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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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The title of the project: China Tongwan Hydropower Project
Version: 06
Date: 21/05/2008

Table 1 Revision History

Version number	Date	Reason
Version 01	June, 2005	Draft PDD
Version 02	Sep, 2005	Revised according to on-site interview.
Version 03	May, 2006	Revised according to second time on-site interview.
Version 04	January, 2007	Revised according to ACM0002 version 6 and for GSP
Version 05	October, 2007	Revised according to NDRC's opinions and Resolution of Corrective Action and Clarification Requests from DOE.
Version 06	May, 2007	Revised according to request for review from EB.

A.2. Description of the project activity:

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China Tongwan Hydropower Project (here after referred to as "the project") is a new-built medium scale hydropower project, locating on Yuanshui River, Zhongfang County, Huaihua City, Hunan Province, P.R. China. The project construction was commenced in March, 2005. The total installed capacity of the project will be 180 MW, the annual utilization time will be 3,950 h, and the annual net electricity generation will be 662,000 MWh. The surface area[1] at the full reservoir level of the project will be 12 km^2, thus the power density of the project will be 15 W/m^2. The generated electricity will be delivered to regional power grid, i.e. Central China Power Grid (CCPG).

The purpose of the project is to generate electricity by using Yuanshui River water resources to alleviate electricity shortage in Central China. The project will contribute to the reduction of GHG emission by displacing part of the electricity from the fossil fuel fired power plants of the CCPG, and the expected annual GHG emission reductions over the first crediting period is 633,945 tCO$_2$e/yr, which will contribute to alleviation of climate change. In addition, the project will be beneficial to:

(a) The project will provide high quality clean electricity to CCPG. The project activity can increase temporary and permanent employment opportunities for local residents during construction and operation

[1] Measured by Water Resources Bureau of Huaihua City

period of the project, which will increase income of the local residents. It is helpful to local socio-economic development.

(b) The project developer will construct traffic infrastructure, it will be greatly convenient for local residents and will ultimately promote the local transportation business development.

(c) During operation period of the project, it will pay lots of tax to tax department, which will promote local economic development.

(d) In order to prevent flood disasters, the project owner will build Anjiang Flood Embankment. The construction of the embankment will be greatly beneficial for maintaining the stabilization and prosperity of Anjiang Town

A.3. Project participants:

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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)	Hunan Zhongfang Tongwan Water Resources & Hydropower Development Co., Ltd	No
Sweden	Carbon Asset Management Sweden AB	No
Netherlands	Carbon Asset Management Sweden AB	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Please refer to Annex 1 for more detailed information.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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People's Republic of China (Host)

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

>>
Hunan Province

A.4.1.3. City/Town/Community etc:

>>
Tongwan Town, Zhongfang County, Huaihua City

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

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The project is located at Tongwan Town, Zhongfang County, Huaihua City, Hunan Province, P.R.China. The project is 49 km away from Huaihua City. The geographical coordinates of project are 110°17′19″ E and 27°35′02″ N. Figure 1 below shows the location of the project.

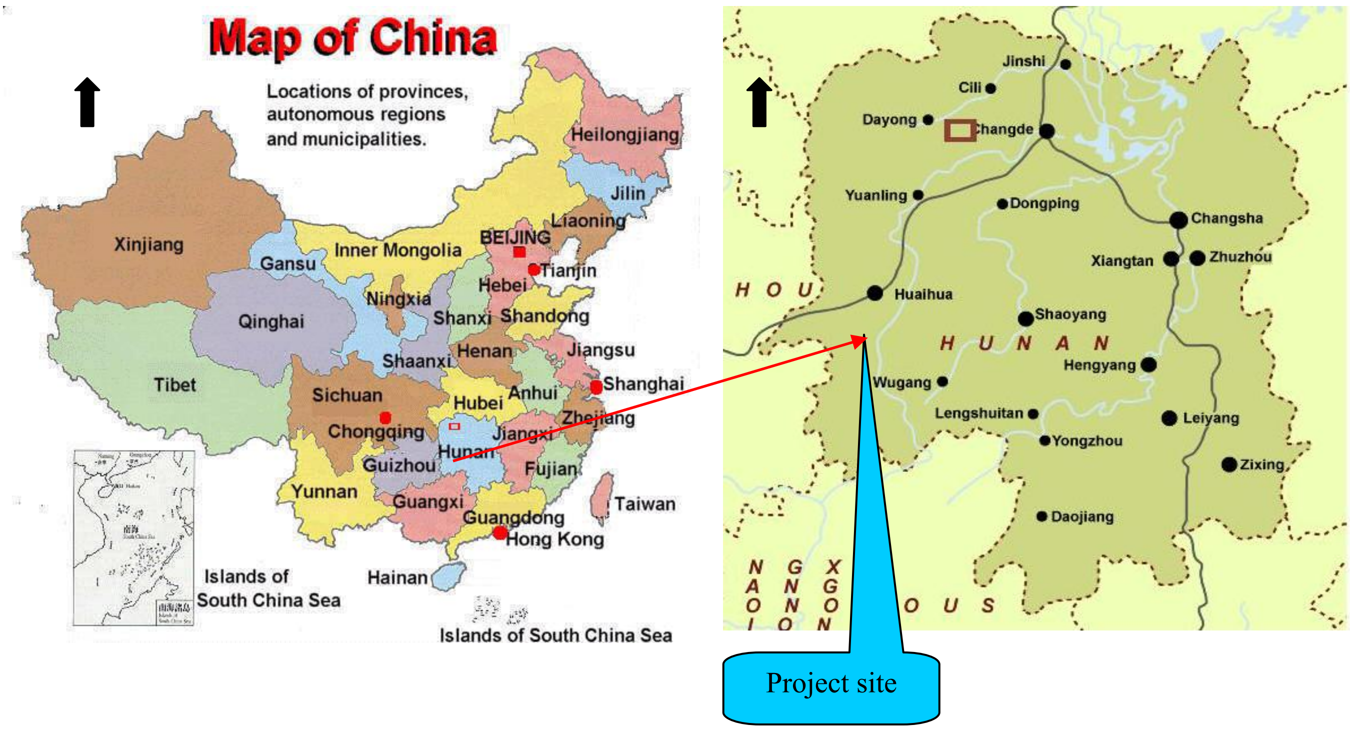

Figure 1 Location of the project

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

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The project falls into:
Sectoral Scope 1: energy industries (renewable sources)

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

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The project is a new-build medium size hydropower plant, the total installed capacity will be 180 MW. The project makes use of water resources for electricity generation. The project is connected to Yangtang Substation through 220 kV×30 km transmission line. The generated electricity will be delivered to

CCPG. The main constructions of the project includes dam, overflow cofferdam, power house and switch station etc. Table 2 below shows the design features and characteristics of the project.

Table 2 Design features & characteristics of the project

Main construction	Dam	Max height: 43 m	
	Overflow cofferdam	Weir elevation: 137 m	
	Power house size	83.45 m×76.73 m×47.19 m	
	Switch station size	43 m×36 m	
Main electromechanical equipment	Turbine	Unit	4
		Model	GZ4BN28B-WP-710
		Manufacturer	Tianjin Alstom Hydro Co., Ltd.
		Rated rotate speed	83.3 r/min
		Rated water head	11 m
		Rated flow rate	459.79 m^3/s
	Generator	Unit	Unit: 4
		Model	SFWG45-72/7550
		Manufacturer	Tianjin Alstom Hydro Co., Ltd.
		Single capacity	45 MW
		Rated voltage	10.5 kV
	Main transformer	Unit	2
		Model	SSP10-100000/220
		Manufacturer	TBEA Hengyang Transformer Co., Ltd.

The main equipments, such as the turbines, generators and main transformers, are made in China. The manufacturers are well-known in the Chinese hydropower equipment manufacture market. The power generation technology for the project is commonly used in China. Thus, the technology applied to the project does not result in a significantly better performance than any other commonly used hydropower technologies in China.

The project is developed by Hunan Zhongfang Tongwan Water Resources & Hydropower Development Co., Ltd and constructed by the 8th and 9th Engineering Bureaus of Sino Hydro, Machinery & Ship Co., Ltd of China Gezhouba Group. The project developer and construction parties are very experienced in hydropower plants development and construction.

The professional technicians and engineers will train the hydropower plant staffs about the monitoring procedures, operation regulation, maintenance procedures and other required knowledge regarding the hydropower plant before the start of operation of the project.

The time schedule of the project is listed in Table 3:

Table 3 Time schedule of the project

Time	Event
12/07/2004	Learn about of CDM
October 2004	Preliminary Design Report (PDR) completed.
03/11/2004	The project owner decided to implement CDM application in board meeting.
23/02/2005	The project signed the LoI of CDM Project Development.
12/03/2005	PDR approved.
17/03/2005	Industrial & Commercial Bank of China Huaihua Branch agreed to provide bank loan due to CDM.
22/03/2005	Construction permission issued.
16/04/2005	Bank of China Huaihua Branch agreed the bank loan application due to CDM.
09/11/2005	Establishment of Hunan Province CDM Project Service Center (HNCDM).
23/06/2006	Letter of Intent of Emission Reductions Purchase signed.
29/09/2006	Emission Reductions Purchase Agreement signed.
January 2007	GSP PDD completed.
20/03/2007	On-site validation by DOE.
05/11/2007	Chinese LoA received.

