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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Project Title: Sichuan Kangding Sandaoqiao Hydropower Station
PDD Version: 2.0
Date: 20/06/2008

Version	Date	Comments
Version 0.1	30/01/2007	Complete version of the PDD, prepared for the host country approval process
Version 1.0	13/09/2007	Revised draft PDD; prepared for GSP and validation, incorporating the latest NDRC emission factors information
Version 2.0	20/06/2008	Revised PDD, prepared on the basis of corrective action requests in the validation protocol of TUV SUD.

A.2. Description of the project activity:

Summary:

The proposed project activity is a diversion type run-of-river hydropower station located in Xiasuozigou Drainage Area, in Kangding County, Ganzi Tibetan Autonomous Prefecture, Sichuan Province, China. The project employs two turbines with a total installed capacity of 30 MW, and is expected to operate 5,246 hours per year, which corresponds to an average annual electricity generation of 157,380 MWh. The power supplied to the grid is estimated to be 125,526 MWh per year. The generated electricity will be transmitted to the Central China Power Grid displacing electricity generation from fossil fuel fired thermal power plants connected to the grid, thereby reducing greenhouse gas emissions.

Contribution to sustainable development:

The project activity contributes significantly to the region's sustainable development in the following ways:

- In recent years, China has witnessed a huge increase in power consumption. Both public and private parties are struggling to meet the demand for electricity.
  The proposed hydropower project will contribute in a sustainable manner to bridging the gap between supply and demand of power on a regional and national level.
- In China, more than 80% of total electricity production is derived from coal based power plants. Being so heavily dependant on coal for its energy requirements, this project carries environmental benefits for the country's air, soil and water sources. The project activity will displace the generation of fossil fuel power plants, reducing CO_2, SO_x and NO_x emissions significantly, thus mitigating the air pollution and its adverse impacts on human health.
  The project activity promotes the growth of sustainable and renewable capacity in China and makes it less dependent on exhaustible and polluting fossil fuels.
- The project will definitely contribute to the province's economic development by improving the local energy generation infra-structure and generating employment during the construction of the power plant.

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）
China (host)	Kangding Jineng Hydropower Exploitation Co., Ltd. (project owner, private entity)	No
Switzerland	South Pole Carbon Asset Management Ltd. (CER purchase facility manager, private entity)	No
Austria	Kommunalkredit Public Consulting GmbH (CER buyer, public entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party (ies):

People’s Republic of China

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

Sichuan Province

A.4.1.3. City/Town/Community etc:

Kangding County, Ganzi Tibetan Autonomous Prefecture

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 in the middle reaches of Xiasuozilou River, which is a branch of Dadu River, within the boundary of Kangding County, Ganzi Tibetan Autonomous Prefecture, Sichuan Province, P.R.China. The plant site is 30 km upriver of Sandaoqiao, 60 km away from Kangding County, and 352 km from Chengdu City. The exact location of the power plant is the latitudes of 30°21′07″N and the longitudes of 102°07′36″E. The exact location of the dam is the latitudes of 30°19′35″N and the longitudes of 102°05′58″E.

The location of the station is shown in Fig. A.1.

Fig A.1 Location of Sichuan Kangding Sandaoqiao Hydropower Station

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

The project activity falls under the category described under CDM as “Sectoral Scope Number 1: Energy Industries – Renewable Sources”.

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

The project is a run-of-river diversion type hydropower station. The construction of the project power station mainly consists of a water retaining dam, a diversion tunnel and penstock, the powerhouse, the auxiliary room and a transformer station. The total installed capacity is 30 MW.

The proposed project will be equipped with two turbines and two generators as specified in Table A.1:

Table A.1 Technical data of the turbine / generator units

Turbines	Designation	Rated Water Head	Rated Flow Rate	Rated Power	Produced by
2	CJA475-L-150/4×11.5	485m	3.775m^3/s	15MW	Sichuan Dongfeng Generator Co., Ltd.
Generators	Designation	Rated Voltage	Rated Capacity	Rated Current	Produced by
2	SF15-10/3250	10.5kV	15MW	1030.98 A	Sichuan Dongfeng Generator Co., Ltd.

The electricity generated by the project activity will be transmitted through a 110kV transmission line to the Sichuan grid, and then finally to the Central China Power Grid.

Experienced experts monitor and coordinate project operations. Project workers will be trained on correct use and maintenance of the turbines by the turbine manufacturer and on operation and management of the power plant by the Grid Company at another hydropower station. Furthermore, the project owner will implement a series of internal safety and operation procedures in order to guarantee an optimum power plant operation in a safe and environmentally sound manner,

In matters of CDM monitoring, a monitoring officer will receive training on monitoring methodologies, procedures and archiving. Then, the monitoring officer will train the project staff in charge for CDM monitoring.

There is no direct technology transfer related to the project activity since all the technology employed is from domestic producers.

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

The project activity will employ the renewable crediting period, and the estimation of the emission reductions in the first seven year crediting period (October 2008 to September 2015) is presented in Table A.2. Estimated Emission Reductions throughout the first crediting period are 829,871 CO_2e.

Table A.2 Estimation of the Emission Reductions in the Crediting Period

Years	**Annual estimation of emission reductions in tones of CO_2e**
Year 1: 01/10/2008 – 30/09/2009	118,553
Year 2: 01/10/2009 – 30/09/2010	118,553
Year 3: 01/10/2010 – 30/09/2011	118,553
Year 4: 01/10/2011 – 30/09/2012	118,553
Year 5: 01/10/2012 – 30/09/2013	118,553
Year 6: 01/10/2013 – 30/09/2014	118,553
Year 7: 01/10/2014 – 30/09/2015	118,553
Total estimated reductions (tons of CO_2e)	829,871
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tons of CO_2e)	118,553

A.4.5. Public funding of the project activity:

There is no public funding from Annex I countries involved in the project activity.

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:

Baseline and monitoring methodology:

Approved consolidated baseline methodology ACM0002 *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 6, dated 19 May 2006.*

Approved consolidated monitoring methodology ACM0002 *"Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", Version 6, dated 19 May 2006.*

The methodology ACM0002/*Version 6* is available at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

Additionality Tool

The *"Tool for the Demonstration and Assessment of Additionality", Version 4 approved on the* 36th *EB meeting,* is used to demonstrate the additionality of the project activity.

The tool is available at:
http://cdm.unfccc.int/EB/029/eb29rep.pdf.

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

The project activity meets all applicability conditions of approved consolidated methodology ACM0002 as follows:

1. The project consists of a run-of-river hydropower capacity addition and is a grid-connected electricity generation project;
2. The project does not involve switching from fossil fuel to renewable energy at the site of the project activity;
3. The geographic and system boundaries for the relevant electricity grid the proposed project connected to (the Central China Power Grid), can be clearly identified and information on the characteristics of the grid is available.

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

The spatial extent of the project boundary includes the project site and all power plants connected physically to the Central China Power Grid. The system boundary of the proposed project is defined as the Central China Power Grid due to following reasons:

1. In a country like China, with a layered dispatch system, grid boundary definitions shall be based on regional grids.
2. The project power plant is connected to the Sichuan Grid via local grid network, and thus finally to the Central China Power Grid. The Central China Power Grid is a large regional grid, which consists of six sub-grids: Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan Grid.

There is substantial inter-grid power exchange among the above mentioned sub-grids of the Central China Power Grid.

3. The Central China Power Grid can be clearly identified as regional grid and information on the characteristics of this grid is publicly available.

4. There is a guidance[1] from the Chinese CDM DNA (National Climate Change Coordination Office) on project boundaries identifying the applicable grid as the project boundary.

According to the applied methodology, emissions related to the construction of power plants are neither considered in the baseline scenario nor in the project scenario. The emissions related to production, transportation and distribution of fuels used in the baseline scenario power plants are also excluded from leakage emission calculations.

Following sources and gases have been considered for calculation of baseline and project activity emissions:

Table B.1 Description of How the Sources and Gases Included in the Project Boundary

	Source	GHG	Included?	Justification / Explanation
Baseline	Thermal power plants in the Central China Power Grid	CO_2	Included	According to ACM0002 methodology, it is only necessary to account for CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity are considered.
		CH_4	Excluded	According to ACM0002 methodology, it is only necessary to account for CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity are considered.
		N_2O	Excluded	According to ACM0002 methodology, it is only necessary to account for CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity are considered.
Project Activity	Sichuan Kangding Sandaoqiao Hydropower Station	CO_2	Excluded	The project is grid-connected electricity generation from renewable sources, According to methodology ACM0002, without CO_2 emission.
		CH_4	Excluded	The hydropower project is a run-of-river hydropower station, According to methodology ACM0002, without CH_4 emission.
		N_2O	Excluded	The project is grid-connected electricity generation from renewable sources, According to methodology ACM0002, without N_2O emission.

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

[1] Notification on Determining the Regional Grid Emission Factors of China, published on August 9, 2007 (available at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf)

As per ACM0002/Version 06, the baseline scenario should be selected based on an evaluation of plausible alternatives to the project activity. Following baseline scenarios to the project activity have been identified and considered:

1. The proposed hydropower activity not undertaken as a CDM project activity;
2. New thermal fossil fuel fired power plant with equivalent annual power generation;
3. Other new renewable energy power plants with equivalent annual power generation;
4. The equivalent amount of electricity is supplied by the Central China Power Grid.

Scenario 1: The proposed hydropower activity not undertaken as a CDM project activity

The first scenario is in compliance with Chinese relevant laws and regulations. The attractiveness of the project without CDM revenues is measured by conducting an Internal Rate of Return (IRR) analysis. According to section B.5, the IRR of the project is 7.88% without CDM revenues which is lower than the benchmark rate of 10%[2]. Therefore, the project faces obvious financial barriers without CDM revenues. The first scenario is therefore not feasible and thus cannot be considered as the baseline scenario for the project activity (please refer to Section B.5 for the detailed investment analysis).

Scenario 2: New thermal fossil fuel fired power plant with equivalent annual power generation

There is a large difference between thermal power and hydropower in terms of annual operating hours and the stability of their operation. However, an alternative fossil fuel power plant that can provide the equivalent amount of electricity would have an annual utilization rate of 5,876 hours[3], which was the average operating hours of thermal power plants in China in 2005. Thus, a comparable thermal power plant would be one with an installed capacity of less than 30 MW. However, according to Chinese regulations, thermal power plants of less than 135 MW are prohibited for construction in China[4]. Therefore, this scenario does not comply with Chinese relevant laws and regulations and cannot be considered a feasible alternative.

