Jiangsu Yancheng LNG Program (4)	0	0	0	0	0	0	0	0	0	0	0	0
	Sub-total 1	5.7	7.345	12.85	14.45	14.45	14.45	14.45	14.45	14.45	14.45	14.45	14.45
Shanghai	West-East Pipeline I (1)	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
	West-East Pipeline II (1)	0	0	0	2	2	2	2	2	2	2	2	2
	West-East Pipeline III (1)	0	0	0	0	0	0	0	0	0	0	0	0
	Sichuan-East Pipeline (2)	0	1.33	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
	Shanghai LNG Program (5)	1.03	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12
	East Sea Oil Gas (6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Sub-total 2	4	8.42	8.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
Zhejiang	West-East Pipeline I (1)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
	West-East Pipeline II (1)	0	0	5	10	10	10	10	10	10	10	10	10
	West-East Pipeline III (1)	0	0	0	0	0	0	0	0	0	0	0	0
	Sichuan-East Pipeline (2)	0	1.35	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
	Zhejiang LNG Project (7)	0	0	0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
	Zhejiang Wenzhou LNG Project (8)	0	0	0	0	0	0	0	0	0	0	0	0
	East Sea Oil Gas (6)	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
	Sub-total 3	2.95	4.3	8.65	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	19.00
Total Yangtze Region		12.65	20.07	30.49	43.29	43.29	43.29	43.29	43.29	43.29	43.29	43.29	44.44

The natural gas supply of Yangtse Delta Region comes from the following sources:

(1) **West-East Gas Pipeline:** The West-East gas pipeline runs from three large gas fields in the western part of China across to the east coast at Shanghai. It comprises three lines:

- **West-East Pipeline I** commenced operation in October 2004 with a capacity of 12bcm, the addition of imported compressors has increased the overall capacity of the pipeline to 17 bcm³⁵. Line 1 of the pipeline supplies 5.7bcm³⁶ to Jiangsu, 1.8 billion to Zhejiang

³⁵ IEA Working Paper, *Natural Gas in China*, June 2009, page 7, please refer to footnote 18.

³⁶ <http://news.zgjrw.com/News/2008226/shanghai%20finance%20net/966736727600.html>



annually³⁷, and 2.37bcm³⁸ of gas to Shanghai. Forecasts are for similar levels of supply in the following years³⁹.

- **West-East Pipeline II** the western segment of this pipeline connecting Xinjiang to Gansu was completed in December 2009, and first gas pumped in January 2010⁴⁰. The second phase of construction, connecting the West-East pipeline across to China's east coast is expected to connect to Zhejiang by mid 2011⁴¹, and across to Shanghai and Jiangsu by the end of 2011⁴². The pipeline will supply Zhejiang with 5bcm⁴³ in 2011, and 10bcm⁴⁴ from 2012 onwards, and 1.6bcm to Jiangsu⁴⁵ and 2.0bcm to Shanghai⁴⁶ annually.
 - **West-East Pipeline III** is currently in the initial planning stages, and has not yet applied to the NDRC for approval⁴⁷. For conservativeness, the supply of gas from this pipeline is discounted to zero.
- (2) **Sichuan-East gas pipeline** reaches from the Puguang gas field in Sichuan Province. Completed in 2009, the pipeline will supply 6.1bcm of gas to the Yangtse Delta region, of which 2.35bcm is allocated for Jiangsu⁴⁸, 1.9bcm for Shanghai⁴⁹ and 1.85 bcm for Zhejiang from 2011 onwards⁵⁰. For 2010, Zhejiang will receive 1.35bcm⁵¹, and for the sake of conservativeness, the volumes for Jiangsu and Shanghai for 2010 have been similarly discounted by 30%.
- (3) **Jiangsu Rudong LNG Project** comprises a manmade island, LNG receiving station, dock, benthall pipeline and trunk pipeline. The project will be constructed in two phases:

³⁷ <http://www.doc88.com/p-31864558628.html>

³⁸ <http://news.sohu.com/20080904/n259376088.shtml>

³⁹ <http://finance.people.com.cn/GB/10978247.html>

⁴⁰ please refer to footnote 23

⁴¹ <http://finance.sina.com.cn/roll/20100121/08113192020.shtml>

⁴² http://news.xinhuanet.com/newscenter/2009-02/07/content_10779524.htm

⁴³ please refer to footnote 41

⁴⁴ please refer to footnote 41

⁴⁵ <http://www.zhaobiao.gov.cn/projectinfodetail/23677466.html>

⁴⁶ http://www.86ne.com/Energy/200802/Energy_114518.html

⁴⁷ <http://news.cnfol.com/091128/101,1278,6874220,00.shtml>

⁴⁸ <http://www.pipechina.net/info/detail/2010/1/19300/>

⁴⁹ please refer to footnote 48

⁵⁰ <http://news.gasshow.com/pages/news/20090116/A7DB18751B30461C916A639380.html>

⁵¹ please refer to footnote 50



- **Phase I** is expected to be commissioned by end of 2010⁵² and has the capacity to supply 4.8bcm to Jiangsu Province annually⁵³; and
 - **Phase II** which when complete will have the capacity to supply 8.7 bcm of natural gas to Jiangsu annually⁵⁴. Currently under construction, the project is expected to be fully completed by 2014, but for the sake of conservativeness, the natural gas supply from this source is estimated as zero.
- (4) **Jiangsu Yancheng LNG Project** includes an affiliated gas-fired power plant, but is yet to obtain approval from the NDRC⁵⁵. Therefore, for the sake of conservativeness, supply from this project has been discounted to zero.
- (5) **Shanghai LNG Program Phase 1** is jointly owned by Shenergy and CNOOC Gas and Power. Construction has completed and the first shipment of LNG was delivered in September 2009 from Malaysia. CNOOC has signed a 25-year contract with a Malaysian supplier for the import of 4.12bcm per annum through this terminal⁵⁶.
- (6) **East Sea Oil Gas** is a project which has transferred gas from the Pinghu gas field to Shanghai through a subsea pipeline since 1999. The pipeline supplies Shanghai with a total volume of 0.6bcm of natural gas per annum⁵⁷, and Zhejiang with a total volume of 1.15bcm per annum⁵⁸.
- (7) **Zhejiang LNG Project** is located in Ningbo City, which commenced construction on 18 December 2009, and which is expected to come into operation in 2012. The annual capacity is expected to be 4.2bcm per year, with phase two expanding the capacity to 8.4bcm per year⁵⁹. However, as the construction of phase two will not start until 2017⁶⁰, for the sake of conservativeness, the supply from phase two is not included in the table above.
- (8) **Zhejiang Wenzhou LNG Project** is still in the planning stages and has yet to receive approvals⁶¹. Therefore, for the sake of conservativeness the values are discounted to zero.

⁵² <http://www.ocn.com.cn/qyqb/201001/tianranqi201448.htm>

⁵³ http://www.jiangsu.gov.cn/shouye/rdgz/jjrd/200903/t20090317_315696.html

⁵⁴ <http://www.ntjhw.com/?viewnews-22016.html>

⁵⁵ http://www.ycdpc.gov.cn/news34/News_View.asp?NewsID=1768

⁵⁶ please refer to footnote 25

⁵⁷ http://www.cctv.com/program/zgzq_new/20050804/100220.shtml

⁵⁸ Please refer to footnote 37

⁵⁹ <http://www.bl.gov.cn/dynamic/czdt/html/2009/07/08/14.shtml>

⁶⁰ http://www.cnscj.net/a/2009/12/19/content_91694.html

⁶¹ <http://www.trq.ibicn.com/market/archive/200808/1811779150755895.html>

Natural gas demand in the Yangtse Delta Region

With regard to the demand for natural gas in the Yangtse Delta, according to the 2008 Energy Year Book of China, the NG consumption for the Yangtse Delta region (Shanghai, Jiangsu and Zhejiang) in 2007 was 9.045bcm⁶².

According to the Report for Energy Development of China, the average growth rate of natural gas demand for China is expected to be in the range of 11-13%⁶³ for the next 15 years. Based on the 2007 consumption of 9.045bcm, and for conservativeness selecting the upper value – a growth rate of 13% – the future demand for gas in the Yangtse Delta region can be calculated as follows:

Table: Natural Gas Demand in Yangtze Delta Region (Unit: billion Nm³/a)

Yangtze Delta Region	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Demand	11.55	13.05	14.75	16.66	18.83	21.28	24.05	27.17	30.70	34.70	39.21	44.30

As has been shown by the updated analysis of supply and demand above, it can be concluded that there is sufficient supply of natural gas in the Yangtse Delta region to meet the demand.

A comparison of the total supply against the total demand is set out in the table below:

Table: Natural Gas Supply and Demand Balance in Yangtze Delta Region (Unit: billion Nm³/a)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Supply	12.65	20.07	30.49	43.29	43.29	43.29	43.29	43.29	43.29	43.29	43.29	44.44
Demand	11.55	13.05	14.75	16.66	18.83	21.28	24.05	27.17	30.70	34.70	39.21	44.30
Balance	1.10	7.01	15.74	26.63	24.46	22.01	19.24	16.12	12.59	8.59	4.08	0.14

The newly updated supply and demand volumes clearly demonstrate that there is sufficient supply of gas in the Yangtse Delta region.

Plans to Construct Further Natural Gas-fired Power Stations similar to the Project

As the supply of natural gas to the Yangtse Delta region has increased, so too have the number of NGCC power plants being constructed.

The two tables below show the existing natural gas fired power plants in the Yangtse Delta region and planned capacity additions after the operation of the proposed project in Yangtse Delta. The table below shows the NGCC plants that were planned and put into operation in the period 2004-2006 when the Project was under development. This demonstrates that at the time the Project was being planned and constructed, there were several other projects under development, so there is no evidence that the construction of the Project constrained other similar projects:

⁶² *Energy Year Book of China, 2008*

⁶³ *2007 Report for Energy Development of China; available for download at:*
http://www.china.com.cn/economic/zhuanti/2007nyfz/2007-05/24/content_8302554.htm

NGCC power plants that have already been constructed in the Yangtse Delta Region

Region	Name of projects	MW	Status
Jiangsu	Jiangsu Zhangjiagang NGCC power plant	2*390	Registered as CDM project
	Jiangsu Wangting NGCC power plant	2*390	Registered as CDM project
	Jiangsu Qishuyan NGCC power plant	2*390	Registered as CDM project
Shanghai	Shanghai Baoshan NGCC power plant	3*400	Registered as CDM project
	Shanghai Jinshan Grid Connected Natural Gas Combined Cycle Power Generation Project	2*390	Under CDM development
Zhejiang	Zhejiang Zhenjiang Natural Gas Power Generation Co.	2*390	Registered as CDM project
	Xiaoshan Gas Power Plant of Zhengjiang	2*390	Registered as CDM project
	Yuyao Natural Gas Power Plant of China Energy Group	2*390	Registered as CDM project
	Hangzhou Banshan Natural Gas Power Plant	3*390	Under CDM development

Additional natural gas fired power plants that have been planned and approved subsequent to the Project activity are set out below.

NGCC Power Plants that are planned or already under construction in the Yangtse Delta region⁶⁴

Region	Name of new project	MW	Status
Jiangsu	Jiangsu Nantong Rudong LNG Power plant	6*390	Awaiting final approval ⁶⁵
	Jiangsu Lianyungang LNG power plant	n/a	Being planned ⁶⁶
	Jiangsu Yancheng LNG power plant	8*300	Awaiting final approval ⁶⁷
Zhejiang	Zhejiang Ningbo Beilun 1 st LNG power plant	4*390	Expected to be operating by end of 2010 ⁶⁸
Shanghai	Shanghai Minhang NGCC power plant	2*350	Awaiting final approval ⁶⁹
Shanghai	Shanghai Lingang LNG Power Plant Phase I	4*350	Approved by NDRC ⁷⁰ , construction started on June 18, 2009 ⁷¹

⁶⁴ In accordance with the Tool for Demonstration and Assessment of Additionality, these planned projects are not included in the common practice analysis as they have not commenced operating.

⁶⁵ http://www.sbfz.gov.cn/fzgh/fzgh_yhkf.htm; and <http://www.ntykg.com/site/lng/rqqlj/rqqlj.shtml>

⁶⁶ http://www.sbfz.gov.cn/fzgh/fzgh_yhkf.htm

⁶⁷ http://www.ycdpc.gov.cn/news34/News_View.asp?NewsID=1768

⁶⁸ <http://yp.knet.cn/news/8b/18/8b185b32851ed936e8b45104e21d9564.shtml>

⁶⁹ <http://finance.ifeng.com/roll/20090825/1141259.shtml>

⁷⁰ please refer to footnote 69



The continued investment in, and construction of, natural gas fired power generating infrastructure in the Yangtse Delta Region further confirms the sufficient supply of natural gas and that the project activity has not resulted in any diversion of natural gas from other projects in the region.

From the information presented above, it is evident that the implementation of the project activity has not limited natural gas (NG) based power capacity additions in the region, nor has it resulted in a diversion of gas from other projects.

Conclusion

As has been demonstrated above, we confirm that the proposed project meets the applicability requirements for baseline methodology AM0029 (version 03). In particular, we confirm that:

- a) the project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant;
- b) the geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available;
- c) natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity.

With regard to the availability of natural gas in the region, it has also been demonstrated that the supply of natural gas at the local Yangtse Delta Region level is sufficient and due to large national and trans-national infrastructure construction, there is sufficient capacity to transport natural gas around the country, as well as to import natural gas via sea and overland. Therefore, the implementation of the project activity will not limit natural gas based power capacity additions in the region, and there will be no diversion of natural gas from other projects in the region.

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

>>

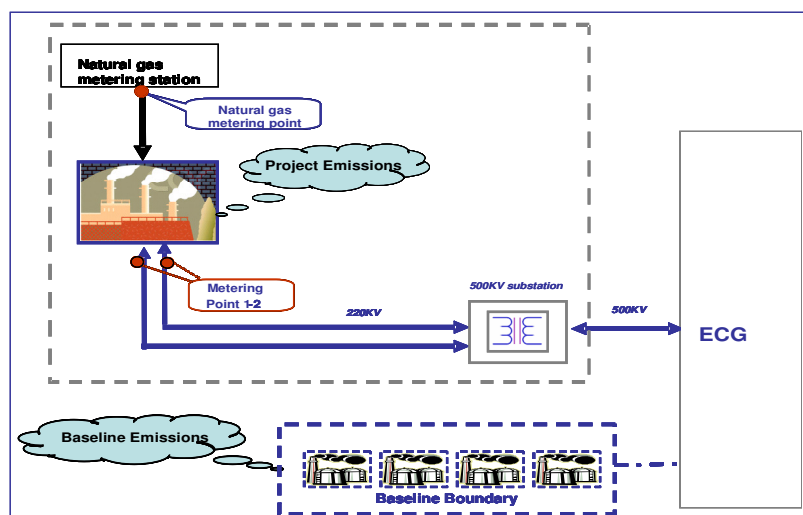
In accordance with AM0029 (Version 3) the spatial extent of the project boundary includes the project site and all power plants physically connected to baseline grid as defined in the “Tool to calculate the emission factor for an electricity system” (Version 01.1). As per the grid delineations published by the NDRC⁷² this comprises all of the power plants physically connected to the ECPG, which consists of the Jiangsu, Shanghai, Zhejiang, Anhui, and Fujian provincial grids.

The flow diagram of the project boundary is set out below (Figure 3), presenting the physical configuration, flows of mass and energy and the emissions sources and gases included in the project boundary.

⁷¹ <http://www.lgxc.gov.cn/news/Info2011.htm>

⁷² Data source: same as footnote 2

Figure 3 Flow Diagram of the Project Boundary



An explanation of the emissions sources which are included in the determination of both baseline and project emissions, and the justification for excluding other emissions sources, is provided in the table below.

	Source	Gas	Included?	Justification / Explanation
Baseline	Power generation in baseline	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.

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 03), the baseline scenario is identified using the following two steps.

Step 1: Identify the Plausible Baseline scenario

According to the methodology AM0029 (Version 3), 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

Alternatives to be analysed 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.

As mentioned in Section A.2, the Proposed Project serves as peak load regulating power plant to increase in the installed capacity of the East China Power Grid. The electricity generated by the Proposed Project will be only used for peak load regulation throughout the crediting period due to the following reasons:

- **Regulatory requirements:** According to the NDRC's *Policy on Utilization of Natural Gas (NDRC-Energy[2007]2155)*, natural gas power generation projects in the region of the Proposed Project are only permitted as peak load regulating power plants⁷³. This means only peak load regulating natural gas power plants are eligible and thus are approved by the government.
- **Grid Company's purchase requirements:** the Power Purchase Agreement (PPA) signed between Jiangsu Electric Power Company (JECPC) and Huaneng Nanjing Jinling Power Generation Co., Ltd in November 2006 (Contract No. 2006SD1102010171) set out clear provisions that in accordance with the regulatory requirements imposed on JECPC, the project company must provide electricity in a peak load regulating capacity⁷⁴.
- **Characteristics of natural gas fired plants:** a research paper⁷⁵ published by China Power shows that natural gas fired power plant are more suitable as peak load regulating power plants for grid management due to its characteristics of rapid startup/shutdown speed and flexible operation.;

Based on the above characteristics of the Proposed Project, the alternatives which cannot provide peak load regulation, equivalent amounts of power and are not compliant with all applicable legal and regulatory requirements will be excluded.

Accordingly, the following baseline scenario alternatives to the Proposed Project are considered in order to identify the appropriate baseline:

1. The project activity not implemented as a CDM project

As this alternative would provide the same outputs and services as the Proposed Project, this alternative is retained as a plausible scenario for further analysis.

2. Power generation using natural gas, but technologies other than the project activity

Other than combined cycle technology, which will be implemented by the Proposed Project, the only alternative technology available for natural gas power generation is single cycle technology. However, typically single cycle gas turbine technology is employed for smaller installed capacities (100-300MW) and the thermal efficiency rate is also considerably lower (38%-39.5%)⁷⁶ than the

⁷³ http://www.ndrc.gov.cn/zcfb/zcfbtz/2007tongzhi/t20070904_157244.htm

⁷⁴ Article 4.5.1 and Article 4.5.2 in *Power Purchase Agreement*; November 2006

⁷⁵ *Assessment on the Application of Gas Turbine Power Generation Technology*,
<http://www.chinapower.com.cn/articleattachment/1000/art1000310.doc>

⁷⁶ <http://www.chinapower.com.cn/articleattachment/1000/art1000310.doc>



technology employed by the Proposed Project. For the MS9001FA gas turbine, the heat rate is 9,757kJ/kWh, i.e. thermal efficiency is 36.9% under the single cycle operation, while the heat rate is 6,350kJ/kWh, i.e. thermal efficiency is 56.7% under the combined cycle operation⁷⁷. Simple cycle technology is much less efficient and therefore, this alternative is not considered a plausible baseline alternative.

3. Power generation technologies using energy resources other than natural gas

According to the *China Electric Power Yearbook 2007* and the 11th Five-Year Plan for Energy Development of China, the type of power generation plants that have been constructed recently or that are planned to be constructed within the project boundary are hydro, wind, nuclear, solar, biomass, and fossil fuel fired power plants.

Alternatives using energy resources other than natural gas include oil, coal, nuclear, wind, solar, biomass, hydro, and fossil-fuels.

Each of these potential resources is considered individually below:

A. Non-renewable energy

According to the data from China Electric Power Yearbook 2006, the total power generation of the East China Power Grid in 2005 is 574,467 GWh, of which 505,855 GWh (or 88.06%) came from fossil fuel-fired power plants. Therefore, the East China Power Grid is dominated by fossil fuel-fired power plants, and this fact will not change in near future.

Oil

According to the “*The Notice on Printing Mid Long term Specific Plan of Energy-saving*” issued by NDRC (file No. NDRC-Environment and Resource [2004]2505)⁷⁸, the development of new oil-fired power plants is prohibited. Therefore, the construction of an oil-fired power plant is not feasible and is not considered further

Coal

The technology of providing the peak load regulation using coal fired plants is mature and available in China. Such technology requires the coal power plant to be able to run at variable loads. Thus, coal-fired plants are considered capable of delivering similar services as the Proposed Project activity as they are currently used across China to provide peak load regulation services as well as base load generation⁷⁹.

In compliance with the Notice of Requirements on the Planning and Construction of Coal-fired Power Plants issued by the NDRC⁸⁰, newly constructed coal-fired power plants with a single unit

⁷⁷ http://www.gepower.com/prod_serv/products/gas_turbines_cc/en/f_class/ms9001fa.htm

⁷⁸ http://www.ndrc.gov.cn/hjbh/jnjs/t20050711_45823.htm

⁷⁹ <http://www.cnaec.com.cn/Info/Show.asp?ID=226054&SortID>

⁸⁰ Notice of Requirements on Planning and Construction of Coal-fired Power Plant, No.FaNengYuan [2004]864, <http://www.ndrc.gov.cn/view.jsp?ID=1287>



capacity should be in principal equal to 600MW or above. Currently, the main type of coal-fired power units in the power grids of China has been upgraded from 300MW level to 600MW level⁸¹.

With regard to ultra super critical technology, the proposed project started construction in June 2005 (as referenced in the Project Timeline in section B.5), at that time ultra super critical technology was still only in the research stage⁸². The first pilot ultra super critical project was not put into operation until November 2006⁸³, more than a year after the Proposed Project start-date. Therefore, ultra super critical plant is not a plausible baseline alternative for the Proposed Project.

Thus one set of 600MW coal fired power unit, namely 1*600MW coal fired sub-critical power plants and 1*600MW coal fired super-critical power plants are chosen as plausible baseline scenarios which both could provide peak load services and comparable amounts of electricity output as the proposed project. Therefore, the construction of either a 600MW sub-critical or super-critical coal-fired power plant is considered plausible and is retained for further analysis.

Nuclear

While nuclear energy can be used for base load electricity generation, it does not provide peak load balancing electricity in China⁸⁴. Therefore, nuclear power is not considered further.

B. Renewable energy

Wind

Wind electricity generation is unstable due to the seasonal nature of wind energy resources, and it is not suitable for peak-load balancing for the East China Power Grid. In addition, wind resources decrease steadily from coastal to inland Jiangsu Province. The coastal and Taihu Lake areas are rich in wind resources whilst the inland resource is relatively poor⁸⁵. The Proposed Project is located inland, and the available wind resources in the local region are insufficient to construct wind power plants. Therefore, wind power is not considered further.

Solar & Biomass

Grid-connected solar power plants would not be able to deliver similar peak load balancing services as the Proposed Project⁸⁶, and it would not be viable to develop a biomass power generation plant at a capacity comparable to the Proposed Project⁸⁷. Therefore, neither solar nor biomass power generation technologies are feasible, and are not considered further.