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

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The renewable crediting period is chosen for the proposed project. The ex-ante estimated amount of emission reductions over the first crediting period of the project is listed in Table 4 below:

Table 4 Ex-ante estimation of emission reductions over the first crediting period

Years	Annual estimation of emission reductions in (tCO_2e)
01/06/2008-31/05/2009	633,945
01/06/2009-31/05/2010	633,945
01/06/2010-31/05/2011	633,945
01/06/2011-31/05/2012	633,945
01/06/2012-31/05/2013	633,945
01/06/2013-31/05/2014	633,945
01/06/2014-31/05/2015	633,945
Total estimated reductions (tones of CO_2e)	4,437,615
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tones of CO_2e)	633,945

A.4.5. Public funding of the project activity:

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There is no public funding for the project.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of the approved baseline methodology: ACM0002-Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 06, 19 May 2006)

Title of the approved monitoring methodology: ACM0002-Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources (Version 06, 19 May 2006)

Reference: Tool for the demonstration and assessment of additionality (Version 03, 16 February 2007)

Please click following link for more information about the methodology and reference:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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The project is a grid-connected renewable power generation project activity which meets all the applicability criteria stated in methodology:

1. The project is a new-built 180 MW hydropower plant by using renewable water resources to generate electricity which is delivered to CCPG.

2. The power density of the proposed project will be 15 W/m^2, which is greater than 4 W/m^2.

3. The project does not involve switching from fossil fuels to renewable energy at the site of the project activity.

4. The geographic and system boundaries for CCPG can be clearly identified and information on the characteristics of the grid is available.

So the baseline and monitoring methodology ACM0002 are applicable to the project.

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

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According to methodology ACM0002, the project boundary for new hydropower project includes the physical site of the plant as well as the reservoir area. The spatial extent of the project boundary includes the project power the project site and all power plants connected physically to the electricity system that the proposed project is connected to. For this project, the delineation of grid boundaries is used as provided by the DNA of P.R. China. The generated electricity of the project will be delivered to CCPG, which covers Henan Province, Hubei Province, Hunan Province, Jiangxi Province, Sichuan Province and

Chongqing Municipality[2]. There is no electricity imported from other power grids to CCPG. The main emission sources and type of GHGs in project boundary are listed in Table 5 below:

Table 5 Sources and gases in project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Fuel-fired Power Plants in CCPG	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded according to ACM0002.
		N_2O	Excluded	Excluded according to ACM0002.
Project Activity	China Tongwan Hydropower Project	CO_2	Excluded	Excluded according to ACM0002.
		CH_4	Excluded	The project power density is greater than 10MW/m^2, CH_4 emissions do not have to be considered.
		N_2O	Excluded	Excluded according to ACM0002.

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

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The baseline scenario of the proposed project is equivalent annual electricity supplied by CCPG, which is the continued operation of the existing power plants and the addition of new generation sources on the CCPG to meet the electricity demand. The proposed project involves constructing a hydropower plant by using energy water resources for power generation. The emission reductions of the project are equal to the baseline emissions.

According to ACM0002, baseline emissions are equal to power generated by the project that delivered to the CCPG, multiplied by the baseline emission factor. The baseline emission factor (EF_y) is calculated as a Combined Margin (CM), which is consisting of the weighted average of Operating Margin (OM) emission factor and Build Margin (BM) factor by utilizing an ex-ante 3 years data vintage for the CCPG. The emission reductions calculation processes are specified in Section 6 and Annex 3.

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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According to “Tool for the demonstration and assessment of additionality”, the additionality of the project is demonstrated and assessed through the following steps:

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

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

There are 4 realistic and credible baseline scenario alternatives identified for the project:

Alternative 1–The project activity not undertaken as CDM project activity

[2] Chinese DNA’s Guideline of emission factors of Chinese grids

Alternative 2–Construct a fossil fuel-fired power plant with equivalent annual electricity generation
Alternative 3–Construct a power plant using other renewable energy to supply equivalent annual electricity generation
Alternative 4–Equivalent annual electricity supplied by CCPG (continuation of current practice)

The identification of baseline scenario is as follow:

Alternative 1–The project activity not undertaken as CDM project activity

In this scenario the project will generate zero-emission power with renewable hydraulic energy source and cause the emission reduction by displacing equivalent power generation from CCPG. However, the project can not be implemented due to the investment barrier, which will be analyzed in detail in following steps of Section B.5.

Therefore, the alternative 1 is not a possible baseline scenario.

Alternative 2–Construct a fossil fuel-fired power plant with equivalent annual electricity generation

This alternative is to construct a fossil fuel-fired power plant with equivalent annual electricity generation to the project. For the average annual utilization hours of the fossil fuel plants are 5,633[3], which are larger than the average annual utilization of hydropower plants. Thus, to install fossil fuel-fired plants with equivalent annual electricity generation to the project will be smaller than 120 MW. However, according to the current laws and regulations in China, the thermal power plants with the installed capacity of 135 MW or below are prohibited for construction in the areas covered by large power grids[4].

Therefore, the alternative 2 is not a possible baseline scenario.

Alternative 3–Construct a power plant using other renewable energy to supply equivalent annual electricity generation

This alternative is to construct renewable power plants, which can generate equivalent electricity annually as the project. However, those kinds of renewable power plants, such as photovoltaics, tidal/wave, wind, geothermal and renewable biomass etc., are strongly depended on climate and natural resources. They can not provide equivalent power supply quality and services as hydropower plants. There is not enough such kind of renewable resources at project site. Furthermore, limited by technology development and high costs, constructing an alternative renewable power plant is not financially attractive compared to the proposed project.

Therefore, the alternative 3 is not a possible baseline scenario.

Alternative 4–Equivalent annual electricity supplied by CCPG (continuation of current practice)

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[3] <National Statistics Express of Power Industry in 2006>, China Electricity Council

[4] General Office of the State Council [Decree No. 2002-6]: <Notice on Strictly Prohibiting the Construction of Thermal Power Plants with Installed Capacity of 135 MW or Below>

Under this alternative, the increasing demand of electricity would be met from CCPG by increasing its installed capacity through the possible expansion of existing power plants as well as construction of new power plants according to the current policies and regulations in China. So the alternative 4 is the only realistic and credible choice.

From the analysis above, the only realistic and credible alternative for the project is:

Alternative 4–Equivalent annual electricity supplied by CCPG

Up to the end of 2006, the total installed capacity for unified dispatch in CCPG is 100879 MW, of which, the installed capacity of hydro power plants is 38041 MW accounting for 37.7%, the installed capacity of fuel-fired plants is 62838 MW accounting for 62.3%[5]. So the fuel-fired plants are dominant in CCPG, this status will last for a long time.

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

As described in *Sub-step 1a*, the alternatives 1, 3 and 4 are in compliance with all current applicable law and regulations in China. The alternative 2 is not consistent with mandatory laws and regulations in China. Thus the proposed project is not the only one that complies with current regulations and laws.

Step 2. Investment analysis

The following sub-steps are used for determining whether the proposed project activity is the economically or financially less attractive than other alternatives without the revenue form the sale of certified emission reductions (CERs).

Sub-step 2a. Determine appropriate analysis method

According to "Tool for the demonstration and assessment of additionality", there are three analysis methods recommended, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

Option I: Simple cost analysis. This analysis method can be used if the project activity produces no economic benefits other than CDM related income. However, this option is not applicable to the project because the project activity generates the revenue from the sale of generated electricity.

Option II: Investment comparison analysis. This analysis method can be only used if the alternatives to the project are similar investment projects. However, this option is not applicable to the project because the alternative to the proposed project is equivalent annual electricity supplied by CCPG, which is not a new investment project.

Option III: Benchmark analysis. According to *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project* formulated by State Electric Power Corporation, the financial benchmark internal rate of return (after tax) of total investment for projects within the power sector is 8%. Thus, the benchmark analysis is applicable to the project.

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[5] http://sgsj.ccpg.com.cn/

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

According to *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project* formulated by State Electric Power Corporation, the financial benchmark internal rate of return (after tax) of total investment for projects within the power sector is 8%.

The main assumptions for the investment analysis are shown in Table 6 below:

Table 6 Basic parameters for financial evaluation

Parameter	Unit	Value	Data source
Installed capacity	MW	180	Preliminary Design Report
Net electricity generation	MWh	662,000	Preliminary Design Report
Total investment	RMB￥10,000	182,296	Preliminary Design Report
Electricity tariff (VAT Incl.)	RMB￥/kWh	0.315	Preliminary Design Report
Electricity tariff (VAT Excl.)	RMB￥/kWh	0.269	Calculated. It equals to electricity tariff (VAT Incl.)/(1+VAT)
Valued-added tax (VAT)	%	17	Preliminary Design Report
Sales tax（Based on VAT）	%	8	Preliminary Design Report
Income tax	%	33	Preliminary Design Report
Annual O&M costs	Ten thousand RMB￥	2572	Preliminary Design Report

Without CERs revenue, the project IRR is only 6.32%, which is lower than benchmark IRR of 8%. The project is not financially attractive.

Sub-step 2d. Sensitivity analysis

The sensitivity analysis is used to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. For the project, three parameters are selected as sensitive factors to check out the financial attractiveness, the sensitivity analysis is shown in Table 7 below:

Table 7 Sensitivity analysis

Critical assumption \ Change scope	-10%	+10%
Total investment	7.01%	5.64%
Electricity tariff	5.53%	6.97%
Annual O&M costs	6.42%	6.21%

The project IRR varies to different degrees within the reasonable variation scope of the total investment, electricity tariff and annual O&M costs. However, the project IRR is always lower than benchmark IRR of 8% whatever the critical assumptions vary. The project is not financially attractive.

Step 4. Common practice analysis

Common practice analysis is a credibility check to complement the investment analysis. The common practice analysis is identified and discussed through the following sub-steps:

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

The other activities similar to the proposed project activity are hydropower projects in the same region (Hunan Province), rely on a broadly similar technology (hydropower plants), are of a similar scale(50MW~300MW), and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing.

