



CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
VERSION 03 - IN EFFECT AS OF: 28 JULY 2006

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

Madushan Hydropower Project on Honghe River in Yunnan Province, China

Version number of the document: 05

Date of completion: 18/05/2011

Revision history:

Version	Date of completion	Nature of revision
01	24/03/2010	Initial adoption for GSP
02	16/07/2010	Revised according to the DOE's request during on-site audit
03	21/10/2010	Revised according to the DOE's further request
04	17/12/2010	Revised according to the TR's request
05	18/05/2011	Revised according to Request for Review

A.2. Description of the project activity:

Madushan Hydropower Project on Honghe River in Yunnan Province, China (hereafter referred to as “the proposed project”) is located on Honghe River in Honghe Hani and Yi Autonomous State, Yunnan Province. It is constructed and operated by Honghe Guangyuan Madushan Hydropower Development Co., Ltd (hereafter referred to as “the project owner”).

The proposed project is a newly built hydropower project with type of diversion. The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity. According to the following analysis in section B.4, in the absence of the proposed project, the most viable baseline scenario is “the same annual power generation provided by South China Power Grid” (hereafter referred to as “SCPG”). SCPG is dominated by fossil fuel-fired power plants, which is developed fast recently. From 2004 and 2008 in annual generation electricity composition, coal-fired generation accounted for 70.05% in 2004, 71.39% in 2005, 70.25% in 2006, 70.72% in 2007 and 63.93% in 2008¹.

The proposed project involves the installation of 3 sets of water turbine and generator, each of which has a rated capacity of 96MW, providing a total capacity of 288MW². After the implementation of the proposed project, when all the 3 sets of water turbine and generator put into operation, the annual grid-connected electricity is 1,217,569MWh³ will be supplied by the proposed project to SCPG. Therefore, the proposed project will substitute a part of the electricity of SCPG, resulting in reducing the CO₂ emission of SCPG. The annual average emission reductions of the proposed project were estimated to be 906,656tCO₂e.

The proposed project will achieve electricity generation by utilizing renewable water resources. It can promote local sustainable development from the following aspects:

- The construction and operation of the proposed project will mitigate shortage of electricity supply in local area, increase electricity quality in the power grid, ensure industrial and agricultural production,

¹ Electric Power Yearbook (2005, 2006, 2007, 2008, and 2009)

² Chapter 1.17 of approved FSR

³ Chapter 17.3.2 of approved FSR



and satisfy local people with sufficient electricity in daily life;

- The electricity generated by the proposed project will substitute part of electricity in SCPG which is dominated by fossil fuel generated electricity. In addition to GHG emission reductions, the proposed project will help to reduce the emission of other pollutants, such as NO_x, SO₂, Total Suspended Particles, etc.;
- The construction and operation of the proposed project will create more job opportunities for local people. Rural labors could be arranged for on-site construction during the construction period, and long-term job opportunities could be offered during the operation period.

A.3. Project participants:

Name of Party involved (*) (host indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host)	Honghe Guangyuan Madushan Hydropower Development Co., Ltd	No
The Netherlands	CF Carbon Fund II Limited	No

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):

People's Republic of China

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

Yunnan Province

A.4.1.3. City/Town/Community etc:

Honghe Hani and Yi Autonomous State/ Gejiu City and Jinping County

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

The proposed project is located on Honghe River in Honghe Hani and Yi Autonomous State, Yunnan Province. It is about 75km away from Gejiu City, about 59km away from Yuanyang County, and about 86km away from Mengzi County. The geographical coordinates of the dam are east longitude of 103°16'58.5" and north latitude of 23°02'43.9", and the geographical coordinates of the power house are east longitude of 103°17'15" and north latitude of 23°02'39". The detailed project location is shown in Figure 1.

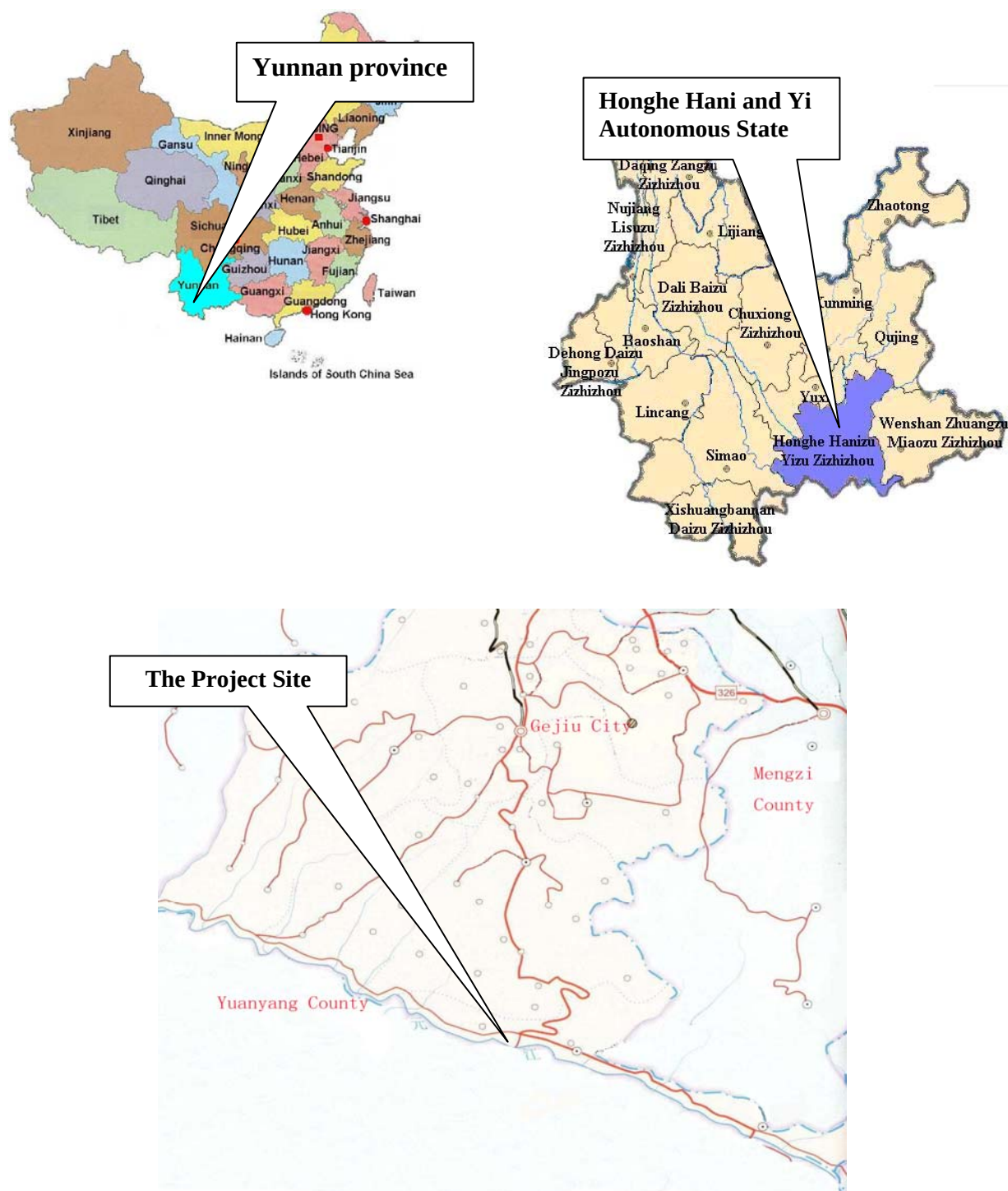


Figure 1. Geographical location of the proposed project

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

Category 1, energy industries (renewable sources)

Subcategory: hydropower

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

The proposed project is a newly-built hydropower station with type of diversion. There is no equipment and system in operation prior to the start of the implementation of the proposed project at the project site.

The scenario existing prior to the start of the implementation of the proposed project is the same as the baseline scenario. According to the following analysis in section B.4, in the absence of the proposed project, the most viable baseline scenario is that power supplied by SCPG. SCPG is dominated by fossil fuel-fired power plants and developed rapidly recently. The baseline emission source is CO₂ emission by SCPG. On the other side, the power density of the proposed project is 15W/m² (288MW/19,180,000m²) larger than 10W/m², so there is no emission source from the project activity.

The project involves the installation of 3 sets of water turbine and generator, each of which has a rated capacity of 96MW, providing a total capacity of 288MW. The main constructions include dam, reservoir, water diversion structures, power house, and switch station. The maximum height of the dam is 107.5 meters, and the surface area of the reservoir is 19,180,000 m²⁽⁴⁾ when the reservoir is full. The annual power generation of the proposed project is 1,314,380MWh, the annual operation hour is 4,564 hours⁵ with the PLF of 52.10%, and the annual grid-connected electricity of 1,217,569MWh will be supplied to Yunnan Power Grid and then to SCPG through one 220kV circuit.

Annual net electricity supplied to the grid = Annual electricity generation (1,314,380MWh) × Effective coefficient (0.95) × (1-Rate of internal consumption (0.5%)) × (1-Rate of transmission loss (2%))⁶ = 1,217,569MWh⁷

The major parameters of the equipments are as follows:

Table 1 The parameters of equipments used in the proposed project⁸

	Number & Model	Manufacturer	Major Parameters
Water Turbine	Three sets of HL210a-LJ-430	Tianjin City Tianfa Hydropower Equipment Manufacture Co., Ltd	Rated Capacity: 96MW; Rated Speed: 142.9 r/min; Rated Water Head: 67 .0m; Rated Flow: 168.67 m ³ /s; Operation year: 50 years in ideal condition
Generator	Three sets of SF96-42/10000	Tianjin City Tianfa Hydropower Equipment Manufacture Co., Ltd	Capacity per set: 96 MW; Power Factor: 0.85; Rated Speed: 142.9r/min Rated Voltage: 13.8 kV Operation year: 50 years in ideal condition
Transformer	Three sets of SFP10-120000/230	Jiangxi Transformer Technology Co., Ltd	Rated Capacity:120000kVA Rated frequency: 50HZ Operation year: >30 years in

⁴ Data source: Attach table 1 of chapter 1 in approved FSR

⁵ Data source: Attach table 1 of chapter 1 in approved FSR.

⁶ Data source: Chapter 17.3.2.1 in approved FSR

⁷ Even if the effective coefficient of 1 is adopted and not taking into account for the transmission loss and internal consumption in the most conservative approach, the IRR of proposed project is 7.30%, which is still much lower than the benchmark of 8%.

⁸ Data source: Turbines and Generators Purchase Agreement and Transformer Purchase Agreement



			ideal condition
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The monitoring equipment is the bidirectional electric energy meter and the accuracy of the meter should be 0.5s or 0.2s in accordance with Technical Administrative Code of Electric Energy Metering (DL/T448-2000). The monitoring equipments will be installed at the grid interface point of the proposed project. For more information about monitoring equipments, see section B.3 and B.7.2.

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

The proposed project chooses the renewable crediting period of 21 years (3*7 years). In the first renewable crediting period (from 01/07/2011 to 30/06/2018), the proposed project will have total emission reductions of about 6,346,590tCO₂e, with annual emission reductions of 906,656tCO₂e.

Year	Annual estimation of emission reductions In tonnes of CO ₂ e
01/07/2011-31/12/2011	236,645 ⁹
01/01/2012-31/12/2012	917,369 ¹⁰
01/01/2013-31/12/2013	917,369
01/01/2014-31/12/2014	917,369
01/01/2015-31/12/2015	959,382 ¹¹
01/01/2016-31/12/2016	959,382
01/01/2017-31/12/2017	959,382
01/01/2018-30/06/2018	479,691 ¹²
Total estimated reductions(tonnes of CO ₂ e)	6,346,590
Total number of crediting years	7
Annual average over the crediting period of estimated reductions(tonnes of CO ₂ e)	906,656

A.4.5. Public funding of the project activity:

No official development assistant (ODA) from Annex I Parties is involved in the proposed project.