⁸¹ <http://www.p5w.net/news/cjxw/200703/t810531.htm>

⁸² <http://www.ccei.org.cn/shownews.asp?ID=31322>

⁸³ http://www.chng.com.cn/minisite/party/new/party_view_index_57037.html

⁸⁴ Safety Management Rules on Nuclear Power Generation issued by Ministry of Power Industry, http://www.jssafety.gov.cn/text_safety/falvfagui/xiazai/zhengcefagui/1997-04/28/content_680.htm

⁸⁵ p46, China Wind Power Report 2007, <http://www.greenpeace.org/raw/content/china/en/press/reports/wind-power-report.pdf>

⁸⁶ The Future Impact of Grid-Connected Photovoltaic Power Generation to the Grid, <http://www.in-en.com/newenergy/html/newenergy-1431143163139011.html>

⁸⁷ <http://baike.baidu.com/view/1032603.html?goodTagLemma>



Hydro

Technically, a hydropower plant could be constructed for peak load regulating operation provided there are sufficient hydro resources. However, as demonstrated in a research report about energy consumption in Jiangsu Province⁸⁸, hydro electricity generation only account for 0.5% in Jiangsu's total primary energy mix in 2005. Thus it can be concluded that Jiangsu province does not have any hydro power potential. Therefore, the construction of such a big hydropower plant with comparable capacity or electricity generation at the project site or nearby area is impractical, and is not considered further.

4. Import of electricity from connected grids, including the possibility of new interconnections

The ECPG is physically connected to the Central China Power Grid (CCPG)⁸⁹. As referred to in Annex 3, even though the same amount of electricity could be imported from the CCPG to the ECPG, this could not be considered as a plausible baseline scenario for the following reasons:

1. The Proposed Project is designed to meet the peak load demand of the ECPG, with an installed capacity of 780MW. The electricity imported from CCPG is 26,933GWh, 27,039GWh, and 24,029GWh in 2004, 2005, and 2006 respectively⁹⁰. Due to changes in seasonal demand, weather conditions⁹¹, and poor regulating capacity of the power transmission networks⁹², most of the regional interconnections – including the CCPG and ECPG – in the PRC experience substantial power shortfalls in peak demand periods⁹³. Therefore, the CCPG would be unable to supply sufficient, safe and stable power to the ECPG in peak demand periods.
2. Jiangsu Province, where the proposed project is located, is covered by Jiangsu Power Grid, which the proposed project is physically connected to. According to the Jiangsu Eleventh Five-Year Plan of Economic and Social Development⁹⁴, no plans have been made for new interconnections with other provincial grids. . Therefore, it is unlikely to import electricity from new interconnections to the Jiangsu Power Grid.

Therefore, the import of electricity from connected grids including possibility of new interconnections is not considered further as a baseline scenario.

Outcome of step 1:

Based on the analysis above, the possible alternatives remaining for further consideration for the Proposed Project are:

⁸⁸ http://www.stats.gov.cn/tjfx/dfxx/t20070816_402426725.htm

⁸⁹ <http://hi.baidu.com/daier/blog/item/f49c2ef5aa711e21bd31092d.html>

⁹⁰ China Electric Power Yearbook:2005-2007

⁹¹ p41, China Electric Power Yearbook 2007

⁹² http://www.zjwater.gov.cn/pages/document/39/document_172.htm

⁹³ Annex 5 - Table C1: 2005-2006 Monthly Maximum Power Shortfalls in Peak load

⁹⁴ http://www.jsdpc.gov.cn/pub/jsdpc/zwdt/zfxxgkz/zfxxgkml/ghjh/zcqh/gmjjhshfzgh/200804/t20080428_85215.htm



Alternative 1: The Proposed Project activity not implemented as a CDM project;

Alternative 2: New sub-critical coal-fired power plant with an installed capacity of 1*600MW; and

Alternative 3: New super-critical coal-fired power plant with an installed capacity of 1*600MW.

All three alternative baseline scenarios above can provide similar services as a peak load regulating power plant.

Step 2: Identify the economically most attractive baseline scenario alternative

Sub-step 1: calculating levelised cost of electricity production for identified plausible baseline

According to AM0029, the most attractive applicable alternative is to be identified using investment analysis. In order to do this, the Levelised Electricity Generation Cost (LEGC) of the alternatives is calculated.

The formula⁹⁵ applied to calculate the levelised electricity generation cost (LEGC) is as follows:

$$LEGC = \frac{\sum_t [(I_t + M_t + F_t)(1+r)^{-t}]}{\sum_t [E_t(1+r)^{-t}]}$$

Where:

LEGC: Average lifetime levelised electricity generation cost per KWh.

It: Capital expenditure in the year t.

Mt: Operation and maintenance expenditures in the year t.

Ft: Fuel expenditure in the year t.

Et: Electricity generation in the year t.

R: Discount rate.

The data and parameters for financial analysis of Alternative 1, i.e. the proposed project not implemented as a CDM project are taken from the feasibility study report (FSR) developed by an independent accredited entity, Hebei Electric Design Institute, in April 2005 and approved by National Development and Reform Commission on 16 September 2005.

The data and parameters for the financial analysis of the sub-critical (Alternative 2) and super-critical coal fired power plants (Alternative 3) are taken from two independent and recognized sources as follows:

- the *Thermal Power Engineering Design Reference Cost Index* (2005 Edition, issued by China Institute of Power Planning and Design), which is generally used by the developers of power plants in China for designing and assessment of power generation projects; and
- the *Notice on Relevant Requirements Regarding the Project Planning and Construction Of Coal Fired Power Plants Issued By NDRC of China* (file No. NDRC-Energy [2004]864).

According to AM0029 methodology, the alternative baseline scenarios need not consist solely of power plants of the same capacity, load factor and operational characteristics.

⁹⁵ Appendix 5 of *Projected Costs of Generating Electricity-2005 Update*, International Energy Agency



The three scenarios identified in Step 1 above could provide similar service by generating comparable peak power (i.e. 2,800,000MWh/a) in terms of methodology requirements despite different operational hours and load factors (positively correlated to the operational hours) among the scenarios.

The detailed parameters and assumptions of levelized cost analysis for three alternatives are given in the Table B4-1:

Table B4-1 Main Parameters and Assumptions for Levelized Cost Analysis

Item	Unit	Alternative 1	Alternative 2	Alternative 3
Investment	RMB/KW	3,161	3,723 ⁹⁶	3,919
Annual operation hours	H	3,500	5,000	5,000
Water expenditure	RMB/MWh	0.5	1	1
Material expenditure	RMB/MWh	8.5	5	5
Maintenance cost rate	%	2.5%	2.5%	2.5%
Other expenditure	RMB/MWh	11	10	10
Pollution discharge fees	RMB per unit	-	3,130,000	5,680,000
Number of staff		80	234	247
Salary and welfare	RMB/year/person	64,200	80,000	80,000
Fuel consumption rate	m ³ /kWh (g standard coal/kWh)	0.2058	336.66 ⁹⁷	299
Fuel price	RMB/m ³ gas RMB/ton coal	1.10 (In VAT)	430(In. VAT)	430(In VAT)
Desulfurization expenditure	RMB/ton coal	-	3.64	3.64
Discount rate	-	8%	8%	8%
Technical Lifetime	Years	20	20	20
Construction period	Years	2	3	4
Levelized cost	RMB/kWh	0.3509	0.2382	0.2548

Detailed information on the selected parameters is provided in *Annex 5- Table C2: LEGC Related Parameters of 600MW Coal-Fired Power Plants and the Proposed Project*.

According to the <Design Index>, the designed annual operating hours ought to be 5000 hours for coal-fired power units and 3500 hours for the NGCC projects in China.

Nanjing project is of 2*390 MW NGCC units with a designed annual operation of 3,500 hours, resulting in an electricity output of about 2,800,000MWh/a. Given the principle of “provide outputs or services comparable with the proposed CDM project activity” for identification of baseline alternatives, 1*600MW coal-fired plant was therefore identified as a baseline alternative, which

⁹⁶ The unit investment for super critical units is commonly 3%~10% higher than sub-critical units. In the PDD, the unit investment of 600MW sub-critical units is assumed as 95% of super critical units, which is reasonable.

<http://www.powersafety.com.cn/default/Article/tech/hdjs/200805/39763.html>

⁹⁷ Data source: same as footnote 2



provides comparable electricity output ($600\text{MW} \times 5000\text{hrs} = 3,000,000\text{MWh/a}$) with the proposed project ($780\text{MW} \times 3500\text{hrs} = 2,800,000\text{MWh/a}$).

Therefore, the current approach for LEGC comparison respects the principle of ‘comparable output’, and also reflects the actual operation hours in design standard for both coal-fired power units and NGCC projects in China.

In order to ensure the calculation of the LEGC is conservative, a further calculation was conducted in which the annual operation hours of the sub-critical and super-critical coal-fired power plants are 3,500 hours, i.e. the same as the Proposed Project. The EGC of the Proposed Project, the 600MW sub-critical, and super-critical coal-fired plant as alternatives are calculated respectively and the results are provided below:

	Annual Operation Hours	EGC (RMB/KWh)
Sub-Critical Power Plant 600 MW	3500	0.2471
	5000	0.2382
Super-Critical Power Plant 600 MW	3500	0.2975
	5000	0.2548
The Proposed Project 2x390 MW	3500	0.3509

As shown in the Table B4-1 and above, a new 600MW sub-critical has the lowest LEGC of RMB0.2382/kWh. In contrast, the LEGC of a new 600MW super-critical coal-fired power plant is RMB0.2548/KWh, while for the Proposed Project the LEGC is the highest at RMB0.3509/KWh.

Therefore, the construction of a 600MW sub-critical coal-fired power generation plant is the most economically attractive of the 3 options, and is therefore preselected as the appropriate baseline.

Sub-step 2: Sensitivity analysis of the indentified plausible scenarios

In order to test the robustness of the LEGC calculations, sensitivity analysis is performed. The fuel expenditure and load factor are selected as sensitive indicators to test the financial attractiveness for three alternative baseline scenarios. When these two sensitive indicators are changed in a range of 10%, the LEGC is as follows:

Baseline scenario	LEGC	Load Factor			
	(RMB/KWh)	-10%	-5%	+5%	+10%
600MW Sub-Critical Coal-Fired Power Plant	0.2382	0.2473	0.2425	0.2343	0.2308
600MW Super-Critical Coal-Fired PowerPlant	0.2548	0.2657	0.2600	0.2502	0.2459
The Proposed Project (2x390MW)	0.3509	0.3613	0.3558	0.3464	0.3424

Baseline scenario	LEGC	Fuel cost			
	(RMB/KWh)	-10%	-5%	+5%	+10%
600MW Sub-Critical Coal-Fired Power Plant	0.2382	0.2268	0.2325	0.2440	0.2497
600MW Super-Critical Coal-Fired PowerPlant	0.2548	0.2438	0.2493	0.2603	0.2658
The Proposed Project (2x390MW)	0.3509	0.3296	0.3403	0.3615	0.3722

The analysis above shows that Alternative 2 is consistently identified as the most economically attractive baseline scenario under various scenarios.



Hence, the Alternative 2, i.e. construction of a new sub-critical coal-fired power plant with an installed capacity of 1*600MW is confirmed as the most plausible baseline scenario.

As required by the EB Request for Review, the suitability of the input values applied in the calculation of the levelised cost of electricity production of each plausible alternative and IRR analysis in line with paragraph 109 of VVM and also an explanation of why sensitivity analysis was not conducted on all other parameters of the levelised cost of electricity production, such as annual operation hours and electricity tariff, have been included in this revised PDD (versions 06.3), as follows:

A) a cross-check of the suitability of the input values in the LEGC of each alternative

According to AM0029, the most attractive applicable alternative to the proposed project activity is to be identified using investment analysis. In order to do this the Levelised Electricity Generation Cost (LEGC) of all plausible alternatives have been calculated and compared⁹⁸.

The alternative with the lowest LEGC was the 600MW sub-critical coal fired power, and this has therefore been selected as the appropriate baseline.

The data and parameters used to calculate the LEGC of these alternatives are explained in more detail below, and confirm the suitability of the input values used, and also confirm the correct selection of the baseline.

The data and parameters used in the calculation of the IRRs and the LEGC of the proposed project not implemented as a CDM project (Alternative 1) have been taken from the FSR approved by the NDRC on 16th September 2005.

The data and parameters for the financial analysis of the alternatives to the Project – a 600MW sub-critical coal-fired power plant (Alternative 2) and a 600MW super-critical coal fired power plant (Alternative 3) – are taken from independent and recognised sources as follows:

- the *Thermal Power Engineering Design Reference Cost Index* (2005 Edition), issued by China Power Engineering Consulting Group Corporation, which is widely used by developers of power plants in China for the design and assessment of power generation projects; and
- the *Notice on Relevant Requirements Regarding the Project Planning and Construction Of Coal Fired Power Plants* (file No. NDRC-Energy [2004]864), issued by the NDRC of China.

According to AM0029 Version3, the alternative baseline scenarios selected should be capable of providing a similar service as the proposed project activity, but do not need to consist solely of power plants of the same capacity, load factor and operational characteristics.

⁹⁸ This is consistent with the 7 NGCC projects in China within the identified boundary of the East China Grid that have been registered under AM0029, which includes Wangting (CDM Ref 2383), Qishuyan (CDM Ref 2382), Zhangjiagang (CDM Ref 2439), Xiaoshan (CDM Ref 1343), Shanghai Baoshan (CDM Ref 1381), Zhenhai (CDM Ref 1344) and Yuyao (CDM Ref 1227).



In accordance with the requirements of the methodology, the three scenarios identified for determining the baseline are all capable of providing a similar service by generating a comparable level of peak-load balancing power (i.e. 2,800,000MWh per annum). The load factor (and thus operating hours) has been adjusted for Alternatives 1 and 2 so that the power output of the three alternatives is the same.

The detailed parameters and assumptions of the levelized cost analysis for the three alternatives are given in the Table B4-2 below:

Table B4-2 Main Parameters and Assumptions for Levelized Cost Analysis

Item	Unit	Alternative 1 – the proposed project	Alternative 2 – 600MW sub-critical coal fired power plant	Alternative 3 – 600MW super-critical coal fired power plant
Investment	RMB/KW	3,161	3,723 ⁹⁹	3,919
Annual operation hours	H	3,500	5,000	5,000
Water expenditure	RMB/MWh	0.5	1	1
Material expenditure	RMB/MWh	8.5	5	5
Maintenance cost rate	%	2.5%	2.5%	2.5%
Other expenditure	RMB/MWh	11	10	10
Pollution discharge fees	RMB per unit	-	3,130,000	5,680,000
Number of staff		80	234	247
Salary and welfare	RMB/year/person	64,200	80,000	80,000
Fuel consumption rate	m ³ /kWh (g standard coal/kWh)	0.2058	336.66 ¹⁰⁰	299
Fuel price	RMB/m ³ gas RMB/ton coal	1.10 (In VAT)	430(In. VAT)	430(In VAT)
Desulfurization expenditure	RMB/ton coal	-	3.64	3.64
Discount rate	-	8%	8%	8%
Technical Lifetime	Years	20	20	20
Construction period	Years	3	3	4
Levelized cost	RMB/kWh	0.3509	0.2382	0.2548

In order to confirm the suitability of the input values used in the calculation of the levelized cost of the different alternatives (the proposed project, the 600MW sub-critical and the 600MW super-critical coal-fired power plant), each alternative is cross-checked one by one below.

i) Alternative 1, the proposed project

The data used to calculate the levelized cost of the proposed project are taken from the FSR, which was approved by the NDRC on the 16th September 2005. This is consistent with the calculation of the IRR, as set out in section B.5 below.

⁹⁹ The unit investment for super critical units is commonly 3%~10% higher than sub-critical units. In the PDD, the unit investment of 600MW sub-critical units is assumed as 95% of super critical units, which is reasonable. <http://www.powersafety.com.cn/default/Article/tech/hdjs/200805/39763.html>

¹⁰⁰ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1051.pdf>



As a further cross-check for the LEGC calculations, the input values are also compared against the 2005 *Thermal Power Engineering Design Reference Cost Index*, which is published by China Power Engineering Consulting Group Corporation, which forms the basis for power plant development and design across China.

In addition to this, the data included in the latest edition of *Thermal Power Engineering Design Reference Cost Index (2008)* have also been included to provide a further cross-check of the continued suitability of the input values. Although the values may have changed in the 2008 version of the Index, and it would not be possible to have used these values in the LEGC calculation because they were not known at the time of publication of the PDD, nevertheless they are included here, but for illustrative purposes only.

TableB4-3: Cross-check of the calculation of levelized cost for Alternative 1

Item	Unit	the proposed project – 2x 390MW NGCC power plant		
		Parameters used in the LEGC calculation	< the Referenced Cost Index 2005 level>	< the Referenced Cost Index 2008 level>
Investment	RMB/KW	3,161	3,060	3,222
Annual operation hours	H	3,500	3,500	3,500
Water expenditure	RMB/MWh	0.5	1	0.5
Material expenditure	RMB/MWh	8.5	8	8
Maintenance cost rate	%	2.5%	2.5%	2.5%
Other expenditure	RMB/MWh	11	12	12
Pollution discharge fees	RMB per unit	-	-	-
Number of staff		80	120	100
Salary and welfare	RMB/year/person	64,200	80,000	80,000
Fuel consumption rate	m ³ /kWh (g standard coal/kWh)	0.2058	0.2120	0.2120
Fuel price	RMB/m ³ gas	1.10 (In VAT)	1.30(In VAT)	2.05(In VAT)
Desulfurization expenditure	RMB/ton coal	-	-	-
Discount rate	-	8%	8%	8%
Technical Lifetime	Years	20	20	20
Construction period	Years	3	3	3
Levelized cost	RMB/kWh	0.3509	0.3859	0.5399

As summarised in Table B4-3, it is demonstrated that the LEGC of the proposed project is lower than the guidance data from the *Thermal Power Engineering Design Reference Cost Index*. It can, therefore, be concluded that the input values used in the LEGC calculation of the proposed project are both reasonable and conservative.

ii. Alternative 2, the 600MW sub-critical coal-fired power plant

In accordance with common practice for power plant design in China, all the data for the LEGC calculation of Alternative 2 are taken from the *Thermal Power Engineering Design Reference Cost Index (2005)*. However, the *Index* only specifies the unit investment and fuel consumption for



300MW level sub-critical coal-fired plants. In order to be consistent in the comparison between alternatives, the unit investment for a 600MW level sub-critical coal-fired plant was sourced from publicly available research reports and the unit fuel consumption for the 600MW level sub-critical coal-fired plants was sourced from Chinese NDRC.

TableB4-4: Cross-check of the calculation of levelized cost for Alternative 2

Item	Unit	Alternative 2 600MW sub-critical coal fired power plant		
		Parameters used in the LEGC calculation	< the Referenced Cost Index 2005 level>	< the Referenced Cost Index 2008 level>
Investment	RMB/KW	3,723 ¹⁰¹	4,596	3,809
Annual operation hours	H	5,000	5,000	5,000
Water expenditure	RMB/MWh	1	1	0.5
Material expenditure	RMB/MWh	5	5	5
Maintenance cost rate	%	2.5%	2.5%	2.5%
Other expenditure	RMB/MWh	10	10	10
Pollution discharge fees	RMB per unit	3,130,000	3,130,000	3,130,000
Number of staff		234	234	234
Salary and welfare	RMB/year/person	80,000	80,000	80,000
Fuel consumption rate	g standard coal/kWh	336.66 ¹⁰²	315	329.94 ¹⁰³
Fuel price	RMB/m ³ gas RMB/ton coal	430(In. VAT)	430(In. VAT)	640(In VAT)
Desulfurization expenditure	RMB/ton coal	3.64	3.64	3.64
Discount rate	-	8%	8%	8%
Technical Lifetime	Years	20	20	20
Construction period	Years	3	3	3
Levelized cost	RMB/kWh	0.2382	0.2501	0.2945

As shown in table B4-4 above, the LEGC result of the Alternative2 is lower than the guidance data from the *Thermal Power Engineering Design Reference Cost Index* (2005). However, as mentioned above, *Index* provides guidance data (including total investment) for a 300MW level sub-critical coal-fired plant. Given that investment per unit of output is lower for a 600MW plant than a 300MW plant, it is reasonable that the LEGC of a 600MW level sub-critical coal-fired plant should be lower than that of a 300MW level plant. Therefore, the LEGC for Alternative 2 is considered suitable.

¹⁰¹ The unit investment for super critical units is commonly 3%~10% higher than sub-critical units. In the PDD, the unit investment of 600MW sub-critical units is assumed as 95% of super critical units, which is reasonable (please refer to footnote 99 for link to source).

¹⁰² Please refer to footnote 100.

¹⁰³ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081231101111351.pdf>



iii) Alternative 3, the 600MW super-critical coal-fired power plant

All the data for the LEGC calculation of Alternative 3 are from the *Thermal Power Engineering Design Reference Cost Index* (2005).

TableB4-5: Cross-check of the calculation of levelized cost for Alternative 3

Item	Unit	Alternative 3 600MW super-critical coal fired power plant		
		Parameters used in the LEGC calculation	< the Referenced Cost Index 2005 level>	< the Referenced Cost Index 2008 level>
Investment	RMB/KW	3,919	3,919	3,724
Annual operation hours	H	5,000	5,000	5,000
Water expenditure	RMB/MWh	1	1	0.5
Material expenditure	RMB/MWh	5	5	5
Maintenance cost rate	%	2.5%	2.5%	2.5%
Other expenditure	RMB/MWh	10	10	10
Pollution discharge fees	RMB per unit	5,680,000	5,680,000	5,680,000
Number of staff		247	247	247
Salary and welfare	RMB/year/person	80,000	80,000	80,000
Fuel consumption rate	g standard coal/kWh	299	299	299
Fuel price	RMB/m ³ gas RMB/ton coal	430(In VAT)	430(In VAT)	640(In VAT)
Desulfurization expenditure	RMB/ton coal	3.64	3.64	3.64
Discount rate	-	8%	8%	8%
Technical Lifetime	Years	20	20	20
Construction period	Years	4	4	4
Levelized cost	RMB/kWh	0.2548	0.2548	0.3021

As shown in Table B4-5, all of the data used in the calculation of the LEGC for Alternative 3 are the same as the guidance data from the *Thermal Power Engineering Design Reference Cost Index* (2005). Therefore, the input values used in the LEGC calculation of the Alternative 3 are considered to be suitable.

In sum, from the detailed cross-checking of the input values to calculate the levelized cost of each alternative, the suitability of the input values can be confirmed. It is also, therefore, confirmed that the 600MW sub-critical coal-fired power generation project is correctly identified as the baseline scenario¹⁰⁴.

¹⁰⁴ This is consistent with all other validated PDDs of registered CDM projects using AM0029 applied to NGCC power plants in China.



B) a discussion of why sensitivity analysis has not been conducted on all other parameters of the levelised cost of electricity production, such as annual operation hour and electricity tariff.

On the basis of the input values above, the LEGC for each alternative was calculated, and in order to test the robustness of these calculations, sensitivity analysis is conducted on the key parameters.

The formula¹⁰⁵ applied to calculate the levelised electricity generation cost (LEGC) is as follows:

$$LEGC = \frac{\sum_t [(I_t + M_t + F_t)(1+r)^{-t}]}{\sum_t [E_t(1+r)^{-t}]}$$

Where:

LEGC: Average lifetime levelised electricity generation cost per KWh.

It: Capital expenditure in the year t.

Mt: Operation and maintenance expenditures in the year t.

Ft: Fuel expenditure in the year t.

Et: Electricity generation in the year t.

r: Discount rate.

In accordance with the Guidance on Investment Analysis, only variables that constitute more than 20% of the total project costs should be subjected to reasonable variation under the sensitivity analysis.

Each variable in the LEGC is discussed in turn below:

Ft: Fuel expenditure accounts for 70.69% of all the expenditure elements. It is, therefore, recognised as one of the most important factors that would affect the LEGC, and sensitivity analysis has been conducted on this parameter in the PDD.