The common practice analysis is limited to the provincial level as the investment environment for each province differs (e.g. with regards to taxes, loan policy and electricity tariffs). The selected geographical area for the project, i.e. Hunan Province, is relatively large. Hunan Province is considerably larger than several countries. The policies and regulations in Chinese provinces are different with each other.

According to *Classification & Design Safety Standard of Hydropower Projects* (DL5180-2003), hydropower plants with capacity between 50 MW~300 MW are classified as medium size projects.

The significant reform to Chinese electric power sector was taken place in 2002. The reform involved establishing State Grid Corporation of China and China Southern Power Grid Corporation[6]. The former State Power Corporation was restructured and separated into 5 national power generation companies[7]. Before the power industry restructure in year 2002[8], the hydropower plants were mainly developed by the state owned enterprises, provincial governments ensured that project entity of power plants can obtain sufficient return by providing guarantee electricity tariff. Power plants were constructed with the national or the local governmental funds, or the government provide the loan guarantee for the companies, the developers didn't have financing difficulties. Thus the electricity tariff for each power plant was determined with the principle of full-cost recovery[9].However, the national policy changed after 2002, the electricity tariff will be determined on the basis of average costs of power generation using the same advanced technology and built within the same period under the provincial power grids. Thus projects operated after 2002 are considered as similar projects to the proposed project since they were operated under a same policy scheme.

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[6] Notice of the State Council on Printing and Distributing the Plans Regarding the Restructuring of the Power Industry(Guofa [2002] No.5), issued by State Council on 10 February 2002

http://www.china5e.com/laws/index2.htm?id=200608080001

[7] Approval from State Development Planning Commission about Power Generation Asset Restructuring and Division Scheme of State Power Corporation, Guodianban (2002) No.952, 26 December 2002

http://www.365dq.com/Research/Info_View.asp?ContentID=1793

[8] Notice of the State Council on Printing and Distributing the Plans Regarding the Restructuring of the Power Industry (Guofa [2002] No.5), issued by State Council, 10 February 2002

[9] Ministry of Water Resources and Electric Power, State Economic Committee and State Price Bureau, Note on Implement methods of Various Power Tariff (No. 101 Shuidiancaizi[1987])

http://www.scicpa.org.cn/html/hyfw/default.asp?id=46&vid=4795

There is no hydropower plants with installed capacity between 50 MW~300 MW operated after 2002 is listed in publicly available *Yearbook of China Water Resources 2006* and *Yearbook of China Water Resources 2007*. In order for the completeness of common practice, the *Investigation Report on Hydropower Plants with Installed capacity above 15 MW Operational since 2002 in Hunan Province*, which is compiled by Grade A provincial design institute, Hunan Hydro & Power Design Institute, is used in common practice for the proposed project.

The other activities implemented or operational previously or currently underway after 2002 in Hunan Province are listed in Table 8 below, other CDM project activities are not included in the table.

Table 8 Hydropower projects list for common practice analysis (50～300 MW)[10]

Project name	Installed capacity (MW)	Operation time (year)
Jinweizhou	63.18	2003
Zhuzhou Hangdian	140	2006
Hongjiang	225	2003
Wanmipo	240	2004

Sub-step 4b. Discuss any similar options that are occurring[11]:

Essential, fundamental and verifiable distinctions between the similar activities and the project activity:

1. Jinweizhou obtained the Hunan Provincial Government's favorable support[12] in electricity tariff and tax. And also, Jinweizhou Project obtained a bank loan with low interests from Austrian government[13]. The project owner only needs to repay foreign bank loan and part of domestic bank loan. Furthermore, the annual operation period of Jinweizhou Project amounts 4628 hours, which is much higher than the Tongwan Project (3950 h).
2. The Zhuzhou Hangdian Project is an inland waterways project financed by government financial support (RMB￥1.15 billion) and World Bank (US$ 0.1 billion of low-interest loan)[14]. The proposed project is invested by private company and has no shipping function. Furthermore, the annual operation period of Zhuzhou Hangdian Project amount s 4740 hours, which is much higher than the Tongwan Project (3950 h).
3. In general, investors will develop the hydropower plants with good technical and economic indicators, the Hongjiang Hydropower Plant was developed earlier with excellent natural

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[10] Hunan Hydro & Power Design Institute, *Investigation Report on Hydropower Plants with Installed Capacity above15MW Operational since 2002 in Hunan Province*.

[11] All the data and information described below are derived from *Investigation Report on Hydropower Plants with Installed Capacity above 15 MW Operational since 2002 in Hunan Province* unless otherwise stated expressly.

[12] http://www.shp.com.cn/news/info/2002/7/22/17401657.html

[13] http://www.cpnn.com.cn/zgdy200206/kfjs/200207010068.btk

[14] http://www.zzx.gov.cn/ReadNews.asp?NewsID=560

http://www.chinabidding.com/xmzx.jhtml?method=detail&docId=351178

conditions such as high water head and low construction costs. The annual operational time of Hongjiang Hydropower Plant is 4311 h[15], which is higher than the proposed project (3950 h). The unit kW investment of Hongjiang Project is 7,569 RMB￥/kW, which is 25% lower than the proposed project (10,128 RMB￥/kW). Furthermore, the unit kWh investment of Hongjiang Project is 1.76 RMB￥/kWh), which is 31% lower than the proposed project (2.56 RMB￥/kWh).

4. Wanmipo Hydropower Plant was also developed earlier than the proposed project. The unit kW investment of Wanmipo Project is 6,292 RMB￥/kW, which is 38% lower than the proposed project (10,128 RMB￥/kW). Furthermore, the unit kWh investment of Wanmipo Project is 1.91 RMB￥/kWh), which is 25% lower than the proposed project (2.56 RMB￥/kWh).

The reasons for the high investment of the project are as follows:

(1) The project is located at the entrance of canyon. The width of riverbed merely meets the minimum layout requirement of overflow dam. Both the left-bank construction and the right-bank power house are required to be placed on the slope of the river banks. The river banks have to be dug more wider and the hill has to be dug to form a artificial slope with height of 120~150 m according to design to meet construction requirements. It can be found from the PDR that the earth and stone work quantity is as many as 3.4 million m^3. For the construction of the similar scale domestic hydropower projects, the height of artificial slope and earth work quantity for the project is extremely rare[16].

(2) The project is equipped with 4 sets of 45 MW horizontal bulb type turbines whose unit installed capacity is the biggest in China at the time of starting construction[17]. Thus the transportation and installation of the turbine is very hard and need high investment.

Thus, the project is not a common practice in Hunan Province.

The CDM development progress of the project is as follow:

As early as in July 2004, the project owner learned about the CDM during an on-site meeting regarding the Tongwan Project organized by the Deputy Governor of People's Government of Zhongfang County[18].

In the end of October 2004, the Preliminary Design Report (PDR) of Tongwan Hydropower Project was completed, in which the CDM was specified. The water regulation storage of the project is weak and the water head of the project is low, the project is significantly affected by upstream hydropower plant. It can be found from the PDR that the expected power supply (used for IRR calculation) of the project will be decreased if the upstream hydropower plant is put into operation. Due to the high investment of the turbines, generator and earth work engineering and low project IRR in PDR, the project owner decided to

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[15] http://www.dianli1000.com/Photo/hcssdz/200705/116.html

[16] Instruction about the Engineering Characteristics of Tongwan Hydropower Plant, Hunan Hydro & Power Design Institute

T[17] http://power.newmaker.com/art_17645.html

[18] Minutes of Governor's Work Meeting, 12 July 2004

implement CDM application to overcome the financial barrier, lower investment risks and apply for bank loan in the board meeting on 3 November 2004[19].

On 23 February 2005, the project owner signed the LoI of CDM Project Development[20] for CDM development and application with Hunan Science & Technology Information Research Institute (HNSTI), which is a public service unit belonged to Science & Technology Bureau of Hunan Province. Science & Technology Bureau is one of two CDM administration authority in China, another authority is Development & Reform Commission.

On 17 March 2005, the Industrial & Commercial Bank of China Huaihua agreed to offer loans to the proposed CDM project activity after seriously considering CDM incentives.[21].

On 22 March 2005, the project owner is permitted to start the construction of the proposed CDM project activity[22].

On 16 April 2005, the Bank of China Huaihua Branch agreed the bank loan application and required the project owner to speed up the CDM implementation process and the CDM revenue should be firstly used for bank loan repayment[23].

With the development of the CDM project activity, the project owner faced unexpected increasing investment which was not budgeted in PDR after project construction, such as two issues as follows:

(1) Land occupation compensation investment increased: The land compensation budget in Preliminary Design Report was calculated in accordance with original regulation. According to new <Land Compensation and Migration Resettlement Regulation for Large and Medium Scale Water Resources and Hydropower Construction> issued by State Council of the People's Republic of China in August 2006, the compensation standard is 4 times higher than the original regulation. The land requisition fee will increase of RMB￥22.84 million[24]. Furthermore, in order to resettle the migrations much better, the project owner will build infrastructure involving water supply, electricity supply and roads etc. These measures will increase migration resettlement budget greatly.

(2) Construction of Anjinag Flood Embankment: In order to prevent flood disasters, the project owner built Anjiang Flood Embankment which was not budgeted in PDR. According to *Engineering Construction Contract of Anjiang Flood Embankment* signed on 14 February 2007, the investment is RMB￥99 million.