⁹ There is only part of the turbines and generators start to operate, so the grid-connected electricity of 01/07/2011-31/12/2011 is not the electricity of the whole year, it is 300,330MWh. The emission factor of SCPG approved by China DNA is 0.78795tCO₂e/MWh, so the emission reductions from 01/07/2011-31/12/2011 will be 236,645tCO₂e.

¹⁰ All the turbines and generators were put into operation, the annual grid-connected electricity from 01/01/2012-31/12/2014 is 1,164,249MWh. The emission factor of SCPG approved by China DNA is 0.78795 tCO₂e/MWh, so the annual emission reductions from 01/01/2012-31/12/2014 will be 917,369tCO₂e.

¹¹ As the hydropower stations in the upstream of the proposed project were start to operation, it is no need for the proposed project to take the function of flood discharge, so the annual grid-connected electricity after the year of 2015 is 1,217,569MWh which is more than before. The emission factor of SCPG approved by China DNA is 0.78795 tCO₂e/MWh, so the annual emission reductions from 01/01/2015-31/12/2017 will be 959,382tCO₂e.

¹² As the year of 01/01/2018-30/06/2018 is half of the year, so the grid-connected electricity is 608,785MWh which is half of the year. The emission factor of SCPG approved by China DNA is 0.78795 tCO₂e/MWh, so the emission reductions from 01/01/2018-30/06/2018 will be 479,691 tCO₂e.

**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:**

- (1) Version 11 of ACM0002¹³;
- (2) Version 2 of the tool to calculate the emission factor for an electricity system¹⁴;
- (3) Version 05.2 of the tool for the demonstration and assessment of additionality¹⁵.

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

The proposed project activity is within the scope of the methodology ACM0002 (Version 11) based on the following reasons:

- According to the approved Feasibility Design Report (FSR) of the proposed project, the proposed project is a newly-built hydropower station with installed capacity of 288MW¹⁶. The electricity generated will be connected to SCPG. So it is a grid-connected renewable power generation project activity.
- According to the approved FSR of the proposed project, the surface area of the reservoir resulted by the proposed project is 19,180,000m², and the power density of the proposed project is calculated to be 15W/m² (17), which is greater than 4W/m²;
- According to the approved FSR of the proposed project, the proposed project doesn't involve switching from fossil fuels to renewable energy sources at the site of the project activity;
- According to the delineation of grid boundaries published by China's DNA on 2nd July 2009¹⁸, the geographic and system boundary of SCPG can be clearly defined and much of the information and data on the features of the power grid can be obtained from publications.

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

The electricity generated by the proposed project will be supplied to Yunnan Power Grid which is a part of SCPG. According to the delineation of grid boundaries published by China's DNA on 2nd July 2009¹⁹, the project electricity system of the proposed project is SCPG, so the boundary of the proposed project includes the proposed project and all power plants connected physically to SCPG which is composed of Guangdong Power Grid, Guangxi Power Grid, Guizhou Power Grid and Yunnan Power Grid.

The GHG sources in and out of the project boundary are shown in the following table. Sources of GHG in/out of the project boundary:

¹³ <http://cdm.unfccc.int/UserManagement/FileStorage/NF9EDA0V5K382HW0JR14GS7XYQUMCP>

¹⁴ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf>

¹⁵ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf>

¹⁶ Table 1-12 of the approved FSR

¹⁷ Refer to section B.6.1

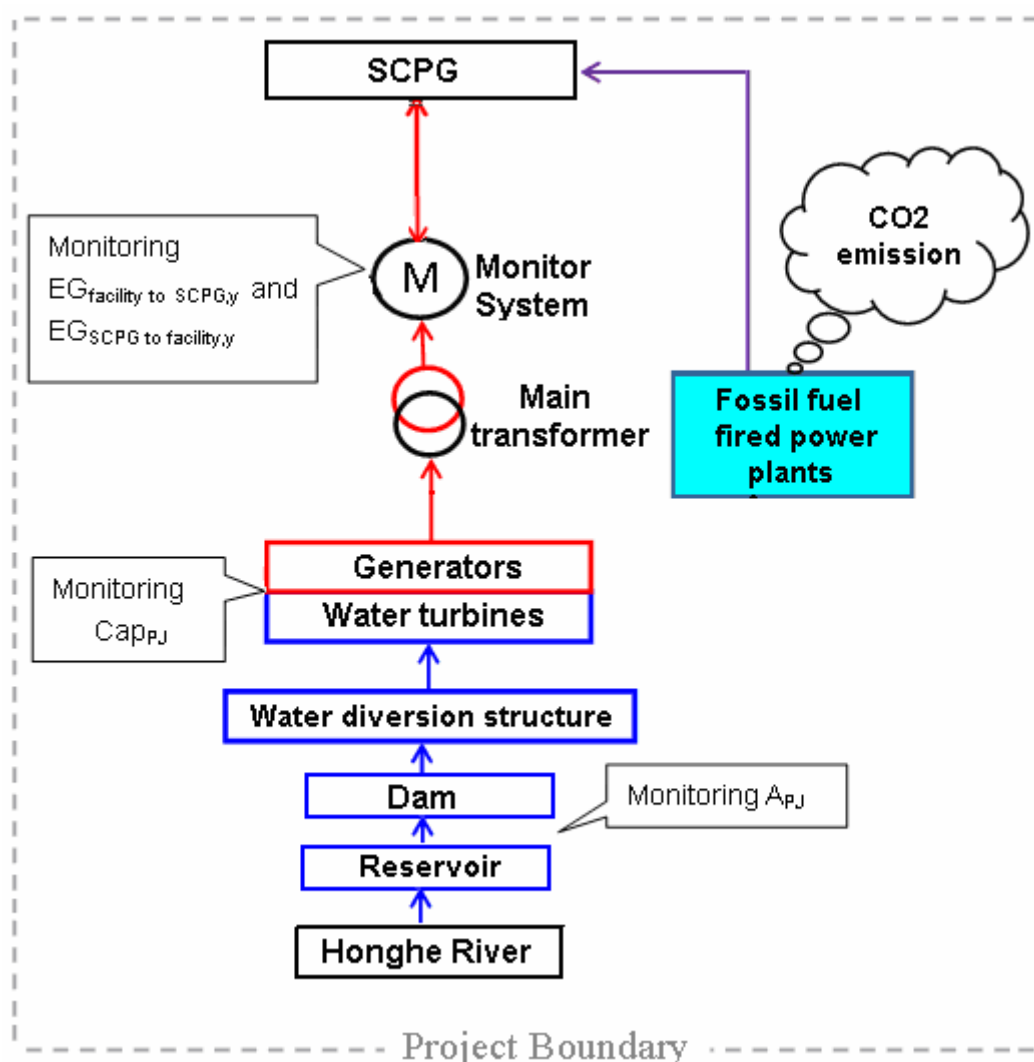
¹⁸ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2333.pdf>

¹⁹ <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf>



	Source	Gas	Included?	Justification / Explanation
Baseline	Electricity generation of SCPG	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
Project Activity	Emissions of CH ₄ from the reservoir	CO ₂	No	Minor emission source.
		CH ₄	No	The power density is 15W/ m ² , which is greater than 10W/m ² . The Cap _{PJ} and A _{PJ} will be monitored throughout the crediting period.
		N ₂ O	No	Minor emission source.

The flowchart of the proposed project is as followings:



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

According to the Identification of the baseline scenario in “*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*” ACM0002 (Version 11), because the proposed project is a new grid-connected hydropower plant, the baseline scenario is the following: in the absence of the CDM project activity, electricity delivered to the SCPG by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”

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):

In accordance with “Guidance on the demonstration and assessment of prior consideration of the CDM” Version 03 (Annex 22, EB 49th Meeting Report) , the serious consideration on incentive of CDM is demonstrated as following:

Milestones of the proposed CDM project development**Table 2 Milestones of the proposed CDM project development**

Time	Milestones	Evidences/Remarks
01/2007	The EIA report was completed by Pearl River Water Resource Conservation Science Institute.	The EIA report
27/09/2007	The EIA was approved by Ministry of Environmental Protection of People’s Republic of China.	Approval letter of EIA, huanshen[2007]No.393
Nov, 2007	The Feasibility Study Report was compiled by China Pearl River Water Resources Planning, Design and Survey Co., Ltd.	The Feasibility Study Report
18/03/2008	Board of directors meeting was held to consider CDM Application.	Minutes of the meeting of serious CDM consideration
06/04/2008	Stakeholders’ meeting was held to collect opinions and suggestions for CDM Application.	Minutes of the meeting of stakeholders
28/05/2008	The CDM consulting agreement was signed between the project owner and Beijing Haohua Rivers International Water Engineering Consulting Co. Ltd.	The CDM consulting agreement
25/12/2008	The project owner asked the bank to loan because the proposed project has feasibility after achieving the CDM revenue.	The Explanation letter to the bank
30/12/2008	The Guangzhou Tianpingjia branch bank of Industrial and Commercial Bank of China consent to loan to the project owner, for the project is feasible as the CDM factor was considered.	The reply letter to the project owner
31/12/2008	The project was approved by the National Development and Reform Commission	The approval letter, fagainengyuan[2008]No.3682
06/01/2009	The purchase agreement of turbines and generators was signed between the project owner and Tianjin City Tianfa Hydropower Equipments Production Co., Ltd	The purchase agreement of turbines and generators
25/01/2009	The construction contract was signed between the project owner and the Guangdong No.2 Hydropower Engineering Company, Ltd.	The construction contract



25/01/2009	The construction permission letter of the proposed project was issued by Guangdong province Keyuan Engineering Supervision and Consultancy Company.	The construction permission letter
02/2009	The Guangzhou Tianpingjia branch bank of Industrial and Commercial Bank of China and the project owner signed the loan contract	The loan contract
05/2009	The ERPA was signed between the project owner and CF Carbon Fund II Limited.	ERPA
03/06/2009	PP informed Chinese DNA in writing of the commencement of the project activity and of their intention to seek CDM status as per Annex 46 of EB41.	Notification letter
10/12/2009	The LOA was issued by NDRC.	The LOA
27/03/2010 ~25/04/2010	GSP	Website of UNFCCC ²⁰
20/04/2010 ~22/04/2010	On-site validation	Meeting minutes of on-site audit
01/07/2011	The proposed project is estimated to be put into operation.	Estimated

Starting date of the proposed project

According to “Glossary of CDM terms” (version 04, EB41, paragraph 67), the starting date of a CDM project activity is defined to be the earliest date at which either the implementation or construction or real action of a project activity begins, and in light of the above definition, the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. In accordance with above definition, the date of signing the purchase agreement of turbines and generators (06/01/2009) is selected to be the starting date of the proposed project.

Prior consideration of CDM

The IRR of the proposed project is much lower than the benchmark of 8% in the FSR. According to the financial evaluation in the FSR, CDM revenues could help the proposed project become financially viable. Based on the evaluation conclusion, the project owner held the board meeting and decided to develop the proposed project as the CDM project on 18/03/2008. This investment decision was made before the starting date of the proposed project.

The proposed project is a new project active with the starting date after 02/08/2008. In accordance with “Guidance on the demonstration and assessment of prior consideration of the CDM”, the project owner has submitted Notification on Prior Consideration of the CDM to China’ DNA within six months of the project start date.

Therefore, CDM was seriously considered in the decision to implement the proposed project.

The additionality of the proposed project was demonstrated in accordance with *Tool for the Demonstration and Assessment of Additionality* (version 05.2).

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations **Sub-step 1a: Define alternatives to the project activity:**

Without the proposed project activities, the alternatives could be as follows:

- a) The proposed project generates power not as a CDM project;

²⁰ <http://cdm.unfccc.int/Projects/Validation/DB/OD7S9WIL867UOESL5TM47VIMZG6RVN/view.html>



- b) Building a new coal-fired power plant generating the same annual power generation;
- c) Building a new power plant generating the same annual power generation from other renewable sources such as wind power, solar power and biomass power;
- d) The SCPG providing the same annual power generation.