Et: Electricity Generation as the denominator in the above formula for LEGC calculation, electricity generation is also recognized as a key factor that would affect the LEGC. In the PDD, sensitivity analysis was conducted on Electricity Generation by adjusting the load factor of each alternative. Load factor is a linear variable of Electricity Generation, as demonstrated below:

Electricity Generation = operation hours x installed capacity.

This equation can also be written as follows:

Electricity Generation = load factor x 8760hrs x Installed Capacity

This also addresses the question raised by the EB regarding the inclusion of operating hours in the sensitivity analysis, as load factor = operation hours/8760hrs (8,760 is the total number of hours in a year).

Therefore, it can be confirmed that sensitivity analysis has already been conducted on Electricity Generation (and thus operating hours) in the PDD.

¹⁰⁵ Appendix 5 of Projected Costs of Generating Electricity-2005 Update, International Energy Agency



It: Capital expenditure only occurs during the construction period and will not affect the operational costs and power output of the projects. Further, it only accounts for about 14.77% of the total costs. It was, therefore, not defined as key factor that would affect the LEGC in the PDD, and was not subject to sensitivity analysis. However, for clarification purposes, it has been included in the updated sensitivity analysis below.

Mt: The Maintenance Costs account for 14.54% of the total costs. Thus, it too was not defined as key factor that would affect the LEGC in the PDD, and was not subject to sensitivity analysis. However, for clarification purposes, it has also been included in the updated sensitivity analysis below.

r: The discount rate applied is the same as the benchmark for the investment analysis, which equals to 8%. Thus, as it is a fixed value, it is not selected to be a factor for sensitivity analysis.

Electricity Tariff: As seen from the formula above, the calculation of levelised electricity generation cost (LEGC) seeks to determine the *cost* of producing one unit of electricity, and includes capital expenditure, operation and maintenance expenditures, fuel expenditure and electricity generation. As a revenue, “electricity tariff” is not an element of the calculation of LEGC. Therefore, the sensitivity analysis for LEGC does not cover electricity tariff.

In order to further demonstrate that the LEGC calculations are robust, sensitivity analysis has been conducted on the following parameters: load factor (and thus Et), fuel costs (Ft), Capital Investment (It), and Maintenance Costs (Mt). The results of the sensitivity analysis are shown as below:

		Load Factor (Et)				Fuel Cost (Ft)			
Type	EGC	-10%	-5%	5%	10%	-10%	-5%	5%	10%
600MW Sub critical Plant	0.2382	0.2473	0.2425	0.2343	0.2308	0.2268	0.2325	0.2440	0.2497
600MW super critical Plant	0.2548	0.2657	0.2600	0.2502	0.2459	0.2438	0.2493	0.2603	0.2658
The Proposed Project	0.3509	0.3613	0.3559	0.3465	0.3424	0.3296	0.3403	0.3616	0.3722
		Capital Investment (It)				Maintenance Costs (Mt)			
Type	EGC	-10%	-5%	5%	10%	-10%	-5%	5%	10%
600MW Sub critical Plant	0.2382	0.2300	0.2341	0.2423	0.2464	0.2341	0.2361	0.2403	0.2424
600MW super critical Plant	0.2548	0.2451	0.2499	0.2597	0.2646	0.2501	0.2525	0.2572	0.2596
The Proposed Project	0.3509	0.3415	0.3462	0.3556	0.3603	0.3465	0.3487	0.3531	0.3553

As shown in the table above, under all of the sensitivity analysis scenarios, varying the selected key parameters in the range -10% to +10%, it can be confirmed that the LEGC of the 600 MW sub-critical coal-fired power plant remains the lowest. Thus, it can be further confirmed that 600 MW sub-critical coal-fired power plant should be selected as the baseline scenario.

Conclusion:

As has been demonstrated above, the input values used in the calculation of the project IRRs and the LEGC of the proposed project and the alternative baseline scenarios are confirmed to be suitable and conservative, and the selection of a 600MW sub-critical power plant as a baseline alternative is reasonable.

The sensitivity analysis further confirms robustness of the LEGC and the selection of the 600MW sub-critical power plant as the appropriate baseline.

**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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In order to demonstrate the additionality of the Proposed Project, the steps prescribed in “Tool for the demonstration and assessment of additionality” (Version 05.2 25th July 2008) have been used.

A detailed explanation of the major steps in the implementation of the Proposed Project and its development as a CDM project is set out below in the timeline. The timeline clearly demonstrates that the Project Owner seriously considered the CDM prior to the start date of the Project activity.

During 2003 and 2004, the Project Owner’s parent company – Huaneng Power International (“Huaneng”) – participated in a number of CDM capacity building initiatives, and began to develop internal capacity to evaluate and develop CDM within its portfolio of potential power generation projects. Of these capacity building initiatives, the most significant was organized by the World Bank together with China’s Ministry of Science and Technology and the German and Swiss Governments. The World Bank program undertook an in-depth study of CDM potential in China, and in June 2004 produced an extensive report called “Clean Development Mechanism: Taking a Proactive and Sustainable Approach” (“the World Bank Study”), which identified six individual projects as case studies for the design of new CDM methodologies. One of the six case studies included in the study was a Huaneng power plant. Two other case studies involved fuel switching to natural gas and included an NGCC plant in Beijing, the Beijing Number Three Thermal Power Plant which was subsequently registered by the EB.

The Proposed Project had originally been conceived in 2003, but was shelved when the FSR, which was prepared for a 3x 390MW, showed unattractive financial returns. After the findings of the World Bank Study were published in June 2004, Huaneng became more confident that CDM could offer an opportunity for enhancing the returns of the Proposed Project and embarked on more specific assessments of the value that might be recovered through the application of the CDM to this Project.

Towards the end of 2004, Huaneng began developing a deeper understanding of the financial impact of the CDM on the Proposed Project, and at the same time began to take preparatory steps to develop the Proposed Project. They commissioned Hebei Electrical Design Institute to prepare a Supplement to the original FSR to consider an amendment in the design of the Proposed Project from 3x 390MW to 2x390MW.

Following the formal publication of the proposed methodology for NGCC projects (NM0080) in November 2004, Huaneng took further measures to develop the learning obtained during its participation in the World Bank Study with regard to applying CDM to its portfolio of projects, and in early December 2004, Huaneng Head Office called a meeting to discuss CDM. This meeting, held on 15th December 2004, was attended by CDM consultants and academics, and in the presentations given at that time, calculations of the potential CDM revenue from NGCC projects were discussed.

In the same month, Huaneng, together with the China National Technical Import Export Corporation (“CNTIEC”) collectively known as the “Huaneng Consortium”, and Harbin Power Equipment Corporation and General Electric collectively known as the “GE Consortium” negotiated the terms of purchase for 3 units of 390MW natural gas powered generation sets. The parties subsequently initialled an equipment purchase agreement for the 3 units on 3rd December 2004. However, this agreement was conditional on the receipt of all Government approvals and receipt of written confirmation from the Buyer (Huaneng Consortium) to the Seller (GE Consortium) that such approvals had been received. This agreement was subsequently amended to reduce the number of



units from 3 to 2 on 26th April 2005, but all other provisions – including the conditionality clauses – remained unchanged.

Also in the same month, on 29th December, 2004, the Project Owner initialled an agreement for the supply of natural gas with PetroChina. As with the Equipment Purchase Agreement, however, the contract only became effective upon receipt of all Government approvals.

It was not until 16th September, 2005, that the NDRC issued its formal approval of the Project and on 30th September, 2005, CNTIEC, on behalf of the Huaneng Consortium wrote to the GE Consortium to confirm that all the conditions had been met and that the Contract had become binding on all parties. Therefore the effective date of the gas supply agreement was not until 16th September, 2005, and 30th September, 2005 for the equipment purchase contract. Furthermore, the NDRC approval required the Project Owner to secure sufficient debt to fund 75% of the overall project cost. Debt financing and financial closure was not achieved until 3rd December, 2005.

On 25th June, 2005, the Project Owner signed a Construction Contract for 2x390MW power station with the Jiangsu Number Three Electric Power Construction and Engineering Corporation. Since this constitutes the first real action on starting the project, this date has been selected as the start-date of the Proposed Project, despite the fact that the necessary government approvals had not been received and financial closure did not occur until five months later when the required bank loans were put in place.

Prior to the signing of the Construction Contract, the Project Owner seriously considered the CDM, and resolved to proceed with the Proposed Project based on the financial benefits from the sale of CERs.

After receiving the Supplement to the FSR in April 2005, which showed that the project return still could not meet the industry benchmark, the Project Owner's management considered the financial benefits of the CDM at a management meeting on 10th May, 2005. During this meeting it was noted that the CDM had the potential to increase the project returns to above the industry benchmark and decided to seek approval to proceed with CDM development at the next meeting of the Project Owner's Board of Directors.

On 15th June, 2005, the Board of Directors resolved to implement CDM since it appeared capable of raising the expected returns on the Proposed Project to above the benchmark level. It was after this decision to implement the CDM that the Project Owner signed the Construction Contract and commenced real action on the Proposed Project.

After the Proposed Project started, continuous actions were taken to secure CDM status in parallel with project implementation, including signing contract with CDM consultant and validation DOE; applying for Letter of Approval from China DNA and UK DNA and negotiation related to sale of potential CERs etc. Following these actions, there was a delay in the formal progress of this project towards Registration. This was as a result of a dispute which arose between the original CDM consultant and the Project Participants. In April 2009, the Project Participants agreed that Gaisi Peony Carbon Capital S.a.r.L. would be responsible for completing the PDD and validation process and submitting the Project for Registration. Following this, a new validation contract was executed between TUV Rheinland and Gaisi Peony Carbon Capital S.a.r.L. on 8th May 2009, and the validation site re-visit took place on 6th – 7th July 2009.

This sequence of events demonstrates serious consideration of the CDM prior to the start date of the



Proposed Project and continuous real actions in parallel with project implementation to secure CDM status of the Proposed Project.

Timeline of the Proposed Project

Project Implementation	CDM Development
5 Mar 2003: State Development and Planning Commission approved the Preliminary Project Proposal and requested Huaneng Power International (“Huaneng”) – the Project Owners parent company - to carry out a formal Feasibility Study Report (FSR) for the NGCC project and submit it for regulatory approval. June 2003: preliminary FSR was drafted by Central Southern Electric Power Design Institute for a 3x390MW natural gas fired power station but never finalised. 19 May 2004: Towards the completion of the World Bank capacity building program highlighted opposite, Huaneng decided to establish the Planning Office for the Nanjing NGCC project to further evaluate the feasibility of the project. 7 June 2004: An official document <i>Notice on Natural Gas price</i> issued by Nanjing Price Bureau, showed that the guiding price of natural gas for industrial consumers in Nanjing City was set at 2.00 RmB/m³. Since this level was much higher than the 1.31 RmB/m³ assumed in the Preliminary Project Proposal, Huaneng began to have concerns about the financial viability of the project and started to evaluate alternatives options which might increase the financial returns. 3 Dec 2004: Equipment Purchase Agreement: (No.: HMR-24002-002CE/04US01GTA01XC0017) was initialled between Huaneng, CNTIEC (China National Technical Import Export Corporation, Huaneng’s import agent and collectively the “Huaneng Consortium”) and a suppliers consortium including General Electric and Harbin Power Equipment	2003 to June 2004: Huaneng Power International (“Huaneng”) – the Project Owner’s parent company – was a key participant in a major World Bank study aimed at developing the CDM in China, which included templates that could be used to evaluate financial benefits available from the application of CDM to NGCC plants. June 2004: The findings of the World Bank study were published in the report called “Clean Development Mechanism: Taking a Proactive and Sustainable Approach”. The Report included 6 case studies for the design of new CDM methodologies. One of the six case studies included in the study was a Huaneng power plant. Two other case studies involved fuel switching to natural gas and included an NGCC plant in Beijing. 17 Nov 2004: Release of a new methodology for NGCC on the EB website (NM0080) for public comment. 2 Dec 2004: HPI attended a bilateral CDM roundtable and made public statement about its CDM considerations.



Corporation (the “GE Consortium). The Contract (which was initialled but not formally signed at this date) included clauses that stated that the contract was only to be valid at Huaneng Buyer Consortium’s option (subject to GE Consortium receiving a written notice from Huaneng Buyer Consortium that all preconditions had been satisfied.) This Contract envisaged the purchase of 3x390MW power generation sets, but it was not formally signed as further considerations on financial feasibility were required by Huaneng before any final decision was made.

29 Dec 2004: Gas Supply Agreement signed: a preliminary supply contract was initialled between the Project Preparatory Office (since at that time the Project Owner had not been incorporated) and PetroChina. The contract draft included terms whereby the Buyer was required to give notice of fulfilment of certain conditions prior to the contract becoming effective, including the receipt of all approvals required for the power plant to enter normal operations.

2 Feb 2005: the Project Owner obtained a temporary Business Licence with registered share capital of RmB 50,000,000, with an operating term of one year only and limited business scope described as “preparation of power plant project (specific business scope to be decided after obtaining the approval certificate).

19 April 2005: In order to reduce the commercial risk of the proposed project to a relative controllable level, Huaneng had requested Hebei Electrical Design Institute to conduct a feasibility study in which the investment was reduced to include two rather than three generating sets of 390MW capacity and on this date, the Supplement to the original FSR was presented in Beijing to Huaneng and the Project Owner.

26 Apr 2005: Equipment Purchase Agreement of 3rd December, 2004 was amended by “Contract Amendment Number One” whereby the Project Owner took over the rights and obligations of Huaneng and the number of generator sets to be purchased was changed from three to two. This Contract was formally signed but remained conditional on the Huaneng Consortium notifying the GE Consortium of fulfilment of all conditions set out in the contract, including receipt of all necessary approvals by the Chinese Government. At this stage, financial closure had not occurred.

15 Dec 2004: A CDM workshop was further convened in Beijing by Huaneng with academics and consultants where methodologies and projections of the potential financial benefits of CDM were considered, including those related to NGCC projects.

10 May, 2005: Project Owner’s management considered the financial returns from the project. Meeting minutes record that management reviewed calculations that showed CDM income could increase returns from the 6% shown in the Supplement to the FSR to more than 13%. Management decided that a CDM development plan was to be submitted to the Board of Directors



25 Jun 2005 (the start-date of the project at which the implementation, or construction, or real action of the project activity began): Construction contract signed between the project Owner and Jiangsu Number three Electrical Power Construction and Engineering Corporation.

28 Jun 2005: Civil construction started

16 Sep 2005: Feasibility Study Report with the final design of the Proposed Project with two generating sets was formally approved by the NDRC. Thus, the Project Owner was in a position to notify the counterparties to the major contracts that the main pre-conditions had been satisfied.

Sep 2005: Grid connection agreement signed with Jiangsu Power Company.

30 Sep 2005: Huaneng Buyer Consortium, through its import agent, CNTIEC, formally notified the GE Consortium of the satisfaction of all conditions to the equipment purchase agreement and that the contract therefore became binding on all parties.

3 Dec 2005: loan contract signed with Bank of Communications. Financial closure is achieved since adequate debt financing was secured to comply with the NDRC approval document and to meet the investment requirements of the Project.

28 Mar 2006: Civil construction completed.

30 Jun 2006: Generators in place.

23 Jul 2006: Gas Turbines in place.

7 Aug 2006: registered share capital of Huaneng Nanjing increased from RMB 50,000,000 to RMB 625,500,000, operating period extended to 2025, and business scope expanded to include all matters

as a key part of the project implementation plan.

15 June 2005 (date of final serious consideration of the CDM): Board Meeting by the Project Company made the formal decision to implement the proposed project with CDM based on internal report potential CDM benefit provided by the management team of the Project Company.

3 July, 2005: management meeting decided to deepen contacts with the fellow subsidiary already undertaking CDM so as to push CDM development into realisation.

27 July, 2005: management meeting reviewed the progress of fellow subsidiary and decided to engage the same consultant as its CDM project consultant.

11 Nov, 2005: Huaneng Group held meeting in Beijing to expedite practical implementation of CDM by the exchange of experience between subsidiaries within the Huaneng Group, pending release of the final methodology by the EB.

19 May 2006: The AM0029 -version 01.1 contained NM0080-rev and NM0153 was approved by EB and became valid.

22 Jun 2006: After clarification of the methodology, a CDM Service Agreement was formally signed to start work on developing the PDD.

20 Sep 2006: Letter of Invitation was sent to the selected potential Buyers for bidding proposals.



necessary for the operation of a power plant.

Nov 2006: HRSGs and Steam Turbines in place.

Nov 2006: Power Purchase Agreement signed.

Dec 2006: first 390MW unit put into commercial operation.

Mar 2007: second 390MW unit put into commercial operation.

23rd November, 2007: Maintenance Contract signed between Project Owner and GE.

10 Oct 2006: The Spanish utility Endesa Generacion S.A. submitted its bidding proposal, which was selected as the winning proposal for the CERs to be generated by the proposed project.

24 Oct 2006: Validation Contract signed between the CDM consultant and the DOE.

01 Sep 2006: The PDD was finalized for the 30-day Global Stakeholder Publication on the internet.

14 Dec 2006: Draft Validation Report for the proposed project was issued by the DOE.

15 Jan 2007: The PDD and the CDM application documents were formally submitted to the Chinese DNA for approval.

5 Feb 2007: A China CDM Board Meeting Notice issued by the Chinese DNA to inform the owner of the proposed project for attending the meeting held by the China CDM Board.

9 Feb 2007: The PDD was reviewed by the China CDM Board Meeting, and was approved at the Meeting as announced on the official website of the Chinese DNA.

28 Mar 2007: Gaisi Peony Carbon Capital s.a.r.l and Credit Suisse International replaced Endesa as the CERs Buyer for the proposed project by signing the Letter of Intent with Huaneng.

22 May 2007: The Official Letter of Approval was issued in the 22 May by the Chinese DNA.

12 Dec 2007: LOA was issued by UK's DNA.

23 Feb 2008: Confirmation from original PDD consultant that validation of Nanjing project would proceed only after Zhengzhou and Shanghai Baoshan NGCC CDM projects had been submitted to the EB for Registration.

27 Aug 2008: Contract signed between Gaisi Peony Carbon Capital S.a.r.L and Perenia Carbon Pty for third party review of Nanjing PDD.

25 Nov 2008: Credit Suisse voluntarily withdraws from the project activity.

28 Apr 2009: Huaneng Power International issues Letter of Authorization for Gaisi Peony Carbon Capital S.a.r.L. to assume



	responsibility for preparation of the PDD. 8 May 2009: new Validation Contract signed between TUV Rheinland and Gaisi Peony Carbon Capital S.a.r.L. 6-7 Jul 2009: Validation site re-visit.
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The response to the Request for Review regarding the suitability of the chosen start-date is incorporated in this revised version of the PDD (version 06.3) for further clarification:

In response to the review question, (i) the definition of the Start Date in the CDM Glossary of Terms has been checked, (ii) the dates and contents of the key contracts have been reviewed; and (iii) the relevant parts of Chinese legislation and planning regulations have been summarised, as follows:

According to the Glossary of CDM Terms (V5):

“The starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project begins....In light of the above definition, the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. This, for example, can be the date on which the contracts have been signed for equipment or construction/operation services required for the project activity. Minor pre-project expenses, eg: the contracting of services/payment of fees for feasibility studies or preliminary surveys, should not be considered in the determination of the start date as they do not necessarily indicate the commencement of the project.”

Therefore, the start date should be taken as the date when the project participant becomes committed to expenditures, excluding minor pre-project expenses, related to the implementation or construction of the project.

As set out in the timeline above, the key contracts for the project activity which involved a “commitment to expenditures related to the implementation or related to the construction of the project activity” were as follows:

- Equipment Purchasing Agreement, 3rd December, 2004,
- Gas Supply Agreement, 29th December, 2004,
- Amendment Number One to Equipment Purchasing Agreement, 26th April, 2005,
- Construction Contract, 25th June, 2005.

As explained below, the Equipment Purchase Agreement, the Gas Supply Agreement and the Amendment Number One did not become effective until September 2005 because:



- the contracts contained conditions which were not fulfilled until that time and were not effective under the Contract Law of the PRC, which states in Article 45 that *“the Parties to a Contract may stipulate conditions to the effectiveness of a contract. Contracts which contain conditions on the effectiveness of the contract become binding only on satisfaction of such conditions.”*¹⁰⁶
- Chinese regulations regarding the investment in power plant projects specifically require Government approval of the Feasibility Study Report (“FSR”) before contracts related to the projects become effective and the Project FSR was not approved until 16th September, 2005.

Conditions in the Contracts

Details of the relevant provisions of the Equipment Purchase Contract, its Amendment, and the Gas Supply Contract are set out below.

a. Equipment Purchase Contract and Amendment Number One

Clause 6 of the Equipment Purchase Contract states that:

6. The Contract shall become effective upon the date when all the following conditions are fulfilled:

- (1) Signing of the Contract by authorized representatives of both parties (including all members of both Parties);*
- (2) The Buyer’s receipt of the Performance Security furnished by the Seller according to the Contract;*
- (3) Obtaining approval and/or registration from the relevant authorities of both countries.*

The Buyer shall notify the Seller of the Effective Date of the Contract in written form.

The Equipment Purchase Contract was amended on 26th April, 2005, but the conditions set out in Clause 6 above were not affected.

The Equipment Purchase Contract cannot have become effective before the approval of the project by the relevant authority (the NDRC) which was issued on 16th September, 2005 and the date of the notification of effectiveness from the Buyer to the Seller which occurred on 30th September, 2005.

Therefore the Equipment Purchase Contract (as amended) was not effective before 30th September, 2005.

b. Gas Supply Contract

According to clause 11 of the Gas Supply Contract:

¹⁰⁶ Article 45, Contract Law of People’s Republic of China

*iii. Pre-conditions to Gas Supply*

- ii) Buyer shall have obtained a complete set of all government approval necessary for Buyer to meet its obligations under this contract, such approvals to be in a form acceptable to Seller, and Buyer shall supply to Seller in a form acceptable to Seller a written notice that Buyer has obtained such complete set of necessary government approvals.*

For this Gas Contract to be effective and financial obligations to arise, the buyer must have received all requisite Government Approvals to meet its obligations under the contract, and must provide written notice to the Seller that it has received such approvals. Therefore the contract cannot have been effective before approval of the project by the relevant authority (the NDRC) which was not issued until 16th September, 2005.

Thus the earliest date at which the Project signed an unconditional contract involving a financial commitment related to the implementation or construction of the project activity, was the signing of the Construction Contract which occurred on 25th June, 2005.

Regulations Governing Construction of Power Plants in China

As explained below, the construction of basic infrastructure projects in China is governed by a series of regulations promulgated by the Chinese Central Government and administered by the National Development and Reform Commission (“NDRC”). These regulations provide that commitments to expenditure for equipment or material supply on infrastructure and power projects cannot be made until the NDRC has approved the FSR. In the case of the project activity, the NDRC approved the FSR on 16th September, 2005.

These regulations are summarised as follows:

- Notice on Strict Implementation of Approval Procedures for Basic Construction Projects issued by the NDRC on 29th July, 1999, document [1999] 693.

This regulation requires that all basic infrastructure projects must prepare feasibility study reports for review and approval by the NDRC. In particular, Article 3 of the regulations stipulates that:

“All enterprises...must strictly implement national regulations and only after approval of the project Feasibility Study Report by the relevant departments can formal contracts be signed for equipment purchase or material supply, and before the approval of the feasibility study report effective contracts may not be entered into.”