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[19] Minutes of Board Meeting, 3 November 2004

[20] LoI of CDM Project Development, 23 February 2005

[21] Approval Regarding the Bank Loan Application from Hunan Zhongfang Tongwan Water Resources & Hydropower Development Co., Ltd, Gongyinhuaihan [2005] No. 3, 17 March 2005

[22] Construction permission issued by Water Resources Bureau of Hunan Province, 22 March 2005

[23] Assessment Report of Bank Loan Application of Tongwan Hydropower Plant (Huaizhongyinfa [2005] No.7), 16 April 2005

[24] Explanation of Increased Land Occupation Compensation Investment, Hunan Xiangyi Resettlement Engineering Supervision Company, 20 September 2006

From the milestones and key events above, it can be concluded that CDM incentives were essential for project owner to go ahead with the implementation of the project activity. The project is still under construction. All the increment of investment during the construction of the project activity makes the project activity much more financially unattractive and CDM is essential for the project owner to the decision to go ahead with the implementation of the project activity.

In the following section, we'll explain why the CDM development is delayed for such a long time.
The CDM development was entrusted to HNSTI, including PDD development, buyer search and so on.

HNSTI has been focused on CDM research since April 2004. Due to lack of English professionals and capable PDD writers as well as huge pressure from project owners and urgent demand of special CDM development team, the Science & Technology Bureau of Hunan Province approved to establish Hunan Province CDM Project Service Center (HNCDM) in July 2005[25]. Finally, the HNCDM was officially established on 9 November 2005.

Thus the delay of Tongwan CDM development is due to the re-construction of CDM business in HNSTI and buyer search.

The HNSTI completed the draft PDD in June 2005. Due to the strong request from project owner, the experts of HNSTI went to project site for PDD writing in September 2005. In order for filling a complete PDD to present to CERs buyers, the experts of HNCDM went to project site again for PDD writing. The project owner signed the Letter of Intent of Emission Reductions Purchase with Carbon Asset Management Sweden AB on June 23 2006. In order for fully investigate the stakeholder's opinions regarding Tongwan Project, the project owner conducted the stakeholder consultation from 1 September 2006 to 30 September 2006 to collect opinions. Later the project owner signed the Emission Reductions Purchase Agreement with Carbon Asset Management Sweden AB on September 29 2006. Finally, the GSP PDD was completed in January 2007 and submitted to buyer for internal QA/QC. The on-site validation was conducted during 20-21 March 2007 by DOE.

From above descriptions, we definitely confirm that the expected additional income from the CDM was essential for the decision to go ahead with the implementation of the project activity although it was submitted for validation almost two years after the start date of construction.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Project Emissions

The proposed project is a new-built medium scale hydropower plant, the power density is 15 W/m^2, greater than 10 W/m^2, thus PE_y=0

Baseline Emissions

[25] Report of CDM Development in Hunan Province, HNSTI, Xiangkexin [2005] No.15, 5 July 2005.

According to baseline methodology ACM0002, the baseline emissions are the CO_2 emissions from the equivalent electricity generation in CCPG that are displaced by the project activity. So the baseline emissions by the project activity during a given year *y* is obtained as follow:

According to ACM0002, the baseline emission should be calculated as:

$$BE_y = EG_y \cdot EF_y \quad (1)$$

Where:

EG_y is electricity supplied by the project activity to the grid in year *y*, in MWh;
EF_y is baseline emission factor in year y, in tCO_2e/MWh.

According to baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated as a Combined Margin (CM), which is consisting of the weighted average of Operating Margin (OM) emission factor and Build Margin (BM) factor by utilizing an ex-ante 3 years data vintage for the CCPG.

The baseline emission factor (EF_y) is calculated as a Combined Margin (CM), which is consisting of the weighted average of Operating Margin (OM) emission factor and Build Margin (BM) factor by utilizing an ex-ante 3 years data vintage for the CCPG. The data used for calculation are from an official source (where available) and publicly available. The calculation processes are as follows:

Step 1. Calculating the Operating Margin emission factor （$EF_{OM,y}$）;
Step 2. Calculating the Build Margin emission factor （$EF_{BM,y}$）;
Step 3. Calculating the baseline emission factor （EF_y）.

Step 1: Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

According to baseline methodology ACM0002, there are four methods for calculating the $EF_{OM,y}$:

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

Method (c) should be the first methodological choice. However, this method requires the detailed dispatch data of the CCPG, which is confidential information and is not available to be obtained by public. Thus, method (c) is not applicable. Due to the same reasons, the method (b) is not applicable.

Method (a) can be used where low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production. It can be found from Table 9 that installed capacity of low-cost/must run resources constitute less than 50% of CCPG during year 2001 to 2005. Thus, method (a) is applicable to calculate $EF_{OM,y}$. And method (d) can only be used where low-cost/must run resources constitute more than 50% of total grid generation, therefore, method (d) is not applicable to calculate $EF_{OM,y}$.

Table 9 Constitution of low-cost/must run resources in CCPG during year 2001～2005[26]

Year	2001	2002	2003	2004	2005
Percentage (%)	36.76	35.95	34.43	38.37	38.56

Due to the detailed data on the individual power plants connected to the power grid is not available, therefore information by type of generating source are used for OM calculation. According to baseline methodology ACM0002, tthe $EF_{OM,y}$ is calculated by utilizing an *ex-ante* 3 years data vintage for CCPG, the formula as follow:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (2)$$

Where:

$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year (s) *y*;
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid;
$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year (s) *y*; and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by power sources *j*. The data is not available in *China Electric Power Yearbook*, so the $GEN_{j,y}$ is calculated as follow:

$GEN_{j,y}$ =*Electricity generation of power plants in CCPG* ×*(1* −*Internal use rate of power plants)* (3)

The CO_2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad (4)$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*;
$OXID_i$ is the the oxidation factor of the fuel;
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

According to the deviation approach[27] agreed by the 22nd CDM EB meeting for OM and BM calculation for Chinese power grids, if the detailed data at the power plant level of the grids, such as power generation quantity, internal use rate of power plants, fuel types, fuel consumption and fuel emission factors, etc., are not publicly available for the $EF_{OM,y}$ calculation, then as an alternative, the statistical data

[26] *China Electric Power Yearbook 2002～2006*

[27] http://cdm.unfccc.int/User/Management/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

on aggregated power generation quantity, the internal use rate of power plants and fuel consumption which publicly available by the fuel types *i* and by province *j* covered by the power grid, can be used. So, the average power generation efficiencies (gce/kWh) and average emission factors of fuel *i* can be used. The fuel *i* based aggregated power generation and the related fuel consumption data are publicly available in *China Electric Power Yearbook* and *China Energy Statistical Yearbook*. Thus, the data quoted from these two kinds of yearbooks are used for $EF_{OM,y}$ calculation.

There are no imports from other power grids to CCPG, thus the imports are not taken into account.

$EF_{OM,y}$ is calculated according to the statistics information of recent 3 years (from 2003 to 2005), the data are the latest and available at the time of this PDD submission, the detailed calculations are shown in Table A2-Table A7 of Annex 3.

Step 2: Calculating the Build Margin emission factor ($EF_{BM,y}$)

According to baseline methodology ACM0002, the Build Margin emission factor ($EF_{BM,y}$) is calculated by utilizing an *ex-ante* 3 years data vintage for CCPG, the formulae as follow:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \qquad (5)$$

Where：

$F_{i,m,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by plants *m* in year (s) *y*;
$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by plants *m* and the percent oxidation of the fuel in year (s) *y*;
$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by plants *m*. It equals to power generation minus power plants self power consumption.

ACM0002 provides two following options to calculate BM:

1) Calculate the BM emission factor $EF_{BM,y}$ *ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission.

2) For the first crediting period, the BM emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1) above.

Option 1) is chosen by project participants to calculate $EF_{BM,y}$ for this project, and can not be changed during the crediting period.

For the sample group *m*, it includes two options:

1) The five power plants that have been built most recently, or

2) The power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The project participants should use from these two options that sample group that comprises the larger annual generation.

Because of the same reasons as the data unavailability at the power plant level in China, the 22nd CDM EB meeting agreed the following deviation[28] approaches for $EF_{BM,y}$ calculation:

1) Use the efficiency level of the most advanced commercialized technologies of provincial/regional or national grid of China, as a conservative proxy, for fuel *i* consumption estimation to estimate the $EF_{BM,y}$.

2) Use of capacity additions during last several years for estimating the $EF_{BM,y}$ i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity.

3) Use of installed capacity to replace annual power generation to estimate weights.

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total thermal installed capacity, the $EF_{BM,y}$ will be calculated as:

1) Based on the most recent years energy balance of the CCPG, calculating the proportions of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total CO_2 emissions of thermal power plants;

2) Based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the emission factor of thermal power plants in CCPG. This approach is more conservative as it assumes all recently built plants have the fuel efficiency as that of the most advanced commercialized technologies;

3) Calculating the $EF_{BM,y}$ through emission factor of thermal power plants times the percentage share of thermal power plants installed capacity addition within all recently built installed capacity. The proper year is selected so that it is the closest time when the last 20% of installed capacity was built.

The above calculation approach has been used by several recently registered China projects. The BM in this PDD is calculated as following sub-steps.

Sub-Step 2a: Calculating the percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in CO_2 emissions from total thermal power plants

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad \lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad \lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (6)$$

[28] http://cdm.unfccc.int/User/Management/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

Where:

λ_{Gas}, λ_{Oil} and λ_{Coal} are respectively the percentages of CO_2 emissions from the gas-fired, oil-fired, coal-fired power plants in CO_2 emissions from total thermal power plants;
$F_{i,j,y}$ is the amount of fuel *i* (tce) consumed by the power sources province *j* in year *y*;
$COEF_{i,j}$ is the CO_2 emission coefficient (tCO_2/tce) of fuel *i*, taking into account the carbon content of the fuels used by the grid and the percent oxidation of the fuel in year *y*.