Scenario 3: Other new renewable energy power plants with equivalent annual power generation

There is neither potential for wave or tidal energy nor for geothermal energy in the project's area. No biomass based power plant with a similar scale to the project has previously been built in the region. Moreover, other renewable energy alternatives, such as solar PV are considered to be too cost intensive for generating the equivalent annual output. The region where the proposed project is located is poor in terms of wind resources with very low wind energy potential. Thus there are no favorable conditions for other power plants based on renewable sources; construction and the economic return of other renewable power plants of similar size would be of little attractiveness (without CDM). The third scenario is therefore not feasible and cannot be considered the baseline scenario.

Scenario 4: The equivalent amount of electricity is supplied by the Central China Power Grid

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[2] Document [1995] No. 186, Economic Evaluation Code for Small Hydropower Projects (SL16-95), published by the Ministry of Water Resources of the People's Republic of China, where a small hydropower project is defined as a power station with installed capacity lower than 25MW. The regulation applies also to hydropower stations up to 50MW located in rural areas and is therefore applicable for the proposed project.

[3] China Electric Power Yearbook 2006. p.37

[4] Notice on Strictly Prohibiting the Installation of Fuel Fired Generators with a Capacity of 135 MW or Below issued by the General Office of the State Council, Decree No. [2002]6.

The fourth scenario is in compliance with relevant Chinese laws and regulations and does not face any financial barriers.

Conclusion:

From above analysis it can be concluded that the fourth scenario is the only plausible alternative to the project activity. Therefore, the baseline scenario of the project is decribed as follows:

In absence of the proposed project activity, the electricity amount exported to the grid by the project activity would have been supplied by grid-connected power plants within the Central China Power Grid (currently installed power plants and power plants to be installed throughout the crediting period).

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):

The project owner considered the revenues from CDM seriously pior to the start of the project activity when making the decision to implement the project activity. In August 2005, the project owner consigned the Design and Planning Institute of 10th Project Bureau of China Water Conservation and Hydropower Administration to make a feasibility study for the proposed project. In the study the installed capacity was chosen to be 24MW, and the IRR of the project was only 8.88%. In the Feasibility Study Report (FSR), the institute therefore advised the project owner to expand the capacity or increase the project IRR to overcome the benchmark of 10% through other financing ways. In October 2005, the project owner started to know about the CDM, and consequently decided to apply for CDM finance to increase the IRR of the project in order to overcome the financial barrier linked to the 10% IRR benchmark. In December 2005, the IRR estimate had to be revised due to plans to increase the rated capacity of the power plant from 24MW to 30MW, which turned out to be the optimal capacity for the proposed project. The revised and more detailed IRR calculations, as per Capacity Optimization Report, indicated that the initial calculations were slightly overestimated, bringing the final IRR figure to 7.88%, which made the need for CDM to overcome the 10% IRR benchmark even more evident.[5] The reason for the lower IRR was a better knowledge of the costs and higher costs for raw and processed material and the transformer station, as well as for adaptation to the difficult geographical and geological situation. In May 2006, the project owner received approval from local government to apply for CDM and at the same time had already contracted the CDM consultant Tianqing Power with access to CER buyers, thus the project owner had great confidence in a successful implementation of the CDM project, which in turn was an assurance for the project owner that he would be able to receive the bank loan needed for the completion of the proposed project. The expected revenues of the sale of CERs allowed the project owner to proceed with the project activity. Hence in June 2006, the project started construction. At the same time, both English and Chinese PDDs were written and after the receival of Chinese LoA, the project started the validation process in September 2007.

The project's chronology is illustrated in the table below:

[5] The Report explicitly refers to the Economic Evaluation Code for Small Hydropower Projects issued by the Ministry of Water Resources in 1995 (Document No. SL16-95), which states 10% as the benchmark IRR for this project type.

Table B.2 Overview of key events in the development of the project

Date	Key Event	Source
August 2005	The Feasibility Study Report with an IRR outcome of 8.88% was written by Investigation, Design and Planning Institute of the 10th Project Bureau of China Water Conservation and Hydropower Administration.	Feasibility Study Report
October 8, 2005	The project owner made a directorate decision to apply as a CDM project to improve the economic attractiveness of the project.	Board Decision of October 8, 2005
November 15, 2005	The Environmental Impact Assessment for 24 MW was approved by Ganzi Tibetan Autonomous Prefecture Environmental Protection Bureau.	First Approval of Environmental Impact Assessment
December 2005	The Capacity Optimization Report for 30 MW with more actual data and an IRR outcome of 7.88% was finished by Investigation, Design and Planning Institute of the 10th Project Bureau of China Water Conservation and Hydropower Administration and Chengdu Yude Industry Co. Ltd.	Capacity Optimization Report
March 8, 2006	Signed contract with CDM developer	Contract with CDM developer
May 10, 2006	Project received approval from local government to apply for CDM.	CDM Approval from Local Government
June 7, 2006	The project started construction.	Approval for Construction Start
June 22, 2006	The equipment purchasing was contracted.	Equipment Purchasing Contract
December 28, 2006	The capacity change to 30 MW was approved by local government.	Approval for Capacity Change
July 2007	Approval of Chinese DNA on Chinese DNA website and receipt of LoA from Chinese DNA.	Chinese LoA
October 24 2007	The Environmental Impact Assessment for 30 MW was approved by Ganzi Tibetan Autonomous Prefecture Environmental Protection Bureau.	Second Approval of Environmental Impact Assessment
August 2008	Expected start of commissioning.	

The project's chronology clearly demonstrates that CDM was seriously considered prior to the start of the project activity.

The additionality of the project activity is demonstrated using the steps described in *the Tool for the*

Demonstration and Assessment of Additionality (version 4) approved by the EB.

Step 1: Identification of Alternatives to the Project Activity Consistent with Current Laws and Regulations

Sub-Step 1a. Define alternatives to the project activity

This methodological step requires a number of sub-steps, the first one being the identification of realistic and credible alternatives to the project activity. As mentioned in Section B.4, there are only a few alternatives that are prima facie realistic and credible in the context of the Central China Power Grid:

1. The proposed hydropower activity not undertaken as a CDM project activity;
2. New thermal fossil fuel fired power plant with equivalent annual power generation;
3. Other new renewable energy power plants with equivalent annual power generation;
4. The equivalent amount of electricity is supplied by the Central China Power Grid.

As explained under Section B.4, the third alternative is not feasible since there are no realistic and plausible alternatives to the project based on other renewable energy sources, such as wind, biomass, solar, wave and tidal or geothermal energy, to provide the equivalent amount of electricity in the project's area.

Sub-Step 1b. Enforcement of applicable Laws and Regulations

The second scenario is not in compliance with Chinese relevant laws and regulations, hence it is not a feasible alternative. However, as discussed in Section B.4, the first, third and fourth alternatives are in compliance with Chinese relevant laws and regulations.

Therefore, the project activity is not the only alternative consistent with Chinese current laws and regulations, and at the same time, the project is not enforced by relevant mandatory laws and regulations. Thus, the project complies with the additionality concept under Sub-Step 1b.

Step 2 Investment Analysis

Sub-step 2a. Determine appropriate analysis method

The Tool for the Demonstration and Assessment of Additionality suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. The investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. Since the alternative scenarios 2 (new thermal power plant) and 3 (other renewable energy plants) have been rejected due to non-compliance with Chinese laws and regulations and non-feasibility of other renewable energy projects in the project's area and since alternative scenario 4 (electricity supply by Central China Power Grid) can not be considered a similar investment project, Option II is not appropriate. Thus, the Project will use the benchmark analysis method (Option III) considering the fact that a benchmark IRR for the power sector in China is available.

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

With reference to the Economic Evaluation Code for Small Hydropower Projects issued by the Ministry of Water Resources in 1995 (Document No. SL16-95), the benchmark Internal Rate of Return (IRR; after tax) adopted by the Project (being a 30 MW hydropower station located in a rural area) is 10%. On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):

The key financial parameters for calculation of the project's internal rate of return are provided in Table B.3:

Table B.3: The Basic Financial Parameters of the Project

Installed capacity (MW)	30	Capacity Optimization Report
Annual Power supplied to the Grid (MWh)	125,526	Capacity Optimization Report
Static Total Investment (€)	16,224,800	Capacity Optimization Report
Loan	70%	Capacity Optimization Report
Rate of the Loan	6.12%	Capacity Optimization Report
Loan Repayment Period (Years)	15	Capacity Optimization Report
Estimated Grid Price (€/ kWh, with VAT)	0.0207	Capacity Optimization Report
Operation Period (years)	30	Capacity Optimization Report
VAT	17%	Capacity Optimization Report
Revenue from Electricity Sale (€/year)	2,598,390	Capacity Optimization Report
Annual Operational Costs (€)	524,910	Capacity Optimization Report

The IRR of this project is only 7.88% without CDM revenues. Based on the Economic Evaluation Code for Small Hydropower Projects, the IRR of small hydropower projects should not be lower than the threshold of 10%. Therefore, the project faces obvious financial barriers without CDM revenues.

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

The sensitivity analysis is conducted to check whether, under reasonable variations of the key IRR calculation assumptions, the results of the analysis remain unaltered. Following parameters are assumed to be critical assumptions:

1. Static total investment
2. Annual operational costs
3. Revenues from electricity sale
4. Electricity supplied to grid

Variations of ±10% have been considered for these parameters. Table B.4 and Figure B.1 summarize the results of the sensitivity analysis.