- Notice on Strictly Implementing State Regulations on Power Plant Projects from the China Electricity Council dated 7th December, 2001

Paragraph 4 of this regulation stipulates that for all power plant projects in China, the selection of equipment and project design can only be finalised after approval of the Feasibility Study Report by all of the relevant government departments, which includes the NDRC.



- Decision of the State Council on Reform of the Investment System issued by China's State Council on 16th July, 2004, document [2004] 20

Section 3.4 of this decision requires that all relevant construction projects submit a Project Proposal Document and Feasibility Study Report for government approval. In Section 5.2.1 of the attachment to the decision, it states specifically that:

“Thermal power plant projects need to be approved by State Council's relevant department which is responsible for investment approval (NDRC).”

- Interim Procedures for Examination and Approval of Enterprises' Investment Projects issued by NDRC on 15th September, 2004

Article 2 refers to the attachment to the document in the paragraph above, thereby confirming that the regulation applies to thermal power plants.

Article 22 states that for projects that have not been properly approved, local government organizations should not proceed with necessary applications for land use and construction, and financial institutions should not release loans for such projects.

Article 27 states that for those projects that have started construction prior to proper approval, the construction shall be halted and legal action shall be taken against the responsible persons.

Conclusion: since:

- i) the effectiveness of the Equipment Purchase Contract and the Gas Supply Contract were conditional upon the occurrence of specific events, which cannot have taken place before 16th September, 2005 and,
- ii) the specific regulations regarding investment in power plants stipulate that no contract for the procurement of equipment or materials or construction of power plants are valid until properly approved by government authorities and such approval must include approval of the FSR by the NDRC,

It is confirmed that the earliest date at which the project entity made a commitment to expenditures related to the implementation or related to the construction of the project activity was the signing of the Construction Contract which occurred on 25th June, 2005. Although arguably this contract was not binding until the project was fully approved by the NDRC on 16th September 2005, since it does not contain any explicit conditionality clauses, for the sake of conservativeness, this has been taken as the Start Date of the Project.

In order to further confirm the suitability of the start-date, this understanding of these contracts has been further confirmed by engaging independent legal advice from two leading law firms, one which is a leading PRC law firm, and another which is one of the largest leading global law firms. Details of the law firms and their advices are as follows:

- **Fangda Partners LP** is a leading PRC law firm with offices in Beijing, Shanghai and Shenzhen, and is authorized to practice law by the PRC Ministry of Justice. Fangda has confirmed that the Equipment Contract and its Amendment, and the Gas Purchasing



Contracts did not create any financial obligations for the PP until after the NDRC approval in September 2005. It states that:

“Upon my review of the above documents and based on my understanding of the PRC laws and regulations, I conclude that:

- (a) the buyer’s obligation to pay the seller for the natural gas under the Gas Purchase Agreement was not triggered before the NDRC Approval was granted in September 2005; and*
- (b) the buyer’s obligation to pay the seller for the equipments under the Equipment Contract was not triggered before the NDRC Approval was granted in September 2005.”*

- **Baker & McKenzie** is one of the largest law firms in the world. It has also reviewed the Gas Turbine Purchase Contract, its Amendment and the NG Supply Contract and concurs with the view above that the contracts do not create any obligation for the Project until after the NDRC approval. Its legal advice states that:

“On the basis of the foregoing... we are of the opinion that:

- (a) the rights and obligations of the buyer and seller with respect to the supply of natural gas under the Natural Gas Purchase Agreement did not become effective before 16 September 2005, which is the date of the NDRC Approval;*
- (b) the Power Plant Equipment Contract did not become effective before 16 September 2005, which is the date of the NDRC Approval;”*

These independent judgements by legal experts confirm that the dates of signing either of these conditional contracts cannot constitute the Start Date for the project because they did not commit the PP to any expenditures.

This approach is consistent with the CDM Glossary of Terms. It is also worthy of note that this approach is consistent with the approach in eight out of the nineteen registered CDM projects in China that use AM0029 and which had signed conditional contracts before their respective Start Dates. These projects are set out in the table below, which shows the date of signature of conditional contracts and the subsequent Start Date for each of these Projects as stated on the UNFCCC website. It is our understanding that it is not uncommon in China to sign conditional contracts and this type of conditional signing often takes place at ceremonies that may coincide with visits by foreign or local dignitaries, or the completion of other important projects in the locality.



The other CDM Projects which signed conditional contracts before their respective Start Dates are as follows:

CDM Ref	Project Name	Date of Conditional Contract	Subject of Conditional Contract	Validated Start Date
1373	Beijing Number Three Thermal Power Plant	6-Mar-04	Equipment Purchase	18-Mar-05
1381	Shanghai Baoshan NGCC Power Plant	10-Oct-04	Equipment Purchase	28-Feb-05
1859	Fujian Putain LNG Power Plant	20-Aug-05	Gas Purchase	15-Mar-06
1884	Guangdong Huizhou LNG Power Plant	5-Apr-04	Gas Purchase	23-Sep-04
1898	Fujian Jinjiang LNG Power Plant	20-Aug-05	Gas Purchase	19-Oct-06
1915	Guangdong Shenzhen Qianwan LNG Plant	1-Mar-03 30-Apr-04	Equipment Purchase Gas Purchase	18-Aug-04
2344	Zhumadian NGCC Power Plant	12-Oct-04	Equipment Purchase	6-Jun-05
2439	Zhangjiagang NGCC Plant	3-Jun-03	Equipment Purchase	29-Dec-04

The following section further justifies that the civil construction contract is a legal and effective contract, given that it was signed before the approval of the FSR by the government:

- I. *Notice on Strict Implementation of Approval Procedures for Basic Construction Projects [1999] 693 (the “Approval Procedure Notice”), and,*
- II. *Interim Procedures for Examination and Approval of Enterprises Investment Projects [2004] 19 (the “Approval Measures”).*

According to Article 3 of the Approval Procedure Notice:

“All enterprises...must strictly implement national regulations and only after approval of the project Feasibility Study Report by the relevant departments can formal contracts be signed for equipment purchase or material supply, and before the approval of the Feasibility Study Report effective contracts may not be entered into.”

This Article clearly states that formal contracts for equipment purchase and material supply cannot be signed prior to the NDRC approval, but in contrast to equipment purchase and material supply contracts, it does not address Construction Contracts. We made the most conservative interpretation of this Article when choosing the Start Date during the validation process and considered during the validation process that Article 3 did not make the signed Civil Construction Contract ineffective or void nor was it subject to preconditions. Since the Construction Contract was valid and effective as at the date of signing (25th June 2005), this is the earliest date at which irrevocable and real action towards project implementation occurred.

This view that the “Approval Procedure Notice” and the “Approval Measures” do not invalidate the Civil Construction Contracts has subsequently been confirmed by both Fangda Partners and Baker & McKenzie – the two independent law firms described above.

In its opinion, Fangda Partners stated that:



“Upon my review of these regulations [Approval Procedure Notice and Approval Measures], I am of the opinion that neither of them shall invalidate a construction contract that is duly concluded by the parties under Chinese law”.

This view is reaffirmed by Baker & McKenzie who state that...

“(c) Neither Article 3 of the Approval Procedure Notice nor Articles 22 and 27 of the Approval Measures apply to render the Civil Construction Contract void or affect its effectiveness, and there are no specific provisions in the Civil Construction Contract which require NDRC Approval prior to its effectiveness.”

Both of these opinions reaffirm the conclusion that 25th June 2005 is the correct Start Date for the Project.

It is also worth noting that according to Articles 22 and 27 of the Approval Measures, a project which does not first go through the required process of obtaining various government approvals, or omits any important steps along the process may face serious consequences, including the need for rectification, fines or in serious cases complete shut down. Similar sanctions are available in respect of a breach of Article 3 of the Approval Procedure Notice.

There are many examples of the Chinese government carrying out such administrative penalties against those projects. For example, as reflected by the China Review News Online, in July 2005 the NDRC, together with the Ministry of Land and Resources, Ministry of Water and the Environmental Protection Bureau, ordered the suspension of construction of 32 power plants, totaling 17GW of installed capacity¹⁰⁷. The project activity, in contrast, did not experience any form of administrative penalties by the NDRC. Construction was completed smoothly in December 2006, when the first unit was commissioned.

This provides further support to the conclusion that the Civil Construction Contract was valid on signing, and that the correct Start Date for the Project is therefore 25th June 2005.

Conclusion

On the basis of careful review of the contents of the key contracts, along with the formal opinion of two independent law firms, it can be confirmed and agreed by the validation team that:

- the Gas Turbine Purchase Contract, its subsequent Amendment and the NG Supply Contract contained pre-conditions which meant that the PP did not commit to expenditures under the contract until after the NDRC approval was received on 16th September, 2005 and the PP had confirmed the effectiveness of the contract to the supplier in written form;
- neither the Approval Procedure Notice nor the Approval Measures impact on the legality or effectiveness of the Civil Construction Contract,

¹⁰⁷ China Review News, “China faces another round of electricity oversupply due to the construction of unapproved power plants”,

<http://www.chinareviewnews.com/doc/1002/7/6/4/100276402.html?coluid=10&kindid=253&docid=100276402&mdate=0911123624> - see VR Ref./N47/



- the Civil Construction Contract did not include pre-conditions which required the NDRC approval prior to becoming effective; and
- the Project construction and operation has proceeded smoothly without any government administrative penalties.

Therefore, as per the Glossary of CDM Terms, we reconfirm the prior conclusion that the Start Date of the project activity is 25th June, 2005, which is the date of signing of the Civil Construction Contract.

In order to demonstrate the first payments related to the project and those under the gas turbine purchase agreement, NG supply contract and civil construction contract, the the payment records, invoices and receipts of the project owner, as well as each of the relevant payment provisions in the contracts listed above have been reviewed in detail, as have the documents surrounding the establishment of the project bank account.

Each of the payments has been cross-checked with the establishment of the project owner and the respective contract, the details of which are set out below, and it can be confirmed by the validation team that none of these payments has any impact on the suitability of the start-date for the project.

(a) First Payments related to the Project

The Chinese PP was established on 2nd February, 2005 when it was issued a temporary business license with a term of one year only and business scope for preparatory work only. The business license shows the following details:

Name: Huaneng Nanjing Natural Gas Power Generation Co., Limited
Number: 3201131003070
Date of Establishment: 2nd February, 2005
Expiry: 1st February, 2006
Scope of Activity: Preparation for Power Plant (with the specific scope of business to be decided only after formal approval of the project.)

Following receipt of the business license, the project owner applied to open a bank account with China Merchants Bank, Nanjing Branch, Gulou Sub-Branch on 3rd February, 2005. On 5th February, 2005, the bank agreed to open the account, with the bank account number [xxxxx30813xxxxxxxxx].

On 5th February, 2005, the first payments were made from that account, which are counter-checked against the Bank Slips. These payments were as follows:

Date	Description	Payee	Amount (RMB)	Evidence
5-Feb-05	Purchase of computers	Nanjing Meicheng Digital Information System Co. Ltd.	20,430	Annex 6
5-Feb-05	Purchase of digital equipment	Nanjing Yongneng Digital Technology Co. Ltd.	5,000	Annex 6
5-Feb-05	Rental of projectors	Nanjing Qiangjing Electronic Products Co.	8,510	Annex 6
5-Feb-05	Purchase of printers	Nanjing Futeng Electronic Devices Co. Ltd.	14,400	Annex 6
	Total		48,340	



Direct confirmation of the opening of the bank account, the account number and the date of first payment has been obtained from the bank.

(b) First Payment related to Gas Turbine Purchase Contract, the Gas Supply Contract and the Construction Contract

i. Gas Turbine Purchase Contract

The Gas Turbine Purchase Contract and the Amendment Number One (the “Equipment Contract” both referred to in the response to Question 1 above), provided for the supply of equipment and services by two suppliers, namely the General Electric Company (“GE”) and Harbin Power Equipment Company (“HPEC”).

The contract provided for advance payments after the effectiveness of the Equipment Contract, and these payments were made in accordance with the contract, as set out in the table below:

Date	Description	Payee	Amount (RMB)	Evidence
	10% of Gas Turbine	GE	US\$ 4,182,107	Annex 8
	10% of Equipment Other than Gas Turbine	GE	US\$ 301,209	Annex 8
26-Oct-05	Total		US\$ 4,483,316 (eq. RMB 36,314,859.6)	Annex 8 & Annex 9
	10% of Gas Turbine	HPEC	RMB 30,670,808	Annex 8
	10% of Equipment Other than Gas Turbine	HPEC	RMB 29,835,956	Annex 8
	10% of Technical Service	HPEC	RMB 147,264	Annex 8
3-Nov-05	Total		RMB 60,654,028	Annex 8 & Annex 11

The amounts of the advance payments made to GE have been cross checked by the validation team and confirmed with the extract of the Equipment Contract and the Notification of Advance Payments from the PP’s Import Agent, CNTIEC. The total amount and the date of the payment have also been cross checked and confirmed with the payment voucher.

The amounts of the advance payment to HPEC have been cross checked and confirmed with the extract of the Equipment Contract and the total amount and the date has been cross checked and confirmed with the receipt from HPEC.

ii. NG Supply Contract

The gas is supplied to the Project under the terms of the NG Supply Contract referred to in the response to Question 1 above, which is a take or pay contract. This NG Supply Contract specifies that an ‘Initial Advance Payment’ should be made ten days before the ‘Trial Operation Date’.

The turbines were inspected by Jiangsu Special Equipment Safety Inspection Academy and Nanjing Boiler Pressure Container Inspection Center on 24th November, 2006 and the Project issued a Notice of Plan for Gas Usage During Trial Operation (Document [2006] 26) on 7th December, 2006. This document noted that the Project would need gas supply for trial operation on 9th December, 2006.



This is consistent with the Project Timeline (see VR Version 05, page 30), which noted that the plant was first put into operation in December 2006.

On 12th December, 2006, the Project transferred RMB 1,600,000 to PetroChina for Advance Payment for Trial Operation Period.

iii. Construction Contract

The project was constructed according to the Civil Construction Contract that was signed on 25th June, 2005 (and referred to in the response to Question 1 above). According to the Civil Construction Contract, 5% of the contract value should be paid by the project owner as advance payment in ten days of the Contract becoming effective.

On 13th July 2005, the Construction Company issued a receipt to the Project for RMB 4,000,000 advance payment. This amount constitutes 5% of the Construction Contract amount, and represents the first payment under the Contract.

Conclusion

In summary, (a) the first payment related to this project; and (b) the first payment corresponding to the three contracts (gas turbine purchase contract and amendment contract, NG supply contract, civil construction contract) are as follows:

Milestone	Date	Amount
First payment related to this project	5 th February 2005	RMB 48,340
First payment corresponding to the Gas Turbine Purchase Contract	26 th October 2005	USD 4,483,316
First payment corresponding to the NG Supply Contract	12 th December 2006	RMB 1,600,000
First payment corresponding to the Civil Construction Contract	13 th July 2005	RMB 4,000,000

In accordance with the Glossary of CDM Terms definition of the Start Date, these payments confirm the following:

- there were no payments related to the Gas Turbine Equipment Purchase Contract and NG Supply Contract until after the pre-conditions had been met on 16th September 2005;
- there were no payments related to the Civil Construction Contract until after its signing on 25th June, 2005;
- the first payments related to the project constitute minor pre-project expenses and the Project's business license at the time restricted the activities to preparatory work only.

Step 1 Benchmark Investment Analysis

The purpose of this step is to demonstrate that without additional revenue from the sale of CERs the Proposed Project is less economically or financially attractive than other alternatives. The investment analysis was conducted according to the following steps:

Benchmark Analysis Method (Option3)



In accordance with the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*, published by the State Power Corporation of China, a project within the Chinese power industry is considered to be financially acceptable when the Internal Rate of Return (IRR after tax) for the project exceeds the sector benchmark of 8%. This is therefore considered a suitable value for the purpose of the benchmark analysis.

Calculation and comparison of financial indicators

The following table sets out the key parameters used for calculating the internal rate of return of the Proposed Project.

Table 2. Basic Parameters of the Project

	Parameters	Value	Source
Income-related parameters	Annual electricity supply to ECG	2,716,000MWh	FSR Supplementary Report
	Electricity tariff (including VAT)	RMB 0.442/kWh	FSR Supplementary Report
	Salvage value of the fixed asset	5%	Thermal Power Engineering Design Reference Cost Index (2005)
Cost-related parameters	Fixed assets investment	RMB2,465.80 million	FSR Supplementary Report
	NG price (including VAT)	RMB1.10/m ³	FSR Supplementary Report
	Material expenditure	RMB8.5/MWh	Thermal Power Engineering Design Reference Cost Index (2005)
	Water expenditure	RMB0.5MWh	Thermal Power Engineering Design Reference Cost Index (2005)
	Other cost	RMB11/MWh	Thermal Power Engineering Design Reference Cost Index (2005)
	Maintenance expenditure rate	2.5%	Thermal Power Engineering Design Reference Cost Index (2005)
	Income tax	33%	Tax law
	City construction and educational taxes	7%	Tax law
	Depreciation period	15 years	Thermal Power Engineering Design Reference Cost Index (2005)
	Circulating fund	RMB55.33 million	FSR Supplementary Report

The CDM related parameters are selected as Crediting period (yrs): 21; and CERs (EUR): 8.5

Based on the data set out above, the IRR (total investment after tax) for the Proposed Project can be calculated as follows:

Table 3: Financial Indicators of the Project



IRR (total investment) Benchmark=8%	
Without CDM	6.54%
With CDM	11.46%

In the absence of CDM revenues, the Proposed Project IRR is 6.54%, which is lower than the industry benchmark of 8%. Therefore, it can be concluded that the Proposed Project is not financially attractive. However, with the inclusion of revenues from the sale of CERs the Proposed Project IRR increases to 11.46%, which is above the benchmark 8%, and can therefore be considered financially attractive to the Project Owner.

Sensitivity analysis

In order to test the robustness of the IRR calculations, a sensitivity analysis was conducted on the financial model by altering the following parameters, which cover the key variables in the project's cash flow and are therefore the most sensitive parameters for testing the robustness of the Project IRR:

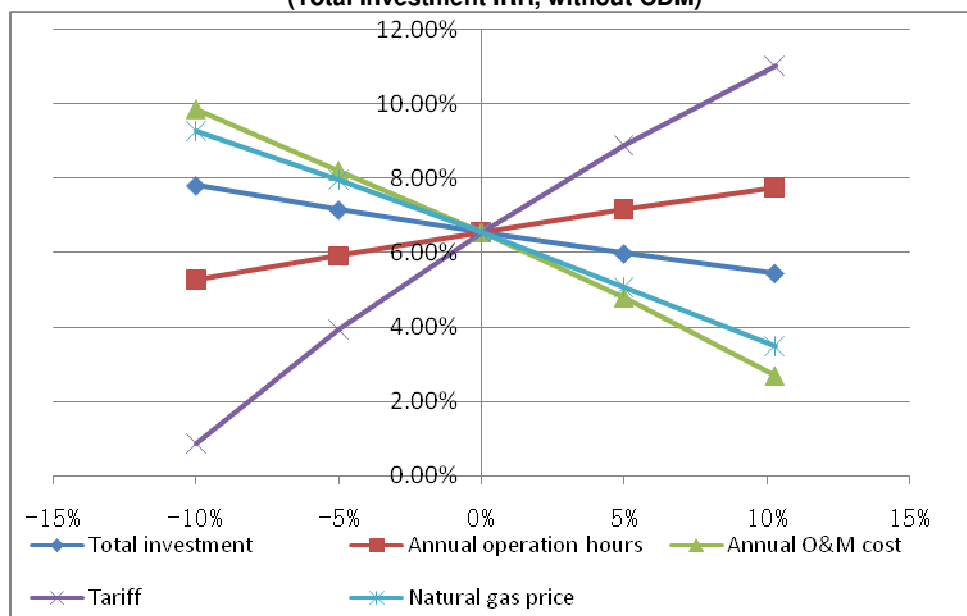
- Total Fixed Asset Investment
- Annual Operation Hours
- Annual O&M Costs
- Electricity Tariff;
- Natural Gas Price

In line with the requirement in Para17 in the 'Guidance on Assessment of Investment Analysis', the impacts of a 10% increase and 10% decrease of each of these parameters on the Proposed Project IRR were assessed, and the results of the sensitive analysis are provided in Table 4 and Figure 4.

Table 4: IRR Sensitivity to Different Financial Parameters of the Project
(Total investment IRR, without CDM)

IRR	-10%	-5%	0	5%	10%
Total Fixed Asset Investment	7.81%	7.15%	6.54%	5.98%	5.44%
Annual Operation Hours	5.28%	5.92%	6.54%	7.15%	7.75%
Annual O&M Cost	9.84%	8.19%	6.54%	4.79%	2.69%
Electricity Tariff	0.86%	3.93%	6.54%	8.88%	11.02%
Natural Gas Price	9.26%	7.94%	6.54%	5.06%	3.48%

**Figure 4: IRR Sensitivity to Different Financial Parameters of the Project
(Total investment IRR, without CDM)**



As illustrated by the above analysis, a +/-10% change in the selected parameters results in an IRR below the industry benchmark of 8%, with the exception of 3 scenarios:

1. -5% change in price of natural gas
2. -5% change in annual O&M costs
3. +5% change in electricity tariff.

However, according to paragraph 18 of the Guidance on the Assessment of Investment Analysis (version 03.1):

- *In cases where a scenario will result in the project activity passing the benchmark or becoming the most financially attractive alternative, the DOE shall provide an assessment of the probability of the occurrence of this scenario in comparison to the likelihood of the assumptions in the presented investment analysis, taking into consideration correlations between the variables as well as the specific socio-economic and policy context of the project activity.*
 - ❖ **Rationale:** *The ultimate objective of the sensitivity analysis is to determine the likelihood of the occurrence of a scenario other than the scenario presented, in order to provide a cross-check on the suitability of the assumptions used in the development of the investment analysis.*

Paragraph 6 of the Guidance on the Assessment of Investment Analysis (version 03.1) also states:

- *Input values used in all investment analysis should be valid and applicable at the time of the investment decision taken by the project participant...*
 - ❖ **Rationale:** *... the [investment] decision will therefore be based on the relevant information available at the time of the investment decision and not information available at an earlier or later point.*



This following explanation demonstrates that:

- i. Based on information available at the time of the investment decision, the likelihood of the occurrence of any scenarios that would have pushed the Project IRR above the industry benchmark was extremely remote, and could not possibly have been used as a credible basis for preparing the FSR for the project. In particular:
 - the FSR was prepared on a very optimistic basis because the NG price assumed in the FSR of 1.10 RMB/m³ was below the actual price for natural gas of 1.14 RMB/m³ in Jiangsu province in 2005, and the electricity tariff assumed in the FSR of 0.442 RMB/kWh (including VAT) was higher than the actual tariff of 0.371RMB/kWh (including VAT) at the time (please see Section 1 page 10 and Section 3 page 13 below for more details), and
 - the electricity tariff and the NG price are effectively correlated because government regulations only allow a tariff increase based on an increase in the fuel price and the regulations do not allow the full effect of increased fuel price to be passed on in the form of tariff increases. This means that any increase in gas price cannot be fully recovered and margins are eroded (please see Section 3 page 13 below for more details); and,
- ii. The assumptions made at the time of preparation of the FSR concerning unlikelihood of a gas price decrease and the inability of the Project to pass on the full effect of gas price increases in the form of an increased tariff have been borne out by subsequent events and based on the actual data for the NG price and the electricity tariff experienced by the Project, the Project IRR for the period of operation is 5.23%, which is below the industry benchmark of 8% and even lower than the IRR of 6.54% which was expected in the FSR (please see Section 3 page 14 below for more details).