As for scenario a) the proposed project generating power not as a CDM project:

It is consistent with China's existing laws and regulations. To further ensure whether the scenario is viable or not, an investment analysis (Step 2 in Section B.5) has been made showing that without CERs sales income from a CDM project, the IRR of the proposed project is far lower than 8% of the benchmark value for electric power projects. Such scenario is not financially attractive and has big financial barriers. Therefore, scenario a) is not viable and cannot be the baseline scenario.

As for scenario b) Building a new coal-fired power plant generating the same annual power generation:

It will be analysis in the Sub-step 1b below.

As for scenario c) Building a new power plant generating the same annual power generation from other renewable sources:

According to "2007 China Wind Power Development Report" published by China Environmental Science Press, there is no available wind power that can be developed in Honghe Hani and Yi Autonomous State²¹.

According to "2007 China Solar PV Development Report" (Li Junfeng, Wang Sicheng etc., China Environmental Science Press), the cost of generation using photovoltaic technology is up to 4 Yuan/kWh²², which is far greater than that of this project and other renewable power generation project, as a result, it is less competitive than other scenarios, consequently it is excluded.

Meanwhile, biomass resources are lack of and dispersive, and biomass generation is at the stage of demonstration in local area, the operated biomass power stations face operation risk, constructed biomass power station with the same installed capacity of the proposed project is unfeasible²³.

Therefore, scenario c) is not viable for control of resources, cannot be the baseline scenario.

As for scenario d), the SCPG providing the same amount of power yearly:

The scenario is consistent with the China's existing laws and regulations and economically viable without financial or other barriers.

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

For scenario b), the grid-connected electricity of the proposed project is 1,217,569MWh. If a coal-fired power plant provided the same annual grid-connected electricity with the proposed project, according to Page 626 of "2007 China Electric power Yearbook", in 2006, the annual operation hours of coal-fired

²¹ Page 39, *China Wind Power Development Report*, China Environmental Science Press, published in October 2007.

²² *China Solar PV Development Report 2007*(Table 19-Page 38 & Table 31-Page 53), Junfeng Li & sicheng Wang, China Environment Science Press.

²³ Biomass generation needs policy supply due to the high investment cost:

<http://finance.21cn.com/news/cydt/2007/06/28/3319602.shtml>. The investment cost of the first biomass generation project (Shandong Shanxian Biomass Generation Project) which was put into delivery in Dec 2006 is around RMB 13 thousand/kW. The investment cost of the proposed project is RMB 6.2 thousand/kW. Therefore, it can be seen clearly that the unit investment of biomass is higher than that of the proposed project.



power plants in Yunnan province was 6,275h, so the installed capacity of the coal fired power plant with the same generated electricity would be 194MW. According to *Notice about Some Opinions of speeding up to shut down Small thermal power plants* approved by State Council of the People's Republic of China on 20th January 2007²⁴, any thermal power generator unit with installed capacity per set lower than 300MW²⁵ is strictly controlled in places which are within a big power grid. Therefore, scenario b) is not consistent with China's existing laws and regulations and cannot be the baseline scenario.

In conclusion, scenario b) and c) were excluded, and scenario a) and scenario d) were reserved. The following analysis step 2 will demonstrate that alternative a) is not economically viable. Therefore, scenario d) the SCPG providing the same amount of power yearly is the most viable baseline scenario.

Step 2: Investment analysis

Sub-step 2a: Determine appropriate analysis method

The *Tool for the Demonstration and Assessment of Additionality* (version 05.2) recommends three analysis methods, namely simple cost analysis (Option I), investment comparison analysis (Option II) and the benchmark analysis (Option III).

Since the proposed project can receive revenue from electricity sales, and also can receive revenue from CERs, so Option I simple cost analysis isn't appropriate.

The investment comparison analysis (Option II) is only applicable when alternatives are also investment projects. However, the alternative baseline scenario of the proposed project is the SCPG providing the same amount of power yearly rather than a new investment project, so the investment comparison analysis (Option II) isn't appropriate.

Since the data on benchmark of internal rate of return on total investment of power industry is available, the benchmark analysis method (Option III) will be used.

Sub-step 2b: Apply benchmark analysis

The applied benchmark of 8% (after tax) of total investment is in accordance with “*Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects* ([2003]623)” issued by State Power Corporation of China, and it was also applied in the approved FSR of the proposed project. The FSR has been approved by China NDRC, which indicated that the benchmark of 8% is considered appropriate for the proposed project by government authorities in China.

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

Table 2 Basic financial parameters of the proposed project

Parameters	Unit	Value	Date source
Installed Capacity	MW	288	Approved FSR
Total static investment	10000Yuan	200,076.2	Approved FSR
Annual grid-in electricity:			
● The grid-in electricity in “year 4”	MWh	300,330	Approved FSR
● The annual grid-in electricity	MWh/y	1,164,249	

²⁴ http://www.gov.cn/zwggk/2007-01/26/content_509911.htm

²⁵ *Notice on Banning the Development of small scale thermal generation issued by the General Office of the State Council*

²⁹ VAT Provisional Regulations of P.R.C. (<http://www.chinatax.gov.cn/n480462/n480513/n480919/index.html>).



in “year 5-7” ● The annual grid-in electricity in “year 8-34”	MWh/y	1,217,569	
Annual O&M cost	10000Yuan	4547.43	Approved FSR
Grid-in tariff (including VAT)	Yuan/kWh	0.215	Approved FSR
Rate of Value Added Tax (VAT)	%	17	Approved FSR, and consistent with State Tax Law ²⁹
Rate of additional tax on city building	%	5	Approved FSR, and consistent with State Tax Law ³⁰
Rate of additional tax on education	%	3	Approved FSR, and consistent with State Tax Law ³¹
Income tax rate	%	25	Approved FSR, and consistent with State Tax Law ³²
Depreciation rate	%	3.2	Approved FSR
Residual value	10000Yuan	8948.5	Approved FSR
Fluid capital	10000Yuan	288	Approved FSR
Construction period	year	4	Approved FSR
Operation period	Year	30 ³³	Approved FSR

According to the approved FSR, the annual generated electricity and net electricity output in the first three operational years and the remaining years are as follows:

	Annual generated electricity	Net electricity output
From 5th year to 7th year(in the first three operational years)	1,256,820MWh	1,164,249MWh
From 8th year to 34th year(in the remaining years)	1,314,380MWh	1,217,569MWh

Reason for the different annual generated electricity between the first three operational years and the remaining years:

According to the approval letter of the Comprehensive Planning Report of the Middle Reaches of Hong River issued by the Ministry of Water Resources on 16/01/2005, three reservoirs are planned to be constructed upstream of the proposed project. The three reservoirs are planned to start operation in the fourth operational year of the proposed project. With the regulation of these reservoirs, the water flow from upstream of the proposed project will be distributed more evenly compared with the natural conditions, therefore the annual generated electricity of the proposed project will be improved. According to the analysis results in the approved FSR, in the absence of the regulation improvement of these three reservoirs, the annual generated electricity is 1,256,820MWh; after the regulation improvement, the

³⁰ Provisional Regulations on Additional tax on City Building of P.R.C. (<http://www.chinatax.gov.cn/n480462/n480513/n480919/index.html>)

³¹ Provisional Regulations on Levy of Additional tax on Education. (http://www.gov.cn/zw/gk/2005-09/27/content_70440.htm)

³² <http://www.chinaacc.com/new/63/67/88/2007/3/wa060911316191370021122-0.htm>

³³ The proposed project adopting 30 years as operation years was fully consistent with the guidance 3 in Annex 58 in EB 51 of “GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS”



annual generated electricity is 1,314,380MWh. Therefore, the annual generated electricity of the first three operational years is 4.6% less than the remaining years.

Even if the annual generated electricity of 1,314,380MWh is also adopted for the first three operational years in IRR calculation, the IRR of the proposed project is 6.67%, which is still much lower than the benchmark of 8%.

The suitability of applying: i) 95% coefficient of effective electricity; ii) 2% loss; and iii) 0.5% auxiliary consumption.

95% Effective coefficient

Application of the effective coefficient is common practice for hydropower projects in China. In order to accurately evaluate the financial viability of the hydropower projects, the factors that affect the power generation under real conditions, such as load characteristics, equipments malfunctions and regular overhaul should be considered in annual generated electricity. These influences factors are integrated considered by the qualified design institute China Pearl River Water Resources Planning, Design and Survey Co., Ltd. and the effective coefficient was finally adopted as 95% in the approved FSR of the proposed project.

2% Rate of transmission loss

According to statistical data published by the China Electricity Council, the average rate of transmission loss for power stations in China is between 5.5% and 5.72%³⁴. Therefore, the rate of transmission loss of 2% adopted by the proposed project is reasonable and conservative.

0.5% Rate of auxiliary consumption

According to *The relationship between House Service System and Power Generation Output in Hydraulic Power Plants* published in the Northeast Electric Power Technology, the auxiliary consumption rate of hydropower stations in China is in the range of 0.3% ~ 2%. Therefore, the auxiliary consumption rate of 0.5% adopted by the proposed project is reasonable and conservative.

The comprehensive coefficient of the proposed project (combination of the coefficient of effective electricity, transmission loss rate and auxiliary consumption rate) has been also cross-checked with the other registered projects with the similar installed capacity (144MW~432MW) in Yunnan Province as follows:

Ref.	Installed capacity (MW)	Annual generated electricity(MWh)	Annual grid-in electricity(MWh)	Comprehensive coefficient	Data source
2580	210	895,000	803,500	89.78%	Registered PDD
2877	201	919,600	825,600	89.78%	Registered PDD
2133	150	702,280	616,314	87.76%	Registered PDD
3390	168	689,000	618,000	89.70%	Registered PDD
1930	180	774,000	637,000	82.30%	Registered PDD
The proposed project	288	1,314,380	1,217,569	92.63%	Approved FSR

Compared with the similar registered projects, it is clearly shown that the comprehensive coefficient of the proposed project is conservative. Furthermore, even if the effective coefficient of 1 is adopted and not

³⁴ <http://www.cec.org.cn/tongjixinxibu/tongji/yuedushuiju/2011-02-23/44224.html>



taking into account for the transmission loss and auxiliary consumption, the IRR of proposed project is 7.30%, which is still much lower than the benchmark of 8%.

Even if the annual generated electricity of 1,314,380MWh is adopted for all the operational years in IRR calculation, and the effective coefficient of 1 is adopted and not taking into account for the transmission loss and auxiliary consumption in the most conservative approach, the IRR of proposed project is 7.41%, which is still much lower than the benchmark of 8%.

Based on the parameters above, the internal rate of returns on total investment of the proposed project without taking account of the CERs sales revenue and by taking in account of the CERs sales revenue (the crediting period to be 7*3 years, the price of CERs to be EUR 8.0/tCO₂e, the exchange rate of RMB: EUR to be 10.8:1) are calculated and shown in Table 3.

Table 3 Comparison of financial indicators with and without CERs Revenues

	Unit	Without CERs Revenues	Benchmark	With CERs Revenues
FIRR	%	6.57	8	10.18

Table 3 has shown that the FIRR of the total investment of the proposed project without CERs sales revenue is 6.57%, lower than the benchmark FIRR of 8%, which means that the proposed project activity has significant financial barriers.

But, if CERs sales revenue (the CERs price is estimated to be EUR 8.0/tCO₂e, and exchange rate of RMB and EUR is 10.8:1³⁵) is taken into account, the FIRR (after tax) of the total investment of the proposed project will be increased to be 10.18%, higher than 8% of the benchmark value. Therefore, it is obvious that CERs sales revenue will help remove the financial barriers of the proposed project.

Sub-step 2d: Sensitivity analysis:

According to “Tool for Demonstration and Assessment of Additionality” (version 05.2) and in accordance with the “Guidance on the Assessment of Investment Analysis” (version 03, EB51)³⁶, the sensitivity analysis is conducted in terms of the four financial indicators with a variation range over ±10%:

- 1) Total static investment
- 2) Annual grid-in electricity
- 3) Grid-in tariff
- 4) Annual O&M cost

The following table shows the variation of FIRR (after tax) of the total investment (without CERs revenues) when the four parameters fluctuate from -10% to +10%.