Table B.4 Impact of Variations in Critical Assumptions on IRR

	-10%	-5%	0%	+5%	+10%
Revenues from electricity sale	6.60%	7.25%	7.88%	8.50%	9.10%

Static total investment	8.98%	8.40%	7.88%	7.40%	6.95%
Annual operational costs	8.23%	8.06%	7.88%	7.70%	7.52%
Electricity supplied to grid	6.64%	7.27%	7.88%	8.48%	9.06%

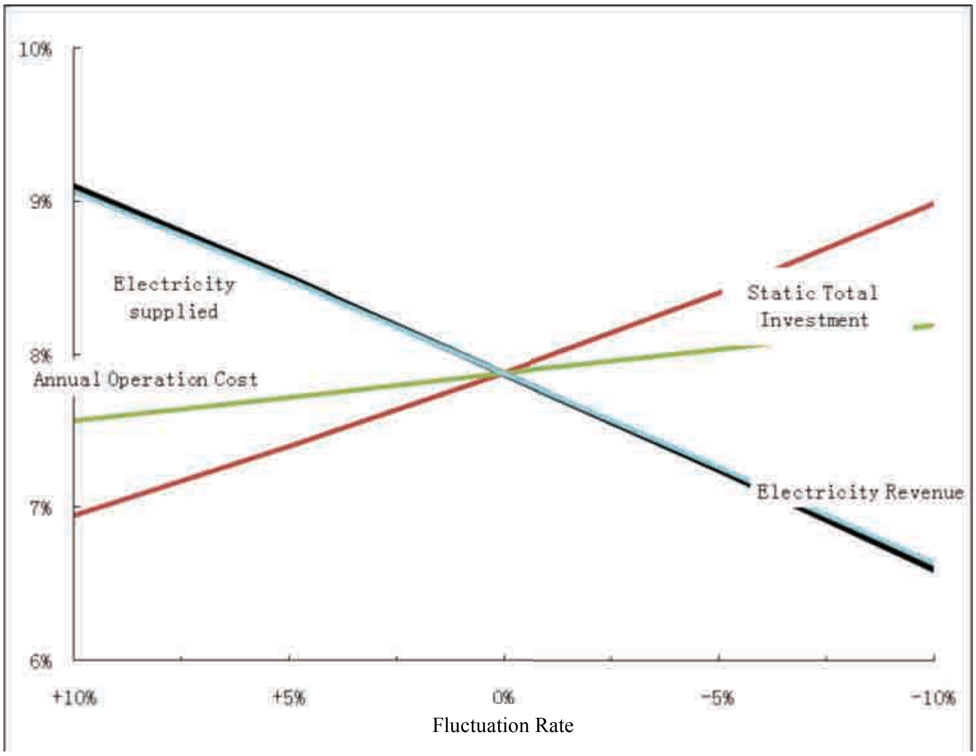

Fig B.1 IRR Sensitivity Analysis when Static Total Investment, Annual Operational Costs, Electricity supplied to Grid or Revenues from Electricity Sale is changed

Fig B.1 shows that the IRR of the project is 7.88% without consideration of CDM revenues, which is far lower than the benchmark rate of 10%. Under realistic assumptions of changes in the main parameters, the IRR can not reach 10%. In the Capacity Optimization Report, fluctuations of key parameters by up to 20% were investigated in order to find the fluctuation rate for which the IRR reaches 10%. The results and the reasons why the resulting fluctuations are not feasible are listed below:

- Even with a decrease in static total investment of 10%, the IRR of the project would still only be 8.98%, which is lower than 10%. In addition, the prices of equipment, material etc. have been rising, so it is impossible to improve the economic attractiveness with a decrease in static total investment. Only if the static total investment decreased by 16%, the project IRR would reach 10%. But due to the rapid increase of the material and equipment prices, it is impossible to decrease the static total investment to 16%.
- If the annual operation costs were to be 10% lower than prospected, the IRR would only rise by as little as 0.35%, therefore it is difficult to adjust the annual operation cost to raise the IRR significantly. Only if the annual operation costs were 28.6% lower than prospected, the IRR could reach 10%; but with rising salaries in China this is not achievable.
- Even if an increase in revenues from electricity sale reached 10%, the IRR of the project would still only be 9.10%. Only if the electricity sale revenue was higher by 17.7%, the IRR could reach

10%. But this is unfeasible because the price is fixed by the local governmental regulation.

- If the electricity supplied to the grid was raised by 10%, the IRR of the project would be 9.06% which is still lower than 10%. The average annual utilisation time of the generators is 5,246 hours after optimisation of the capacity, therefore further increases in the average annual utilisation time over the operation period are unfeasible without a significant change in rainfall patterns and water flow. Therefore the project can not simply raise the IRR through a raise of the electricity supplied to the grid.

Hence, the results of the sensitivity analysis confirm that the project faces significant economic and financial barriers without CDM revenues, thus the first alternative lacks economic attractiveness and cannot be considered as a feasible alternative.

However, if the impact of CDM is considered, the IRR of the project increases significantly. When the project has access to a CER income at €8/tCO_2e[6]; the IRR reaches 10.40%, thus passing the critical barrier of 10%, leading to a positive decision to invest in the project. It is obvious that the benefit from CDM will help to eliminate the financing barriers which would have prevented the project construction.

Step 3: Barrier Analysis

This step is not applicable.

Step 4 Common Practice Analysis

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

According to the tool for the demonstration and assessment of additionally, projects are considered "similar" in case they are located in the "same county/region", are of "similar scale", and "take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc". Sichuan Province with an area of 485,000 km², is comparatively and considerably larger than many countries. According to the requirements of common practice, the projects with similar conditions, such as investment conditions and natural conditions (including geographical conditions, climate conditions, development conditions and so on), are necessary to be analyzed. Projects located in different provinces of Central China Power Grid have not the similar investment conditions [7] and natural conditions.[8] Therefore the geographical area, i.e. Sichuan Province, is chosen as the common practice comparison region.

Projects analyzed in this section are defined as hydropower projects in Sichuan Province with similar installed capacity (15 MW to below 50 MW[9]) that started operation before 2002.

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[6] A price of 8 €/tCO2e is considered a conservative value which reflects minimum price expectations by Chinese DNA at the time of LoA approval.

[7] Yearbook of China Water Resources 2006

[8] http://www.checc.cn/zgsd/zgsd_zy.jsp, http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=20, http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=19, http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=13, http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=11, http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=14, http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=15.

[9] Almanac of China's Water Power, Volume 10, Page 141: Projects with a capacity of 0.5 MW~50 MW (excluding 50MW) are defined as small scale hydropower projects.

Projects within the indicated capacity range are comparable to the project activity both in terms of CDM as well as national regulations because UNFCCC classifies hydropower projects above 15 MW as large-scale projects, whereas the Chinese government classifies hydropower stations below 50 MW as small-scale projects, hence projects within this range are subject to the same set of regulations.

The hydropower stations that started operation before 2002 were developed by the state under a regulatory environment that was substantially different from the current regulatory environment.

The situation of the Chinese electricity market before 2002 was as follows: Between 1949-1985 the Chinese electricity industry was a vertically integrated, government-owned and -operated enterprise. The Ministry of Power was the main regulatory arm of the central government. After 1985 a reform was introduced to encourage investment in the country's power sector in order to ease the worsening power shortages. This allowed regional governments, local companies, and foreign investors to invest in the power sector. An investment guarantee was introduced that guaranteed 12-15 % profit in order to attract power plant investors. Prices were set at costs plus the 12–15 % profit return. However, with profits guaranteed, power producers had no incentive to keep production costs low. The State Power Corporation was formed in 1997 to run the power industry independently.[10]

The year 2002 was marked by significant regulatory changes, implementing crucial market liberalization reforms within the electricity generation sector. The major features of the reform were presented in the Reform Scheme of the Electricity Industry (Scheme of 2002), which was approved by the State Council in April of 2002. The focus was to break the up-to-then vertical monopoly of the State Power Company and introduce competition on the generation side through diversifying the generating entities, which was aimed primarily to lower cost and improve efficiency.[11] Consequently, the rate of return guarantee was abandoned and power generation companies now competed with each other for access to the transmission grid, creating a competitive and open power market environment. Due to these regulatory reforms from 2002 and the essential changes in the market environment, representing harsher financial conditions for new projects after 2002, the common practice analysis focuses on projects that started construction after 2002.

24 hydropower plants with commissioning date post 2002 have been identified in Sichuan province within the capacity range of 15 up to 50 MW (excluding 50 MW). Seventeen (17) of these hydropower projects started operation before 2002 as demonstrated in table B.5. Therefore these projects are not similar with the proposed project and are excluded.

Table B.5. Hydropower plants put into operation before 2002

Name of hydropower plant	Capacity (MW)	Location	Operation year
Ganbao Hydropower Station	34	Aba Prefecture	1990[12]
Luosichi Hydropower Station	31.5	Shehong County	1992[13]
Huaneng Mingtai Hydropower Station	45	Santai County	1998[14]
Huangdan Hydropower Station	45	Muchuan County	1995[15]

[10] Boon-Siew Yeoh, Rajesh Rajaraman: Electricity in China. The Latest Reforms. In: The Electricity Journal, Volume 17, Issue 3, April 2004, p. 60-69 and http://www.taxchina.cn/ssfg/2002-02/10/cms319608article.shtml

[11] Chunbo Ma, Lining He: From state monopoly to renewable portfolio. Restructuring China's electric utility. In: Energy Policy, Volume 36, Issue 5, May 2008, p. 1697-1711.

[12] http://www.schuanglong.com/home.asp

[13] http://www.mzdl.cn/outer/qywh/yhfzview.asp?xsjlID=23

[14] http://ls.swufe.edu.cn/department/kjxy/ckslt/printpage.asp?BoardID=4&ID=615

Sijiutan Hydropower Station	25.5	Guang'an County	1995[16]
Li County Hydropower Station	33	Li County	1996[9]
Caopo Hydropower Station	46	Wenchuan County	Oct.1996[17]
Wenfeng Hydropower Station	30	Yong'an County	before 1997[18]
Longdonggou Hydropower Station	26.25	Longshi Town	1997[19]
Shapai Hydropower Station	36	Wenchuan County	March 1998[20]
Damo Hydropower Station	25	Shawan District Leshan City	1998[21]
Huatan Hydropower Station	25	Yingjing County	30th May, 1999[22]
Boluo Hydropower Station	48	Mabian County	Dec.1999[23]
Laifu Hydropower Station	30	Gao County	2000[24]
Dingcunba Hydropower Station	30	Tianquan County	2000[25]
Jinhua Hydropower Station	42	Hong County	2001[26]
Sanxing Hydropower Station	48	Shimian County	August 2001[27]

Seven (7) hydropower plants with commissioning date post 2002 have been identified in Sichuan province within the capacity range of 15 to below 50 MW (excluding 50 MW). Detailed information about these 7 projects is listed in table B.6., followed by a discussion of similar projects.