The reasons for the great unlikelihood of NG prices or O&M costs decreasing, or electricity tariffs increasing so as to raise the Project IRR above the industry benchmark are addressed under the following three headings:

1. The price of natural gas has been rising continuously in China and is set to increase further in the future.
2. The O&M costs faced by the project have been increasing steadily.
3. Government policy requires that any increase in electricity tariff must be preceded by an increase in the price of natural gas, and there are strict limits on the amount of gas price increase that can be recovered by power plants in China through an increase in the electricity tariff. This Government policy means that the two key variables of electricity tariff and gas price are effectively correlated and a rise in tariff cannot occur in isolation from increase gas costs.

1. The price of natural gas has been rising continuously in China and is set to increase further in the future

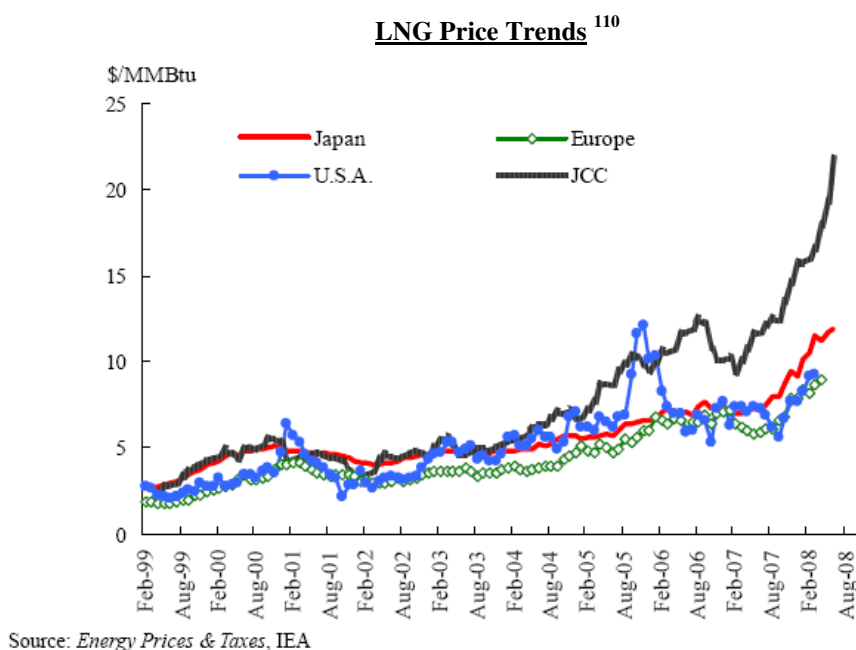
At the time of the Project design in 2005, the NG price assumed in the FSR was 1.10 RMB/m³. However, between the finalization of the FSR and the Project Start Date, the gas price was increased to 1.14 RMB/m³¹⁰⁸, so at the time of the investment decision, the project owner was aware that the assumption for the gas price was already too optimistic, and that a continuing upward trend in gas prices was almost certain. These assumptions

¹⁰⁸ Nanjing Government homepage, "Approval on adjustment of variation of NG price", http://www.nanjing.gov.cn/gsgg/wjsf/200610/t20061002_105714.htm - see VR Ref./N60/



were confirmed when the NDRC shortly afterwards issued a notice that gas prices would be increased in the near term¹⁰⁹.

Since the Project design in 2005, and in line with the project owner's expectations, the price of natural gas has increased both domestically and across the world. The increase in the international price of gas is illustrated in the diagram below.

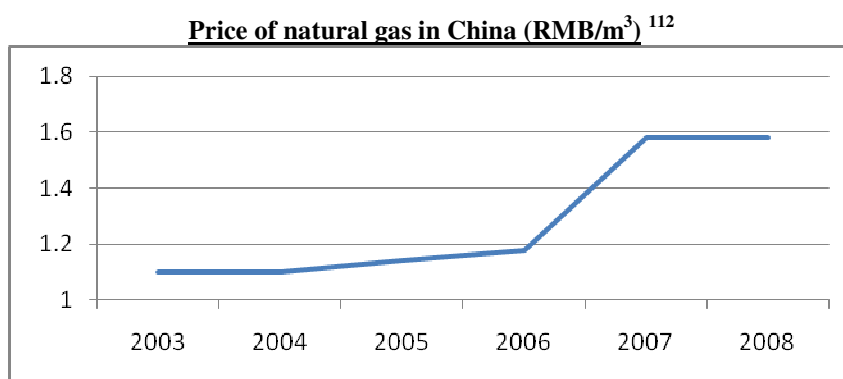


At the domestic level, the price of natural gas in China has also increased. According to the NDRC, the price of natural gas in China is expected to continue to increase, at a rate of 5 – 8% each year for the foreseeable future¹¹¹.

¹⁰⁹ "Notification of the reform of NG price mechanism and increase of NG price", 2756[2005] NDRC, 23rd Dec 2005, http://law.baidu.com/pages/chinalawinfo/6/66/f51656d4d1955778c45b441ba3fd5dbf_0.html - see VR Ref./N61/

¹¹⁰ Institute of Energy Economics Japan (2010) Natural gas situation and LNG supply/demand trends in Asia Pacific and Atlantic Markets, see <http://eneken.ieej.or.jp/data/2940.pdf> - see VR Ref./N62/

¹¹¹ XinhuaNet News Online, "NDRC: NG price is determined to be increased, the planned increasing ratio will be 5%~8% year by year", http://news.xinhuanet.com/fortune/2006-11/10/content_5311926.htm - see VR Ref./N63/



The data at the international and domestic level also illustrate that the domestic price of natural gas in China remains considerably lower than the international gas price. According to the IEA, the international price for natural gas reached US\$13/MBtu in 2008¹¹³, compared to the actual US\$6.42/MBtu¹¹⁴ (1.58RMB/m³) paid by the Project.

China became a net importer of natural gas in 2007, and as imports of natural gas from overseas increase, the pressure for domestic prices to equalize with international prices is increasing¹¹⁵. Gas imported through the Central Asia pipeline by PetroChina (the gas supplier of the Project) costs 2RMB/m³¹¹⁶. This is substantially higher than the 1.58RMB/m³ currently paid by the project owner. At the end of 2008, PetroChina requested that the project owner indicate the quantity of natural gas it is intending to buy in the future, starting with a base price of 3RMB/m³¹¹⁷.

According to public statements made by PetroChina, news sourced from National Business Daily, that the NG price in China will increase by approximately 10% in 2010 alone¹¹⁸.

It can, therefore, be concluded that at the time of the investment decision, the gas price assumed in the financial analysis was overly optimistic, and prices were almost certain to increase further. Trends in the actual gas price since the date of the Project FSR further demonstrate that it is highly improbable that the Project could experience any decrease in the natural gas price, let alone one which is of a magnitude large enough to push the project IRR over the 8% industry benchmark.

¹¹² <http://www.chinaccm.com/21/2101/210101/news/20031124/100003.asp> (figures for 2003 & 2004) - see VR Ref./N64/; http://www.nanjing.gov.cn/gsgg/wjsf/200610/t20061002_105714.htm (figures for 2005, see VR Ref./N60/; <http://www.jzfgw.gov.cn/old/content.asp?id=1472> (figures for 2006) - see VR Ref./N65/; <http://www.sxzz.gov.cn/show.asp?id=69> (figures for 2007) - see VR Ref./N66/

¹¹³ IEA (2009) Natural gas in China, market evolution and strategy, IEA Working Paper, p24 - see VR Ref./N9/

¹¹⁴ 1m³ equals 36,000 Btu; Rmb/\$US rate is 6.83: conversion is 1,000,000/36,000*1.58/6.83 = 6.42

¹¹⁵ Caijing Net, "Rising Imports may force gas price reform", <http://english.caijing.com.cn/2009-08-07/110221639.html> - see VR Ref./N67/

¹¹⁶ Same as Footnote 115 above - see VR Ref./N67/

¹¹⁷ PetroChina circular on gas demand, 17th November 2008 - see VR Ref./N68/

¹¹⁸ National Business News, "NG price would increase by 10%", <http://www.mysteel.com/gc/cjzh/syhg/2010/01/21/085237.2192195.html> - see VR Ref./N69/



2. The O&M costs faced by the project have been increasing steadily

With regard to the O&M costs of the Project, as explained in the Project PDD & validated in the VR Version 05 Section 3.5.3., the O&M costs are comprised of the following elements:

- ❖ Fuel costs, i.e. expenditure on natural gas (82.2%);
- ❖ Maintenance costs (9.2%);
- ❖ Water expenditure (0.2%);
- ❖ Material costs (3.2%);
- ❖ Employee payroll (0.7%);
- ❖ Insurance (0.3%); &
- ❖ Other costs (4.2%).

As the costs associated with the purchase of natural gas account for 82.2% of the Project's O&M costs, the impact of the sensitivity analysis on the O&M costs is largely the same as for the price of natural gas, and the Project IRR crosses the industry benchmark with a 5% decrease in O&M costs.

However, as discussed above, at the time of the investment decision, the assumed natural gas price in the FSR was very conservative, and below the actual gas price at the time of the Project start-date and, as discussed above, the gas price has risen substantially since that time.

Furthermore, if the fuel cost is held constant, the other O&M costs would have to decrease by 25% in order to reduce the total O&M by 5%. However, the price for raw materials, fuels and power (VR Ref./N70/) and the average wage index (VR Ref./N71/) have increased 8.5% and 14.6% respectively¹¹⁹.

In addition to this, since the Project commenced construction, a Maintenance Service Contract was signed with a consortium of GE companies on 23rd November, 2007. According to this contract and other normal maintenance expenses, the actual annual maintenance costs are expected to be slightly higher than the level included in the FSR.

Taken together, the increase in the price of natural gas, combined with inflation in the price of raw materials and employee payrolls further demonstrates that it was very unlikely that the O&M costs would decrease during the operation of the project.

3. Government Policy concerning fuel costs and electricity tariff mean that a rise in electricity tariff must be predicated on a rise in the price of natural gas

The sensitivity analysis conducted in the PDD shows that the Project IRR will cross the industry benchmark if the electricity tariff increases by 5%. However, at the time of the investment decision:

- the electricity tariff applied in the FSR was over optimistic – 19% higher than the actual tariff experienced by power plants in Jiangsu province (i.e. 0.442 vs. 0.371RMB/kWh) in 2005¹²⁰,
- the actual gas price was higher than the level assumed in the FSR, as explained above in Section 1 on page 10, and,
- the project owner was aware that in accordance with the regulations governing the setting of electricity tariffs in China, any increase in the electricity tariff must be preceded by a rise in the cost of fuel.

¹¹⁹ China Statistics Yearbook (2009) - see VR Ref./N70 & N71/

¹²⁰ NDRC, "Announcement of adjustment on grid-in tariff in East China Grid April 2005", <http://scjc.scpi.gov.cn/flfg-content.asp?id=1296> - see VR Ref /N8/



In China, the level of electricity tariffs is strictly controlled by the central government, and is directly linked to fuel costs. According to Article 10 of the Management Rules on Feed-in Tariff (NDRC [2005] 514, 28th March 2005), the electricity tariff can be adjusted¹²¹ **only** when there is a significant increase in the fuel price.

Furthermore, the regulations also stipulate that electricity price increases are limited such that the power producers must bear a minimum of 30% of the effect of the fuel price increase and the government will only permit an increase in electricity tariffs to compensate for a maximum of 70% of the fuel price move¹²². This means that in practice, as fuel prices increase, the margin for power plant operators (including this Project, as demonstrated below by the actual prices) is eroded as electricity tariffs are not permitted to keep up with fuel price changes.

In order to demonstrate the interdependence between the fuel costs and the electricity tariff, the following table sets out the actual values for the price of natural gas and the electricity tariff experienced by the Project during its period of operation. From the table and the footnote, it can be seen that the electricity tariff increased in the middle of 2008 and this increase only occurred after a significant rise in the fuel cost at the end of 2007.

Furthermore, from the calculated Project IRR for each year since operation, it can also be seen that the increase in the tariff has not fully compensated for the negative effect of the fuel cost increase on the project owner.

	NG price with VAT ¹²³ (RMB/m ³)	Tariff with VAT ¹²⁴ (RMB/KWh)	Calculated Project IRR (Benchmark 8%)
FSR/PDD values	1.10	0.442	6.54%
Actual value in 2007	1.247 ¹²⁵	0.480	6.95%
Actual value in 2008	1.58	0.509 ¹²⁶	2.56%
Actual value in 2009	1.58	0.545	6.19%
Average 2007 – 2009	1.469	0.511	5.23%

The above table demonstrates two important points:

- The average tariff price during the plant's operation from 2007 to 2009 is 15.6% higher than the price used in the FSR, whereas the average gas price is 33.5% higher than that used in the FSR. As stated above, the regulations stipulate that electricity price increases are limited such that the power producers must bear a minimum of 30% of the effect of the fuel price increase. In this case, the project owner has absorbed 50% of the cost increase (the electricity tariff has only increased by 50% of the corresponding gas price), which demonstrates convincingly the application of the government's policy of only allowing power producers to pass on a maximum of 30% of the increased fuel costs to the consumer; and,
- the calculated project IRRs, based on the actual values of the NG price and the electricity tariff for the years 2007, 2008 and 2009, are 6.95%, 2.56%, and 6.19% respectively. These are all considerably below the industry benchmark of 8%, thus confirming the continued financial additionality of the Project;

¹²¹ NDRC, "Management Rules on Feed-In Tariff, 28th March, 2005, NDRC[2005]514, http://www.ndrc.gov.cn/zcfb/zcfbtz/zcfbtz2005/t20050613_6670.htm - see VR Ref /90/

¹²² NDRC Coal-Electricity Linking Directive; 15th December 2004 Fagaijiage[2004]2909, http://www.ndrc.gov.cn/zcfb/zcfbtz/zcfbtz2004/t20080710_223762.htm - see VR Ref /89/

¹²³ Same as references in Footnote 112 above

¹²⁴ See attached spreadsheet - see VR Ref./N72/

¹²⁵ Weighted average value calculated as the NG price was increased from 1.18 RMB/m³ to 1.58RMB/m³ incl VAT from early Nov 2007

¹²⁶ Weighted average value calculated as the tariff was increased from 0.480 to 0.520 on 30 June, 2008 and then to 0.545 on 20th August, 2008



moreover, the average IRR during the period of operation of 5.23% is below the level expected in the FSR, which demonstrates the deteriorating financial returns from the project as gas price increases steadily erode the Project's margins.

Conclusion

It has been demonstrated that, in accordance with Paragraph 18 of the Guidelines on the Assessment of Investment Analysis (version 03.1), the likelihood of any scenarios occurring which would push the Project IRR over the industry benchmark are highly improbable and such a scenario could not possibly have been used in the preparation of the FSR that supported the investment decision.

In particular it has been demonstrated that:

- at the time of the investment decision, the assumptions for key parameters – namely the price of natural gas and electricity tariff – were already too optimistic. The actual price of natural gas was increased before the project start-date, and the actual electricity tariff used in the financial model was 19% higher than the tariff for the thermal power plants in Jiangsu province at the time.
- the price of natural gas has been increasing both domestically and internationally, and domestic gas prices are set to increase further so as to equalize with international prices in the near future. The price of natural gas in 2009 paid by the Project itself has increased by 33.5% over the price assumed in the project design in 2005. Therefore the likelihood of a decrease in the price of natural gas of a magnitude sufficient to push the project IRR above the industry benchmark is extremely low;
- the O&M costs are closely correlated to the price of natural gas (which accounts for 82.2% of total O&M costs) for which it has been demonstrated that gas prices have been increasing, and are set to increase further in the future. In addition to this, there has been continuous inflation in the cost of other materials and employee payroll and this inflation is expected to continue. Therefore, the likelihood of a decrease in O&M costs is also very remote;
- electricity tariffs in China are strictly regulated by the Chinese government, and are adjusted based upon adjustments to the fuel price. Therefore, any increase in electricity tariff cannot occur in isolation, and thus the likelihood that the electricity tariff would increase in a way that could push the IRR above the industry benchmark is highly improbable; and
- the actual electricity tariffs and gas prices experienced by the project owner since the start of operation in 2007 have resulted in a project IRR lower than that calculated in the FSR (and PDD), thereby further confirming the financial additionality of the Project.

Cross-check of the suitability of the input values in the IRR analysis

As explained above, China's regulations require the preparation of an FSR before any power project can be approved and implemented. FSRs for power plants in China are customarily prepared using standard engineering cost reference data which are published annually by the China Power Engineering Consulting Group Corporation. For the Proposed Project, the *Thermal Power Engineering Design Reference Cost Index* (2005 edition) reflects the data applicable at the time of the project design.

In order to demonstrate the suitability of the input values for the calculation of the IRRs (and also for the calculation of the LEGC of the proposed project), the FSR input values in relation to this reference material and also to the actual values of the various inputs prevailing at the time have been reviewed. Each value is assessed in detail in the table below.

**Table Cross-Check for the input values for IRR analysis of the proposed project**

Parameters	Value	Source	Underlying source and assessment of reasonableness
Income-related parameters	Annual electricity supply to ECG	2,716,000 MWh FSR	The designed power output of the power plant is 780 MW. The Thermal Power Engineering Design Reference Cost Index (2005) stipulates that the annual operating hours for gas-fired power plants should be 3,500 pa. In fact, the plant has not actually operated at the planned level since it commenced operations and the figure in the FSR is much higher than real power generation as shown in the operation record of 2007, 2008 and 2009 (2,321,510 MWh, 2,207,330 MWh and 2,273,351 MWh ¹²⁷ respectively). Thus, the annual power generation assumed in the FSR was reasonable.
	Electricity tariff (including VAT)	RMB 0.442/kWh FSR	In the Hebei Design Institute Supplement to FSR the grid-in tariff was RMB 0.442 Yuan/kWh (incl. VAT). It has also been counter-confirmed that in the PPA signed in November 2006, the grid-in tariff is also agreed to be RMB 0.442 Yuan/kWh (incl. VAT). According to Thermal Power Engineering Design Reference Cost Index (2005 level), the guidance Tariff for GE produced 9-F 790MW newly-built NGCC project should be 0.435 RMB/KWh (inc VAT) in case the gas price is 1.1 RMB/m ³ (inc VAT). This is much lower than the applied 0.442 RMB/KWh (inc VAT) in both FSR and PDD under the same assumption of price level for the gas. Furthermore, the grid-in tariff used in the financial analysis was approximately 19% higher than the actual grid-in tariff given to thermal power plants in Jiangsu province (RMB 0.371/KWh) in 2005 (the year when the FSR with the final Project Design was conducted) (see link below). Therefore, the Tariff assumed in the FSR was significantly higher than the tariff available in 2005, and was also higher than the guidance Tariff specified in the Thermal Power Engineering Design Reference Cost Index available at the time of the project design. The Tariff used in the investment analysis was, therefore, conservative. http://scjc.scpi.gov.cn/flfg-content.asp?id=1296
	Salvage value of the fixed asset	5% FSR	Thermal Power Engineering Design Reference Cost Index (2005 Edition) Official document No.[2005] 883 released by State Administration of taxation in 2005/9/14 http://www.chinatax.gov.cn/n480462/n480498/n575817/1008375.html

¹²⁷ Nanjing Jinling NGCC Power Plant 2007, 2008 and 2009 Operation Reports.



Cost-related parameters	Fixed assets investment	RMB2,465 million	FSR	The fixed assets investment per unit power output used in the FSR is 3,161 RmB per kW, (being 2,465,800,000RmB/780MW.) This is very close to the guidelines in the Thermal Power Engineering Design Reference Cost Index (2005), which shows unit cost of 3,060 RmB/kW for newly built power plants using F-series turbines. It is also conservative compared to the other six NGCC plants using the same F-series turbines technology as the Proposed Project in the East China Grid that have been successfully validated and registered as CDM projects. <table><tr><td>Project name</td><td>UNFCCC CDM reference number</td><td>Unit fixed asset investment (RmB)/kW</td></tr><tr><td>Wangting</td><td>2383</td><td>3,818</td></tr><tr><td>Qishuyan</td><td>2382</td><td>3,474</td></tr><tr><td>Zhangjiagang</td><td>2439</td><td>3,671</td></tr><tr><td>Xiaoshan</td><td>1343</td><td>3,337</td></tr><tr><td>Yuyao</td><td>1227</td><td>2,969</td></tr><tr><td>Zhenhai</td><td>1344</td><td>3,253</td></tr></table> These plants had an average investment cost per kWh of 3,454 RmB/kW, which is 10% higher than in the FSR for this project. Therefore the investment cost in the FSR is conservative in relation to other similar projects within the region.	Project name	UNFCCC CDM reference number	Unit fixed asset investment (RmB)/kW	Wangting	2383	3,818	Qishuyan	2382	3,474	Zhangjiagang	2439	3,671	Xiaoshan	1343	3,337	Yuyao	1227	2,969	Zhenhai	1344	3,253
	Project name	UNFCCC CDM reference number	Unit fixed asset investment (RmB)/kW																						
	Wangting	2383	3,818																						
	Qishuyan	2382	3,474																						
	Zhangjiagang	2439	3,671																						
	Xiaoshan	1343	3,337																						
	Yuyao	1227	2,969																						
Zhenhai	1344	3,253																							
NG price (inc VAT)	RMB1.10 /m ³	FSR	According to the Thermal Power Engineering Design Reference Cost Index for 2005, the natural gas price for 300MW level GE units is 1.30 RMB/m3. Therefore, the level used in the FSR of 1.10 RmB/m3 seems very conservative. At the time that the FSR was prepared, the NDRC had already issued a notice that gas prices would be increased in the near term, so it was conservative to use the lower figure in the FSR. In fact, the NDRC did adjust the price substantially on 2007/11/08, during the first year of operations of the Plant, when it was increased to 1.58 RMB/m3. Thus, it can be concluded that the NG price applied in FSR is conservative.																						
Material expenditure	RMB8.5 per MWh	FSR	The Material expenditure, Water expenditure, and Other costs are defined as RMB8 per MWh, RMB1 per MWh, and RMB12 per MWh respectively in the Thermal Power Engineering Design Reference Cost Index (2005 Edition), with a sub-total of RMB 21 per MWh. This is higher than the sub-total of RMB 20 per MWh applied in the FSR (8.5+0.5+11=20). Thus, it can be concluded that the value applied in FSR is conservative.																						
Water expenditure	RMB0.5 per MWh	FSR																							
Other cost	RMB11 per MWh	FSR																							
Maintenance expenditure rate	2.50%	FSR	Thermal Power Engineering Design Reference Cost Index (2005 Edition)																						
Payroll	64,200 RMB /year/ person	FSR	The payroll applied in the FSR was 64,200 RMB /year/person, which is lower than 80,000 RMB /year/person as set out in the Thermal Power Engineering Design Reference Cost Index (2005 Edition). Furthermore, the number of staff in the FSR is 80, which is also lower than the 120 as set out in the Thermal Power Engineering Design Reference Cost Index																						



			(2005 Edition).
Income tax	33%	FSR	http://www.chinatax.gov.cn/n8136506/n8136608/n8138877/n8139027/8357260.html
City construction tax	7%	FSR	http://www.gov.cn/banshi/2005-08/19/content_24817.htm
Education tax	3%	FSR	http://www.gov.cn/gongbao/content/2005/content_91662.htm
Circulating Fund	RMB55.33 million	FSR	For industrial projects, the circulating fund should be about 5%~12% of the total investment. Thus, for the proposed project, 5% of the total investment is about 123 million RMB, which is much higher than 55.33 million RMB as designed in FSR. Thus, the value of the circulating fund applied in FSR and PDD is reasonable and conservative. http://www.edu24ol.com/web_news/html/2009-2/2009210171616664.html

Step 2. Common practice analysis

Analyze other activities similar to the proposed project activity:

According to the “Tool for the demonstration and assessment of additionality”, projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.