Table 4 FIRR sensitivity analysis of the proposed project

	-10.00%	-5.00%	0	5.00%	10.00%
Total static investment	7.52%	7.03%	6.57%	6.13%	5.72%
Annual grid-in electricity	5.58%	6.08%	6.57%	7.03%	7.48%
Grid-in tariff	5.52%	6.05%	6.57%	7.06%	7.53%
Annual O&M cost	6.78%	6.67%	6.57%	6.46%	6.36%

³⁵ <http://www.123cha.com/hl/?q=81&from=EUR&to=CNY&s=EURCNY#symbol=EURCNY=X;range=3m;>

³⁶ Guidance 17 and Guidance 18 of the “Guidance on the Assessment of Investment Analysis” (version 3, EB51)

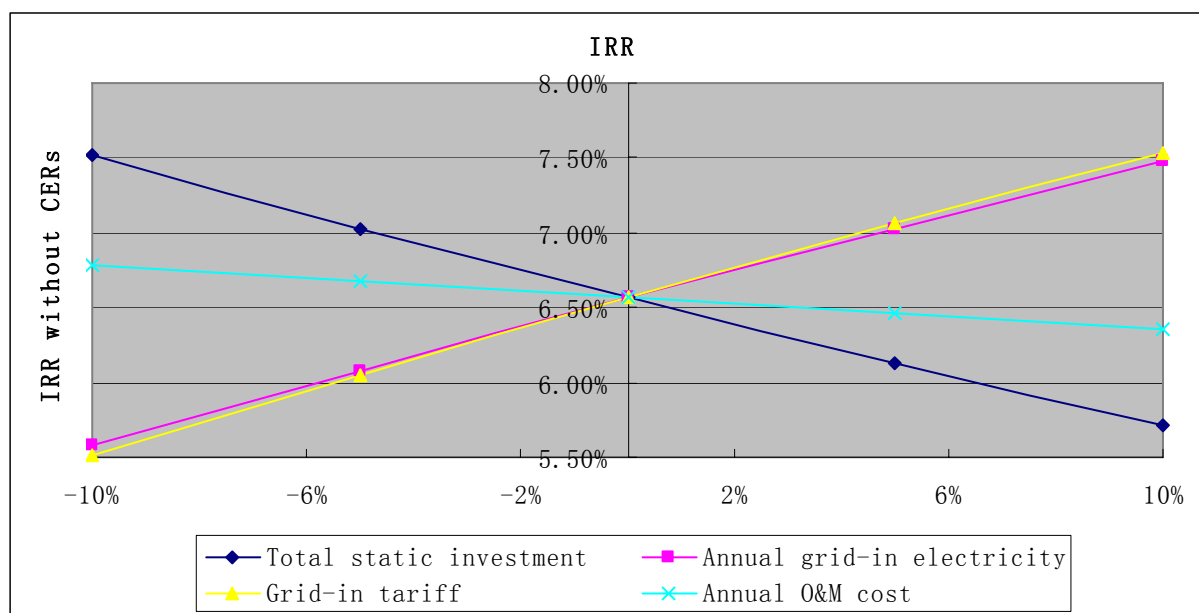


Figure 2 FIRR sensitivity analysis of the proposed project

Table 5 Variations to reach the benchmark

Item	Variation to reach the benchmark of 10%
Total static Investment	-14.60%
Annual grid-in electricity	+16.20%
Grid-in tariff	+15.30%
Annual O&M Cost	-73.50%

Table 4 and figure 2 have shown that when the four parameters fluctuate between the range of -10% and +10%, FIRR of the proposed project can't reach the benchmark of 8%.

As for Total static investment

Only when the total static investment is decreased by 14.60%, the IRR would reach 8%. The proposed project is still under construction, the actual total investment is unavailable at present, but according to the available contracts such as the construction contract, equipments purchase contract and so on, the contract prices of equipments are already higher than the budgetary prices in the approved FSR. Furthermore, according to the National Bureau of Statistics of China, the procurement price index for material, fuel and power was increased by 8.3%³⁷, 6.0%³⁸, 4.4%³⁹ and 10.5%⁴⁰ during 2005, 2006, 2007 and 2008 respectively, and such prices still continue to keep increasing. Based on the increased price indices in the recent years in China, it is unlikely for the static total investment of the proposed project to be increased.

As for Annual grid-in electricity

Only when the annual grid-in electricity is increased by 16.20%, the IRR would reach 8%. According to the approved FSR of the proposed project, the annual grid-in electricity is a long-term average value that

³⁷ http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20060227_402307796.htm

³⁸ http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20070228_402387821.htm

³⁹ http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20080228_402464933.htm

⁴⁰ http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20090226_402540710.htm



was determined considering the long-term variations of water flow in the flooding and dry seasons of 50 years hydrology data of Manhao hydrometric station which is an authoritative hydrometric station for hydrological monitoring in the local area, so the hydrological data for annual grid-in electricity calculation is authoritative, and the long-term variations of water flow in the flooding and dry seasons has been taken into consideration, so the annual grid-in electricity of the proposed project is reliable.

Therefore, when the annual grid-in electricity fluctuates within a reasonable range, the IRR of the proposed project will never reach 8% and the proposed project is not feasible.

As for Grid-in tariff

Only when the grid-in tariff is increased by 15.30%, the IRR would reach 8%. In China, the policy of electricity tariff was strictly controlled by the State⁴¹. Furthermore, according to the notification of the tariff (Yunfagaijiage[2004]No.589) issued by Yunnan Development and Reform Commission on 30/07/2004 and notification of the tariff (Yunfagaijiage [2006]No.28) issued by Yunnan Development and Reform Commission on 06/01/2006, tariff of 0.215yuan/kWh (including VAT) was applicable for hydropower projects in Yunnan province. The assumed tariff of 0.215yuan/kWh (including VAT) in investment analysis is consistent with these notifications, so it is appropriate and reliable. The Power Purchase Agreement of the proposed project has not yet been signed at present, and the tariff of the proposed project can be cross-checked by other hydropower project with similar installed capacity in the same region, i.e. Nansha hydropower station with installed capacity of 150MW (No.2133), which is located in the upstream of Honghe river, the tariff in PPA of Nansha is 0.215yuan/kWh (including VAT). Thus, it is unlikely for the annual grid-in electricity to be increased by 15.30%.

Therefore, when the grid-in tariff fluctuates within a reasonable range, the IRR of the proposed project will never reach 8% and the proposed project is not feasible.

As for Annual O&M cost

Only when the annual O&M cost is decreased by 73.5%, the IRR would reach 8%. The annual O&M cost is derived from the approved FSR, it was comprised of wage and benefit costs, reservoir maintenance cost, maintenance fee, material fee, water resources fee and other cost, it was calculated in accordance with the relevant national regulations. As the trend of cost increasing, the cost of wage and benefit, reservoir maintenance, maintenance fee, material fee, and water resources fee will be higher, it is impossible to decrease. The O&M costs equal of the total investment costs was calculated to be 0.15million yuan/MW (45.4743 million yuan/288MW), which is equal to the average of 0.15million yuan/MW. Therefore, when the annual O&M cost fluctuates within a reasonable range, the proposed project will never reach 8%.

As described above, without CERs sales revenue, the proposed project is not financially viable and is always lack of financial attractiveness. If the proposed project will be registered by EB, the revenue from selling CERs can overcome the investment barriers and alleviate the pressure of the project owner.

Step 3.Barrier analysis.

Not applicable (Only step 2 is selected).

Step 4: Common practice analysis

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

Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC

⁴¹ Notice of the State Council General Office on print and distribute tariff reform programme, Guobanfa[2003]No.62



website for global stakeholder consultation as part of the validation process) are not to be included in this analysis.

Choose the similar scale

For the similar scale to the proposed project, the capacity range of +/- 50%⁴² (144~432MW) has been taken into consideration in the common practice analysis.

Choose the similar region

China has a vast territory, and the development policies and investment environment for hydropower projects in each province of China are not same. Particularly the different tariff policies are implemented in each province⁴³. According to “*Tool for the demonstration and assessment of additionality*” (Version 05.2), the similar project activities should take place in a comparable environment with respect to regulatory framework and investment climate. The proposed project is located in Yunnan Province, thus Yunnan Province was chosen as the similar region.

Choose the similar construction period

There was a significant reform in year 2002 on the electric power sector conducted by the State Council⁴⁴. Since 2002, the power generation enterprises and power grid companies are separated and private capital providers were allowed to invest in power plants. The investment climate was different compared to the situation before the reform. Therefore, the similar projects were those which started construction since year 2002.

According to *China Water Resource Yearbook 2006, 2007 and 2008*, and State Power Information Network⁴⁵ which is the first portal of Electric Industry and the authoritative platform for information service in China, the hydropower stations with installed capacity from 144MW to 432MW located in Yunnan Province which started construction after year 2002 is Tukahe Hydropower Station⁴⁶.

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

As for Tukahe Hydropower Station

Tukahe Hydropower Station was developed by Lixianjiang River Basin Hydropower Development Company under Dayang International Power Generation Co., Ltd which is the listed company in China. According to the development plan of “west-east electricity transmission projects” in Yunnan Province, Tukahe Hydropower Station is a representative project. And in accordance with Document Fagaijiage [2008] No.1682 issued by NDRC on 29 June, 2008, the bus-bar tariff for the electricity transmitted from Yunnan Province to Guangdong Province is 0.333 yuan/kWh⁴⁷, which is much higher than the tariff of the proposed project of 0.215 yuan/kWh.

Based on the above analysis, there is no similar activity as the proposed project in Yunnan Province.

⁴² <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218656122.69/Review/V0E4YLROO0SJQDEP7RWNBP3G2YOHG6/display>

⁴³ http://www.sdpc.gov.cn/zcfb/zcfbtz/2008tongzhi/t20080702_222228.htm

⁴⁴ <http://www.lawon.cn/law/detail.do?id=2211075>

⁴⁵ http://www.sp.com.cn/zgsd/tjzl/gsstj/200805/t20080515_104330.htm

⁴⁶ <http://www.china-cdt.com/aboutdatang/memberenterprise/datangunion/42339.html>

⁴⁷ <http://money.163.com/08/0702/13/4FRMQUI6002524SD.html>



The above analysis has shown that the proposed project meets the requirements of *Tool for Demonstration and Assessment of Additionality* on additionality. In a word, the proposed project has additionality.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission reductions of the proposed project are equal to baseline emission reductions subtract to project emission and project leakage.

1. Project emissions

According to ACM0002 (version 11), the project emissions shall be accounted by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad (1)$$

Where:

PE_y = Project emissions in year y (tCO₂e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO₂e/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO₂e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO₂e/yr)

The proposed project is a hydropower project. According to ACM0002 (version 11), only the CH₄ emissions from the reservoir shall be accounted for. So:

$$PE_y = PE_{HP,y} \quad (2)$$

Emissions from water reservoirs of hydropower plants ($PE_{HP,y}$)

In order to decide the project emissions for hydro power plants, firstly the power density must be calculated according to ACM0002 (version 11):

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (3)$$

Where:

PD = Power density of the project activity, in W/m².

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero. The proposed project is a new hydro plant, so Cap_{BL} is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²).

A_{BL} = Area of the reservoir measured in the surface of the water before the implementation of the project activity, when the reservoir is full (m²).

The installed capacity of the proposed project (Cap_{PJ}) is 288 MW, the area of the new reservoir (A_{PJ}) is 19,180,000m², so the power density is calculated to be 15W/m², much higher than 10 W/ m². According to ACM0002 (version 11), the project proponents shall not account for project emissions, so:



$$PE_y = PE_{HP,y} = 0 \quad (4)$$

2. Baseline emissions

Baseline emission is equal to multiply of baseline emission factor and net grid-connected electricity.

According to ACM0002 (Version 11), the baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad (5)$$

Where:

BE_y = Baseline emissions in year y (tCO₂e/yr).