Table B.6. Hydropower plants comparable to the proposed activity

Name of hydropower plant	Capacity (MW)	Location	Operation year	Applying for CDM or not	Investor	Company type	Remarks
Tongkou Hydropower Station	45	Beichuan County Tongkou Town	2003	No	Sichuan Bashu Electricity Development Co., Ltd.	State owned[28]	The IRR is 18%[29]

[15] http://www.newssc.org/gb/Newssc/meiti/lsrb/yb/userobject10ai486765.html
[16] http://bbs.sun0769.com/dispbbs.asp?boardid=43&id=129892
[17] http://www.mjsdgs.com/ReadNews.asp?NewsID=625&typeid=26
[18] http://www.chinarein.com/qkhc/detail.asp?id=1762
[19] http://www.newssc.org/gb/Newssc/meiti/gzb/yb/userobject10ai1095526.html
[20] http://www.sdgtja.com/shzl/600131.txt
[21] http://www.cs.com.cn/gqfz/gongsi/200611/600644/02/200611/t20061126_1021921.html
[22] http://www.21cnci.com/miif_view.php?Id=7389
[23] http://www.mabian.gov.cn/e/DoPrint/?classid=35&id=1077
[24] http://www2.yibin.gov.cn/reco/disp.asp?ID=5342
[25] http://www.waterpub.com.cn/SLNJ/DetailSlnj.asp?id=513
[26] http://www.mzdl.cn/
[27] The Annual Report in 2001 of Sichuan Mingxing Electric Power C., Ltd.
[28] http://www.scol.com.cn/nsichuan/bsxw/20030618/200361812815_sc.htm
[29] http://www.chinaqw.com.cn/node2/node116/node120/node334/node389/node783/userobject6ai4672.html

Wan'er Hydropower Station	33	Jiulong County	2005	No	Sichuan Jiulong Hydropower Development Co., Ltd.	State owned [30]	In 2005 Ganzi prefecture invested around 2,280,000,000 RMB to ensure that Wan'er Hydropower Station and two other important construction projects could be completed smoothly.[31]
Fuliutan Hydropower Station	30	Yuechi County	2003	No	Yuechi Electricity Group	State owned [32]	Electricity price 0.322 RMB/kWh, annual utilisation time 5,733h[33]
Niujiaowan Third Level Hydropower Station	25	Butuo Coutry	2003	No	Sichuan Xichang Electric Power Co., Ltd.	Listed company [34]	Unit investment: 3,415 RMB/kW[35], annual utilization time: 6127h
Baishuihe Hydropower Station	26	Ya'an City and Ganzi Prefecture	2004	No	Shimian Kaiyuan Electricity Co., Ltd.	Private owned	Electricity price 0.288 RMB/kWh[36], annual utilisation time 6,633h[37]
Shazui Hydropower Station	38	Luding County	2004	No	Hongchang Electric Power Co. Ltd.	Private owned	Unit investment 4,289 RMB/kW, annual utilisation time 6,374h[38]
Zhongzui Hydropower Station	28	n.a.	n.a.	Yes [39]	Sichuan Dachuan Electricity Co., Ltd.	n.a.	n.a.

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

Out of 7 comparable projects, five projects enjoy significantly better economical benchmarks: Baishuihe, Shazui, Fuliutan and Niujiaowan Third Level Hydropower Stations, have an utilization time of 6,633, 6,374, 5,733 and 6,127 hours respectively, compared to 5,246 hours of the proposed project. Furthermore, Baishuihe and Fuliutan Hydropower Stations receive electricity prices of 0.288 RMB/kWh and 0.322

[30] http://www.cscb.com.cn/html/qyjs/zzjg.htm, http://www.54yjs.cn/html/mingqixiaoyuanzhaopin/chengdu/20071211/19222.html, http://www.scjlsd.com/commpanyt.asp
[31] http://info.tibet.cn/news/szxw/t20050303_12728.htm
[32] http://www.southcn.com/finance/zhengquan/yanjiu/200309090831.htm and http://www.chinarein.com/qkhc/detail.asp?id=781
[33] http://www.southcn.com/finance/zhengquan/yanjiu/200309090831.htm
[34] http://money.finance.sina.com.cn/corp/go.php/vCI_CorpInfo/stockid/600505.phtml
[35] http://www.xichang.tv/BZNews/read.php?recid=1008
[36] http://www.scpi.gov.cn/zcfg/zcfg-content.asp?id=1057
[37] Yearbook of China Water Resources 2006, p.576
[38] According to http://www.gzz.gov.cn/hongchang/ the annual utilization time is 6,374 h and the total investment of this project is 163,000,000 RMB.
[39] http://cdm.unfccc.int/Projects/Validation/DB/1APPA7AKNAWZCSJFXK8I36RESQK07O/view.html. In the PDD under validation it is explained that: "The project consisting of Zhongzui Hydropower Station […], Changshiba Hydropower Station […], Foshan Hydropower Station […], Xiaoniujing Hydropower Station […] and Masangping Hydropower Station […] is constructed and operated by Sichuan Dachuan Power Generation Co., Ltd."

RMB/kWh respectively, which is much more attractive than the 0.207 RMB/kWh for the proposed project. In combination with the higher utilization rate, this makes it very likely that Baishuihe and Fuliutan Hydropower Stations enjoy significantly better conditions than the proposed project. Shazui Hydropower Project had a unit investment of only 4,289 RMB/kW compared to the unit investment of 4,608.27 RMB/kW of the proposed project. In combination with the much higher utilization rate, this makes it very likely that Shazui Hydropower Station enjoys significantly better conditions than the proposed project. Niujiaowan Third Level Hydropower Station had a unit investment of only 3,415 RMB/kWh, which is again much lower than the unit investment of the proposed project and together with the much higher utilization rate makes this project significantly more economically attractive. Tongkou Hydropower Station has a much higher IRR than the proposed project, 18% compared to 7.88%. This shows that Tongkou Hydropower Station did not face the same barriers as the proposed project. Wan'er Hydropower Station, on top of being a state owned project, received special financial support from Ganzi prefecture which ensured that the project could overcome a possible financial barrier and be completed smoothly because it is considered as a project of regional importance.

The one remaining similar project, Zhongzui Hydropower Station, faced the same or similar barriers as the proposed project and is now applying for CDM. Hence similar activities to the project activity, which face similar financial barriers due to low economic performance, are not judged to have already diffused in the relevant region without consideration of CDM. Therefore, the proposed project is not considered to represent a common practice and fulfills the criteria under step 4 of the additionality tool.

In today's China, it is uncommon to have privately financed, owned, constructed and operated small-scale[40] hydropower projects. The relatively long preparation time of hydropower projects and increasing site selection limitations make it much easier (and more attractive) to develop coal-fired plants in contemporary China. Coal based thermal power plants dominate the electricity generation matrix in China. According to the EIA Energy Outlook 2007[41], coal based power plants accounted for 79.7% of the net electricity generation in China in 2004 and the growth rate of thermal fossil fuel fired power plants (in terms of added installed capacity to the grid) surpassed the growth rate of renewable technologies in 2006 by far. This trend applies to China as a whole and is not likely to change in the future: Projections for the year 2030 predict that coal based electricity generation in China will grow from 79.7% in 2004 to 83.9% in 2030, despite higher annual growth rates for natural-gas-fired and nuclear power generation. The renewable share of total generation is expected to decline from 16.4% in 2004 to 8.3% in 2030 as the shares of fossil fuels and nuclear power grow more strongly.

Conclusion: The proposed project fulfills all criteria of the Tool for the Demonstration and Assessment of Additionality. It faces prohibitive financial barriers without CDM revenues. Therefore, the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As described under Section B.3, the CO_2 emissions from power plants connected to the Central China Power Grid represent the baseline emissions to the project activity. The baseline emissions are calculated as follows:

[40] Almanac of China's Water Power, Volume 10, Page 141: Projects with a capacity of 0.5MW~50MW are defined as small hydropower projects.
[41] EIA International Energy Outlook 2007 (www.eia.doe.gov/oiaf/ieo/index.html)

Baseline emissions

According to methodology ACM0002, baseline emissions are equal to the power delivered to the grid, multiplied by the baseline emission factor EF_y. The baseline emission factor is defined as the Combined Margin (CM): the equally weighted average of the Operating Margin (OM) emission factor ($EF_{OM,y}$) and the Build Margin (BM) emission factor ($EF_{BM,y}$).

The data used to calculate the grid emissions factor comes from reliable and publicly accessible statistics e.g. China Energy Statistic Yearbook and China Electric Power Yearbook, as well as Chinese DNA.

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

ACM0002 (Version 06) outlines four options for the calculation of the Operating Margin emission factor(s) ($EF_{OM,y}$):

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

As per ACM0002, "Dispatch Data Analysis" should be the first methodological choice. However, the method is not selected herein, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, the simple adjusted OM methodology cannot be used.

The Simple OM method has been chosen instead. This is possible because low cost/must run resources account for less than 50% of the power generation in the grid in most recent years. Specifically, from 2000 to 2004, according to gross annual power generation statistics for the Central China Power Grid, the ratio of power generated by hydro-power and other low cost/compulsory resources was: 38.00% in 2000, 36.76% in 2001, 35.95% in 2002, 34.43% in 2003, 38.37% in 2004 respectively, significantly lower than 50%.

The simple Operating Margin (OM) emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. A three-year average, based on the most recent fuel consumption statistics available at the time of PDD submission, is used ("ex-ante" approach).

The calculation equation of the Simple OM is as follows:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$ Equation (B.1)

Where:

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

j refers to the power sources delivering electricity to the grid, not including low-operating cost and mustrun power plants, and including imports to the grid,
$COEF_{i,j}$ is the CO_2 emission coefficient of fuel i (tCO_2e/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel(coal, oil and gas) in year(s) y; and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by relevant power sources j.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i$$ Equation (B.2)

Where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i, using country specific values;
$OXID_i$ is the oxidation factor of the fuel i, according to default values from 1996 Revised IPCC Guidelines for default values;
$EF_{CO_2,i}$ is the CO_2 emission factor per unit of energy of the fuel i, as per 1996 Revised IPCC Guidelines for default values.

According to Chinese Electricity Statistics, it is assumed that there is no net imported power to the Central China Power Grid in the calculations above.

The Operating Margin emission factors for 2002, 2003 and 2004 are calculated separately and then the three-year average is calculated as a full-generation-weighted average of the emission factors. For details please refer to Annex 3.

The result of the Operating Margin emission factor (EF_{OM}) for the Central China Power Grid is **1.2526 tCO_2e/MWh**. The operating margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period of the project activity. $EF_{OM,y}$ calculations adopt the most recent data announced by China's DNA in the *Notification on Determining the Regional Grid Emission Factors of China*, published on Dec. 15, 2006
(available at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls)

STEP 2 Calculate the Build Margin emission factor ($EF_{BM,y}$)

According to ACM0002, the Build Margin Emission Factor is calculated as the generation weighted average emission factor (measured in tCO_2e/MWh) of a sample of m power plants. The calculation equation is as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$ Equation (B.3)

Where
$F_{i,m,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power plants m in years y,
$COEF_{i,m}$ is the CO_2 emission coefficient of fuel i (tCO_2e/mass or volume unit of the fuel), taking into account the carbon content of the fuels (coal, oil and gas) used by relevant power plants m and the percent oxidation of the fuel in year(s) y; and
$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by power plants m.

The methodology provides the following two options:

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

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

Project participants have chosen Option 1.

The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. From these two options, project participants should use the sample group that comprises the larger annual generation.