Sub-Step 2b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)

$$EF_{Thermal} = \lambda_{coal} \times EF_{coal,adv} + \lambda_{oil} \times EF_{oil,adv} + \lambda_{gasl} \times EF_{gas,adv} \qquad (7)$$

Where:

$EF_{Thermal}$ is the emission factor of thermal power plants;
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are corresponding to the emission factors of coal, oil and gas, which are applied by the most advanced commercialized technologies.

Sub-Step 2c: Calculating the Build Margin (BM) emission factor ($EF_{BM,y}$)

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

Where:

$EF_{BM,y}$ is the Build Margin (BM) emission factor with advanced commercialized technologies for year *y*;
CAP_{Total} is the installed capacity of all recently built power plants;
$CAP_{Thermal}$ is the newly installed capacity of recently built thermal power plants;
$EF_{Thermal}$ is the emission factor of thermal power plants.

$EF_{BM,y}$ is calculated according to the latest and available data at the time of this PDD submission, the detailed calculations are shown in Table A8-Table A11 of Annex 3.

Step 3: Calculating the baseline emission factor (EF_y)

According to baseline methodology ACM0002, baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \qquad (9)$$

Where:

The weighs w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2e/MWh.

The EF_y applied in this PDD is fixed for a crediting period and may be revised at the renewal of the crediting period.

Leakage

According to baseline methodology ACM0002, there is no need for the project to consider leakage (L_y).

Emission Reductions

The annual emission reduction (ER_y) of the project is the difference between baseline emission, project activity emission and leakage. The final GHG emission reduction is calculated as follows:

$$ER_y\ (tCO_2e/yr) = BE_y - PE_y - L_y \quad (10)$$

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

Data / Parameter:	NCV_i
Data unit:	kJ/kg or kJ/m^3 or TJ/tce
Description:	The net calorific value (energy content) per mass or volume unit of fuel *i*
Source of data used:	*China Energy Statistical Yearbook 2006*.
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	/
Description:	Oxidation factor of the fuel *i*
Source of data used:	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	No specific local value available, adopt the IPCC default value.
Any comment:	

Data / Parameter:	$F_{i,j,y}$
Data unit:	10^4 t, 10^8 m^3
Description:	The quantity of fuel *i* (in a mass or volume unit) consumed by the relevant provinces *j* in year(s) *y*
Source of data used:	*China Energy Statistical Yearbook 2004-2006*

Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	*Electricity generation of power plants in CCPG*
Data unit:	MWh
Description:	The electricity generated by province *j* in CCPG in year *y*.
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	*Internal use rate of power plant*
Data unit:	%
Description:	The internal power consumption rate of power plants in province *j* in CCPG in year *y*.
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/TJ
Description:	The CO_2 emission factor per unit of fuel i
Source of data used:	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually	No specific local value available, adopt the IPCC default value.

applied :	
Any comment:	

Data / Parameter:	*$CAP_{i,j,y}$*
Data unit:	MW
Description:	Installed capacities of power plant category *i* of province *j* in years *y*.
Source of data used:	*China Electric Power Yearbook 2001-2006*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.

Data / Parameter:	*$GENE_{best,coal,}$*
Data unit:	/
Description:	The power supply efficiency of most advanced commercialized coal-fired power plants
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	35.82%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	*$GENE_{best,oil/gas}$*
Data unit:	/
Description:	The power supply efficiency of most advanced commercialized oil-fired power plants and gas-fired power plants
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	47.67%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

Project Emissions

The proposed project is a new small scale hydropower station, the power density is 15 W/m^2, greater than 10 W/m^2. According to baseline methodology ACM0002, it is not needed to calculate project emissions, $PE_y = 0$

Baseline Emissions

According to formulae (2)-(9) in section B.6.1, the calculation results of EF_{OM} , EF_{BM} and EF_y are listed in Table 10, the detailed calculation processes are shown in Annex 3.

Table 10 EF_{OM} , EF_{BM} and EF_y of CCPG (tCO_2e/MWh)

EF_{OM}	EF_{BM}	EF_y
1.29086	0.65923	0.97504

The project will involve influencing 3 small hydropower plants, the total installed capacity of the 3 small hydropower plants is 1.35 MW. The 3 small hydropower plants have been compensated by Tongwan project owner. The average annual total power generation of the 3 small hydropower plants is 7000 MWh[29]. In order to be conservative, the 3 small hydropower plants are assumed to operate full year. Thus, the annual power generation of 11826 MWh (1.35 MW×8760 h=11826 MWh) is deducted from power supply by Tongwan (66200－11826=650174 MWh) and the method will always be used to calculate the baseline emission during the whole 3 renewable crediting periods.

According to formula (1) in section B.6.1, the annual baseline emission (BE_y) of the project in a typical year is calculated as follow:

$$BE_y = 650174 \times 0.97504 = 633{,}945 \ tCO_2e/yr$$

Leakage

According to baseline methodology ACM0002, there is no need for the project to consider leakage (L_y).

Emission Reductions

According to formula (10) in section B.6.1, the annual emission reductions (ER_y) of the project in typical year is calculated as follow:

$$ER_y \ (tCO_2e/yr) = 633945 - 0 - 0 = 633{,}945 \ tCO_2e/yr$$

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

>>

The summary of the ex-ante estimation of emission reductions are listed in Table 11 below:

Table 11 Summary of the ex-ante estimation of emission reductions

Year	Estimation of	Estimation of	Estimation of	Estimation of

[29] Statistical data from local government

	project activity emissions (tonnes of CO_2e)	baseline emissions (tonnes of CO_2e)	leakage (tonnes of CO_2e)	overall emission reductions (tonnes of CO_2e)
01/06/2008-31/05/2009	0	633,945	0	633,945
01/06/2009-31/05/2010	0	633,945	0	633,945
01/06/2010-31/05/2011	0	633,945	0	633,945
01/06/2011-31/05/2012	0	633,945	0	633,945
01/06/2012-31/05/2013	0	633,945	0	633,945
01/06/2013-31/05/2014	0	633,945	0	633,945
01/06/2014-31/05/2015	0	633,945	0	633,945
Total (tonnes of CO_2e)	0	4,437,615	0	4,437,615

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

B.7.1 Data and parameters monitored:

Data / Parameter:	Surface Area
Data unit:	km^2
Description:	Surface area at the full reservoir level
Source of data used:	Water Resources Bureau of Huaihua City
Value of data applied for the purpose of calculating expected emission reductions in section B.5	12
Description of measurement methods and procedures to be applied:	The data has been measured by the Water Resources Bureau of Huaihua City through an engineering survey, based on the forecast water level and the topographical reservoir map, once, at the start of the project.
QA/QC procedures to be applied:	N/A.
Any comment:	The data measured by Water Resources Bureau of Huaihua City is reliable and creditable.

Data / Parameter:	EG_y
Data unit:	MWh

Description:	Net generated electricity delivered to CCPG
Source of data to be used:	Electricity meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	662,000 for a typical year
Description of measurement methods and procedures to be applied:	The net generated electricity is the difference of the generated electricity exported to power grid and electricity imported from power grid. The imported electricity and exported electricity are monitored hourly through two bidirectional Master Meters and will be recorded monthly. All the electronic and paper monitoring documents will be archived during the crediting period and two years after.
QA/QC procedures to be applied:	Net power supply data from power grid company and sales receipts will be used for double check of data. The meters will be calibrated in line with Chinese regulation.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

An overall monitoring plan will be applied to the project. The project owner compiled a monitoring and management manual i.e. *The Monitoring and Management Manual of Tongwan Hydropower Plant*. The aim of monitoring plan is to make sure that the net generated electricity monitored and evaluated during the project activity operation period is completed, consistent, and precise. It has identified the duties of the related responsibilities. The details are summarized as follows:

1. Monitoring subject

The main data to be monitored is the net generated electricity by the project.

2. Monitoring management structure

In order to obtain effective monitored data, the project owner established a monitoring management structure which identified the relative staffs for data recording, collection and preservation. In addition, the project owner will designate a special monitoring director to take charge of supervision. The monitoring director is responsible for the check of monitoring and recording tasks (such as meter reading, sales receipts), emission reductions calculation and monitoring reports preparation etc.. The director will receive technical supports from the Hunan CDM Project Service Centre. The detailed structure is as follow:

Monitoring Director

Take full responsibility of implementation, management and supervision of monitoring plan:

(1) Establish and implement *The Monitoring and Management Manual of Tongwan Project*

(2) Responsible for communicating with EB, DNA and Hunan CDM Project Service Centre.

Technical Department

Duty: Adjust and repair meters, supervise and check the monitor data

Finance Department

Duty: Emission reductions calculation

Statistician

Duty: Record and save the monitoring data

Figure 2 Operation and management structure

3. Monitoring apparatus and installation:

The meters will be installed in accordance with *Technology & Management Regulations for Power Metering Devices* (DL/T448-2000), the accuracy of the meters must meet the national standard.

Two bidirectional electronic meters (Master $Meter_1$ and Master $Meter_2$) are installed in power house to monitor the generated electricity exported to power grid and electricity imported from power grid.

4. Data monitoring

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

(1) The electricity imported and exported will be monitored hourly and recorded monthly through the Master Meters. The difference of exported and imported electricity is the net electricity generation.
(2) The Power Grid Company provides the project owner with the net electricity generation data;
(3) The project owner provides the Power Grid Company with sales receipts and preserves the copies of the sales receipts.
(4) The project owner provides DOE with readings record of meters and copies of sales receipts.