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

$EF_{grid,CM,y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO₂/MWh).

The detailed processes are as follows:

Step 1 Identify the relevant electric power system

As the demonstration in section B.3, according to the delineation of grid boundaries published by China’s DNA on 2nd July, 2009, the project electricity system of the proposed project is SCPG, so the boundary of the proposed project includes the proposed project and all power plants connected physically to SCPG which is composed of Guangdong Power Grid, Guangxi Power Grid, Guizhou Power Grid and Yunnan Power Grid. The power from SCPG has been also considered as the net grid-in electricity.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional).

The proposed project chooses the “Option I: only grid power plants are included in the calculation”.

Step 3. Select a method to determine the operating margin (OM)

According to the “Tool to calculate the emission factor for an electricity system”, four methods could be used to calculate the OM and any of the four methods can be used:

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

The simple OM method is applicable if low-cost/must run resources⁴⁸ constitute less than 50% of total grid generation in average of the five most recent years. From 2004 to 2008, the proportion of low-cost/must-run resources in the total grid electricity of SCPG was 29.95% in 2004, 28.61% in 2005 and 29.75% in 2006, 29.28% in 2007 and 63.93% in 2008⁴⁹, respectively, far lower than 50%. So the simple OM method is applicable to the proposed project.

According to this tool, the emissions factor can be calculated using either of the two following data vintages:

⁴⁸ Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

⁴⁹ China Electric Power Yearbooks (2005, 2006, 2007, 2008, and 2009)



- *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.
- *Ex post* option: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The proposed project chooses the “Ex ante option”. The simple OM is calculated ex-ante using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the first crediting period.

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

As for the chosen simple OM, there is two methods to calculate simple emission factor in this tool:

- Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit;⁵⁰ or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For data of each power station and power unit is not public available in China, it can't adopt option A. Meanwhile, only nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known from “China Electric Power Yearbook” and “China Energy Statistical Yearbook” and off-grid power plants are not included in the calculation. Therefore, option B could be used to calculate OM emission factor.

According to the selected method above, the calculation formula of OM emission factor is as below:

$$EF_{\text{grid,OMsimple,y}} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{\text{CO}_2,i,y}}{EG_y} \quad (6)$$

Where:

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

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

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

$EF_{\text{CO}_2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂/GJ);

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

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

y = the three most recent years (2006, 2007 and 2008) for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option);

SCPG also imports electricity from Central China Power Grid (CCPG), the imported electricity from CCPG should be treated as generation from one power plant. Because it's impossible to identify the specific power plants which exporting electricity to SCPG, the simple operating margin emission factor

⁵⁰ Power units should be considered if some of the power units at the site of the power plant are low-cost/must-run units and some are not. Power plants can be considered if all power units at the site of the power plant belong to the group of low-cost/must-run units or if *all* power units at the site of the power plant do *not* belong to the group of low-cost/must-run units.



of CCPG which exporting electricity was chosen as the CO₂ emission factor for net electricity imports ($EF_{grid, import, y}$) from CCPG.

The proposed project adopts the latest data of OM emission factor in SCPG which is issued by China DNA on 2nd July 2009. Please refer to “2009 Baseline Emission Factors for Regional Power Grids in China” by NDRC and Annex 3 for the concrete calculation process.

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

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

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

Due to the data availability in China, it is impossible to adopt either one of the two options mentioned above for BM calculation. The deviation method to calculate BM for the situation of China which can be approved by CDM EB is elaborated in Step 6.

“Tool to calculate the emission factor for an electricity system” provided two methods to calculate BM:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

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

Option 1 was adopted by the proposed project.

Step 6 Calculate the build margin emission factor

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

$$EF_{grid, BM, y} = \frac{\sum_m EG_{m, y} \times EF_{EL, m, y}}{\sum_m EG_{m, y}} \quad (7)$$

Where:

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

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

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

m = Power units included in the build margin;



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

In China, because some of the data is not available, a deviation methods agreed by the CDM EB⁵¹ was adopted.

Because the generating capacity of the coal-fired, oil-fired and gas-fired technology can not be separated from the existing statistical data, the BM calculation in this PDD adopts the following method: First, use the available data in the energy balance tables on the most recent year, then calculate the proportion of CO₂ emissions from solid, liquid and gaseous fuels corresponding to the total emissions of CO₂ emissions; Second, the proportion used as the weight, based on the emission factors of the optimal efficient and commercial technologies, calculate the emission factor of the thermal power in each grid. Finally, this thermal emission factor is multiplied by the proportion of thermal power added capacity in the additional 20% capacity. The result is BM emission factor.

Concrete steps and the formula for BM are as follows:

Sub-step1: Calculation of the proportion of CO₂ emissions from solid, liquid and gaseous fuels corresponding to the total emissions of CO₂ emissions.

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (8)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (9)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (10)$$

Where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by plant j in year y ;

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

$EF_{CO_2,i,j,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂/GJ);

Coal, Oil and Gas is the feet for solid fuels, liquid fuels and gas fuels.

Sub-step2: Calculation the emission factor of thermal power.

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (11)$$

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$ represent the emission factors of the optimal efficient and commercial coal-fired, oil-fueled and gas-fueled technologies.

Sub-step 3: Calculation of BM in the grid.

⁵¹ The clarifications for some proposed projects in China adopting the approved methodology AM0005 and AMS-I.D to calculate the build margin emission factor.



$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (12)$$

Where:

$CAP_{Total,y}$ is the total added installed capacity;

$CAP_{Thermal,y}$ is the total added installed capacity for thermal power.

The proposed project adopts the latest data of OM emission factor in SCPG which is issued by China DNA 2nd July 2009. Please refer to “2009 Baseline Emission Factors for Regional Power Grids in China” by China DNA (NDRC) and Annex 3 for the concrete calculation process.

Step 7 Calculate the combine margin emission factor

CM emission factor is weighted average OM margin emission factor and BM margin emission factor:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (13)$$

Where:

$EF_{grid,CM,y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y (tCO₂e/MWh)

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

$EF_{grid,OM,y}$ (i.e. $EF_{grid,OM,simple,y}$) = Operating margin CO₂ emission factor in year y (tCO₂/MWh);

w_{OM} = Weighting of operating margin emissions factor (%);

w_{BM} = Weighting of build margin emissions factor (%);

In this PDD for the first crediting period, the weights w_{OM} and w_{BM} are 50%.

Calculation of $EG_{PJ,y}$

The proposed project is a newly-built project, according to ACM0002 (Version 11), then:

$$EG_{PJ,y} = EG_{facility,y} \quad (14)$$

Where:

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

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

The project is likely to import the electricity from the SCPG in case of equipment shutdown or overhaul. Then the net quantity of electricity supplied will be calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} = EG_{facility \text{ to } SCPG,y} - EG_{SCPG \text{ to } facility,y} \quad (15)$$

Where:

$EG_{facility \text{ to } SCPG,y}$ = quantity of exported electricity from the proposed project to SCPG in year y;

$EG_{SCPG \text{ to } facility,y}$ = quantity of imported electricity from SCPG to the proposed project in year y.

According to ACM0002 (Version 11), in base of calculation of $EF_{grid,CM,y}$ and $EG_{PJ,y}$ above, calculation method of the proposed project baseline emission is as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$



$$\begin{aligned}
 &= EG_{\text{facility},y} \times EF_{\text{grid},\text{CM},y} \\
 &= (EG_{\text{facility to SCPG},y} - EG_{\text{SCPG to facility},y}) \times EF_{\text{grid},\text{CM},y} \quad (16)
 \end{aligned}$$

3. Project leakage

According to ACM0002 (Version 11), no leakage emissions are considered.

4. Emission reductions

$$ER_y = BE_y - PE_y = BE_y \quad (17)$$

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

BE_y = Baseline emissions in year y (t CO₂/yr)

PE_y = Project emissions in year y (t CO₂e/yr)

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

Data / Parameter:	NCV _{i,y}
Data unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	China Energy Statistical Yearbook (2008);
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the “Tool to calculate the emission factor for an electricity system”, the national average default value can be applied.
Any comment:	-

Data / Parameter:	EF _{CO₂,i,y}
Data unit:	tCO ₂ e/GJ
Description:	CO ₂ emission factor of fossil fuel type i in year y
Source of data used:	Defaults in table 1.4 of Chapter 1 of Vol.2(Energy) of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the “Tool to calculate the emission factor for an electricity system”, 2006 IPCC defaults can be used;
Any comment:	-

Data / Parameter:	FC _{i,y}
Data unit:	Mass or volume unit of fuel i
Description:	the amount of fossil fuel type i (in a mass or volume unit) consumed by power plant/unit in SCPG in year(s) y
Source of data used:	China Energy Statistical Yearbooks (2006,2007,2008)



Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the “Tool to calculate the emission factor for an electricity system”, values from government records or official publications can be used; Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option)
Any comment:	-

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant/unit in year y
Source of data used:	China Electric Power Yearbook (2006,2007,2008)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the “Tool to calculate the emission factor for an electricity system”, values from government records or official publications can be used; Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option)
Any comment:	-

Data / Parameter:	$CAP_{y,i}$
Data unit:	MW
Description:	The installed capacity of every kind of electricity generation (such as thermal power, hydro power, nuclear power, wind power and other energy sources etc.) of SCPG in the recent years. And to find the change of capacity additions in the SCPG in the past few years.
Source of data used:	China Electric Power Yearbook (2006,2007,2008)
Value applied:	See annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the “Tool to calculate the emission factor for an electricity system”, values from government records or official publications can be used.
Any comment:	-

Data / Parameter:	$GENE_{best,coal}$
Data unit:	%
Description:	The maximized efficiency of coal-fired power supply
Source of data used:	China’s DNA: Report on 2009 Baseline Emission Factor for Regional Power Grids in China
Value applied:	38.10



Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific national value
Any comment:	-

Data / Parameter:	$GENE_{best,oil/gas}$
Data unit:	%
Description:	The maximized efficiency of oil and gas-fired power supply
Source of data used:	China's DNA: Report on 2009 Baseline Emission Factor for Regional Power Grids in China
Value applied:	49.99
Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific national value
Any comment:	-

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data used:	Project site
Value applied:	0 (For new hydro power plants, this value is zero)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Determine the installed capacity based on recognized standards
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2).
Source of data used:	Project site
Value applied:	0 (For the proposed project with a new reservoir, this value is zero.)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	-



Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO ₂ e/MWh
Description:	OM emission factor of SCPG
Source of data used:	China's DNA: Report on 2009 Baseline Emission Factors for Regional Power Grids in China issued on 2 nd July 2009
Value applied:	0.9987
Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific national value
Any comment:	-

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO ₂ e/MWh
Description:	BM emission factor of SCPG
Source of data used:	China's DNA: Report on 2009 Baseline Emission Factors for Regional Power Grids in China issued on 2 nd July 2009
Value applied:	0.5772
Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific national value
Any comment:	-

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO ₂ e/MWh
Description:	CM emission factor of SCPG
Source of data used:	China's DNA: Report on 2009 Baseline Emission Factors for Regional Power Grids in China issued on 2 nd July 2009
Value applied:	0.78795
Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific national value
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

1. Project emissions

The power density of the proposed project is 15 W/m², larger than 10 W/m². According to ACM0002, emission of the proposed project is zero, namely, $PE_y=0$.

2. Baseline emissions



Based on the formula in section B.6.1 and data from section B.6.2, the figures of emission factors of SCPG are as follows:

- $EF_{grid,OM,y}$: 0.9987tCO₂e/MWh;
- $EF_{grid,BM,y}$: 0.5772 tCO₂e/MWh;
- $EF_{grid,CM,y}$: 0.78795tCO₂e/MWh.

The annual grid-connected electricity of the proposed project is estimated to be 1,217,569MWh, and ex-ante estimated emission reductions, adopt grid-off electricity of the proposed project is zero, therefore, estimated annual average baseline emission is as follows:

$$\begin{aligned} BE_y &= EG_{PJ,y} \times EF_y \\ &= (EG_{\text{facility to SCPG, } y} - EG_{\text{SCPG to facility, } y}) \times EF_{grid,CM,y} \\ &= (1,217,569 - 0) \times 0.78795 = 959,382 \text{ tCO}_2\text{e} \end{aligned}$$

3. Leakage emissions

According to ACM0002 (Version 11), no leakage emissions are considered.