Across China, there are a total of 7 regional power grids, each of which is composed of a number of localised sub-grids (of which Jiangsu Grid is one). Each of these grids – regional and sub-grids – faces a unique economic, investment and regulatory environment, which means that drawing direct and valuable comparisons is difficult from province to province, and from grid to grid¹²⁸. Therefore, in accordance with the ‘Tool’, other NGCC projects in Jiangsu Province are recognized as facing a similar investment climate, and Jiangsu Province could be acceptable for the geographical boundary for Common Practice analysis.

However, in order to apply a rigorous common practice analysis, the East China Power Grid (ECPG) has been selected as the geographical boundary. Jiangsu Grid is a sub-grid of the ECPG, and the ECPG covers the most economically developed Yangtze Delta Economic Region in China. This spans not only Jiangsu, but also Shanghai, Zhejiang, Fujian and Anhui provinces. Therefore, this incorporates a larger number of projects which face the most economically developed operating environments for assessment as part of the Common Practice analysis.

A number of project activities exist which are similar to the Proposed Project in terms of similar outputs, services and technology – i.e. peak load regulating electricity supply to the East China Power Grid, using combined cycle technology.

¹²⁸ http://www.ce.cn/ztpd/xwzt/lianghui/dbyl/t20040311_385774.btk



These projects were identified from a list of NGCC projects published by the China National Technology Import Export Company (CNTIEC), under the commission of the NDRC, which is responsible for technology transfer and the import of all NGCC technology from the West. Details of all similar projects connected to the ECPG are provided in the table below¹²⁹:

Project	Capacity	Status
Zhejiang Zhenhai Natural Gas Power Generation Co.	2×390MW	Registered as a CDM project
Xiaoshan Gas Power Plant of Zhengjiang	2×390MW	Registered as a CDM project
Yuyao Natural Gas Power Plant of China Energy Group	2×390MW	Registered as a CDM project
Fujian Putian LNG Generation Project	3×382MW	Registered as a CDM project
Fujian Jinjiang LNG Power Generation Project	4×379MW	Registered as a CDM project
Fujian Xiamen Dongbu LNG power project	4×350MW	Under construction
Hangzhou Banshan Natural Gas Power Plant	3×390MW	under CDM development
Shanghai Baoshan Natural Gas Power Plant	3×400MW	Registered as a CDM project
Jiangsu Qishuyan Natural Gas Based Power Generation Project	2x390MW	Requesting Registration
Jiangsu Wangting Natural GasBased Power Generation Project	2x390MW	Requesting Registration
Zhangjiagang Natural Gas Power Generation Project	2x390MW	Requesting Registration
Shanghai Jinshan Grid Connected Natural Gas Combined Cycle Power Generation Project	2x390MW	Under CDM development

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

As shown above, all Natural Gas Power Generation Projects in the ECPG except for Fujian Xiamen Dongbu LNG power project are currently under CDM development and many have already been registered by the UNFCCC Executive Board.

Fujian Xiamen Dongbu LNG power project is fully invested by an international company, East Asia Power (EAP) China, which is owned by RGM International, a multinational corporation with its head office located in Singapore. This is the first gas-fired power plant fully invested by a foreign enterprise¹³⁰ and has essential distinctions with other NGCC projects in terms of financial flows because it has received preferential policies¹³¹ from the local government of Xiamen, including tax exemptions, lower tax rates and VAT subsidies specially to foreign invested enterprises. Therefore this project does not affect the additionality of the proposed project.

Step 3. Impact of CDM Registration

As has been demonstrated by the investment analysis, in the absence of CDM revenue, the Proposed Project IRR is below the industry benchmark of 8%, at 6.54%, and is therefore financially unattractive. Upon considering the revenue from the sale of CERs, however, the Proposed Project IRR increases to 11.46%, thus making the Proposed Project financially attractive. On the basis of this, the Project Owner proceeded with the construction of the Proposed Project.

¹²⁹ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1721.pdf>

<http://www.cntic.com.cn/cntic/zywjy/dlly/dlly-biao.htm>

¹³⁰ http://www.66163.com/Fujian_w/news/sebc/gb/20061127/dncj105371.html

¹³¹ <http://portal.gd-n-tax.gov.cn/web/vfs/fs/content/ContentTemplate.jsp?CategoryId=4986&ContentId=99045>

**B.6. Emission reductions:****B.6.1. Explanation of methodological choices:**

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Emission reductions from the Proposed Project can be calculated according to the approved methodology AM0029 (version 03).

Step1: Project emissions

The project activity is on-site combustion of natural gas to generate electricity without auxiliary fuels in project operation. The CO₂ emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = \sum_f FC_{f,y} \times COEF_{f,y} \quad (1)$$

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:

$$COEF_{f,y} = \sum NCV_y \times EF_{CO_2,f,y} \times OXID_f \quad (1a)$$

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.

In this PDD, NCV_{f, y} is from the FSR of the Project. Since the EF_{CO₂ f, y} is not available from the fuel supplier, it is taken from publicly available national data issued by the Chinese DNA, and OXID_f is the IPCC default value. As a result, the COEF_{f, y} equals to 0.001972 tCO₂e/m³, resulting in project emissions of approximately 1,136,620tCO₂e per annum (For more detailed information please refer to Annex 3, Table A19).

Step 2: Baseline emission

Baseline emissions are calculated by multiplying the electricity generated in the project plant (EG_{PJ, y}) with a baseline CO₂ emission factor (EF_{BL, CO₂, y}) as follows:

$$BE_y = EG_{PJ,y} \times EF_{BL,CO_2,y} \quad (2)$$

According to the selected methodology AM0029 (version 03), the EF_{BL, CO₂, y} should be the lowest emission factor among the following three options:

Option 1: The build margin, calculated according to “Tool to calculate the emission factor for an electricity system”;

Option 2: The combined margin, calculated according to “Tool to calculate the emission factor for an



electricity system”, 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:

$$EF_{BL,CO2,option3} = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6GJ / MWh \quad (3)$$

Option 1 & Option 2:

According to the “Tool to calculate the emission factor for an electricity system”, the following six steps should be applied to calculate the emission factor for an electricity system:

Step 1: Identity the project electric system;

Step 2: Select an operating margin method (OM);

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

Step 4: Identity the cohort of power units to be included in the build margin;

Step 5: Calculate the build margin (BM) emission factor;

Step 6: Calculate the combined margin (CM) emission factor.

Sub-Step 1: Identity the project electric system

According to “2006 Baseline Emission Factors for Regional Power Grids in China” announced by Office of National Coordination Committee on Climate Change, National Development and Reform Commission (NDRC) of China (Chinese DNA), ECPG is a regional power grid in China, which includes Shanghai city, Jiangsu province, Zhejiang province, Anhui province and Fujian province. As the DNA of China (host country) has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. Hence the electric power system defined by the DNA of China is applied and the relevant electric power system of the project electricity system is ECPG¹³².

Sub-Step 2: Select an operating margin method (OM)

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

- (A) Simple OM, or
- (B) Simple adjusted OM, or
- (C) Dispatch data analysis OM, or
- (D) Average OM

Method (A), Simple OM, is used when low-cost/must run resources constituted less than 50% of the total grid generation in an average of 5 most recent years. According to the data from *China Power Yearbook 2001~ 2005*, the share of the low-cost/must run resources in ECPG are 10.47%, 11.49%, 11.86%, 10.96%, and 9.77% for 2000, 2001, 2002, 2003 and 2004 respectively. Therefore, method (A) is selected to calculate the OM emission factor.

For the simple OM, the emission factor can be calculated using either of the two following data

¹³² Data source: same as footnote 2



vintages:

- Ex-ante option A: 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period;
- Ex-post option B: The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data are required to calculate the emission factor for year y is usually only available later than six months after the end of year y.

The data vintage selected for the emission factor calculation is Option A.

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

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

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

Because the power sector in China is in a transitional period of “separating the plant operation from the grid operation”, resulting in the detailed data of dispatch and fuel consumption are often taken as confidential business information by the grid company and the power plants, the fuel consumption data for each power plant / unit is not publicly available.

Therefore option C is chosen and the Simple OM emission factor ($EF_{grid,OMsimple,y}$) is calculated as:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_y} \quad (5)$$

Where:

$EF_{grid,OMsimple,y}$: Simple operating margin CO₂ emission factor in year y (tCO₂/MWh);

$FC_{i,y}$: Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit);

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

$EF_{CO2,i,y}$: CO₂ emission factor of fossil fuel type i in year y (tCO₂/GJ);

EG_y : The net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh);

i : All fossil fuel types combusted in power sources in the project electricity system in year y

y: Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).

The Simple OM Emission Factor ($EF_{grid,OM,y}$) of the proposed project is calculated based on the electricity generation mix of the ECPG, excluding low-operating cost and must-run power stations,



such as hydropower, wind power etc. The data of installed capacity and electricity generation of different power generation sources are taken from the *China Electric Power Yearbook* (published annually, 2003, 2004 and 2005 editions). The data on different fuel consumptions by type for power generation in the ECPG are taken from the *China Energy Statistical Yearbook* (2003, 2004 and 2005 editions).

The detailed calculation can be found in Annex 3, the $EF_{grid,OM,y} = 0.9588$

Sub-Step 4: Identity the cohort of power units to be included in the build margin.

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

- The set of five power units that have been built most recently, or
- The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently

Project participants should use the set of power units that comprises the larger annual generation.

In terms of vintage of data, project participants choose the ex-ante option.

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

Taking into account such situations in China, on the 22nd meeting of CDM EB, it is decided to accept three deviations¹³³ based on the request for deviation proposed by DNV on Oct. 7th, 2005¹³⁴, to use the grid aggregated data at generation mix level instead of those at power plant level, as follows:

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

And the EB suggested that the Project participants use the following alternative solution in absence of data:

- (a) For small scale project activities, use the average emission factor of the grid described in the AMS-I.D;
- (b) 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. For the estimation of the operating margin the average emission factor for the grid for each type can be used.

In this PDD, as required, the data published by DNA¹³⁵ was used for estimating the $EF_{grid,BM,y}$

In terms of vintage of data, project participants can choose between one of the following two options:

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

¹³³ "Request for clarification on use of approved methodology AM0005 for several projects in China"
http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_OEJWJEF3CFBP1OZAK6V5YXPQK7WYJ

¹³⁴ "Request for guidance: Application of AM0005 and AMS-I.D in China"
<http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM>

¹³⁵ Data source: same as footnote 2



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

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

Sub-Step 5: Calculate the build margin (BM) emission factor:

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (6)$$

Where:

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

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

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

m: Power units included in the build margin;

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

As described above, the necessary data for the calculation of $EF_{EL,m,y}$ is unavailable. As a result, in this PDD, as required, according to the data published by DNA¹³⁶ was used for estimating the $EF_{grid,BM,y}$. Therefore it is calculated as follows:

Step a: Calculate the proportions of the corresponding CO₂ emissions of the solid fuel, liquid fuel and gas fuel to the total emission by the energy information available of the last year;

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

¹³⁶ Data source: same as footnote 2



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

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

Where:

$F_{i,j,y}$: Fuel (tce) consumed by the province j in the year y;

$COEF_{i,j,y}$: CO₂ emission coefficient of fuel i (tCO₂/tce), taking into account the carbon content and the percent oxidation of the fuel in year y;

COAL, OIL and GAS are the footnotes of the solid fuel, liquid fuel and gas fuel respectively.

Step b: Calculate the fuel-fired emission factors ($EF_{Thermal}$) of the grids based on the emissions of the best technology commercially

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (10)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ is emission factor of coal, oil, the gas-fired power with the most efficiency level of the best technology commercially available in China was selected (see Annex 3 for details).

Step c: Calculate $EF_{BM,y}$ of the grid based on equation (11):

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

Where:

CAP_{Total} : Total Change in installed capacity of the Grid, MW;

$CAP_{Thermal}$: Incremental capacity of fuel-fired power of the Grid, MW.

Based on these data, the build margin emission factor ($EF_{grid,BM,y}$) of the ECPG is 0.8030 tCO₂e/MWh.

Sub-Step 6: Calculate the combined margin (CM) emission factor:

The baseline emission factor $EF_{grid,CM,y}$ should be calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$).

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

w_{OM} : Weighting of operating margin emissions factor w_{BM} : Weighting of build margin emissions factor

According to AM00029, the weight w_{OM} is 0.5 and the weight w_{BM} is 0.5 for the Project, therefore,



$$EF_{CM,y} = 0.9588 \times 0.5 + 0.8030 \times 0.5 = 0.8809 \text{ (tCO}_2\text{e/MWh)}$$

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:

$$EF_{BL,CO_2,y} \text{ (tCO}_2\text{ / MWh)} = \frac{COEF_{BL}}{\eta_{BL}} \times 3.6 \text{ GJ / MWh}$$

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.

In this PDD, as analyzed in the B.4., the most likely baseline scenario is to build a new 600MW sub-critical coal-fired power plant, with a coal consumption value of 336.66kg/MWh provided by the Chinese DNA at its public website, the technology efficiency $\eta_{BL} = 36.53\%$ ¹³⁷, while the $COEF_{BL}$ is from IPCC defaults, at 0.0946tCO₂/TJ. Based on these data available, the $EF_{BL,CO_2,y}$ is calculated as 0.9322 tCO₂e/MWh.

The baseline CO₂ emission factor was calculated according the options mentioned above is as following:

Option	Baseline CO ₂ Emission Factor (tCO ₂ e/MWh)
Option 1	0.8030
Option 2	0.8809
Option 3	0.9322

According to AM0029, the Project shall use the lowest $EF_{BL,CO_2,y}$ among these three Options, thus the Option 1 is selected as the $EF_{BL,CO_2,y}$ with the lowest volume of 0.8030 tCO₂e/MWh. Where the net annual grid-connected electricity supplied to the grid is about 2,716,000MWh, the baseline emissions for the proposed project therefore can be calculated base on the selected Option 1 for a total amount of 2,180,948 tCO₂e/a (For more detailed information please refer to Annex 3, Table A20).

Step 3: 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. In the methodology AM0029, the leakage emission is calculated as follows:

$$LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y} \quad (12)$$

Where:

LE_y : Leakage emissions during the year y in tCO₂e

$LE_{CH_4,y}$: Leakage emissions due to fugitive upstream CH₄ emissions in the year y in t CO₂e

$LE_{LNG, CO_2, y}$: Leakage emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas

¹³⁷ Data source: same as footnote 2



transmission or distribution system during the year y in t CO₂e

Step 3.1: $LE_{LNG,CO2,y}$

As described in Section B.2, the LNG will be supplied to meet the NG market demand of Jiangsu province from the year of 2011, so in this PDD, to be conservative, the leakage emission due to the uses of LNG was taken into account.

According to AM0029, where applicable, 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 ($LE_{LNG,CO2,y}$) should be estimated by multiplying the quantity of natural gas combusted in the project with an appropriate emission factor, as follows:

$$LE_{LNG,CO2,y} = FC_{LNG,y} \cdot EF_{CO2,upstream,LNG} \quad (13)$$

Where

$LE_{LNG,CO2,y}$: 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

$FC_{LNG,y}$: Quantity of LNG combusted in the project plant during the year y in m³

$EF_{CO2, upstream, LNG}$: 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

Due to the data of $EF_{CO2, upstream, LNG}$ is not available, in this PDD, $EF_{CO2, upstream, LNG}$ is 6tCO₂/TJ which was determined by AM0029.

Base on the above analysis, if the proposed project use LNG as fuel in the future, the leakage due to LNG use ($LE_{LNG,CO2,y}$) is about 121,563tCO₂e/a (Please see Annex 3, Table A21).

Step 3.2: Calculation of $LE_{CH4,y}$

According to AM0029, for the purpose of estimating fugitive CH₄ emissions, the Project participants should multiply the quantity of natural gas consumed by the project in year y with an emission factor for fugitive CH₄ emissions ($EF_{NG, upstream, CH4}$) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the project activity, as follows:

$$LE_{CH4,y} = \left(FC_y \times NCV_y \times EF_{NG,upstreamCH4} - EG_{PJ,y} \times EF_{BL,upstreamCH4} \right) \times GWP_{CH4} \quad (14)$$

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

$NCV_{NG,y}$: Average net calorific value of the natural gas combusted during the year y in GJ/m³;

$EF_{NG,upstream,y}$: 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 CH₄ per GJ fuel supplied to final consumers;

$EG_{PJ,y}$: Electricity generation in the project plant during the year in MWh;

GWP_{CH4} : Global warming potential of methane valid for the relevant commitment period



$EF_{BL,upstream,CH_4}$: Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t CH₄ per MWh electricity generation in the project plant, as defined below; According to AM0029, 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}) used in step 2, so the $EF_{BL,upstream,CH_4}$ in this PDD was calculated as follows:

$$EF_{BL,upstream,CH_4} = \frac{\sum_j FF_{j,k} \times EF_{k,upstream,CH_4}}{\sum_j EG_j} \quad (15)$$

Where:

j : Plants included in the build margin;

$FF_{j,k}$: Amount of fuel 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) in t CH₄ per MJ fuel produced.

Based on the the method of calculating BM emission factor taken by the Chinese DNA, the calculation formula for $EF_{BL,upstream,CH_4}$ could be converted to:

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal,upstream,CH_4} \quad (16)$$

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,upstream,CH_4} + \lambda_{Oil} \times EF_{Oil,upstream,CH_4} + \lambda_{Gas} \times EF_{Gas,upstream,CH_4} \quad (17)$$

$EF_{Coal,upstream,CH_4}$: Emission factor for upstream fugitive methane emissions from production of coal; ACM0029 (Version 01.1) gives the default values of two sources i.e. underground or surface mines). Because 95% of the coal production in China is produced by underground mining¹³⁸, so,

$EF_{Coal,upstream,CH_4} = 13.4$ tCH₄/ kt coal. As the emission factor of coal is provided based on a mass unit, it needs to be converted in an energy units required by the methodology. According to data issued by Chinese DNA, the best technology for coal-fired power plant is domestic sub-critical 600MW coal power unit with the fuel consumption of is 336.66 g standard coal/kWh (see the Annex 3 for details). In accordance with China Energy Statistics Yearbook 2006, the net caloric value of standard coal is 1.4 times of the one of raw coal. Thus, $EF_{Coal,upstream,CH_4} = 13.4/1000 \times 0.33666 \times 1.4 = 0.006315$ tCH₄/MWh

$EF_{gas,upstream,CH_4}$: Emission factor for upstream fugitive methane emissions from production of natural gas(tCH₄/ GJ), 296 tCH₄/PJ, the default value given in Methodology AM0029 (Version 01.1) is adopted.

¹³⁸ <http://www.qimay.com.cn/Htmls/SAFE/SAFE/20080702110142.htm>



$EF_{Oil,upstream,CH_4}$: Emission factor for upstream fugitive methane emissions from production of oil (tCH₄/GJ), 4.1 tCH₄/PJ, the default value given in AM0029 (Version 01.1) is adopted.

The data of year 2005 given by Chinese DNA is adopted: $\lambda_{Coal}=96.16\%$, $\lambda_{Oil}=3.36\%$, $\lambda_{Gas}=0.48\%$.

Therefore, based on the formula (17) above, the $EF_{thermal,upstream,CH_4}$ is calculated as below:

$$EF_{thermal,upstream,CH_4} = 96.16\% \times 0.006315 + 0.00000413 \times 3.36\% + 0.000296/36 \times 0.48\% = 0.00607 \text{ tCH}_4/\text{MWh}$$

Therefore, the $EF_{BL,upstream,CH_4}$ is calculated as below:

$$EF_{BL,upstream,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal,upstream,CH_4} = 87.39\% \times 0.00607 = 0.005304 \text{ tCH}_4 / \text{MWh}$$

87.39% is the proportion of fuel-fired power plants in the recently built installed capacity of ECG during 2002~2004, which is released by the Chinese DNA (see the Table A17 in the Annex 3).

Based on these data, the leakage emissions due to fugitive upstream CH₄ emissions in the year y ($LE_{CH_4,y}$) is -176,579tCO₂e (For more detailed information please refer to Annex 3, Table A21).

Step 3.3: Calculation of LE_y

$$LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y} = -176,579 + 121,563 = -55016 < 0,$$

So according to the AM0029, when the total net leakage effects are negative, the Project should assume $LE_y = 0$.

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

>>

Data / Parameter:	$OXID_f$
Data unit:	
Description:	The oxidation factor of natural gas
Source of data used:	IPCC
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using the IPCC default
Any comment:	

Data / Parameter:	$EF_{NG,upstream,y}$
Data unit:	tCH ₄ /GJ
Description:	Emission factor for upstream fugitive methane emissions of natural gas
Source of data used:	IPCC



Value applied:	0.000296
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using the IPCC default
Any comment:	

Data / Parameter:	$EF_{k,upstream,CH_4}$
Data unit:	tCH ₄ /ktcoal
Description:	Emission factor for upstream fugitive methane emissions from production of the fuel (coal)
Source of data used:	IPCC
Value applied:	13.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using the IPCC default
Any comment:	

Data / Parameter:	$EF_{CO_2, upstream, LNG}$
Data unit:	tCO ₂ /TJ
Description:	Emission factor for upstream CO ₂ emissions due to fossil fuel combustion / electricity consumption associated with LNG processing
Source of data used:	Barclay, M. and N. Denton, 2005. Selecting offshore LNG process.< http://www.fwc.com/publications/tech_papers/files/LN J091105p34-36.pdf > (10th April 2006)
Value applied:	6
Justification of the choice of data or description of measurement methods and procedures actually applied :	No reliable and accurate data on this parameter is available.
Any comment:	

Data / Parameter:	$F_{i,y}$
Data unit:	t/m ³
Description:	Amount of fuel consumed in year(s) y for power generation
Source of data used:	China Energy Statistical Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	As detailed information on fuel consumed by power plants is not publicly available, aggregated data on the fuel types is used instead.
Any comment:	

Data / Parameter:	$GEN_{i,y}$
Data unit:	MWh
Description:	Electricity (MWh) delivered to the grid excluding low operation



	cost/must run power plants in year y
Source of data used:	China Electricity Power Yearbook 2004~2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	As detailed information on fuel consumed by power plants is not publicly available, the aggregated data on the fuel types is used instead.
Any comment:	

Data / Parameter:	NCV _i
Data unit:	GJ/t(ce)
Description:	Net caloric value of fuel i used in the project activity
Source of data used:	China Energy Statistics Yearbook 2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Provided by national statistics.
Any comment:	

Data / Parameter:	OXID _i
Data unit:	
Description:	The oxidation factor of fuel i
Source of data used:	IPCC default value in 2006 IPCC Guideline for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using the IPCC default value, as the national specific value is unavailable.
Any comment:	

Data / Parameter:	EF _{co2,f,y}
Data unit:	tCO2/GJ
Description:	The emission factor of fuel i
Source of data used:	IPCC default value in 2006 IPCC Guideline for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	As detailed information on fuel consumed by power plants is not publicly available, the aggregated data on the fuel types is used instead.
Any comment:	

Data / Parameter:	COEF _i
Data unit:	tCO2/t(m ³)
Description:	CO2 emission coefficient of fuel i
Source of data used:	Calculated
Value applied:	See Annex 3
Justification of the choice of data	Calculated according to the formula suggested by AM0029.



or description of measurement methods and procedures actually applied :	
Any comment:	

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

>>

According to AM0029, the calculation of the emission reductions was applying the following equation:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y : emissions reductions in year y (t CO₂e)

BE_y : emissions in the baseline scenario in year y (t CO₂e), 2,180,948t CO₂e/a;

PE_y : emissions in the project scenario in year y (t CO₂e), 1,136,620t CO₂e/a

LE_y : leakage in year y (t CO₂e)

According to the calculation in Step 3 of section B.6.1, in this Project, LE_y equals to zero, so the emission reductions are 1,044,328tCO₂e/a.