The principle of the processes is to guarantee the DOE could obtain the actual and precise data of net generated electricity.

5. Calibration of meters

The calibration of meters conducted by qualified organization must comply with national standard and sectoral regulations. The meters must be pasted with seal after calibration.

6. Data management

All monitoring data and records will be archived in electronic document and paper document. All the electronic and paper documents will be archived during the crediting period and two years after.

7. Training program

The project owner and Hunan CDM Service Center together will train together all the relative staffs before operation of generators. The training contains CDM knowledge, operational regulations, quality control (QC) standard flow, data monitoring requirements and data management regulations etc..

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

>>

Final Date of completion of the baseline study and monitoring methodology (DD/MM/YYYY)

08/10/2007

The persons and entity completing the application of the baseline and monitoring methodology are:

Hengzhi Xu, Hunan CDM Project Service Center, E-mail: cdmxhz@163.com

Yaguo Zheng, Hunan CDM Project Service Center, E-mail: hncdmzyg@126.com

Hanwen Zhang, Hunan CDM Project Service Center, E-mail: hncdmzhw@126.com

The persons and entity mentioned above are not project participants.

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:

>>
22/03/2005 (Starting date of construction)

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

>>
30 years and 0 month

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

C.2.1. Renewable crediting period

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

>>
01/06/2008 or date of registration whichever is later.

C.2.1.2. Length of the first crediting period:

>>
7 years and 0 month

C.2.2. Fixed crediting period:

Not applicable.

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

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

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The project owner entrusted a third party: Hunan Environmental Engineering Evaluation Centre to conduct the environmental impact assessment (EIA) on Tongwan Hydropower Plant and obtained the approval (Xianghuanping [2005] No 21) from Hunan Provincial Environmental Protection Bureau in March, 2005.

The EIA report is prepared for future reference, and the main comments of the EIA are as follows:

1. Description of Project

The project introduction has been described in section A, please refer to it.

2. Existing Environment

2.1 Natural Environment

The project is located in middle course of Yuanshui River, the site of project belongs to semitropical monsoon climate. Annual average temperature is above 17 ℃, the annual average rainfall is 1,353 mm while the annual average evaporation of surface water is 1,225 mm. The annual average flow rate of the project site is 863 m^3/s.

2.2 Vegetation

The project belongs to Central China Vegetation Area, the main vegetation are timber forest and oil-yielding trees. There are no any rare wild trees in submerged area.

2.3 Animals

The terrestrial animals are mainly vertebrate animals and arthropod animals and the aquatic animals are mainly vertebrate fishes. There are no any rare animals in submerged area.

2.4 Water, Air Environment

The water pollutions are mainly come from country domestic wastewater and urban wastewater as well as few industrial wastewater. The air quality in project site is well, it can reach environmental air quality standard.

3. Environmental Impact Assessment and Prevention Measures

3.1 Construction Period

3.1.1 Water Pollution: The wastewater will mainly come from construction raw materials and domestic wastewater. Wastewater will have slight impact on water quality. In general, wastewater will cause trifling contamination during the construction period. To avoid the impacts, wastewater from power plant will be treated by septic tanks before discharged. Wastewater including oils will be treated by oil separator before discharged into the river. In order to prevent water pollution, the direct discharge of industrial and domestic wastes is forbidden. The biomass in the submerged area will be cleaned up to satisfy the acceptability of the environment before submerging.

3.1.2 Air Quality: The main impacts on the air quality will come from flying dust and emission caused by cement mixture process and transportation. To avoid these impacts, the project owner will ensure exhaust gas emission reaching the national standard, spray water regularly, and the workers will be protected by masks. These measures would prevent air pollution greatly.

3.1.3 Noise: The noise impact will mainly come from construction machines and transportaion of construction materials. To avoid these impacts, the project owner will strengthen the construction management and control the operation time of construction machines with high noise. In addition, the workers will be protected by ear-muffs and helmets.

3.1.4 Solid Wastes: The solid wastes will mainly come from construction wastes and life trash. To avoid these impacts, the project owner will specially build a garbage dump for the storage of life trash and solid waste produced during the construction process.

3.1.5 Water Lose and Soil Erosion: In China, the Law of Water and Soil Conservation requires that a soil conservation plan should be prepared and implemented for all kind of hydropower projects. An investigation was carried out for protecting the water and soil in Water & Soil Preserve Planning of Tongwan Hydropower Plant. In the plan, total amount of soil erosion was predicted, detailed protection measures were identified.

The project construction will increase water lose and soil erosion in the affected area. To minimize the impacts, the project owner will construct drainage ditch in solid wastes dump, retaining walls around dumping zones, plant trees and grasses around the project site etc. These measures will improve the water lose and soil erosion situations. It is concluded that with implementation of the plan the soil erosion will be under effective control and the soil erosion due to construction of the project would be within an acceptable level.

3.2 Operation Period

3.2.1 Water Environment: The project itself will not discharge wastewater into river. The main impact to water environment is the change of flow rate will affect pollution tolerant function of river. The construction of reservoir will affect pollutants diffusion. In general, it will not emerge eutrophication in river, the impacts of project to water quality are slight.

3.2.2 Ecological Environment: The construction of reservoir will have positive impacts to improve soil and air humidity, thus it is beneficial for plants growth. Meanwhile, aquatic animal species will increase because of improvement of water habitat. It is beneficial for ecology stabilization. The main negative impact to aquatic animals is that reservoir will affect aquatic animals' migration, thus it will affect aquaculture. According to opinions from fisheries department, the best solution way for aquiculture is breed artificial fry in river. The artificial fry will ensure quantity of aquiculture resources.

4. Migration resettlement

There are 3861 inhabitants (563 households) need to be resettled due to the project. Among of them, 707 inhabitants need to be resettled to another village or county, 3154 inhabitants need to be resettled from low water level places to high water level places. According to the Report of Land Use and Resettlement Plan of Tongwan Hydropower Plant, total 2.83 km^2 of previously used land is submerged due to the project, including 1.4 km^2 farmland, 1.43 km^2 garden land and forest land.

According to the related laws and regulations of Chinese government, a detailed resettlement plan was edited in the Migration Resettlement Planning Report of Tongwan Hydropower Project. The purpose of the plan is to guarantee the migrations' living standard equal to or better than the previous situation and to achieve the sustainable development. The migration resettlement will be implemented strictly based on the national policies and local government migration resettlement plan. The DOE has reviewed all information regarding the WCD guidelines and confirmed the project's compliance with Chinese law and the WCD guidelines.

At the time of final PDD submission, 2534 inhabitants have finished resettlement. The flooded land and resettlers are compensated and resettled according to <Land Compensation and Migration Resettlement Regulation for Large and Medium Scale Water Resources and Hydropower Construction>[30]. Due to the resettlement planning, the remaining resettlers are expected to be compensated and resettled before June 2008.

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:

>>
Both of the host Party and the project owners regard that the proposed project will not bring significant impacts on the environment. After the completion of the project construction, the project will be put into operation only after the inspection and acceptance of local environmental protection department.

[30] Proof documents from Resettlement Bureau of Hongjiang City and Zhongfang County

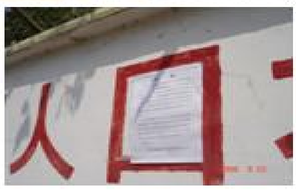
SECTION E. Stakeholders' comments

>>

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

>>

In order to consult stakeholders' comments, the project owner carried out a survey to stakeholders in form of questionnaire during 1 September to 30 September of 2006. The project owner invited these resettlers to fill in a questionnaire during 1 September to 30 September of 2006. The resettlers were invited both by personal visits from local government officials as well as by 55 bulletins that were posted around the project site, Zhongfang County and Hongjiang City. The questionnaires were easily accessible by the resettlers, either through the local government or the project owner. 425 filled in questionnaires were received and the project owner then held a symposium on 20 October 2006 in office of Hunan Zhongfang Tongwan Water Resources & Hydropower Development Co., Ltd to discuss the opinions and comments presented in questionnaires with government officials and resettler representatives.



The results of the survey will be outlined in the next section.

E.2. Summary of the comments received:

>>

Summary of the comments received are as follows:

The results of questionnaire are shown in table below:

Table 11 Results of questionnaire

Item	Yes	No	Unconcerned	Population
1. Do you support this project to be implemented?	100%	0	0	425
2. Is the project beneficial to the local economic development?	97%	2%	1%	425
3. Will the project have impacts on water quality?	8%	74%	18%	425
4. Will the project have impacts on ecology?	8%	79%	13%	425
5. Will the project have impacts on natural scenery?	5%	87%	8%	425
6. What are your most concerned environmental and social issues?				
7. What's your opinion to the proposed project?				

It can be concluded from table above that the participants all support construction of the project. The participants of the survey thought that the project construction will relieve the power shortage situation of the local region and promote the development of local economy. The construction of roads will bring great convenience to the local people's daily life. The participants of the survey agreed on that the proposed project will be beneficial to the environment. They expressed full support to the construction of the project and also raised some issues which need to be solved.

Issues reflected in the stakeholders consultation are as follows:

1. The water quality protection measures as well as solid wastes treatment measures in project site should be implemented.

2. Some participants worried the construction of dam will affect aquiculture.

3. Some people requested the project owner should restore destructed vegetation after completion of project construction.

4. The project owner should plant trees to ensure the project construction will not lead to significant soil erosion.

5. The construction of project will have impacts on surrounding environment.

6. The migrations worried about whether the resettlement compensation would be disbursed in accordance with the national policies.

7. The project owner was requested to coordinate relationships through the communication with local government and relevant departments, in particular the township government and villages.