However, in China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts[42] the following deviation in methodology application:

1) Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1 - 3 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.
2) Proportional weights that correlate to the distribution of installed capacity in place during the selected period above are applied, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency levels of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Since there is no way to separate the different generation technology capacities based on coal, oil or gas fuel etc from the generic term "thermal power" in the present energy statistics, the following calculation measures will be taken:

First, according to the energy statistics of the selected period in which approximately 20% capacity has been added to the grid, determine the ratio of CO_2 emissions produced by solid, liquid, and gas fuel

42 This is in accordance with the "Request for guidance: Application of AM0005 and AMS-I.D in China", a letter from DNV to the Executive Board, dated 07/10/2005, available online at:
http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM.
This approach has been applied by several registered CDM projects using methodology ACM0002 so far.

consumption for power generation; than multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency. Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

Sub-step 1
Calculate the proportion of CO_2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO_2 emissions from the total fossil fuelled electricity generation (sum of CO_2 emissions from coal, oil and gas).

$$\lambda_{Coal} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$ Equation (B.4)

$$\lambda_{Oil} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$ Equation (B.5)

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$ Equation (B.6)

Where,
$F_{i,m,y}$, is the amount of fuel i (in a mass or volume unit) consumed by power sources j in year(s) y,
$COEF_{i,j,m}$ is the CO_2 emission coefficient of fuel i (tCO_2e/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power plants m and the oxidation percentage of the fuel in year(s) y,
Coal, Oil and *Gas* stands for solid, liquid and gas fuels respectively.

Sub-step 2: Calculate the operating margin emission factor of fuel-based generation.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$$ Equation (B.7)

Where,
$EF_{Thermal}$ is the weighted emissions factor of thermal power generation with the efficiency level of the best commercially available technology in China in the previous three years.
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$ are the emission factors of coal, oil and gas-fired power generation with efficiency levels of the best commercially available technology in China in the previous three years.

A coal-fired power plant with a total installed capacity of 600MW is assumed to be the commercially available best practice technology in terms of efficiency. The estimated coal consumption of such a National Sub-critical Power Station with a capacity of 600MW is 336.66gce/kWh, which corresponds to an efficiency of 36.53% for electricity generation.

For gas and oil power plants a 200MW power plant with a specific fuel consumption of 268.13gce/kWh, which corresponds to an efficiency of 45.87% for electricity generation, is selected as commercially available best practice technology in terms of efficiency.

The main parameters used for calculation of the thermal power plant emission factors $EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$ are provided in Annex3.

Sub-step 3: Calculate the Build Margin emission factor

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

Where,

CAP_{Total} is the total capacity addition of the selected period in which approximately 20% capacity has been added to the grid,

$CAP_{Thermal}$ is the total thermal power capacity addition of the selected period in which approximately 20% capacity has been added to the grid.

As mentioned above, the build margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period. $EF_{BM,y}$ calculations adopt the most recent data announced by China's DNA in the *Notification on Determining the Regional Grid Emission Factors of China*, published on Dec. 15, 2006 (available at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1365.pdf).

The result of the Build Margin emission factor calculation is **0.6363 tCO_2e/MWh**.

The data sources for calculating OM and BM are:
1. Installed capacity, power generation and the rate of internal electricity consumption of thermal power plants for the years 2000 to 2004

Source: *China Electric Power Yearbook* (2001-2005)

2. Fuel consumption and the net caloric value of thermal power plants the years 2000 to 2004

Source: *China Energy Statistics Yearbook* (figures are for 2001-2005)

3. Carbon emission factor and carbon oxidation factor of each fuel
4. Source: *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*, Table 1-2 of Page 1.6 and Table 1-4 of Page 1.8 in Chapter one.

STEP 3 Calculate the Electricity Baseline Emission Factor (EF_y)

The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the Operating Margin and Build Margin.

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$ Equation (B.9)

The Operating Margin emission factor (EF_{OM}) of Central China Power Grid is 1.2526 tCO_2e/MWh and the Build Margin emission factor (EF_{BM}) is 0.6363 tCO_2e/MWh,. The defaults weights for hydroelectric power projects are used as specified in ACM0002 (Version 06).

$w_{OM} = 0.5$; $w_{BM} = 0.5$

The result of the Combined Margin Baseline Emission Factor calculation is **0.94445 tCO_2e/MWh**.

Emission Reductions (ER_y)

The project activity reduces carbon dioxide emissions through displacement of grid electricity generation based on fossil fuel fired power plants by renewable electricity. The emission reduction ER_y achieved by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y):

$$ER_y = BE_y - PE_y - L_y$$ Equation (B.10)

where the baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh), calculated under Step 3 above, times the electricity exported to the grid by the project activity (EG_y in MWh):

$$BE_y = EG_y \times EF_y$$ Equation (B.11)

The project activity is a run-of-river hydropower project and, according to ACM0002, greenhouse gas emissions from such project activities are considered to be zero.

Hence: $PE_y = 0$.

According to ACM0002, no leakage calculation is required for the proposed project activity.

Hence: $L_y = 0$.

Therefore, the emission reductions are equal to the baseline emissions, namely:

$$ER_y = BE_y = EG_y \times EF_y$$ Equation (B.12)

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

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity delivered to the grid by relevant power sources j in (years) y (2000-2004, including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan)
Source of data used:	*China Electric Power Yearbook 2001-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source
Any comment:	To calculate the OM and BM

Data / Parameter:	*Electricity Imports to Central China Power Grid*
Data unit:	MWh
Description:	The Power Transmitted from other regional grids to the Central China Power Grid in (years) y (2003-2005)
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	Electricity imports to Central China Power Grid are assumed to be zero.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source
Any comment:	To calculate the OM

Data / Parameter:	$F_{i,j,y}$
Data unit:	10^4t/10^8m^3
Description:	Amount of fuel *i* consumed by relevant power sources *j* in (years) y (2002-2004, including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan)
Source of data used:	*China Energy Statistics Yearbook 2000-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source
Any comment:	To calculate OM and BM

Data / Parameter:	NCV_i
Data unit:	TJ/10^3 t
Description:	Net calorific value per mass or volume unit of fuel i
Source of data used:	*China Energy Statistics Yearbook 2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source

Any comment:	To calculate OM and BM

Data / Parameter:	$EF_{CO_2,i}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per energy unit of fuel i
Source of data used:	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	To calculate OM and BM

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of fuel i
Source of data used:	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	To calculate OM and BM

Data / Parameter:	*Efficiency level of best technology commercially available in China for coal-fired power generation*
Data unit:	%
Description:	Efficiency level of best technology commercially available in China for coal-fired power generation
Source of data used:	*China DNA: Bulletin on Baseline Emission Factors of the China's Regional Grids-the calculation of baseline Build Margin emission factor for the China's Regional Grids*
Value applied:	36.53%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source
Any comment:	To calculate BM

Data / Parameter:	*Efficiency level of best technology commercially available in China for oil and gas-fired power generation*
Data unit:	%
Description:	Efficiency level of best technology commercially available in China for oil and gas-fired power generation
Source of data used:	*China DNA: Bulletin on Baseline Emission Factors of the China's Regional Grids -the calculation of baseline Build Margin emission factor for the*

	China's Regional Grids
Value applied:	45.87%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source
Any comment:	To calculate BM

Data / Parameter:	$CAP_{y,i}$
Data unit:	MW
Description:	The installed capacity of power generation sources j in (years) y (2000-2004, including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan)
Source of data used:	*China Electric Power Yearbook 2001-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Officially released statistics; publicly accessible and reliable data source
Any comment:	To calculate BM

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

According to B.6.1, the Combined Margin baseline emission factor of the Central China Power Grid is 0.94445 tCO_2e/MWh throughout the first crediting period of the project. The expected net amount of electricity generation by the project to be exported to the Central China Power Grid is 125,526 MWh per year.

The average annual emission reductions to be achieved by the project activity throughout the first crediting period are equal to the baseline emissions of the project, which amount to 118,553 tCO_2e/yr.

$ER_y = BE_y = EG_y \times EF_y = 118{,}553\ tCO_2e$

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

The total emission reductions of the project are 829,871 tCO_2e during the first 7 year crediting period.

Table B.17 Estimate of Emission Reductions Due to the Project

Years	Estimation of project activity emissions (tCO_2e)	Estimation of baseline Emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
Year 1: 01/10/2008 – 30/09/2009	0	118,553	0	118,553
Year 2: 01/10/2009 – 30/09/2010	0	118,553	0	118,553
Year 3: 01/10/2010 – 30/09/2011	0	118,553	0	118,553
Year 4: 01/10/2011 – 30/09/2012	0	118,553	0	118,553
Year 5: 01/10/2012 – 30/09/2013	0	118,553	0	118,553

Year 6: 01/10/2013 – 30/09/2014	0	118,553	0	118,553
Year 7: 01/10/2014 – 30/09/2015	0	118,553	0	118,553
Total (tCO_2e)	0	829,871	0	829,871

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

B.7.1. Data and parameters monitored:

According to ACM0002, using a fixed ex-ante approach to determine the Combined Margin baseline emission factor, the only parameter to be monitored throughout the crediting period of the project activity is the net amount of electricity exported to the grid.

Table B.18 Data and parameters monitored (EG_y)

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net amount of electricity exported to the grid
Source of data to be used:	Measured by meter
Value of data:	The expected net amount of electricity to be exported to the grid by the project is 125,526 MWh per year
Description of measurement methods and procedures to be applied:	Measured continuously and recorded on a monthly basis
QA/QC procedures to be applied:	▪ Exported electricity to the grid is measured by kilowatt meters, which are controlled by both the hydropower plant operator (backup meters) and by the power grid company (main meter) ▪ Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter ▪ Meters will be calibrated periodically according to relevant national standards ▪ Data measured by meters will be crosschecked by electricity sales receipts. In sales receipts, incomes not deriving from electricity production but declared as electricity supplied to grid because of limitations of accounting system shall be identified and subtracted. If differences still occur, the more conservative amount shall be used.
Any comment:	▪ Only the net electricity export to the grid shall be taken into account. This means that the monitoring measurement method shall exclude electricity imported from the grid by the project activity and possible transmission losses. ▪ Calibration of the main meter (owned by the grid company) and the backup meter (owned by the project developer) will be done by a qualified party every year. In case of questionable readings or calibration reports from the main meter, readings from the backup meter (owned and managed by the project developer) shall be used. ▪ Further details are provided in section B.7.2.

B.7.2. Description of the monitoring plan:

The objective of the monitoring plan is to insure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period of the project activity. The project owner will be responsible for the implementation of the monitoring plan, and the Grid Company will cooperate with the project entity.

1. Monitoring Objective

The only parameter to be monitored is the net amount of electricity supplied to the grid since the baseline emission factor is fixed by ex-ante calculations.

2. Monitoring Organization

The project owner will appoint a monitoring officer, who will supervise and verify metering and recording, collection of data (e.g. sales / billing receipts), calculation of emission reductions and development of monitoring report. The plant manager will be in charge of direct electricity measurement.

The monitoring officer will receive support from Beijing Tianqing Power International CDM Consulting, Co., Ltd., Ltd in his/her responsibilities through the following actions:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and data archiving;
- Provide the monitoring officer with a calculation template in electronic form for calculation of annual emission reductions;
- Continuous advice to the monitoring officer as required;
- Review of monitoring reports.