4. Emission reductions

Emission reductions (ER_y) are equal to baseline emissions (BE_y) subtract to project emissions (PE_y) and leakage emissions (LE_y), namely:

$$ER_y = BE_y - PE_y = BE_y = (EG_{\text{facility, } y \text{ to SCPG, } y} - EG_{\text{SCPG to facility, } y}) \times EF_{grid,CM,y} = 959,382 \text{ tCO}_2\text{e}$$

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

Year	Estimation of project activity emissions (tonnes of CO ₂ e)	Estimation of baseline emissions (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of emission reductions (tonnes of CO ₂ e)
01/07/2011-31/12/2011	0	236,645	0	236,645
01/01/2012-31/12/2012	0	917,369	0	917,369
01/01/2013-31/12/2013	0	917,369	0	917,369
01/01/2014-31/12/2014	0	917,369	0	917,369
01/01/2015-31/12/2015	0	959,382	0	959,382
01/01/2016-31/12/2016	0	959,382	0	959,382
01/01/2017-31/12/2017	0	959,382	0	959,382
01/01/2018-30/06/2018	0	479,691	0	479,691
Total (tonnes of CO ₂ e)	0	6,346,590	0	6,346,590

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{\text{facility to SCPG, } y}$
Data unit:	MWh/yr
Description:	Quantity of electricity supplied by the proposed project to the grid in year y
Source of data to be used:	Measured by meter



Value of data applied for the purpose of calculating expected emission reductions in section B.6	1,217,569
Description of measurement methods and procedures to be applied:	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	Measurement results should be cross-checked by electricity sales receipts.
Any comment:	-

Data / Parameter:	$EG_{SCPG\ to\ facility,y}$
Data unit:	MWh/yr
Description:	Quantity of electricity imported from the grid in year y
Source of data to be used:	Measured by meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be applied:	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	Measurement results should be cross-checked by electricity sales receipts.
Any comment:	-

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.6	1,217,569
Description of measurement methods and procedures to be applied:	Continuous measurement and at least monthly recording
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity
Any comment:	This parameter is calculated based on $EG_{facility\ to\ SCPG,y}$ subtract to $EG_{SCPG\ to\ facility,y}$

Data / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.6	288
Description of measurement	Verified yearly by the nameplate of water turbine generators



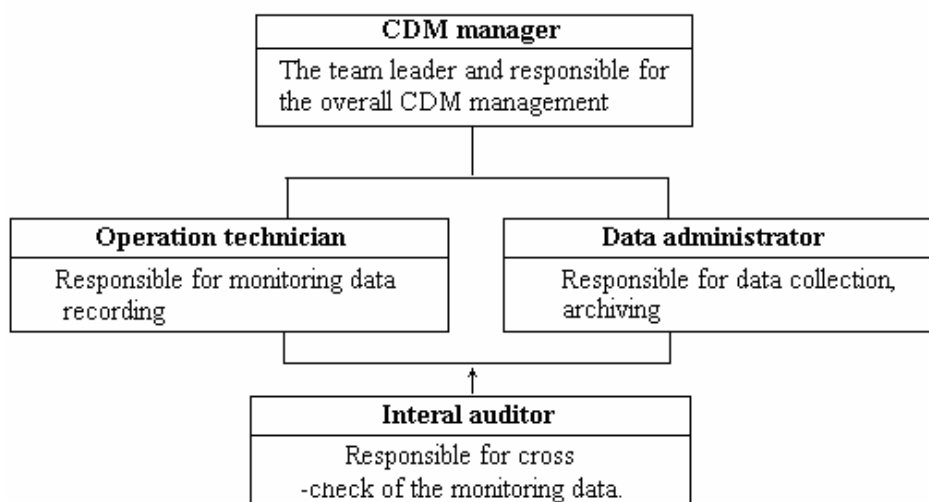
methods and procedures to be applied:	
QA/QC procedures to be applied:	Cross check against the project documentation-
Any comment:	For PE _v

Data / Parameter:	A _{PJ}
Data unit:	m ²
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.6	19,180,000
Description of measurement methods and procedures to be applied:	Measured by the qualified design institute
QA/QC procedures to be applied:	The measured frequency is once a year
Any comment:	For PE _v

B.7.2 Description of the monitoring plan:

1. Monitoring team

Monitoring will be carried out by the monitoring team, and the detailed responsibility of each team member is as below:



- CDM manager is the team leader and responsible for the overall CDM management;
- Operation technician is responsible for monitoring data recording;
- Data administrator is responsible for data collection, archiving.
- Internal auditor is responsible for cross-check of the monitoring data.

2. Monitoring system

The electricity exported to the grid in the positive direction ($EG_{\text{facility to SCPG}, y}$) and the electricity imported from the grid in the reverse direction ($EG_{\text{SCPG to facility}, y}$) will be directly measured through the bidirectional



energy meter. The $EG_{\text{facility},y}$ is calculated based on $EG_{\text{facility to SCPG},y}$ subtract to $EG_{\text{SCPG to facility},y}$. The meters will be installed at the grid interface point of the proposed project according to the Power Purchase Agreement signed between the project owner and the grid company.

The accuracy class of the energy meters should be no less than 0.5s which meets the requirement of Technical Administrative Code of Electric Energy Metering (DL/T448-2000). Power Purchase Agreement, DL/T448-2000 and the technical parameters of the meters should be archived for verification.

3. Monitoring frequency

$EG_{\text{facility to SCPG},y}$ and $EG_{\text{SCPG to facility},y}$ will be continuously measured and monthly recorded by the grid company and the project owner.

4. Calibration

The meters installed at the grid interface point will be calibrated at least once a year in accordance with Technical Administrative Code of Electric Energy Metering (DL/T448-2000) by the qualified calibration entity.

5. Internal audit

All the monitoring data are forwarded to the internal auditor monthly for the cross-check. The $EG_{\text{facility to SCPG},y}$ and $EG_{\text{SCPG to facility},y}$ from meter records will be cross-checked against the electricity sales receipts issued by the grid company.

6. Training

The team members of the monitoring team will be trained by the CDM consulting company before the operation of the project.

7. Data management

All of the data records relevant to monitoring such as Power Purchase Agreement, DL/T448-2000, technical parameters of the energy meters, monthly meter records, electricity transaction receipts, calibration records, training records and so on will be archived electronically and kept at least for 2 years after the end of the last crediting period. Thereinto, monthly meter records, electricity transaction receipts will be preserved monthly and kept at least for 2 years after the end of the last crediting period or the last issuance of CERs, whichever occurs later; the Power Purchase Agreement, calibration records will be preserved yearly and kept at least for 2 years after the end of the last crediting period or the last issuance of CERs, whichever occurs later; DL/T448-2000, technical parameters of the energy meters and training records will be preserved and kept at least for 2 years after the end of the last crediting period or the last issuance of CERs, whichever occurs later.

8. Monitoring and management manual

Monitoring and management manual of the proposed project has been compiled. The monitoring system diagram, monitoring frequency, calibration, data collection procedures and organizational structure are clearly described in the manual. It will be also updated according to the upgrade of DL/T448-2000.

9. Emergency Plan

In normal condition, meter records from the main meters are used for CER calculation. In the case of main meter malfunction, the meter records from the backup meters will be used for CER calculation, and the electricity transaction receipts will be kept for cross check. Problem occurred in monitoring and measurement process will be recorded and reported to project manager or CDM manager.

B.8 Date of completion of the application of the baseline study and monitoring methodology and

**the name of the responsible person(s)/entity(ies)**

The applied study on the baseline and monitoring methodology of the proposed project was completed on 24/03/2010. The individuals/entities involved in the study are as follows:

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Beijing Haohua Rivers International Water Engineering Consulting Co. Ltd. is not a project participant

**SECTION C. Duration of the project activity / crediting period****C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

06/01/2009 (the date signing the purchase agreement of turbines and generators)

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

30 years

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period**

7*3 years

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

01/07/2011 (or the registration date which is later)

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

Not applicable

C.2.2.2. Length:

Not applicable

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

The Environment Impact Assessment (EIA) report for the proposed project was made by Pearl River Water Resource Conservation Science Institute. The EIA report for the proposed project was approved by State Environmental Protection Administration on 27th Sep 2007. According to the EIA report, the environmental impacts likely to be caused by the proposed project, protective actions adopted by the project owner and effect analysis are analyzed as follows:

Construction Period**Wastewater**

The wastewater produced by the proposed project will be industrial, workers' and power station's wastewater. Production wastewater treatment facilities will be built to gather the wastewater, after the treatments of sand setting, precipitation, adding neutralizer etc., then the production wastewater will be discharged. Domestic wastewater will also be dealt before being discharged.

Both production wastewater and domestic wastewater will meet the Level-two standard of Integrated Wastewater Discharge Standard (GB8978-1996).

Waste Air

Waste air during the construction period will be mainly from blasts, crushed sand processing, dust and the pollutant discharged by construction equipment etc. Wet techniques and protect measures will be adopted; dust collecting equipment is installed.

These measures will ensure that the discharge of air pollutants will meet the standard of the Integrated Emission Standard of Air Pollutants (GB16297-1996).

Noise

Noise during the construction period will be mainly from blasts, drilling, crushed sand processing, mixing of concrete and traffic. Low-noise processing equipments will be used. Meanwhile the construction time will be strictly controlled. If the condition allows, greenbelt will be built to decrease the effect of noise. These measures will ensure that the construction site will meet the Standard of Noise at Boundary of Industrial Enterprises (GB 12523-90).

Waste Residue

Waste residue consists of engineering refuse and domestic waste produced by constructors. The construction waste and domestic waste will be piled up in corresponding abandoned dredge site respectively. All the abandoned dredge sites will be reinforced, and slag dam will be built along rivers and roads. Domestic waste will be put together, and delivered to landfill sites to be dealt at set intervals.

Ecological impacts

There is little impact to terricolous plant. The large lizard and tortoise will be affected by the construction of the proposed project. It must take measures to protect them. Five species of fish will be affected by the construction of the proposed project, as there is no influence to fishes in other branch of river, so the influences to fishes in Honghe river will be very small either. There are two terminalia myriocarpa trees (a Class II nationally protected species) in the Project affected area, they will be relocated. They won't be affected by the construction of the proposed project. The Mayutian village relocation is near the protection area, it will be taken measures to protect.

Operation Period



- The production wastewater is mainly little oil pollution during the operation phase, there is base sumps and corresponding treatment equipments, there are also integrative domestic wastewater treatment. These measures will ensure that the operation of station will not contaminate the water of the reservoir.
- The project owner will shoulder the obligation of the effects of construction and operation on the fishes, the construction of remedial measures and the corresponding cost.
- The operation and management of this project will be optimized, which will ensure that the minimum flow is no less than 30.2m³/second, and satisfy the demand of water environment of lower and aquatic biological environment.
- Adopting water and soil conservation engineering and vegetation measures to control soil loss, the main places are slag dumps, material yards, temporary area for construction, roads for construction, affected zones and the occupied areas of key building.

Because of reservoir inundation and project permanent land occupation, there are people need to resettle. Resettlement can't occupy ecological protection wetland. The prevention of water and soil loss, meanwhile the measures of water environment protection, waste disposal etc. in the resettlement area should be reinforced. Environmental protection measures should be implemented during relocation and reconstruction.