8. The project owner was requested to strengthen the downriver flood prevention embankment.

9. Some local residents requested the project owner to improve traffic infrastructure of project site.

10. Some local residents worried about that storage of water in reservoir will affect broadcasting & TV circuit.

11. Some people worried about that storage of water in reservoir will affect normal prediction measurement of hydrological station.

12. Some people worried about that the Anjiang County will suffer flood disasters after construction of the project, the project owner was requested to take actions to prevent flood.

13. The three submerged small scale hydropower plants requested for compensation.

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

>>

After the project owner compiling the investigation results, project owner made quick response in views of question reflected by the questionnaire and symposium. In the symposium, project owner replied towards the opinions and comments shown in the previous section as follows:

1. According to EIA, the project construction will have slight impacts on water quality, and solid wastes will be transported to special garbage dump for storation.

2. The project owner will breed fry in reservoir to ensure the quantity of aquiculture resources.

3. The project owner will plant trees and will restore vegetation in accordance with Water & Soil Preserve Planning of Tongwan Hydropower Plant.

4. According to EIA, the project construction will not lead to large scale soil erosion. Anyhow, trees will be planted to restore vegetation.

5. The project owner spraied water regularly during construction period to avoid air pollution. The project site is far away from residential area, thus the noise will not affect local residents.

6. The project owner will compensate the migrations in accordance with the migration resettlement policies punctually.

7. The project owner promised to communicate frequently with local government officials, leaders of various departments, village cadres and the related masses in the period of construction and operation of the project so as to coordinate the relationship, and make an appropriate treatment when finding problems related to the project.

8. The project owner designed the downriver flood prevention embankment specially and put it into implementation.

9. In order to facilitate the local residents' daily life, the project owner will built roads.

10. The project owner will change the installation places of broadcasting & TV circuit which is under water level to ensure local residents could receive broadcasting & TV signal.

11. The project will negotiate with hydrological department to make out a modification plan.

12. In order to prevent flood disasters, the project owner will build Anjiang Flood Embankment to ensure people's personal and property safety.

13. The project owner agreed to compensate the three submerged small scale hydropower plants' owners.

At the time of final PDD submission, the items 1, 5, 6, 7, 8, 11, 12 and 13 above have been resolved by project owner. The items 9 and 10 are under process now. The items 2, 3 and 4 will be solved after operation of power plant[31].

In conclusion, according to the results of the questionnaires, the residents support the construction of the project, they hope that the project construction could be completed as soon as possible.

[31] Proof documents from local government

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Entity

Organization:	Hunan Zhongfang Tongwan Hydro & Power Development Co., Ltd
Street/P.O.Box:	/
Building:	Office Building of Hunan Zhongfang Tongwan Hydro & Power Development Co., Ltd, Tongwan Town, Zhongfang County
City:	Huaihua City
State/Region:	Hunan Province
Postfix/ZIP:	418002
Country:	P.R.China
Telephone:	+86-745-2649006
FAX:	+86-745-2649004
E-Mail:	hncxyuer168@sina.com
URL:	/
Represented by:	Yong Li
Title:	President
Salutation:	Mr.
Last Name:	Li
Middle Name:	/
First Name:	Yong
Department:	/
Mobile:	+86-13874586696
Direct FAX:	+86-745-2649004
Direct tel:	+86-745-2649006
Personal E-Mail:	hncxyuer168@sina.com

Purchaser

Organization:	Carbon Asset Management Sweden AB
Street/P.O.Box:	Drottninggatan 92-94
Building:	
City:	Stockholm
State/Region:	
Postfix/ZIP:	111 36
Country:	Sweden
Telephone:	+46 8 506 885 00
FAX:	+46 8 34 60 80
E-Mail:	co2@tricorona.se
URL:	www.tricorona.se
Represented by:	Niels Von Zweigbergk
Title:	President & CEO
Salutation:	Mr.
Last Name:	Zweigbergk
Middle Name:	Von
First Name:	Niels
Department:	
Mobile:	+46 708 59 35 00
Direct FAX:	+46 8 34 60 80
Direct tel:	+46 8 506 263 96
Personal E-Mail:	nvz@tricorona.se

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

The installed capacity, fuel consumption data used for OM and BM calculation are derived from <China Energy Statistical Yearbook>, <China Electric Power Yearbook>.

The low calorific value, CO_2 emission factor and oxidation factor of fuels are listed in Table A1 below.

Table A1 Low calorific values, CO_2 emission factors and oxidation factors of fuels

Fuel	Low Calorific Value	Emission Factor (tC/TJ)	Oxidation Factor
Raw Coal	20908 kJ/kg	25.8	100%
Cleaned Coal	26344 kJ/kg	25.8	100%
Other Washed Coal	8363 kJ/kg	25.8	100%
Coke	28435 kJ/kg	29.2	100%
Crude Oil	41816 kJ/kg	20.0	100%
Gasoline	43070 kJ/kg	18.9	100%
Diesel Oil	42652 kJ/kg	20.2	100%
Fuel Oil	41816 kJ/kg	21.1	100%
Natural Gas	38931 kJ/m^3	15.3	100%
Coke Oven Gas	16726 kJ/m^3	12.1	100%
Other Gas	5227 kJ/m^3	12.1	100%
LPG	50179 kJ/kg	17.2	100%
Refinery Dry Gas	46055 kJ/kg	15.7	100%

Data Source:

The net calorific values are quoted from <China Energy Statistical Yearbook 2006>, Page 287.

The emission factors and oxidation factors are quoted from <Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories >, Table 1.4, Page 1.24, Chapter 1, Volume 2.

Step 1: Calculating the Operating Margin emission factor ($EF_{OM,y}$)

Table A2 Simple OM Emission Factors Calculation of CCPG for Year 2003

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	(MJ/t,km^3)	K=G*H*I*J*44 /12/10000 (for mass unit)
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K=G*H*I*J*44 /12 /1000 (for volume unit)
Raw Coal	10^4 t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13851.66	25.8	100	20908	273971539.89
Cleaned Coal	10^4 t							0	25.8	100	26344	0
Other Washed Coal	10^4 t	2.03	39.63			106.12		147.78	25.8	100	8363	1169146.40
Coke	10^4 t				1.22			1.22	29.2	100	28435	37142.18
Coke Oven Gas	10^8 m^3			0.93				0.93	12.1	100	16726	69013.15
Other Gas	10^8 m^3							0	12.1	100	5227	0
Crude Oil	10^4 t		0.5	0.24			1.2	1.94	20	100	41816	59490.23
Diesel Oil	10^4 t	0.52	2.54	0.69	1.21	0.77		5.73	20.2	100	42652	181015.94
Fuel Oil	10^4 t	0.42	0.25	2.17	0.54	0.28	1.2	4.86	21.1	100	41816	157229.00
LPG	10^4 t							0	17.2	100	50179	0
Refinery Dry Gas	10^4 t	1.76	6.53		0.66			8.95	15.7	100	46055	237285.34
Natural Gas	10^8 m^3					0.04	2.2	2.24	15.3	100	38931	489222.52
											Total	**276371084.63**

Data Source: <China Energy Statistical Yearbook 2004>

Table A3 Fuel-fired Electricity Generation of CCPG for Year 2003

Province	Electricity Generation	Electricity Generation	Internal Use Rate	Supplied Electricity
	(10^8 kWh)	**(MWh)**	**(%)**	**(MWh)**
Jiangxi	271.65	27165000	6.43	25418291
Henan	955.18	95518000	7.68	88182218
Hubei	395.32	39532000	3.81	38025831
Hunan	295.01	29501000	4.58	28149854
Chongqing	163.41	16341000	8.97	14875212
Sichuan	327.82	32782000	4.41	31336314
Total				225987719

Data Source: <China Electric Power Yearbook 2004>

There are no imports from other power grids to CCPG, thus the imports are not taken into account. According to Table A2, the total CO_2 emissions of CCPG is **276371084.63** tCO_2e in year 2003. According to Table A3, the total supplied electricity of CCPG is 225987719.2 MWh. According to formula (2) in section B.6.1, the $EF_{OM, Simple, 2003}$ is 1.2229 tCO_2e/MWh.

Table A4 Simple OM Emission Factors Calculation of CCPG for Year 2004

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	($MJ/t,km^3$)	K=G*H*I*J* 44/12/10000 (for mass unit)
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K=G*H*I*J*4 4/12 /1000 (for volume unit)
Raw Coal	10^4 t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	17144.1	25.8	100	20908	339092605.29
Cleaned Coal	10^4 t		2.34					2.34	25.8	100	26344	58316.13
Other Washed Coal	10^4 t	48.93	104.22			89.72		242.87	25.8	100	8363	1921441.23
Coke	10^4 t		109.61					109.61	29.2	100	28435	3337011.41
Coke Oven Gas	10^8 m^3			1.68		0.34		2.02	12.1	100	16726	149899.53
Other Gas	10^8 m^3					2.61		2.61	12.1	100	5227	60527.09
Crude Oil	10^4 t		0.86	0.22				1.08	20	100	41816	33118.27
Gasoline	10^4 t		0.06			0.01		0.07	18.9	100	43070	2089.33
Diesel Oil	10^4 t	0.02	3.86	1.7	1.72	1.14		8.44	20.2	100	42652	266627.32
Fuel Oil	10^4 t	1.09	0.19	9.55	1.38	0.48	1.68	14.37	21.1	100	41816	464893.14
LPG	10^4 t							0	17.2	100	50179	0
Refinery Dry Gas	10^4 t	3.52	2.27					5.79	15.7	100	46055	153506.38
Natural Gas	10^8 m^3						2.27	2.27	15.3	100	38931	495774.61
											Total	**346035809.73**

Data Source: <China Energy Statistical Yearbook 2005>

Table A5 Fuel-fired Electricity Generation of CCPG for Year 2004

Province	Electricity Generation	Electricity Generation	Internal Use Rate	Supplied Electricity
	(10^8 kWh)	**(MWh)**	**(%)**	**(MWh)**
Jiangxi	301.27	30127000	7.04	28006059
Henan	1093.52	109352000	8.19	100396071
Hubei	430.34	43034000	6.58	40202363
Hunan	371.86	37186000	7.47	34408206
Chongqing	165.2	16520000	11.06	14692888
Sichuan	346.27	34627000	9.41	31368599
Total				249074186

Data Source: <China Electric Power Yearbook 2005>

There are no imports from other power grids to CCPG, thus the imports are not taken into account. According to Table A4, the total CO_2 emissions of CCPG is 346035809.73 tCO_2e in year 2004. According to Table A5, the total supplied electricity of CCPG is 249074186 MWh. According to formula (2) in section B.6.1, the $EF_{OM, Simple, 2004}$ is 1.3893 tCO_2e/MWh.