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

>>

The estimated annual emission reductions for the first crediting period, estimated to start from 1 January 2010, are set out in the table below:

Year	Estimation of project activity emissions (tones of CO ₂ e)	Estimation of baseline emissions (tones of CO ₂ e)	Estimation of leakage (tones of CO ₂ e)	Estimation of overall emission reductions (tones of CO ₂ e)
1 Jan 2009-31 Dec 2010	1,136,620	2,180,948	0	1,044,328
1 Jan 2011 -31 Dec 2011	1,136,620	2,180,948	0	1,044,328
1 Jan 2012 -31 Dec 2012	1,136,620	2,180,948	0	1,044,328
1 Jan 2013 -31 Dec 2013	1,136,620	2,180,948	0	1,044,328
1 Jan 2014 -31 Dec 2014	1,136,620	2,180,948	0	1,044,328
1 Jan 2015 -31 Dec 2015	1,136,620	2,180,948	0	1,044,328
1 Jan 2016 -31 Dec 2016	1,136,620	2,180,948	0	1,044,328
Total (tones of CO₂e)	7,956,340	15,266,636	0	7,310,296

B.7. Application of the monitoring methodology and description of the monitoring plan:**B.7.1. Data and parameters monitored:**

>>

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh



Description:	Electricity supplied to the grid by the project activity
Source of data to be used:	Reading of the Meter at the identified Metering Point
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2,716,000
Description of measurement methods and procedures to be applied:	The meter readings will be measured hourly and recorded monthly. Data will be archived for 2 years following the end of the crediting period by means of electronic and paper backup.
QA/QC procedures to be applied:	Electricity supplied by the project activity to the grid will be monitored and recorded at the control centre using a computer system. Commercial receipts for electricity will also be kept for cross checking.
Any comment:	

Data / Parameter:	$EF_{Grid, BM, y}$
Data unit:	tCO ₂ /MWh
Description:	Build margin emission factor of ECPG
Source of data to be used:	Calculated based on public available data as per provisions given in the “Tool to calculate emission factor for an electricity system” Version01
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.8030
Description of measurement methods and procedures to be applied:	As demonstrated in PDD Section B.6.1, the lowest value of the three options given in AM0029 Version03 is Option1-Build Margin of ECPG, it should therefore be monitored ex post as per AM0029 Ver03. According to the “Tool to calculate emission factor for an electricity system”, for the first crediting period, the build margin emission factor shall be updated annually, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available.
QA/QC procedures to be applied:	As per QA/QC procedures for relevant monitored parameters in the “Tool to calculate emission factor for an electricity system”
Any comment:	

Data / Parameter:	$FC_{f,y}$
Data unit:	m ³
Description:	The net amount of NG consumed by the proposed project.
Source of data to be used:	Fuel flow meter readings
Value of data applied for the purpose of calculating expected emission reductions	576,240,000



in section B.5	
Description of measurement methods and procedures to be applied:	The natural gas flow rate will be monitored continuously both by the supplier and the Project Owner. The natural gas consumption will be aggregated automatically and recorded daily.
QA/QC procedures to be applied:	The total net amount of natural gas consumed by the Proposed Project will be monitored by both supplier and Project Owner for cross-verification. All meters used for the reading of the gas supplied will be retained for regular maintenance and testing services for an ensured accuracy.
Any comment:	.

Data / Parameter:	$NCV_{f,y}$
Data unit:	GJ/m ³
Description:	The net calorific value per volume unit of natural gas
Source of data to be used:	Fuel supplier, Local Authority, Country specific, that order of preference
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.03516
Description of measurement methods and procedures to be applied:	From NG test report issued by the NG supplier if applicable, the test will be performed fortnightly. Local or country specific data would be used in case data from NG supplier is not accessible
QA/QC procedures to be applied:	
Any comment:	.

Data / Parameter:	$EF_{CO_2,f,y}$
Data unit:	tCO ₂ /GJ
Description:	Emission factor of natural gas
Source of data to be used:	Fuel supplier, local data, country-specific values
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0561
Description of measurement methods and procedures to be applied:	Use supplier-provided data, local data, country-specific values, in this order of preference.
QA/QC procedures to be applied:	
Any comment:	.

B.7.2. Description of the monitoring plan:

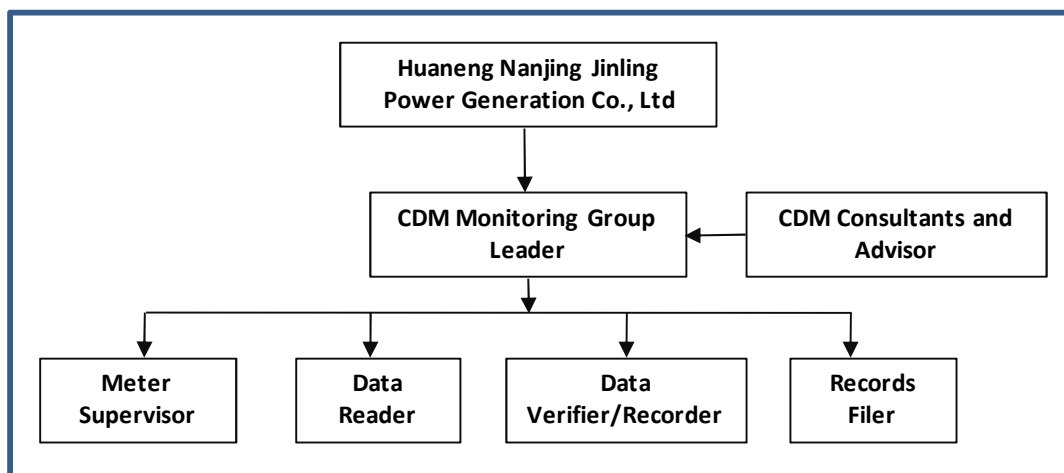
>>

The monitoring plan, implemented by the Project Owner, is made to ensure that the emission reductions will be monitored transparently throughout the crediting period.

1. Monitoring institution and training plan

The Project Owner is responsible for the work related to the monitoring, including the relevant data collection, documentation, monitoring and verification. A CDM working group will be established internally. The operational and organizational structure for the monitoring process is shown in Figure 5.

Figure 5: The Operational and Organizational Structure of the CDM Monitoring

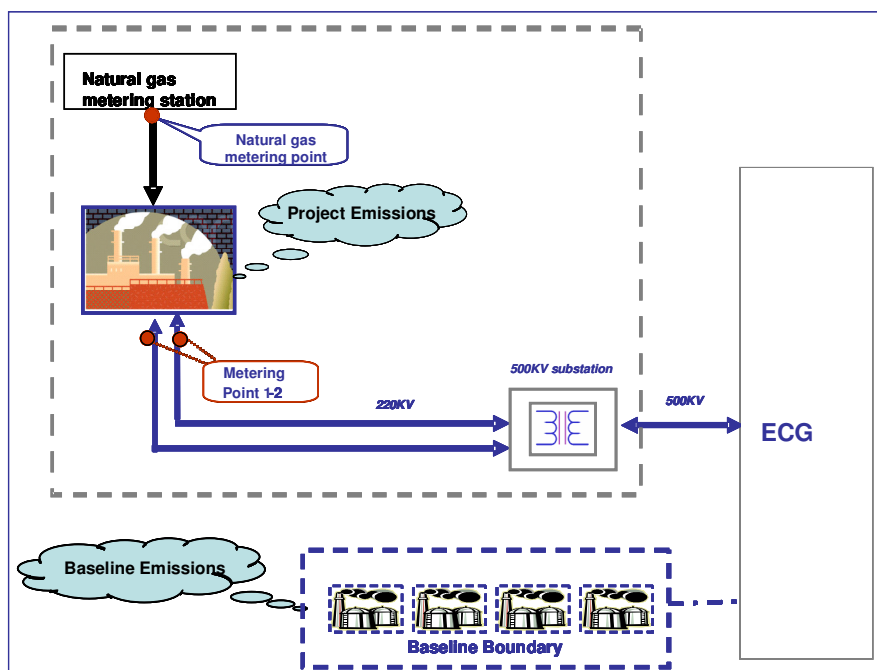


In order to ensure all the relevant personnel has sufficient knowledge and capacity to perform the assigned tasks, the Project Owner will provide relevant training for personnel, and the corresponding minutes and reports should be documented.

2. The data to be monitored

The emission reductions are calculated ex-ante, so the set of data to be monitored during the Proposed Project operation phase includes the electricity supplied by the Proposed Project to the grid, and the amount of the natural gas, as fuel, to be supplied to the Proposed Project. In order to achieve the expected monitoring results, a set of metering points has been identified and these are set out in the Figure 6.

Figure 6: The Project/Baseline Boundaries and the Monitoring Settings



3 The equipment for monitoring and the installation of Meters

3.1 Monitoring of the net electricity generated by the Project and sold into the Grid (ECPG)

The ammeter should be installed according to the relevant technical rules in China, and checked before acceptance by both grid company and the Project Owner before the ammeter is operational.

According to the power generation and distribution layout stated in the PPA, the proposed project is connected, via two 220kv transmission lines, to a 500kv substation linking to the Jiangsu Grid, a sub-grid of ECPG; the Metering Point for electricity sold to ECPG ($EG_{out,y}$) is set at the project side of each transmission line, as shown in the Figure 6. A main meter and a backup meter are installed at each Metering Point. The readings of the main meters are taken for billing purpose between the Project Owner and Grid Company, as well as for CDM purposes, while the readings of the backup meters only serve for emergency situations.

Serving as a peak-load balancing power plant, the Proposed Project will be in standby mode at certain points of time during the course of operation. Therefore, it will need to import electricity from the grid whilst in idle status. The amount of electricity imported from the grid ($EG_{in,y}$) will also be measured by ammeter at the project side.

The meter readings will be readily accessible for the DOE. Calibration records will also be maintained for verification.

The calculation for the net amount of electricity supplied to the Grid is equal to $(EG_{out,y} - EG_{in,y})$.

Should any readings of the Main Meter be inaccurate by more than the specific uncertainty, or the meters have otherwise functioned improperly, the electricity sold to the grid shall be determined by:



- (1) First, by reading Backup Meter, unless a test by either party reveals it is inaccurate;
- (2) if the backup system is not within the acceptable limits of accuracy or is otherwise performing improperly the Project Owner and the ECPG shall jointly prepare an estimate of the correct reading; and
- (3) If the Project Owner and the Jiangsu Grid Company fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to agreed procedures.

1)

3.2 Monitoring of quantity of NG combusted

The amount of natural gas combusted in m³ is monitored both at NG supplier and project end through flow meters and meter readings are recorded automatically. The meter at the NG supplier side is taken for billing purpose between NG supplier and the Project Owner, as well as for CDM purpose. The commercial receipts for the gas purchased by the Project Owner will be kept and will be readily accessible for verification by the DOE.

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

3.3 Monitoring of NCV

NCV of the natural gas was used during the calculation of the CO₂ emission coefficient, so the NG test reports will be obtained from fuel supplier if applicable.

4. Calibrations

According to the PPA negotiated and signed between the Project Owner and Jiangsu Power Grid Company, the metering point arrangements and the required quality control procedures to ensure the accuracy of all related readings include:

- 1) The metering equipment will be properly calibrated for accuracy in compliance with relevant industrial standards in China.
- 2) 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.
- 3) The recorded electricity readings of the Main Meters will be sufficient for the purpose of billing and emission reduction verification as long as the error in the Main Meter is within the specific uncertainty of the ammeter.

Calibration is carried out by the Grid Company with the records being provided to the Project Owner, and these records will be maintained by the Project Owner for verification.

5. Data management

A CDM working team assigned by the project owner will be responsible to collect, record and document all the related monitoring records.

Any other physical documentation such as paper-based maps, diagrams and environmental assessment will be collected, together with this monitoring plan, and indexed for auditor's reference.



All relevant paper-based information will be stored by the CDM working team and kept, at least with one hard copy, for two more years after the end of the crediting period for the Proposed Project.

6. Monitoring Report

The CDM group is responsible for finalising the monitoring report of the Proposed Project. All the related records of calibration, reading and invoices will be readily accessible for the verification of the DOE. The monitoring report shall include all information used to calculate the emission reductions of the Proposed Project, which reflect the real, measurable and long-term GHG reductions achieved by the Proposed Project.

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)

>>

The baseline and monitoring study of the Project was completed on 29th July 2009 by Gaisi Peony Carbon Capital S.a.r.l.

The contact information of the Gaisi Peony Carbon Capital S.a.r.l.:

Mr Timothy Clissold

Tel.: +44(0)770-763-1442, Fax: +44(0)770-763-1442; Email: tclissold@peonycapital.com.

Gaisi Peony Carbon Capital S.a.r.l. is a project participant.

Earlier drafts of the PDD were completed by Green Capital Consulting.

Green Capital Consulting is not a project participant.

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:

>>

25/06/2005

This date is the date of signing the Civil Construction Contract for the proposed project, which is the earliest date on which the implementation or the construction or real action of a project activity began.

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

>>

22 years (2 years construction and 20 years operation)

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

>>

C.2.1. Renewable crediting period

>>

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

>>

01/01/2010, or the date of registration, whichever is later.

**C.2.1.2. Length of the first crediting period:**

>>

7 years

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date of the first crediting period:

>>

Not applicable

C.2.2.2. Length of the first crediting period:

>>

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 clauses 13 and 19 of the Environmental Evaluation Law of the P. R. China, the project entity must analyse the environmental impacts of project activities in P. R. China before utilising natural resources and beginning project construction. Therefore, the Project Owner commissioned the Central Southern Electric Power Institute to conduct The Environmental Impact Assessment (EIA) of the Proposed Project in 2003, and it was approved by the State Environmental Protection Administration of China on 10 June 2003.

In accordance with Chinese regulations, the EIA report has been reviewed by relevant experts. The EIA identified the potential environmental impacts during the period of project preparation, construction and operation and proposed the response measures for mitigate environmental impacts.

The main environmental impacts and mitigation measures to be carried out during construction and operation are summarized as follows:

Key Parameters	Source	Mitigation Measures
Water pollution	Construction phase:	1) Retaining of wastewater from tunnel construction, as well as sand and rock processing in the sedimentation pond before discharge into river;
	- Construction Wastewater	2) Treatment of domestic sewage with wastewater treatment equipment before discharge into river.
	- Domestic sewage	3) Wastewater treatment with wastewater treatment equipment before discharge into river
	Operation phase:	4) Installation of monitoring equipment for water quality at wastewater drain outlet to ensure compliance with relevant guideline set out in GB8978-1996.
	- Domestic sewage	
	- Cooling water system bow down	



	-	Demineralization waste water	
Air pollution	Construction phase:		1) Watering of exposed area or worksite of excavation
	- Construction equipments and vehicles		2) Selection of closed and semi-closed vehicles to transport construction materials;
	- Construction sites		3) Regular maintenance of construction equipments and transportation vehicles.
	Operation phase:		4) Selection of fuel with low nitrogen in flamer to ensure compliance with relevant guideline set out in GB13223-1996.
	-	fuel combustion (SO ₂ 、 NOx)	
Noise pollution	Construction Phase:		1) Setting noise barrier around the construction site, and arrangement of construction time and plane reasonably to ensure compliance with relevant guideline set out in the <i>Noise Limits for Construction Site</i> (GB 12523-1990);
	- Construction equipments and vehicles		2) Adjustment of vehicle speed
			3) Choice of equipments with low noise
			4) Regular maintenance of construction equipments
	Operation phase:		1) Arrangement of plane time reasonably
	- Equipments		2) Installation of noise barrier equipment
			3) Green belt of 2.58hm ² , and the greening rate can reach 15%
			4) Through above measures to ensure compliance with relevant guideline set out in GB12348-1990

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:

>>

These findings and approval evidence that strict environmental monitoring and mitigation measures will be carried out during the construction and operation phase of the Project. Multiple measures are taken into account to deal with environmental impacts that might arise from or hide in the Project minimizing negative effects to the lowest possible level with little significance.

SECTION E. Stakeholders' comments

>>

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

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1. In August 2006, a meeting for the local villagers was organized by the Project Owner with the assistance of local village committee. Stakeholders from the local community aged between 20 and 60 were first identified, and then selected from diversified ages, professions and education background based on the principle of representation and randomness, so as to reflect public opinion and concerns in a way of transparent and equality, and for those selected stakeholders were further invited to attend the meeting for the purpose of receiving the related opinions on the proposed project. The information of the Project was provided during the meeting, including the



issues in respect of on energy resources, technology applied, economic benefit and environmental protection aspects, then followed by open discussion. In the end, questionnaires were distributed to the villagers to better understand stakeholders' comments.

2. The Project Owner also invited officials from 3 relevant local governmental agencies, including the Finance Bureau, Taxation Bureau and Development and Economic Trade Bureau of Qixia district of the Nanjing city. As a result, the Supporting Letter issued from the above mentioned relevant government agencies were received by the Project owner.

E.2. Summary of the comments received:

>>

The Survey received 100% participation, 36 copies of the questionnaires returned out of 49. (Questionnaires are provided to DOE). The following is a summary of the key findings based on returned questionnaires.

1. The key issues affect the local economic development

The stakeholders generally deem that the shortage of power supply is one of the main issues affecting the local economic development. They hope that electricity supply condition can be improved as a result of the Project.

2. Attitude of the residents toward the Project:

The stakeholders generally deem that the Project utilizing natural gas as the fuel which is considered as a 'cleaner energy', emits less pollutants compared to those coal-fired power plants, therefore it does have no harm to the local ecological environment.

At the same time, the stakeholders believe that the Project will bring multiple benefits to their livelihoods, particularly in the aspect of employment increase, and power supply improvement.

3. Conclusion

As indicated by the Survey, all stakeholders believe that the construction of the Proposed Project will have positive impacts on the local ecology, environment and social life. All stakeholders expressed their support to the Proposed Project

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

>>

The Survey shows that the proposed project receives very strong support from local community and the relevant local government agencies; No negative comments have been received on the project.

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

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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There is no public funding for the Project.

Annex 3

BASELINE INFORMATION

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Table A1. Fossil Fuel-fired Power Generation of ECG in 2002

Regions	Electricity Generation (MWh)	Rate of Electricity Consumption (%)	Electricity Supply to Grid (MWh)
Shanghai	61,648,000	5.44	58,294,349
Jiangsu	116,716,000	6.09	109,607,996
Zhejiang	69,287,000	5.95	65,164,424
An'hui	45,703,000	6.36	42,796,289
Fujian	30,850,000	6.68	28,789,220
Total			304,652,277

Data source: China Electric Power Yearbook 2003

Table A2. Power Import of ECG in 2002

Power Import from CCG	7,883,000
Emission of CO ₂ (tCO ₂ /MWh)	0.7274
Total Emission of CO ₂ in CCG (tCO ₂)	215,081,403
Total Power Supply of CCG (MWh)	295,691,681

Data source: <http://cdm.ccchina.gov.cn/web/index.asp>



Table A3. Calculate the Operating Margin Emission Factor of ECG in 2002

Fuel	Unit	Shanghai	Jiangsu	Zhejiang	An'hui	Fujian	Total	Emission Factors ¹³⁹ tc/TJ	Oxidation Factor ¹⁴⁰ %	Ave Low Calorific Value MJ/t, km ³	Emission of CO ₂ tCO ₂ e
Raw Coal	10 ⁴ t	2,386	5,674.69	2,923.66	2,025.05	1,336.49	14,345.89	25.8	100	20,908	283,746.90
Cleaned Coal	10 ⁴ t						0	25.8	100	26,344	0
Other Washed Coal	10 ⁴ t						0	25.8	100	8,363	0
Coke	10 ⁴ t						0	29.2	100	28,435	0
Coke Oven Gas	10 ⁸ m ³	2.23	0.02				2.25	12.1	100	16,726	166,967.30
Other Gas	10 ⁸ m ³	66.82					66.82	12.1	100	5,227	1,549,586.31
Crude Oil	10 ⁴ t						0	20.0	100	41,816	0
Gasoline	10 ⁴ t		0.07				0.07	18.9	100	43,070	2,089.32
Diesel Oil	10 ⁴ t	1.21	13.45	30			44.66	20.2	100	42,652	1,410,850.25
Fuel Oil	10 ⁴ t	53.2	1.19	91.38	1.09	12.6	159.46	21.1	100	41,816	5,158,793.37
PLG	10 ⁴ t						0	17.2	100	50,179	0
Refinery Gas	10 ⁸ m ³	0.84					0.84	15.7	100	46,055	22,270.36
Other Coking Products	10 ⁴ t						0	25.8	100	28,435	0
Other Petroleum Products	10 ⁴ t	10	3.47				13.47	20.0	100	38,369	3,790,089.82
Other Energy	10 ⁴ tce	3		10.4			13.4	0	0	0	0
Subtotal											295,975,223.5
CO₂ emission caused by power import from CCG											5,733,968.07
Total CO₂ emission											301,709,191.7
Total power supply of ECG											312,535,277.1

¹³⁹ Date source: Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook¹⁴⁰ Date source: Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook



Data source: China Energy Statistical Yearbook 2000-2002

Table A4. Fuel-Fired Power Generation of ECG in 2003

Regions	Electricity Generation (MWh)	Rate of Electricity Consumption (%)	Electricity Supply to Grid (MWh)
Shanghai	69,444,000	5.14	65,874,578
Jiangsu	133,277,000	5.9	125,413,657
Zhejiang	83,089,000	5.31	78,676,974
An'hui	54,156,000	6.06	50,874,146
Fujian	42,146,000	5.07	40,009,198
Total			360,848,554

Data source: China Electric Power Yearbook 2004

Table A5 Power Import of ECG in 2003

Power Import from CCG	13,756,040
Emission Factor of CO ₂ (tCO ₂ /MWh)	0.7686
Total Emission of CO ₂ in CCG (tCO ₂)	270,902,650
Total Power Supply of CCG (MWh)	352,435,719
Power Import from Yangcheng Power Plant	10,705,870
Emission Factor of CO ₂ for Yangcheng Power Plant	0.9498
Fuel Consumption of Yangcheng Power Plant	343gce/kwh