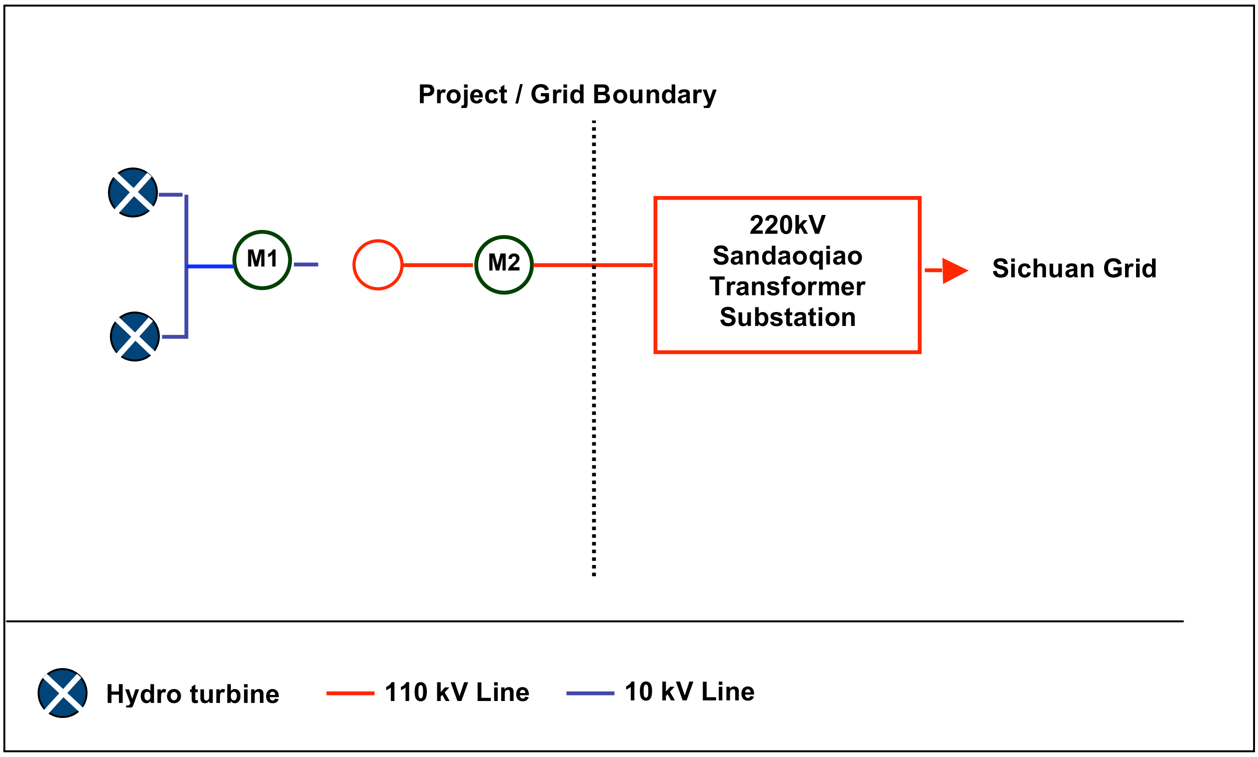
3. Monitoring Equipment and Program

According to the Chinese national standard "*Technical Management Code for Electricity Metering" (DL/T448-2000),* the electricity metering equipment will be properly configured and the metering equipment will be checked by both the project owner and the grid company before the project is in operation.

The power generated will be transmitted to Sichuan Grid via 220kV Sandaoqiao Transformer substation, and finally to the Central China Power Grid. (This scheme is an estimated one. The scheme of the power transmission to the grid will implement according to the approval from the grid company).

Two meters (double measured, accuracy is 0.2S) shall be used, i.e. one main meter and one backup meter. The main meter is used to measure power supplied to the Sichuan Grid as well as electricity imports supplied by the grid to the project plant. When readings from the main meter are questionable (due to abnormal circumstances) or not possible (due to meter failure or meter reparation), the project owner shall employ the data monitored by the backup meter.

The disposition of electricity meters at the project site is illustrated as follows:



4. Data Collection:

The project owner and the Grid Company are responsible for operation monitoring of the electricity meters and guarantee that the measuring equipments are in good operation and completely sealed.

The electricity recorded by the main meter alone will suffice for the purpose of billing and emission reduction verification, as long as the main meter error is within the permissible tolerance. The main monitoring process is as follows:

- i The project owner and Grid Company read and check the backup meters and the main meter and record the data at 24:00 on the last day of every month;
- ii The project owner sells the electricity to the Grid Company;
- iii The project owner provides an electricity sales invoice to the Grid Company. A copy of the invoice is stored by the project owner, together with a record of the payment by the grid company;
- iv The Grid Company provides an electricity receipt confirmation to the project owner and the confirmation is stored by the project owner;
- v The project owner records the net electricity supplied to the grid electronically;
- vi The project owner keeps the records of the main meter's data readings for verification by the DOE.

If inaccuracy of the reading data from the main meters exceed the allowable tolerance, when the meters operate abnormally during a month or any other unexpected problems occur, the net amount of electricity exported to the grid shall be determined by:

- i Using readings from the backup meter (taking potential transmission losses into consideration)t, unless a test by either party reveals it is inaccurate;
- ii If the backup system is not within acceptable limits of accuracy or performed improperly, the proposed project owner and the Grid Company shall, based on mutual agreement, determine the

amount of supplied electricity to the grid during the period of the occurred distortion or malfunction of backup meter by means of referring to voltage and current data in accordance with relevant rules; and

iii If the proposed project owner and the Grid Company fail to reach an agreement concerning the amount of supplied electricity to the grid during the period of the occurred distortion or malfunction of backup meter, then the matter will be submitted for arbitration according to agreed procedures.

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

5. Calibration

The verification of electric energy meter should be annually carried out according to relevant National electric industry standards or regulations. After verification, meters should be sealed. Both meters shall be jointly inspected and sealed on behalf of the project owner and Grid Company and shall not be accessible by either party except in the presence of the other party or its accredited representatives.

All the meters installed shall be tested by the qualified metrical organization co-authorized by the project owner and the Grid Company within 10 days after:

i The detection of a difference larger than the allowable tolerance in the readings of the main meter and/or the backup meter;

ii Repair to the faulty meter caused by improper operation.

6. Data Management

Data will be archived at the end of each month using electronic spreadsheets. The electronic files will be stored on hard disk and CD-ROM. In addition, a hard copy printout will be archived.

In addition, the project owner will collect sales receipts for the power delivered to the grid as a cross-check. At the end of each crediting year, a monitoring report will be compiled detailing the metering results and evidence (i.e. sales receipts).

Physical documentation will be collected and stored by the project owner in a central place, together with the monitoring plan. In order to facilitate the auditor's reference, monitoring results will be indexed. All data records will be kept for a period of 2 years following the end of the crediting period.

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)

Date of completion: 21/06/2008
Names of persons determining the baseline:

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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:

Start of construction: 07/06/2006

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

The expected operational lifetime of the project activity is 30 years.

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

C.2.1. Renewable crediting period

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

01/10/2008 or after the date of registration

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

Not applicable

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Environmental impacts

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

According to the relevant environmental law and regulations, an Environmental Impact Assessment (EIA) had been carried out, and the Environmental Impact Assessment Report has been approved by the Environment Protection Bureau of Ganzi Tibetan Autonomous Prefecture on October 24, 2007. The main assessment conclusions are provided below:

1. Impact on Land Utilization and Migration

There is no migration occuring within the permanently occupied land of 5.03ha, and temporarily occupied land of 3ha. The permanently used land will be compensated according to the national and local standards.

2. Air Impact

Pollution will mainly occur during the construction period. The sources and the corresponding mitigation measures include:

1) The gas emissions from the equipments using coal or oil include CO, NO_2 and SO_2. Equipment should employ electricity as the mechanism energy where possible and vehicle shall be arranged reasonably, in order to reduce the emission of pollutants.
2) Vehicles will produce transport dust, helix transporters and airproofed pipes can be used to control the dust effectively.
3) The detonations, stone exploitation and cement mixer system in the construction will produce dust pollution, a barrier for construction in closure should be applied.

3. Impact on Aquatic Environment

Pollution will occur during both construction period and operation period, the sources and the measures include:

1) The construction wastewater will include the wastewater coming from cement mixer and foundation pit, of which the main pollutants are sands. The former will be taken as construction grey water after sedimentation treatment and the latter can be ejected to the cofferdam downriver after quiescence and first precipitation.
2) The pollutants of the municipal water are mainly BOD_5, COD, suspensions, NH4 and so on, it will be treated by septic tanks and whole set wastewater treatment equipment.
3) A minimal environmental flow of 0.544 m^3/s must be ensured.

4. Noise Impact

Noise will mainly come from the construction, including the stone machining system, cement mixer system, detonation and transport vehicles. The measures such as sound insulation, forbidding detonations in the evenings, forbidding surcharge, high speed and whistles of vehicles can be employed to reduce the noise impact.

5. Impact of Solid Waste

During the construction period, the project will produce discard slag in large quantities – about 31,470,000m^3 – which will be piled up on six designated waste disposal sites, and the waste disposal site

will be recovered and greened for protection.

6. Impact on Soil and Water Loss

Impacts will appear mostly in digging for main construction and discarding slag. In order to reduce the negative impacts, following measures will be taken: restraining construction activity to within the dedicated area, employing engineering or planting measures in the area of main construction, and carrying away all waste slag and cleaning up the construction site and recover the original vegetation when the construction is over.

7. Impact on Ecosystem

The project will cause a little negative impact on the local animal and plant system. Since human activities are frequent in the flooding area and allocating area, there is little habitat for rare animal and plant species in the dam area and construction area, thus there is no danger of extinction for rare animals. The project owner will keep the minimum environmental flow of 0.544 m3/s.

8. Transboundary impacts

Xiasuozigou River is a small county river and located within Kangding County, the project is a run-of-river hydropower station with the water dispatched back to the same river, therefore, according to the Environmental Impact Assessment there is no transboundary impact coming from the project.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The project participants and the host party involved consider negative environmental impacts of the project to be marginal. Comparing the environmental impacts and the mitigation measures mentioned above to the contribution of the project towards sustainable development on a regional and national level, the project will have an overall positive impact on the local and global environment.

SECTION E. Stakeholders' comments

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

A stakeholder consultation meeting for the parties interested in the project was organized from 9:00-12:00 November 9, 2006 in Kangding County, Sichuan Province to collect opinions of all the potential stakeholders, such as local residents, aiming at gathering inputs and advices on the influence imposed on the local society, economy, daily life etc. for the project.