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:

In the EIA approval, the project owner was requested to implement the environmental protection measures. The project owner will take the measures to meet the requirement of authority as follows:

- The project owner will make ensure that the safe flow is no less than 30.2m³/second, to satisfy the demand of water environment of lower and aquatic biological environment.
- The project owner will take the responsibility to make sure there is small influence to the local fish and take the remediation measures. Before the operation of the project, fish breeding station will be built to satisfy the need of fish breeding of the proposed project and Nansha project.
- The project owner will carry out the environment measures to strengthen the water and soil conservation and water environment protection. Protect quarantine wire net will be built near the protection zone to reduce the influence possibly made by the immigrants.
- The project owner will take water and soil protection and plant protection measures. The waste will be transported to the appointed disposal site, the dust in construction site will be collected and the local plant will be protected. Destroy to the environment will be decreased to be the least.
- The project owner will investigate the plant in reservoir and the construction waste to meet the environment standard and water storage requirement. The project owner will also carry out the measures of wastewater disposal, domestic solid waste disposal, dust disposal, noise pollution and strengthen the clean work and dust control on road.

In a word, the project owner of the proposed project will follow the requirements in the approved EIA report and the EIA approval as above, and do the environment protection and environment management well during construction and operation period. The proposed project will not cause significant reverse impacts.

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

In order to know the attitudes and views of the public on the project's construction, Pearl River Water Resource Conservation Science Institute, made a sampling survey when compiling EIA Report. A total of 125 questionnaires had been handed out and 100 questionnaires were returned, so the return rate was 80%. The information of stakeholders is as follows⁵²:

The information of stakeholders is as follows:

Age situation of the stakeholders							
Age	19~29		30~40		41~45		46~66
Number (people)	28		34		21		17
Proportion (%)	28		34		21		17
Occupation situation of the stakeholders							
Occupation	Cadre	Worker	teacher	technician	Farmer	Student	others
Number (people)	20	15	5	28	15	5	12
Proportion (%)	20	15	5	28	15	5	12
Education situation of the stakeholders							
Education	Junior college		Technical secondary school		Senior high school		Junior high school
Number (people)	30		25		20		25
Proportion (%)	30		25		20		25

The contents of investigation are as follows:

- Do you know the proposed project?
- What's your attitude toward the construction of the project?
- What are the impacts of the proposed project after its construction?
- What are the effects of this hydropower station on local environment?
- Will the reservoir worsen the water pollution?
- What are the effects of this hydropower station on landscape? If there are effects on landscape, what are the effects?
- If you need to resettle, do you agree the resettlement?
- Where do you think the immigrants to move?
- What are the influence to the immigrants?
- If there are immigrants move to your living place, do you accept?

⁵² Chapter 11 in EIA of the proposed project

**E.2. Summary of the comments received:**

The analysis of 100 questionnaires is as follows:

Item	Survey result	Proportion
1. Do you know the proposed project?	Know and somehow know	85%
	Don't know	15%
2. What's your attitude toward the construction of the project?	Agree	88%
	Indifferent	12%
	Oppose	0
3. What are the impacts of the proposed project after its construction?	Great affects to the local development	65%
	Accelerate the economic development	70%
	Improve environment in downstream area and country water supply	63%
	Improve water environment in downstream area	65%
	Improve the local peoples' life	56%
	Improve traffic situation in	30%
4. What are the effects of this hydropower station on local environment?	Is benefit to improve the environment	75%
	Some influence, must take measurement to control	15%
	No influence	10%
5. Will the reservoir worsen the water pollution?	No pollution	84%
	Little pollution	16%
6. What are the effects of this hydropower station on landscape?	No influence	100%
	Little influence	0
7. If you need to resettle, do you agree the resettlement?	Would like to immigrate	92%
	Obeys the arrangement	8%
8. Where do you think the immigrants to move?	Would like to backwards	60%
	Would like to move to other place	8%
	Obeys the arrangement	24%
	Don't know	8%
9. What are the influences to the immigrants?	Increase the incomes	58%
	No changes of the incomes	21%
	Don't know	21%



10. If there are immigrants move to your living place, do you accept?	Accept	50%
	Indifferent	20%
	Obey the arrangement	30%

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

The investigation shows that the majority of common people have the supportive attitude towards the construction of this project, only few people think there are a few questions, which focus on the ecology and environment after the implementation of this project, immigration and compensation. As for the above 3 questions, the project owner will solve them by the following ways:

- As for the ecology and environmental protection, a big investment will be used during the construction phase, which will ensure that the environment and water protection, it will minimize the damage to ecological environment.
- The resettlement areas consist of Yuanyang County, Gejiu City, Mengzi County and Jinping County, which will ensure the resettlement of immigrants.
- The compensation for the land and crops is constituted according to the relevant policies of the State and Yunnan Province. Based on the local price level, that will satisfy the need of immigration and reproduction.

In conclusion, the problems of this project brought forward by the public can be solved effectively, and there would be no negative effects.

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

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No official development assistant (ODA) from Annex I Parties is involved in the proposed project.

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

The proportion of the hydro power plus nuclear power plus the power produced by other low-cost/must run resources in the total electricity output of SCPG in the last five years:

Table 3-1 Power generation of SCPG in 2004

Power generation (GWh)	Guangdong	Guangxi	Guizhou	Yunnan	Total
Fossil fuelled	169,389	20,143	49,720	24,322	263,574
Hydro power	14,114	17,229	23,379	29,350	84,072
Others	28,630	0	0	0	28,630
Total	212,133	37,372	73,099	53,672	376,276

The proportion of low operating cost/must-run power plants of SCPG in 2004: $(376,276-263,574)/376,276=29.95\%$.

Data Source: China Electric Power Yearbook 2005.

Table 3-2 Power generation of SCPG in 2005

Power generation (GWh)	Guangdong	Guangxi	Guizhou	Yunnan	Total
Fossil fuelled	176,453	25,023	58,430	27,281	287,187
Hydro power	17,482	19,582	10,848	33,228	81,140
Others	33,924	0	0	0	33,924
Total	227,859	44,604	69,278	60,509	402,251

The proportion of low operating cost/must-run power plants of SCPG in 2005: $(402,251-287,187)/402,251=28.61\%$.

Data Source: China Electric Power Yearbook 2006.

Table 3-3 Power generation of SCPG in 2006

Power generation (GWh)	Guangdong	Guangxi	Guizhou	Yunnan	Total
Fossil fuelled	188,429	27,967	76,039	39,791	332,226



Hydro power	26,799	24,369	22,596	35,572	109,336
Others	31,354	0	0	0	31,354
Total	246,582	52,334	98,636	75,363	472,916

The proportion of low operating cost/must-run power plants of SCPG in 2006: $= (472,916 - 332,226) / 472,916 = 29.75\%$.

Data Source: China Energy Statistical Yearbook 2007.

Table 3-4 Power generation of SCPG in 2007

Power generation (GWh)	Guangdong	Guangxi	Guizhou	Yunnan	Total
Fossil fuelled	215,700	36,100	84,300	47,400	383,500
Hydro power	23,200	32,400	29,500	43,100	128,200
Others	30,590	0	0	0	30,590
Total	269,490	68,500	113,800	90,500	542,290

The proportion of low operating cost/must-run power plants of SCPG in 2007: $= (542,290 - 383,500) / 542,290 = 29.28\%$.

Data Source: China Electric Power Yearbook 2008.

Table 3-5 Power generation of SCPG in 2008

Power generation (GWh)	Guangdong	Guangxi	Guizhou	Yunnan	Total
Fossil fuelled	210,700	34,200	81,300	41,800	368,000
Hydro power	25,600	51,300	36,600	62,200	175,700
Others	31,900	0	0	0	31,900
Total	268,200	85,500	117,900	104,000	575,600

The proportion of low operating cost/must-run power plants of SCPG in 2008: $= (575,600 - 368,000) / 575,600 = 36.07\%$.

Data Source: China Electric Power Yearbook 2009.



The calculation of the emission factors of SCPG adopts the data from “Report on 2009 Baseline Emission Factor for Regional Power Grids in China” issued by China DNA-National Development & Reform Commission on 2nd July 2009, which are Operating Margin ($EF_{grid,OM,y}$) 0.9987 tCO₂/MWh, and Build Margin ($EF_{grid,BM,y}$) 0.5772 tCO₂/MWh.

The concrete calculation process is shown in the following tables:

Operating Margin (OM) Calculation

Table 3-6 Thermal power generation of SCPG in 2005

Province	The fuel fired electricity generation (MWh)	The rate of electricity self-consumption (%)	The fuel fired electricity connected to the grid (MWh)
Guangdong	176,453,000	5.58	166,606,923
Guangxi	25,023,000	7.95	23,033,672
Guizhou	58,430,000	7.34	54,141,238
Yunnan	27,281,000	6.94	25,387,699
Total	--	--	269,169,531

Note: When calculating simple OM emission factor of SCPG in 2005, the electricity imports from Central China Power Grid is 20,264,000 MWh, so the total thermal power generation of SCPG in 2005 is 20,264,000+269,169,531=289,433,531MWh.

Data source: China Electric Power Yearbook 2006.

Table 3-7 Calculation of simple OM emission factor of SCPG in 2005

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	Carbon content (tC/TJ)	OXID (%)	Emission factors (kgCO ₂ /TJ)	NCV(MJ /t, km ³)	CO ₂ emissions (tCO ₂)
		A	B	C	D	E=A+...+D	F	G	H	I	J=E×H×I/100,000 (quality unit) or J=E×H×I/10,000 (volume unit)
Raw coal	10 ⁴ ton	6696.47	1435	3212.31	1975.55	13319.33	25.8	100	87300	20908	243,113,522
Washed coal	10 ⁴ ton				0.15	0.15	25.8	100	87300	26344	3,450



Other washed coal	10 ⁴ ton			10.39	33.88	44.27	25.8	100	87300	8363	323,211
Coke	10 ⁴ ton	4.79			8.05	12.84	29.2	100	95700	28435	349,406
Coke oven gas	10 ⁸ m ³				0.79	0.79	12.1	100	37300	16726	49,287
Other gas	10 ⁸ m ³	1.87			15.96	17.83	12.1	100	37300	5227	347,626
Crude oil	10 ⁴ ton	10.91				10.91	20	100	71100	41816	324,367
Gasoline	10 ⁴ ton	0.68				0.68	18.9	100	67500	43070	19,769
Diesel	10 ⁴ ton	31.96	2.02		1.81	35.79	20.2	100	72600	42652	1,108,250
Fuel oil	10 ⁴ ton	887.21				887.21	21.1	100	75500	41816	28,010,178
LPG	10 ⁴ ton					0	17.2	100	61600	50179	0
Refinery gas	10 ⁴ ton	4.92				4.92	15.7	100	48200	46055	109,217
Natural gas	10 ⁸ m ³	0.93				0.93	15.3	100	54300	38931	196,598
Other petroleum products	10 ⁴ ton	1.7				1.7	20	100	75500	38369	53,671
Other coking products	10 ⁴ ton					0	25.8	100	95700	28435	0
Other energy	10 ⁴ tce	104.66	133.15		59.72	297.53	0	0	0	0	0
Total		-	-	-	-	-	-	-		-	274,008,550
Total CO ₂ emission (tCO ₂)						274,008,550+1.16148*20264000= 297,544,857					
Total thermal power generation connected to the grid (MWh)						20,264,000+269,169,531= 289,433,531					
EF _{simple,OM,2005} (tCO ₂ /MWh)						1.02802					

Note: The electricity import from Central China Power Grid in 2005 is 20,264,000 MWh, and the average emission factor of Central China Power Grid in 2005 is 1.16148 tCO₂/MWh, so the total CO₂ emission of SCPG in 2005 is 274,008,550+1.16148*20,264,000=**297,544,857** tCO₂.

Data source:

- China Energy Statistical Yearbook 2006.
- “2009 Baseline Emission Factors for Regional Power Grids in China” by China DNA (NDRC) at <http://cdm.ccchina.gov.cn> issued on 2nd July 2009.

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**Table 3-8 Thermal power generation of SCPG in 2006**

Province	The fuel fired electricity generation (MWh)	The rate of electricity self-consumption (%)	The fuel fired electricity connected to the grid (MWh)
Guangdong	188,429,000	5.27	178,498,792
Guangxi	27,967,000	4.45	26,722,469
Guizhou	76,039,000	6.06	71,431,037
Yunnan	39,791,000	4.12	38,151,611
The total			314,803,908

Note: When calculating simple OM emission factor of SCPG in 2006, the electricity imports from Central China Power Grid is 21,730,840 MWh, so the total thermal power generation of SCPG in 2006 is 21,730,840+314,803,908=336,534,748MWh.