Table A6 Simple OM Emission Factors Calculation of CCPG for Year 2005

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	(MJ/t,km^3)	K=G*H*I*J*44 /12/10000 (for mass unit)
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K=G*H*I*J *44/12/1000 (for volume unit)
Raw Coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	25.8	100	20908	352614496.76
Cleaned Coal	10^4 t	0.02	0					0.02	25.8	100	26344	498.43
Other Washed Coal	10^4 t		138.12			89.99		228.11	25.8	100	8363	1804669.00
Coke	10^4 t		25.95		105			130.95	29.2	100	28435	3986695.05
Coke Oven Gas	10^8 m^3			1.15		0.36		1.51	12.1	100	16726	112053.61
Other Gas	10^8 m^3		10.2			3.12		13.32	12.1	100	5227	308896.88
Crude Oil	10^4 t		0.82	0.36				1.18	20	100	41816	36184.78
Gasoline			0.02			0.02		0.04	18.9	100	43070	1193.90
Diesel Oil	10^4 t	1.3	3.03	2.39	1.39	1.38		9.49	20.2	100	42652	299797.78
Fuel Oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	21.1	100	41816	286959.09
LPG	10^4 t							0	17.2	100	50179	0.00
Refinery Dry Gas	10^4 t	0.71	3.41	1.76	0.78			6.66	15.7	100	46055	176572.11
Natural Gas	10^8 m^3						3	3	15.3	100	38931	655208.73
											Total	**360283226.12**

Data Source: <China Energy Statistical Yearbook 2006>

Table A7 Fuel-fired Electricity Generation of CCPG for Year 2005

Province	Electricity Generation (10^8 kWh)	Electricity Generation (MWh)	Internal Use Rate (%)	Supplied Electricity (MWh)
Jiangxi	300	30000000	6.48	28056000
Henan	1315.9	131590000	7.32	121957612
Hubei	477	47700000	2.51	46502730
Hunan	399	39900000	5.00	37905000
Chongqing	175.84	17584000	8.05	16168488
Sichuan	372.02	37202000	4.27	35613474.6
Total				286203304.6

Data Source: <China Electric Power Yearbook 2006>

There are no imports from other power grids to CCPG, thus the imports are not taken into account. According to Table A6, the total CO_2 emissions of CCPG is 360283226.12 tCO_2e in year 2005. According to Table A7, the total supplied electricity of CCPG is 286203304.6 MWh. According to formula (2) in section B.6.1, the $EF_{OM, Simple, 2005}$ is 1.2588 tCO_2e/MWh.

The Operating Margin (OM) emission factor is the weighted average emission factors of year 2003-2005, as follow:

$$EF_{OM} = 1.29086\ tCO_2e/MWh$$

Step 2: Calculating the Build Margin emission factor ($EF_{BM,y}$)

Sub-Step 2a: Calculating of percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

Table A8 Percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

		Jiangxi	**Henan**	**Hubei**	**Hunan**	**Chongqing**	**Sichuan**	**Total**	**Average Low Calorific Value**	**Emission Factor (tC/TJ)**	**Oxidation**	**CO_2 Emission (tCO_2e)**
Fuel	Unit	A	B	C	D	E	F	G=A+…+F	H	I	J	K=G*H*I*J*44 /12/100
Raw Coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	20908 kJ/kg	25.8	100%	352614496.76
Cleaned Coal	10^4 t	0.02	0					0.02	26344 kJ/kg	25.8	100%	498.43
Other Washed Coal	10^4 t		138.12			89.99		228.11	8363 kJ/kg	25.8	100%	1804669.00
Coke	10^4 t		25.95		105			130.95	28435 kJ/kg	29.2	100%	3986695.05
Subtotal												**358406359.24**
Crude Oil	10^4 t		0.82	0.36				1.18	41816 kJ/kg	20	100%	36184.78
Gasoline	10^4 t		0.02			0.02		0.04	43070 kJ/kg	18.9	100%	1193.90
Diesel Oil	10^4 t	1.3	3.03	2.39	1.39	1.38		9.49	42652 kJ/kg	20.2	100%	299797.78
Fuel Oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	41816 kJ/kg	21.1	100%	286959.09
Subtotal												**624135.55**
Natural Gas	10^7 m^3						30	30	38931 kJ/m^3	15.3	100%	655208.73
Coke Oven Gas	10^7 m^3			11.5		3.6		15.1	16726 kJ/m^3	12.1	100%	112053.61
Other Gas	10^7 m^3		102			31.2		133.2	5227 kJ/m^3	12.1	100%	308896.88
LPG	10^4 t							0	50179 kJ/kg	17.2	100%	0.00
Refinery Dry Gas	10^4 t	0.71	3.41	1.76	0.78			6.66	46055 kJ/kg	15.7	100%	176572.11
Subtotal												**1252731.33**
Total												**360283226.12**

Data Source: <China Energy Statistical Yearbook 2006>

According to Table A8 and formula (6) in section B.6.1, the percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions are calculated as:

$$\lambda_{Coal} = 99.48\%,\ \lambda_{Oil} = 0.17\%,\ \lambda_{Gas} = 0.35\%$$

Sub-Step 2b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)

The most advanced commercialized technologies for coal-fired power plants in China are domestic 600 MW sub-critical generators, with the standard coal consumption of power supply of 343.33 gce/kWh. For gas-fired and oil-fired power plants in China, the most advanced commercialized technologies are 200 MW combined cycle generators. The standard coal consumption (equivalent) for power supply of oil-fired and gas-fired power plants are 258 gce/kWh.

Parameters used for calculating fuel-fired emission factor are shown in Table A9 below:

Table A9 Parameters used for calculating fuel-fired emission factor

	Parameter	Efficiency of Power Suppy	Emission Factor of Fuel (tc/TJ)	Oxidation Factor	Emission Factor (tCO2/MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coar-fired Power Plant	$EF_{Coal,Adv}$	35.82%	25.8	100%	0.9508
Gas-fired Power Plant	$EF_{Gas,Adv}$	47.67%	15.3	100%	0.4237
Oil-fired Power Plant	$EF_{Oil,Adv}$	47.67%	21.1	100%	0.5843

According to Table A9 and formula (7) in section B.6.1, the $EF_{Thermal}$ is 0.94828 tCO_2e/MWh

Sub-Step 2c: Calculating the Build Margin (BM) emission factor ($EF_{BM,y}$)

Table A10 Installed Capacities of CCPG

Installed Capacity	Unit	2000	2001	2002	2003	2004	2005
Fuel-fired	MW	39864.6	42569.2	43303.2	46893.5	53744.7	60167.3
Hydro	MW	28637.8	30397	31034.7	36557	34642	38405.1
Nuclear	MW	0	0	0	0	0	0
Wind & Others	MW	0	0	0	0	0	24
Total	MW	**68502.4**	**72966.2**	**74337.9**	**83450.5**	**88386.7**	**98596.4**

Data Source: <China Electric Power Yearbook 2001-2006>

Table A11 Newly Added Installed Capacity from Year 2000-2005

	2000	2001	2002	2003	2004	2005	F-C
	A	B	C	D	E	F	
Fuel-fired (MW)	39864.6	42569.2	43303.2	46893.5	53744.7	60167.3	16864.1
Hydro (MW)	28637.8	30397	31034.7	36557	34642	38405.1	7370.4
Nuclear	MW	0	0	0	0	0	0
Wind & Others	MW	0	0	0	0	24	24
Total（MW）	68502.4	72966.2	74337.9	83450.5	88386.7	98596.4	24258.5
Percentage of newly installed capacity to 2005	30.51%	25.98%	24.59%	15.34%	10.33%	0.00%	
Percentage of newly added fuel-fired plants			69.52%				

It can be concluded from Table A11 that capacity additions from year 2002 to 2005 is closer to 20% of the total additions and it is obvious the capacity additions during year 2002 to 2005 are larger than the capacity of five plants, so year 2002 and 2005 are chosen to calculate the BM emission factor of CCPG.

According to Table A11 and formula (8) in section B.6.1, the EF_{BM} is calculated as:

$$EF_{BM} = 0.65923 \text{ tCO}_2\text{e/MWh}$$

Step 3: Calculating the baseline emission factor (EF_y)

According to formula (9) in section B.6.1, the baseline emission factor of CCPG is calculated as:

$$EF_y = 0.97504 \text{ tCO}_2\text{e/MWh}$$

The EF_y applied in this PDD is fixed for a crediting period and may be revised at the renewal of the crediting period.

Annex 4

MONITORING INFORMATION

Please refer to the section B.7 of the PDD.