Potential stakeholders have been informed about the stakeholder meeting through bulletins in the newspaper *Ganzi Daily* on November 9, 2006, and via the website of www.tqcdmchina.com. In the bulletin, the company invited the potential stakeholders to get to know detailed information about the hydropower station. Furthermore, during the meeting, the project owner and the consultant invited the participants to express their comments and concerns about the project and CDM. The main questions discussed during the meeting were:

1. Will the construction of the power station result in more benefits or losses for the stakeholders?
2. Are there any situations where there is a lack of electricity? What type of energy source is used for daily life? How will the power station have an influence?
3. What type of negative influence will the station bring to the local residents?
4. Will the construction of a hydro power station influence noise and drinking water pollution? How far is it from the nearest local residents?
5. Will the construction of the station influence the living environment for animals, fish and plants? If yes, how much?
6. Will there be migration as a result of this project?
7. What is the land used for before the construction of the power station? And is there some tilled land used for the plant construction? If it is, is the compensation in compliance with the national policy?
8. What is the main source of income of local residents? Will the project have an impact on local residents' income situation?
9. What impact will the project have on the ecosystem?
10. Do you understand CDM? And what is your attitude toward the development of CDM? Do you oppose or support it?
11. Do you agree with the construction of this power station?

E.2. Summary of the comments received:

Some residents who may be impacted by the project were interviewed and 30 investigation questionnaires returned to the project owner. The interviewed people were all villagers, of which 36.7% were women, 100% have graduated from junior high school or lower, 100% were older than twenty years. The questionaire results are the following:

- 100% of the investigated residents use coal or gas for warming and cooking.
- 90% of the investigated residents think that the hydropower station will bring benefits to their live.
- 100% of the investigated residents think that the hydropower station will not cause negative impacts to the environment.
- 100% of the investigated residents agree with the construction of the project.

From the questionnaires and from the stakeholders' meeting, we find that the residents as well as the local government agree with the construction of the project. All stakeholders think that hydroelectric power is a renewable energy which will not cause negative impacts on the environment. There are few residents living around the project site, and the station is away from the residential areas, so the project will cause only a few negative impacts on local residents. All stakeholders think that although the project will occupy some infield, the owner will supply corresponding compensation. Furthermore, the project will improve the transportation infrastructure for local residents. The project will also help to increase the local employment opportunities by employing local people. The impact of this project is generally positive, therefore, all stakeholders were pleased with the development of the project and support the construction of the station.

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

Given the generally positive (or neutral) nature of the comments received, no action has been taken to address the comments received.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I countries used in the project activity.

Annex 3

BASELINE INFORMATION

Table2. Calculation of the Thermal Power supplied to CCPG in 2002

Province	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan
Thermal power Generation (MWh)	18,648,000	84,734,000	34,301,000	20,058,000	14,727,000	27,879,000
Rate of Electricity Consumption of Power Plant (%)	7.67	8.03	7.73	7.73	10.21	9.59
Thermal power Supplied to the Grid (MWh)	17,217,698.4	77,929,859.8	31,649,532.7	18,507,516.6	13,223,373.3	25,205,403.9
Total Thermal Power Supplied to CCPG (MWh)	183,733,384.7					

Data source: 2003 China Electric Power Yearbook.

Table3. Calculation of the Thermal Power supplied to CCPG in 2003

Province	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan
Thermal Power Generation (MWh)	27,165,000	95,518,000	39,532,000	29,501,000	16,341,000	32,782,000
Rate of Electricity Consumption of Power Plant (%)	6.43	7.68	3.81	4.58	8.97	4.41
Thermal Power Supplied to the Grid (MWh)	25,418,290.5	88,182,217.6	38,025,830.8	28,149,854.2	14,875,212.3	31,336,313.8
Total Thermal Power Supplied to CCPG (MWh)	225,987,719.2					

Data source: 2004 China Electric Power Yearbook.

Table4. Calculation of the Thermal Power supplied to CCPG in 2004

Province	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan
Thermal power Generation (MWh)	30,127,000	109,352,000	43,034,000	37,186,000	16,520,000	34,627,000
Rate of Electricity Consumption of Power Plant (%)	7.04	8.19	6.58	7.47	11.06	9.41
Thermal Power Supplied to the Grid (MWh)	28,006,059.2	100,396,071.2	40,202,362.8	34,408,205.8	14,692,888.0	31,368,599.3
Total Thermal Power Supplied to CCPG (MWh)	249,074,186.3					

Data Source: 2005 China Electric Power Yearbook.

Table 5. Energy Consumption Statistics of Power Generation of CCPG in 2002

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	The CCPG G=A+B+C+D+E+F
Raw coal	Ten thousand Tons	1,062.63	4,679.02	1,710.00	1,113.78	398.57	1,964.32	10,928.32
Clean coal	Ten thousand Tons	2.72	0.00	0.00	0.00	0.00	0.00	2.72
Other washed coal	Ten thousand Tons	3.66	26.49	0.00	0.00	249.99	0.00	280.14
Coke	Ten thousand Tons	0.00	1.15	0.00	0.00	0.00	0.00	1.15
Coke oven gas	10^8 Cubic meter	0.00	0.00	1.11	0.00	0.00	0.00	1.11
Other gas	10^8 Cubic meter	0.00	2.16	0.00	0.00	0.00	0.00	2.16
Crude oil	Ten thousand Tons	0.00	0.67	1.17	0.00	0.00	0.81	2.65
Diesel oil	Ten thousand Tons	1.00	1.34	1.08	2.19	0.51	0.51	6.63
Fuel oil	Ten thousand Tons	0.33	0.16	0.34	0.69	0.00	1.51	3.03
LPG	Ten thousand Tons	0.00	0.02	0.00	0.00	0.00	0.00	0.02
Refinery gas	Ten thousand Tons	0.49	0.00	0.00	1.90	0.00	0.00	2.39
Natural gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	0.00	1.75	1.75
Other petroleum products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Energy	Ten thousand Tce	0.00	3.38	0.00	0.00	0.00	0.00	3.38

Data Source: China Energy Statistical Yearbook 2000-2002.

Table 6. Energy Consumption Statistics of Power Generation of CCPG in 2003

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	The CCPG G=A+B+C+D+E+F
Raw coal	Ten thousand Tons	1,427.41	5,504.94	2,072.44	1,646.47	769.47	2,430.93	13,851.66
Clean coal	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other washed coal	Ten thousand Tons	2.03	39.63	0.00	0.00	106.12	0.00	147.78
Coke	Ten thousand Tons	0.00	0.00	0.00	1.22	0.00	0.00	1.22
Coke oven gas	10^8 Cubic meter	0.00	0.00	0.93	0.00	0.00	0.00	0.93
Other gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crude oil	Ten thousand Tons	0.00	0.5	0.24	0.00	0.00	1.20	1.94
Diesel oil	Ten thousand Tons	0.52	2.54	0.69	1.21	0.77	0.00	5.73
Fuel oil	Ten thousand Tons	0.42	0.25	2.17	0.54	0.28	1.20	4.86
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refinery gas	Ten thousand Tons	1.76	6.53	0.00	0.66	0.00	0.00	8.95
Natural gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	0.04	2.2	2.24
Other petroleum products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Energy	Ten thousand Tce	0.00	11.04	0.00	0.00	16.2	0.00	27.24

Data Source: China Energy Statistical Yearbook 2004.

Table 7. Energy Consumption Statistics of Power Generation of CCPG in 2004

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	CCPG G=A+B+C+D+E+F
Raw coal	Ten thousand Tons	1,863.80	6,948.50	2,510.50	2,197.90	875.50	2,747.90	17,144.10
Clean coal	Ten thousand Tons	0.00	2.34	0.00	0.00	0.00	0.00	2.34
Other washed coal	Ten thousand Tons	48.93	104.22	0.00	0.00	89.72	0.00	242.87
Coke	Ten thousand Tons	0.00	109.61	0.00	0.00	0.00	0.00	109.61
Coke oven gas	10^8 Cubic meter	0.00	0.00	1.68	0.00	0.34	0.00	2.02
Other gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	2.61	0.00	2.61
Crude oil	Ten thousand Tons	0.00	0.86	0.22	0.00	0.00	0.00	1.08
Gasoline	Ten thousand Tons	0.00	0.06	0.00	0.00	0.01	0.00	0.07
Diesel oil	Ten thousand Tons	0.02	3.86	1.7	1.72	1.14	0.00	8.44
Fuel oil	Ten thousand Tons	1.09	0.19	9.55	1.38	0.48	1.68	14.37
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refinery gas	Ten thousand Tons	3.52	2.27	0.00	0.00	0.00	0.00	5.79
Natural gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	0.00	2.27	2.27
Other petroleum products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Energy	Ten thousand Tce	0.00	16.92	0.00	15.2	20.95	0.00	53.07

Data Source: China Energy Statistical Yearbook 2005.

Table 8. The Operation Margin Emission Factor Calculation of CCPG in 2002

Fuel	Unit	Fuel Consumption of the CCPG in 2002 G	Emission Factor H（tc/TJ）	Oxidation Rate I (%)	Average NCV J (MJ/t,km^3)	CO_2 Emission(tCO_2e) K=G*H*I*J*44/12/10000 (for quality unit) K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	Ten thousand Tons	10,928.32	25.8	98.0	20,908	211,827,873.70
Clean coal	Ten thousand Tons	2.72	25.8	98.0	26,344	66,430.55
Other washed coal	Ten thousand Tons	280.14	25.8	98.0	8,363	2,171,973.06
Coke	Ten thousand Tons	1.15	29.5	98.0	28,435	34,663.36
Coke oven gas	10^8 Cubic meter	1.11	13.0	99.5	16,726	88,054.786
Other gas	10^8 Cubic meter	2.16	13.0	99.5	5,227	53,548.11
Crude oil	Ten thousand Tons	2.65	20.0	99.0	41,816	80,449.80
Diesel oil	Ten thousand Tons	6.63	20.2	99.0	42,652	207,353.29
Fuel oil	Ten thousand Tons	3.03	21.1	99.0	41,816	97,045.23
LPG	Ten thousand Tons	0.02	17.2	99.5	50,179	629.76
Refinery gas	Ten thousand Tons	2.39	18.2	99.5	46,055	73087.08
Natural gas	10^8 Cubic meter	1.75	15.3	99.5	38,931	380294.07
Other petroleum products	Ten thousand Tons	0.00	20.0	99.0	38,369	0.00
Other coking products	Ten thousand Tons	0.00	25.8	98.0	28,435	0.00
Other Energy	Ten thousand Tce	3.38	0.0	0.0	0.0	0.00
Total Emission (Q)		215,081,402.80tCO_2e				
Thermal Power supplied to CCPG (P)		183,733,384.70MWh				
OM Emission Factor in 2002 [＝Q/P]		1.17062tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2000-2001; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook: p. 1.8;,p. 1.6.