Data source: China Electric Power Yearbook 2007.

Table 3-9 Calculation of simple OM emission factor of SCPG in 2006

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	Carbon content (tC/TJ)	OXID (%)	Emission factors (kgCO ₂ /TJ)	NCV(MJ /t, km ³)	CO ₂ emission (tCO ₂)
		A	B	C	D	E=A+...+D	F	G	H	I	J=E×H×I/100,000 (quality unit) or J=E×H×I/10,000 (volume unit)
Raw coal	10 ⁴ ton	7303.19	1490.01	4001.54	2735.88	15530.62	25.8	100	87300	20908	283,475,499
Washed coal	10 ⁴ ton					0	25.8	100	87300	26344	0
Other washed coal	10 ⁴ ton			19.53	45.8	65.33	25.8	100	87300	8363	476,968
Coal Briquette	10 ⁴ ton	133.75				133.75	26.6	100	87300	20908	2,441,296
Coke	10 ⁴ ton				1.31	1.31	29.2	100	95700	28435	35,648
Coke oven	10 ⁸ m ³		0.84		2.06	2.9	12.1	100	37300	16726	180,925

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gas											
Other gas	10 ⁸ m ³	0.89			19.15	20.04	12.1	100	37300	5227	390,714
Crude oil	10 ⁴ ton	0.87				0.87	20	100	71100	41816	25,866
Gasoline	10 ⁴ ton	0				0	18.9	100	67500	43070	0
Diesel	10 ⁴ ton	29.92	1.26		3	34.18	20.2	100	72600	42652	1,058,396
Fuel oil	10 ⁴ ton	685.85	0.09			685.94	21.1	100	75500	41816	21,655,867
LPG	10 ⁴ ton					0	17.2	100	61600	50179	0
Refinery gas	10 ⁴ ton	0				0	15.7	100	48200	46055	0
Natural gas	10 ⁸ m ³	7.92				7.92	15.3	100	54300	38931	1,674,251
Other petroleum products	10 ⁴ ton	0.67				0.67	20	100	75500	38369	21,153
Other coking products	10 ⁴ ton					0	25.8	100	95700	28435	0
Other energy	10 ⁴ tce	93.54	189.68		20.29	303.51	0	0	0	0	0
Total		-	-	-	-	-	-	-		-	311,436,583
Total CO ₂ emission (tCO ₂)						311,436,583 + 1.12157*21,730,840=335,809,186					
Total thermal power generation connected to the grid (MWh)						21,730,840+314,803,908=336,534,748					
EF _{simple,OM,2006} (tCO ₂ /MWh)						0.99784					

Note: The electricity imports from Central China Power Grid in 2006 is 21,730,840 MWh, and the average emission factor of Central China Power Grid in 2006 is 1.12157 tCO₂/MWh, so the total CO₂ emission of SCPG in 2006 is 311,436,583 + 1.12157*21,730,840=335,809,186 tCO₂.

Data source:

- China Energy Statistical Yearbook 2007;
- “2009 Baseline Emission Factors for Regional Power Grids in China” by China DNA (NDRC) at <http://cdm.ccchina.gov.cn> issued on 2nd July 2009.

Table 3-10 Thermal power generation of SCPG in 2007

Province	The fuel fired electricity generation (MWh)	The rate of electricity self-consumption (%)	The fuel fired electricity connected to the grid (MWh)
Guangdong	215,700,000	6.01	202,736,430

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Guangxi	36,100,000	7.42	33,421,380
Guizhou	84,300,000	6.62	78,719,340
Yunnan	47,400,000	7.23	43,972,980
Total	--	-	358,850,130

Note: When calculating simple OM emission factor of SCPG in 2007, the electricity imports from Central China Power Grid is 24,237,240 MWh, so the total thermal power generation of SCPG in 2007 is 24,237,240+358,850,130=383,087,370 MWh.

Data source: China Electric Power Yearbook 2008.

Table 3-11 Calculation of simple OM emission factor of SCPG in 2007

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total	Carbon content (tC/TJ)	OXID (%)	Emission factors (kgCO ₂ /TJ)	NCV (MJ/t, km ³)	CO ₂ emission (tCO ₂)
		A	B	C	D	E=A+...+D	F	G	H	I	J=E×H×I/100,000 (quality unit) or J=E×H×I/10,000 (volume unit)
Raw coal	10 ⁴ ton	8214.78	1750.63	4298.8	3170.79	17435	25.8	100	87,300	20,908	318,235,546
Washed coal	10 ⁴ ton	3.46				3.46	25.8	100	87,300	26,344	79,574
Other washed coal	10 ⁴ ton		0.65	21.58	14.64	36.87	25.8	100	87,300	8,363	269,184
Coal Briquette	10 ⁴ ton	271.25				271.25	26.6	100	87,300	20,908	4,951,041
Coke	10 ⁴ ton	0.04	1.69		2.15	3.88	29.2	100	95,700	28,435	105,584
Coke oven gas	10 ⁸ m ³		0.96	3.19	1.8	5.95	12.1	100	37,300	16,726	371,208
Other gas	10 ⁸ m ³		30.77		21.63	52.4	12.1	100	37,300	5,227	1,021,628
Crude oil	10 ⁴ ton					0	20	100	71,100	41,816	0
Gasoline	10 ⁴ ton					0	18.9	100	67,500	43,070	0
Diesel	10 ⁴ ton	21.37	2.13		2.29	25.79	20.2	100	72,600	42,652	798,596
Fuel oil	10 ⁴ ton	467.97	0.41			468.38	21.1	100	75,500	41,816	14,787,262

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LPG	10 ⁴ ton					0	17.2	100	61,600	50,179	0
Refinery gas	10 ⁴ ton	0.37				0.37	15.7	100	48,200	46,055	8,213
Natural gas	10 ⁸ m ³	32.17				32.17	15.3	100	54,300	38,931	6,800,588
Other petroleum products	10 ⁴ ton	8.47				8.47	20	100	75,500	41,816	267,407
Other coking products	10 ⁴ ton					0	25.8	100	95,700	28,435	0
Other energy	10 ⁴ tce	118.04	81.89	44.1	50.3	294.33	0	0	0	0	0
Total		-	-	-	-	-	-	-		-	347,695,831
Total CO ₂ emission (tCO ₂)						347,695,831+1.10197*24,237,240=374,404,628					
Total thermal power generation connected to the grid (MWh)						24,237,240+358,850,130=383,087,370					
EF _{simple,OM,2007} (tCO ₂ /MWh)						0.97733					

Note: The electricity imports from Central China Power Grid in 2007 are 24,237,240 MWh, and the average emission factor of Central China Power Grid in 2007 is 1.10197 tCO₂/MWh, so the total CO₂ emission of SCPG in 2007 is 347,695,831+1.10197*24,237,240=374,404,628 tCO₂.

Data source:

- China Energy Statistical Yearbook 2008.
- “2009 Baseline Emission Factors for Regional Power Grids in China” by China DNA (NDRC) at <http://cdm.ccchina.gov.cn> issued on 2nd July 2009.

Table3-12 the three years average OM emission factor of SCPG

Years	Total CO ₂ emission (tCO ₂)	Total thermal power generation connected to the grid (MWh)	Three years average emission factor (tCO ₂ /MWh)
2005	297,544,857	289,433,531	0.9987
2006	355,809,186	336,534,748	
2007	374,404,628	383,087,370	

Data Source: from the above table 3-6~3-11.

Build Margin (BM) Calculation

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**Table 3-13 Calculation of the weight of CO₂ emissions from solid fuels, liquid fuels and gas fuels among total emissions in SCPG**

Fuels	Units	Guang dong	Guangxi	Guizhou	Yunnan	Total	NCV (KJ/kg, km ³)	Emission factor (tc/TJ)	OXID (%)	CO ₂ emissions (tCO ₂)
		A	B	C	D	E=A+...+ D	F	G	H	I=E×F×G×H/10,000 ,000
Raw coal	10 ⁴ ton	8,214.78	1,750.63	4,298.8	3,170.79	17,435	20,908	87,300	100	318,235,546
Washed coal	10 ⁴ ton	3.46	0	0	0	3.46	26,344	87,300	100	79,574
Other washed coal	10 ⁴ ton	0	0.65	21.58	14.64	36.87	8,363	87,300	100	269,184
Coal Briquette	10 ⁴ ton	271.25	0	0	0	271.25	20,908	87,300	100	4,951,041
Coke	10 ⁴ ton	0.04	1.69	0	2.15	3.88	28,435	95,700	100	105,584
Other coke chemicals	10 ⁴ ton	0	0	0	0	0	28,435	95,700	100	0
Total of solid fuels										323,640,928
Crude oil	10 ⁴ ton	0	0	0	0	0	41,816	71,100	100	0
Gasoline	10 ⁴ ton	0	0	0	0	0	43,070	67,500	100	0
Diesel	10 ⁴ ton	21.37	2.13	0	2.29	25.79	42,652	72,600	100	798,596
Fuel oil	10 ⁴ ton	467.97	0.41	0	0	468.38	41,816	75,500	100	14,787,262
Other petroleum products	10 ⁴ ton	8.47	0	0	0	8.47	41,816	75,500	100	267,407
Total of liquid fuels										15,853,266
Natural gas	10 ⁷ m ³	321.7	0	0	0	321.7	38,931	54,300	100	6,800,588
Coke oven gas	10 ⁷ m ³	0	9.6	31.9	18	59.5	16,726	37,300	100	371,208
Other gas	10 ⁷ m ³	0	307.7	0	216.3	524	5,227	37,300	100	1,021,628

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LPG	10 ⁴ ton	0	0	0	0	0	50,179	61,600	100	0
Refinery gas	10 ⁴ ton	0.37	0	0	0	0.37	46,055	48200	100	8,213
Total of gas fuels										8,201,637
Total of solid, liquid and gas fuels										347,695,831

Data source: China Energy Statistical Yearbook 2008.

From the above table, $\lambda_{Coal,y}=93.08\%$, $\lambda_{Oil,y}=4.56\%$, $\lambda_{Gas,y}=2.36\%$.

Table 3-14 Emission factor of the most efficient commercial thermal power plants

Thermal power	Variable	Efficiency of electricity supply (%)	Emission factor of the fuels (kgCO ₂ /TJ)	OXID (%)	Emission factor (tCO ₂ /MWh)
		A	B	C	D=3.6/A/100,000,000*B*C
Coal-fired power plant	EF _{Coal,Adv,y}	38.10%	87,300	100	0.8429
Gas- fired power plant	EF _{Gas,Adv,y}	49.99%	54,300	100	0.5437
Oil- fired power plant	EF _{Oil,Adv,y}	49.99%	75,500	100	0.3910

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.8018 \text{ tCO}_2/\text{MWh}.$$

Table 3-15 Calculation of BM emission factor of SCPG

	Installed capacity in 2005	Installed capacity in 2006	Installed capacity in 2007	Newly added installed capacity between 2005 and 2007	Weight in newly added installed capacity
	A	B	C	D=C-A	

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Thermal power (MW)	54,507	68,963	80,610	26,103	71.98%
Hydropower (MW)	30,347.1	34,176	40,340	9,992.9	27.56%
Nuclear power (MW)	3,780	3,780	3,780	0	0.00%
Wind power (MW)	83.4	183	250	166.6	0.46%
Total (MW)	88,717.5	107,102	124,980	36,262.5	100.00%
Share in 2007 installed capacity	70.99%	85.70%	100%		

$$EF_{\text{Grid,BM,y}} = 0.8018 \times 71.98\% = 0.5772 \text{ tCO}_2/\text{MWh}.$$

Data source: China Electric Power Yearbook 2006, China Electric Power Yearbook 2007, China Electric Power Yearbook 2008.



Annex 4

MONITORING INFORMATION

No other information.