Data source: <http://cdm.ccchina.gov.cn/web/index.asp>



Table A6. Calculate the Operating Margin Emission Factor of ECG in 2003

Fuel	Unit	Shanghai A	Jiangsu B	Zhejiang C	An'hui D	Fujian D	Total A+...+BI	Emission Factors ¹⁴¹ tc/TJ	Oxidation Factor ¹⁴² %	Ave Low Calorific Value MJ/t,km ³	Emission of CO ₂ tCO ₂ e
Raw Coal	10 ⁴ t	2,618	6,417.74	3,442.40	2,669.67	1,754	16,901.81	25.8	100	20,908	334,300,359.1
Cleaned Coal	10 ⁴ t						0	25.8	100	26,344	0
Other Washed Coal	10 ⁴ t						0	25.8	100	8,363	0
Coke	10 ⁴ t						0	29.2	100	28,435	0
Coke Oven Gas	10 ⁸ m ³	1.99	0.06				2.05	12.1	100	16,726	152,125.76
Other Gas	10 ⁸ m ³	66.34					66.34	12.1	100	5,227	1,538,454.90
Crude Oil	10 ⁴ t						0	20	100	41,816	0
Diesel Oil	10 ⁴ t	1.26	14.71	13.99			29.96	20.2	100	42,652	946,463.80
Fuel Oil	10 ⁴ t	95.49	0.76	174.48		18.89	289.62	21.1	100	41,816	9,369,683.52
PLG	10 ⁴ t						0	17.2	100	50,179	0
Refinery Gas	10 ⁴ t	0.49	0.96				1.45	15.7	100	46,055	38,442.88
Nature Gas	10 ⁸ m ³						0	15.3	100	38,931	0
Other Petroleum Products	10 ⁴ t	18.91	5.3	15.04			39.25	20	100	38,369	1,104,387.72
Other Coking Products	10 ⁴ t						0	25.8	100	28,435	0
Other Energy	10 ⁴ tce	5.68		7.08			12.76	0	0	0	0
Subtotal											347,564,348.20
CO ₂ emission caused by power import from CCG											10,572,892.34
CO ₂ emission caused by power import from Yangcheng											10,168,435.33
Total CO ₂ emission											368,306,259.30
Total power supply of ECG											385,310,463.70
OM											0.9559

Data source: China Energy Statistical Yearbook 2004

¹⁴¹ Date source: Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook¹⁴² Date source: Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook





Table A7. Fuel-Fired Power Generation of ECG in 2004

Regions	Electricity Generation (MWh)	Rate of Electricity Consumption (%)	Electricity Supply to Grid (MWh)
Shanghai	71,127,000	5.22	67,414,171
Jiangsu	163,545,000	5.93	153,846,782
Zhejiang	95,255,000	5.68	89,844,516
An'hui	59,875,000	6.03	56,264,538
Fujian	50,490,000	6.07	47,425,257
Total			414,795,263

Data source: China Electric Power Yearbook 2005

Table A8. Power Import of ECG in 2004

Power Import from CCG	26,933,850
Emission Factor of CO ₂ (tCO ₂ /MWh)	0.8110
Total Emission of CO ₂ in CCG (tCO ₂)	339,209,150
Total Power Supply of CCG (MWh)	418,261,666
Power Import from Yangcheng Power Plant	11,649,610
Emission Factor of CO ₂ for Yangcheng Power Plant	0.9442
Fuel Consumption of Yangcheng Power Plant	341gce/kwh

Data source: <http://cdm.ccchina.gov.cn/web/index.asp>



Table A9. Calculate the Operating Margin Emission Factor of ECG in 2004

Fuel	Unit	Shanghai A	Jiangsu B	Zhejiang C	An'hui D	Fujian E	Total A+...+E	Emission factors ¹⁴³ tc/TJ	Oxidation factor ¹⁴⁴ %	Average low Calorific Value ³ MJ/t,km ³	Emission of CO ₂ tCO ₂ e
Raw Coal	10 ⁴ t	2,779.60	7,601.9	4,008.9	2906.2	2183.7	19,480.30	25.8	100	20,908	385,300,230.3
Cleaned Coal	10 ⁴ t						0	25.8	100	26,344	0
Other Washed Coal	10 ⁴ t		5.46			4.63	10.09	25.8	100	8,363	79,826.00582
Coke	10 ⁴ t						0	29.2	100	28,435	0
Coke Oven Gas	10 ⁸ m ³	2.59					2.59	12.1	100	16,726	192,197.9085
Other Gas	10 ⁸ m ³	72.46					72.46	12.1	100	5,227	1,680,380.49
Crude Oil	10 ⁴ t						0	20	100	41,816	0
Diesel Oil	10 ⁴ t	2.69	27.17	6.23			36.09	20.2	100	42,652	1,140,116.11
Fuel Oil	10 ⁴ t	58.52	55.07	202.89		23.26	339.74	21.1	100	41,816	10,991,147.99
PLG	10 ⁴ t						0	17.2	100	50,179	0
Refinery Gas	10 ⁴ t	0.77	0.55				1.32	15.7	100	46,055	34,996.2734
Nature Gas	10 ⁸ m ³		0.14				0.14	15.3	100	38,931	30,576.4074
Other Petroleum Product	10 ⁴ t	21.22	1.37	24.89			47.48	20	100	38,369	1,335,957.421
Other Coking Products	10 ⁴ t						0	25.8	100	28,435	0
Other Energy	10 ⁴ tce	6.43		15.48			21.91	0	0	0	0
Subtotal											400,910,415.90
CO₂ emission caused by power import from CCG											21,843,283.94
CO₂ emission caused by power import from Yangcheng											10,999,561.76
Total CO₂ emission											433,753,744.90
Total power supply of ECG											453,378,722.60
OM											0.9567

Data source: China Energy Statistical Yearbook 2005

¹⁴³ Date source: Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook¹⁴⁴ Date source: Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook



Table A10. The Operating Margin Emission Factor of ECG in 2002~2004

Year	2002	2003	2004	OM
CO ₂ emission (tCO ₂ e)	301,696,772.7	368,306,259.3	433,753,744.9	0.9588
Fuel-fired power generation of ECG (MWh)	312,535,277.0	385,310,464	453,378,723	

Data source: Table A1-A9

Table A11. The Oxidation Factor, Emission Factors and Average Low Calorific Value of the Fuel

Fuel	Low Calorific Value	Emission Factors tC/TJ	Oxidation Factor
Raw Coal	20,908 kJ/kg	25.80	1
Cleaned Coal	26,344 kJ/kg	25.80	1
Other Washed Coal	8,363 kJ/kg	25.80	1
Coke	28,435 kJ/kg	29.20	1
Crude Oil	41,816 kJ/kg	20.00	1
Gasoline	43,070 kJ/kg	18.90	1
Coal oil	43,070 kJ/kg	19.60	1
Diesel Oil	42,652 kJ/kg	20.20	1
Fuel oil	41,816 kJ/kg	21.10	1
Other Petroleum Products	38,369 kJ/kg	20.00	1
Natural gas	38,931 kJ/m ³	15.30	1
Coke oven gas	16,726 kJ/m ³	12.10	1
Other coal gas	5,227 kJ/m ³	12.10	1
LPG	50,179 kJ/kg	17.20	1
Refinery gas	46,055 kJ/kg	15.70	1

According to the statistical analysis of newly-built fuel-fired power plants in the 10th Five-Year Plan (2000-2005) a by State Electricity Regulatory Commission of China, for the coal-fired power plant, the most efficiency level of the best technology commercially available in China was selected as 600MW. The fuel consumption is 336.66 gce/kWh, while the corresponding efficiency of the power supply is 36.53%.

The best technology commercially with the most efficiency level applied in the combined cycle power plant (including gas power plant and oil power plant) is selected as 200MW level, (equals to the technology of 9E unit from GE). According to the data in 2004, the fuel consumption of the combined cycle power plant with the actual most efficiency level of the best technology commercially is 268.13 gce/kWh, while the corresponding efficiency of the power supply is 45.87%.

The emission factors of coal-fired power, oil-fired power and gas-fired power respectively with the most efficiency level of the best technology commercially was described in Table A12



Table A12. The Emission Factor of Coal, Oil, Gas-Fired Power Plant

Table 1: The Emission Factor of Coal, Gas, and Oil-fired Power Plant					
	Variable	Efficiency of Power Supply A	Emission Factor of the Fuel (tc/TJ) B	Oxidation Factor C	Emission Factor (tCO ₂ /MWh) D=3.6/A/1000*B*C*44/12
Coal-fired power plant	EF _{Coal,Adv}	36.53%	25.80	1	0.9323
Gas-fired power plant	EF _{Gas,Adv}	45.87%	15.3 0	1	0.4403
Oil-fired power plant	EF _{Oil,Adv}	45.87%	21.1 0	1	0.6072

Table A13. Emission of CO₂ in ECG

Fuel	Unit	Shanghai A	Zhejiang B	Jiangsu C	Anhui D	Fujian E	Total F=A+...+E	Calorific Value G	Emission Factor of the Fuel (tc/TJ) H	Ox Factor I	Emission of CO ₂
Raw coal	10 ⁴ t	2,779.6	7,601.90	4,008.90	2,906.20	2,183.70	19,480.3	20,908 kJ/kg	25.80	1.0	385,300,230.3
Cleaned coal	10 ⁴ t	0	0	0	0	0	0	26,344 kJ/kg	25.80	1.0	0
Other washed coal	10 ⁴ t	0	5.46	0	0	4.63	10.09	8,363 kJ/kg	25.80	1.0	79,826.0
Coke	10 ⁴ t	0	0	0	0	0	0	28,435 kJ/kg	29.20	1.0	0
Subtotal											385,380,056.0
Crude oil	10 ⁴ t	0	0	0	0	0	0	41,816 kJ/kg	20.00	1.0	0
Gasoline	10 ⁴ t	0	0	0	0	0	0	43,070 kJ/kg	18.90	1.0	0
kerosene	10 ⁴ t	0	0	0	0	0	0	43,070 kJ/kg	19.60	1.0	0
Diesel	10 ⁴ t	2.69	27.17	6.23	0	0	36.09	42,652 kJ/kg	20.20	1.0	1,140,116
Fuel oil	10 ⁴ t	58.52	55.07	202.89	0	23.26	339.74	41,816 kJ/kg	21.10	1.0	10,991,147
Other Petroleum Products	10 ⁴ t	21.22	1.37	24.89	0	0	47.48	38,369 kJ/kg	20.00	1.0	1,335,957
Subtotal											13,467,221
Natural gas	10 ⁷ m ³	0	1.4	0	0	0	1.4	38,931 kJ/m ³	15.30	1.0	30,576
Coke oven gas	10 ⁷ m ³	25.9	0	0	0	0	25.9	16,726 kJ/m ³	12.10	1.0	192,198
Other coal gas	10 ⁷ m ³	724.6	0	0	0	0	724.6	5,227 kJ/m ³	12.10	1.0	1,680,380
Liquefied Petroleum	10 ⁴ t	0	0	0	0	0	0	50,179 kJ/kg	17.20	1.0	0
Refinery gas	10 ⁴ t	0.77	0.55	0	0	0	1.32	46,055 kJ/kg	15.70	1.0	34,996
Subtotal											1,938,151
Total											400,785,429

Data Source: The China Energy Statistical Yearbook 2005

Based on table A13 and formula (6), (7) and (8), $\lambda_{Coal}=96.16\%$, $\lambda_{Oil}=3.36\%$, $\lambda_{Gas}=0.48\%$.

$$\text{So } EF_{\text{Thermal}} = \lambda_{\text{Coal}} \times EF_{\text{Coal, Adv}} + \lambda_{\text{Oil}} \times EF_{\text{Oil, Adv}} + \lambda_{\text{Gas}} \times EF_{\text{Gas, Adv}} = 0.9189$$



Table A14. The Installed Capacity of ECG in 2004

	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Fuel-fired power	MW	12,014.9	28,289.5	21,439.8	9,364.5	8,315.4	79,424.1
Hydropower	MW	0	126.5	6,418.4	692.8	7,180.1	14,417.8
Nucleus power	MW	0	0	3,056	0	0	3,056.0
Wind power	MW	3.4	17.6	39.7	0	12	72.7
Total	MW	12,018.3	28,433.6	30,953.9	10,057.3	15,507.5	96,970.6

Data source: China Electric Power Yearbook 2005

Table A15. The Installed Capacity of ECG in 2003

	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Fuel-fired power	MW	11,092.6	22,245	15,321.2	9,284.9	7,092.8	65,036.5
Hydropower	MW	0	137.8	6,054.5	649.1	6,761.1	13,602.5
Nucleus power	MW	0	0	2,406.0	0	0	2,406.0
Wind power	MW	0	0	39.7	0	12	51.7
Total	MW	11,092.6	22,382.7	23,821.4	9,934	13,865.8	81,096.5

Data source: China Electric Power Yearbook 2004

Table A16. The Installed Capacity of ECG in 2002

	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Fuel-fired power	MW	11,382.6	20,599	13,082.4	9,056.3	6,999.9	61,120.2
Hydropower	MW	0	137.2	5,866.8	649.1	6,512.0	13,165.1
Nucleus power	MW	0	0	1,678.0	0	0	1,678.0
Wind power	MW	0	0	50.2	0	12	62.2
Total	MW	11,382.6	20,736.2	20,677.4	9,705.4	13,523.9	76,025.5

Data source: China Electric Power Yearbook 2003



Table A17. Change in Installed Capacity of ECG in 2002~2004

Year	2002 A	2003 B	2004 C	Change in Installed Capacity from 2002 to 2004 D=C-A	The Proportion of the Total Change Capacity
Fuel-fired power(MW)	61,120.2	65,036.5	79,424.1	18,303.9	87.39%
Hydropower(MW)	13,165.1	13,602.5	14,417.8	1,252.7	5.98%
Nucleus power	1,678.0	2,406.0	3,056.0	1,378.0	6.58%
Other(MW)	62.2	51.7	72.7	10.5	0.05%
Total (MW)	76,025.5	81,096.7	96,970.6	20,945.1	100.00%

$$EF_{\text{Grid}, \text{BM}, y} = 0.9189 \times 87.39\% = 0.8030 \text{ tCO}_2/\text{MWh}$$

Table A18. Data for $EF_{BL, \text{upstream}, CH_4}$ Calculation

Change in Fuel-fired Power Installed Capacity from 2004 to 2005	Annual Operation Hours	Standard Coal Consumption kgce/kwh	NCV (IPCC)	Coal Consumption MJ
18,303.9	6,497h	0.33666	29,27KJ/kg	1.17×10^{12}



Table A19. Data for Project Emissions Calculation

	ID number	Value	Unit	Data Source
Quantity of NG consumption by the Project during the year y	FC_f	576,240,000	m ³	Feasibility Study Report of the Project
Net calorific value of NG	NCV_{NG}	0.03516	GJ/m ³	Feasibility Study Report of the Project
CO ₂ emission factor per unit of energy of NG	$EF_{CO_2, f, y}$	56.1	tCO ₂ /TJ	National Data updated by the Chinese DNA
Oxidation factor of NG	$OXID_f$	1	-	IPCC Default
Project emissions	PE_y	1,136,620	tCO ₂ e	-

Table A20. Data for Baseline Emissions Calculation

	ID number	Value	Unit	Data Source
Electricity generation in the plant during the year	$EG_{PJ, y}$	2,716,000	MWh	Feasibility Study Report of the Project
Baseline CO ₂ emission factor	$EF_{BL, CO_2, y}$	0.8030	tCO ₂ e /MWh	-
Baseline emissions	BE_y	2,180,948	tCO ₂ e	-

TableA21. Data for Leakage Emissions Calculation

	ID number	Value	Unit	Data Source
Quantity of NG consumption by the Project during the year y	FC_f	576,240,000	m ³	Feasibility Study Report of the Project
Net calorific value of NG	NCV_{NG}	0.03516	GJ/m ³	Feasibility Study Report of the Project
Emission factor for upstream fugitive methane emissions of NG	$EF_{NG, upstream}$	0.000296	tCH ₄ /GJ	AM0029
Electricity generated by the Project during the year	$EG_{PJ, y}$	2,716,000	MWh	Feasibility Study Report of the Project
Emission factor for upstream fugitive methane emissions from production of the coal	$EF_{k, upstream, CH_4}$	13.4	tCH ₄ /ktcoal	AM0029
Emission factor for upstream CO ₂ emissions due to LNG consumption associated	$EF_{CO_2, upstream, LNG}$	6	tCO ₂ /TJ	AM0029
Net calorific value of coal	NCV_{coal}	29.27	GJ/tsce	General Principles for Calculation of Total Production Energy Consumption (GB2589-90)
The emission factor for upstream fugitive CH ₄ emissions occurring in the absence of the Project activity	$EF_{BL, upstream, CH_4}$	0.005304	tCH ₄ /MWh	-
Global warming potential of methane	GWP_{CH_4}	21	-	-
Leakage emissions due to LNG consumption	$LE_{LNG, y}$	121,563	tCO ₂ e	-
Leakage emissions due to fugitive upstream CH ₄ emissions	$LE_{CH_4, y}$	-176,579	tCO ₂ e	-
Leakage emissions	LE_y	-55,016	tCO ₂ e	-

Annex 4**MONITORING INFORMATION**

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Detailed monitoring plan can be seen in B.7.2, and the primary parameters to be monitored during the crediting period of the Project activity are listed below.

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
EG_y	Electricity supplied to the grid by the project	Ammeter reading	MWh	m	Hourly measurement and monthly recording	100%	Electronic	Power sold to the grid. Double check by receipt of sales
FC_{f,y}	Annual quantity of natural gas consumed in project activity	Fuel flow meter reading at project boundary	m ³	m	Daily	100%	Paper	The total fuel consumption will be monitored both at supplier and project end for cross-verification.
NCV_{f,y}	Net Calorific Value of natural gas	Fuel supplier	GJ/m ³	e	Fortnightly	100%	Paper	Use supplier-provided data.
OXID_f	Oxidation factor	IPCC		e	Annual	100%	Electronic	Use IPCC current default
EF_{CO2,f,y}	Emission factor for natural gas	Global (IPCC)	tCO ₂ /GJ	e	Annual	100%	Electronic	Use IPCC values
COEF_y	CO ₂ emission coefficient	Calculated under project activity	tCO ₂ /m ³	c	Annual	100%	Electronic	
GEN_{j/k/n,,y}	Electricity generation of each power source / plant j, k or n	National authority	MWh/ a	m	Yearly	100%	Electronic	During the crediting period and two years after



PE_y	Project emission due to combustion of fuel	Calculated under project activity	tCO ₂	c	Annual	100%	Electronic	$\frac{[\sum_i F_{i,y} * COEF_i]}{[\sum_m GEN_{m,y}]}$ over recently built power plants defined in the baseline methodology
EF_{BM,y}	CO ₂ Build Margin emission factor of the grid	National authority	tCO ₂ / MWh	c	Yearly	100%	Electronic	National statistics provided by the Chinese DNA
F_{i,y}	Amount of each fossil fuel consumed by each power source / plant	National authority	Mass or volume	m	Yearly	100%	Electronic	National statistics provided by the Chinese DNA

**Annex 5****RELATED POWER STATISTICS AND PROJECT FINANCIAL ASSUMPTIONS****Table C1: 2005-2006 Monthly Maximum Power Shortfalls in Peak load¹⁴⁵**

2005	Mar	Apr	May	June	July	August
Peak-Time	2005/3/14	2005/4/25	2005/5/11	2005/6/23	2005/7/4	2005/8/15
Maximum Shortfall (MW)	7,610	9,000	5,990	12,230	17,800	13,340
North China Grid	3,410	6,140	5,170	9,370	4,100	7,290
East China Grid	3,170	1,140	450	190	12,790	5,750
Central China Grid	530	1,240		1,680	910	300
Northwest Grid	500	0	0	890	0	0
Northeast Grid	0	480	37	10	0	0
2006	Mar	Apr	May	June	July	August
Peak-Time				2006/6/19	2006/7/13	2006/8/14
Maximum Shortfall (MW)	1,660	1,590	890	3,780	5,720	7,720
North China Grid	-	-	-	1,860	1,340	410
East China Grid	-	-	-	360	1,100	1,010
Central China Grid	-	-	-	730	1,320	3,810
Northwest Grid	-	-	-	0	0	0
Northeast Grid	-	-	-	830	1,960	2,490

Table C2: EGC Related 600MW Coal-Fired Power Plants and the Proposed Project¹⁴⁶

Item	Unit	Sub-Critical Power Plant 600MW	Super-Critical Power Plant 600MW	The Proposed Project 2x390MW
Investment	RMB/KW	3723	3919	3161
Annual operation hours	h	5000	5000	3500
Water expenditure	RMB/MWh	1	1	0.5
Material expenditure	RMB/MWh	5	5	8.5
Maintenance cost rate	%	2.5%	2.5%	2.5%
Other expenditure	RMB/MWh	10	10	11
Pollution discharge fees	RMB per unit	3,130,000	5,680,000	-
Number of staff		234	247	80
Salary and welfare	RMB/year. person	80,000	80,000	64,200
Fuel consumption rate	Kg/MWh	336.66 ¹⁴⁷	299	0.2058m ³ /kwh
Fuel price	RMB/t	430(In. VAT)	430(In VAT)	RMB1.10/m ³ (In VAT)
Desulfurization	RMB /ton coal	3.64	3.64	-

¹⁴⁵ Data source: Status of National Grid Power Supply and Demand, official statistics from the State Grid Corporations, http://www.sgcc.com.cn/dlgx/gxzk/default_2.shtml

¹⁴⁶ Data source: Text book, Thermal Power Engineering Design Reference Cost Index, 2005 Edition

¹⁴⁷ Data source: same as footnote 2



expenditure				
Discount rate	-	8%	8%	8%
Life time	years	20	20	20
Construction period	years	3	4	2



Table C3: Basic Parameters for IRR Calculation and Conservative Reasoning

Parameters		Value used in PDD	Conservative Reasoning
Income-related parameters	Annual electricity supply to ECG	2,716,000MWh/a	Determined by the FSR
	Electricity tariff	RMB 0.442/kWh	Determined by the FSR, which is much higher than the bus-bar tariff of ECG for thermal power plants in 2005 (RMB0.371/KWh) and thus would be conservative.
	Salvage value of the fixed asset	5%	Determined by the FSR, which is also in consistence with the official document (GuoShuiFa[2005] NO.883).
Cost-related parameters	Fixed assets investment	RMB2,465.8 Million	Determined by the FSR, and also is consistence with institutional guidelines currently governing in the power investment market of the PRC.
	NG price	RMB1.10/m ³	Determined by the FSR, which is much lower than the guiding gas price of RMB2.00 /m ³ in 2004 ¹⁴⁸ , thus would be conservative.
	NG consumption	576.24 million m ³ per year	Determined by the FSR.
	Material expenditure	RMB8.5/MWh	All the values of these parameters of expenditures are determined by the FSR of the proposed project.
	Water expenditure	RMB0.5MWh	
	Other cost	RMB11/MWh	
	Maintenance expenditure rate	2.5%	
	Income tax	33%	
	City construction and educational taxes	7%	
	Circulating Fund	RMB55.33Million	

¹⁴⁸ Data Source: Notice on natural gas price, issued by Nanjing Price Bureau; 7th June 2004
<http://www.njprice.com/col81/articleinfo.php/infoid=2446>