Table 9. The Operation Margin Emission Factor Calculation of CCPG in 2003

Fuel	Unit	Fuel Consumption of The CCPG in 2003 G	Emission Factor H（tc/TJ）	Oxidation Rate I (%)	Average NCV J (MJ/t,km^3)	CO_2 Emission(tCO_2e) K=G*H*I*J*44/12/10000 (for quality unit) K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	Ten thousand Tons	13,851.66	25.8	98.0	20,908	268,492,109.10
Clean coal	Ten thousand Tons	0.00	25.8	98.0	263,44	0.00
Other washed coal	Ten thousand Tons	147.78	25.8	98.0	8,363	1,145,763.47
Coke	Ten thousand Tons	1.22	29.5	98.0	28,435	36,773.30
Coke oven gas	10^8 Cubic meter	0.93	13.0	99.5	16,726	73,775.63
Other gas	10^8 Cubic meter	0.00	13.0	99.5	5,227	0.00
Crude oil	Ten thousand Tons	1.94	20.0	99.0	41,816	58,895.33
Diesel oil	Ten thousand Tons	5.73	20.2	99.0	42,652	179,205.78
Fuel oil	Ten thousand Tons	4.86	21.1	99.0	41,816	155,656.71
LPG	Ten thousand Tons	0.00	17.2	99.5	50,179	0.00
Refinery gas	Ten thousand Tons	8.95	18.2	99.5	46,055	273,694.28
Natural gas	10^8 Cubic meter	2.24	15.3	99.5	38,931	486,776.41
Other petroleum products	Ten thousand Tons	0.00	20.0	99.0	38,369	0.00
Other coking products	Ten thousand Tons	0.00	25.8	98.0	28,435	0.00
Other Energy	Ten thousand Tce	27.24	0.0	0.0	0	0.00
Total Emission (Q)		270,902,650.00tCO_2e				
Thermal Power supplied to CCPG (P)		225,987,719.20MWh				
OM Emission Factor in 2003 [＝Q/P]		1.19875tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2004; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook: p. 1.8;,p. 1.6.

Table 10. The Operation Margin Emission Factor Calculation of CCPG in 2004

Fuel	Unit	Fuel Consumption of the CCPG in 2003 G	Emission Factor H（tc/TJ）	Oxidation Rate I (%)	Average NCV J (MJ/t,km^3)	CO_2 Emission(tCO_2e) K=G*H*I*J*44/12/10000 (for quality unit) K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	Ten thousand Tons	17,144.10	25.8	98.0	20,908	332,310,753.20
Clean coal	Ten thousand Tons	2.34	25.8	98.0	26,344	57,149.81
Other washed coal	Ten thousand Tons	242.87	25.8	98.0	8,363	1,883,012.41
Coke	Ten thousand Tons	109.61	29.5	98.0	28,435	3,303,869.86
Coke oven gas	10^8 Cubic meter	2.02	13.0	99.5	16,726	160,243.83
Other gas	10^8 Cubic meter	2.61	13.0	99.5	5,227	64,703.96
Crude oil	Ten thousand Tons	1.08	20.0	99.0	41,816	32,787.09
Gasoline	Ten thousand Tons	0.07	18.9	99.0	43,070	2,068.43
Diesel oil	Ten thousand Tons	8.44	20.2	99.0	42,652	263,961.05
Fuel oil	Ten thousand Tons	14.37	21.1	99.0	41,816	460,244.21
LPG	Ten thousand Tons	0.00	17.2	99.5	50,179	0.00
Refinery gas	Ten thousand Tons	5.79	18.2	99.5	46,055	177,060.32
Natural gas	10^8 Cubic meter	2.27	15.3	99.5	38,931	493,295.73
Other petroleum products	Ten thousand Tons	0.00	20.0	99.0	38,369	0.00
Other coking products	Ten thousand Tons	0.00	25.8	98.0	28,435	0.00
Other Energy	Ten thousand Tce	53.07	0.0	0.0	0	0.00
Total Emission (Q)		339,209,149.90tCO_2e				
Thermal Power supplied to CCPG (P)		249,074,186.30MWh				
OM Emission Factor in 2004 [＝Q/P]		1.36188tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2005; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook: p. 1.8;,p. 1.6.

According to electricity supplied to the grid of fire power, the OM of latest three years should be weighted average, so the weighted average OM is:

$$EF_{OM,y} = \frac{(1.170266 \times 183{,}733{,}384.70 + 1.19875 \times 225{,}987{,}719.20 + 1.36188 \times 249{,}074{,}186.30)}{(183{,}733{,}384.70 + 225{,}987{,}719.20 + 249{,}074{,}186.30)} = 1.2526 tCO_2e / MWh$$

Table11. Calculation of CO_2 Emission of Solid, Liquid and Gas Fuel for Power Generation in 2004

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total G=A+B+C +D+E+F	NCV kJ/kg kJ/m^3 H	Emission Factor I	Oxidation Rate J	CO_2 emission (tCO_2e)	λ_{Coal}, λ_{Oil} λ_{Gas}
Raw coal	10^4 Tons	1,863.80	6,948.50	2,510.50	2,197.9	875.50	2,747.90	17,144.10	20,908	25.80	0.980	332,310,753	-
Clean coal	10^4 Tons	0.00	2.34	0.00	0.00	0.00	0.00	2.34	26,344	25.80	0.980	57,150	-
Other washed coal	10^4 Tons	48.93	104.22	0.00	0.00	89.72	0.00	242.87	8,363	25.80	0.980	1,883,012	-
Coke	10^4 Tons	0	109.61	0.00	0.00	0.00	0.00	109.61	28,435	29.50	0.980	3,303,870	
Subtotal	-	-	-	-	-	-	-	-	-	-	-	337,554,785	99.51%
Crude oil	10^4 Tons	0.00	0.86	0.22	0.00	0.00	0.00	1.08	41,816	20.00	0.990	32,787	-
Gasoline	10^4 Tons	0.00	0.06	0	0.00	0.01	0	0.07	43,070	18.90	0.990	2,068	-
Coal oil	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43,070	19.60	0.990	0	-
Diesel oil	10^4 Tons	0.02	3.86	1.70	1.72	1.14	0	8.44	42,652	20.20	0.990	263,961	-
Fuel oil	10^4 Tons	1.09	0.19	9.55	1.38	0.48	1.68	14.37	41,816	21.10	0.990	460,244	-
Other petroleum products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,369	20.00	0.990	0	-
Subtotal	-	-	-	-	-	-	-	-	-	-	-	759,060	0.22%
Natural gas	10^7 m^3	0.00	0.00	0.00	0.00	0.00	22.7	22.70	38,931	15.30	0.995	493,296	-
Coke oven gas	10^7 m^3	0.00	0.00	16.8	0.00	3.40	0.00	20.20	16,726	13.00	0.995	160,244	-
Other gas	10^7 m^3	0.00	0.00	0.00	0.00	26.10	0.00	26.10	5,227	13.00	0.995	64,704	-
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,179	17.20	0.995	0	-
Refinery gas	10^4 Tons	3.52	2.27	0.00	0.00	0.00	0.00	5.79	46,055	18.20	0.995	177,060	-
Subtotal	-	-	-	-	-	-	-	-	-	-	-	895,304	0.27%
Total	-	-	-	-	-	-	-	-	-	-	-	339,209,149	100%

Table12. Calculating of Emission Factor for Various Power Plant

	Variable	Power Supply Efficiency L	Emission Factor for Fuels (tc/TJ) I	Oxidation Rate J	Emission Factor (tCO_2e/MWh) O=3.6/L/1000*I *J*44/12
Coal-fired Power Plant	$EF_{Coal,Adv}$	36.53%	25.8	0.980	0.9136
Gas-fired Power Plant	$EF_{Oil,Adv}$	45.87%	15.3	0.995	0.4381
Oil-fired Power Plant	$EF_{Gas,Adv}$	45.87%	21.1	0.990	0.6011

Therefore, the emission factor of thermal power is:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9116tCO_2e/MWh$$

Table13. Installed Capacity of CCPG in 2004

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	5,496.0	21,788.5	9,509.3	6,779.5	3,271.1	6,900.3	53,744.7
Hydro Power	MW	2,549.9	2,438.0	7,415.1	7,448.2	1,407.9	13,382.9	34,642.0
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and others	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	MW	8,045.9	24,226.5	16,924.4	14,227.8	4,679	20,283.2	88,386.8

Data Source: 2005 China Electric Power Yearbook.

Table14. Installed Capacity of CCPG in 2001

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	4,869.8	15,349.0	8,077.3	4,997.8	2,898.3	6,377.0	42,569.2
Hydro Power	MW	2,067.8	2,438.0	7,125.6	5,966.1	1,268.0	11,531.5	30,397.0
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and others	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	MW	6,937.6	17,787.0	15,202.9	10,963.8	4,166.3	17,908.5	72,966.1

Data Source: 2002 China Electric Power Yearbook.

Table15. Installed Capacity of CCPG in 2000

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	4,474.3	13,789.0	8,038.8	4,477.4	2,995.0	6,090.1	39,864.6
Hydro Power	MW	1,846.0	1,528.0	7,070.5	5,858.0	1,327.0	11,008.3	28,637.8
Nuclear Power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Power and others	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	MW	6,320.3	15,317.0	15,109.3	10,335.4	4,322	17,098.4	68,502.4

Data Source: 2001China Electric Power Yearbook.

Table16. The BM Calculation of CCPG

	Installed Capacity in 2000	Installed Capacity in 2001	Installed Capacity in 2004	Capacity Addition Of 2000-2004	Ratio of Capacity Addition
Thermal Power（MW）	39,864.6	42,569.2	53,744.7	13,880.1	69.80%
Hydro Power（MW）	28,637.8	30,397.0	34,642.0	6,004.2	30.20%
Nuclear Power（MW）	0.0	0.0	0.0	0.0	0.00%
Wind Power（MW）	0.0	0.0	0.0	0.0	0.00%
Total（MW）	68,502.4	72,966.2	88,386.7	19,884.3	100.00%
Percent of Installed Capacity in2004	77.50%	82.55%	100.00%	-	-

Therefore, the BM was calculated as $EF_{BM,y} = 0.9116 \times 69.80\% = 0.6363 tCO_2e/MWh$.

The baseline emission factor was calculated as the weighted average of the OM Emission Factor (1.2526 tCO_2e/MWh) and the BM Emission Factor（0.6363 tCO_2e/MWh）. The defaults weights for these projects are used as 0.5 respectively. We obtain a baseline emission factor of 0.94445 tCO_2e/MWh.

Annex 4

MONITORING INFORMATION

The monitoring plan will monitor the net power supplied to the grid, provided the relative information in section B7.2.