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: Guizhou Shuicheng Jinshizi Hydropower Station
Version Number: Version 0.3
Completion date of PDD: 16/07/2007

Version 0.1: First draft, submitted for host country approval
Version 0.2: Minor editorial changes, submitted for validation / global stakeholder comments
Version 0.3: Amendments in response to the validation audit
Version 0.4: Amendments in response to request for review

A.2. Description of the project activity:

Summary:

The proposed project activity involves the construction and operation of a diversion type hydropower station with daily regulating capacity in Shuicheng County of Liupanshui City, Guizhou Province, China by Shuicheng County Jinshizi Hydropower Development Co., Ltd. The total installed capacity is 20MW, the surface area of the reservoir at full water level is 0.95km^2, corresponding to a power density is 21.05W/m^2. On average, the project activity is expected to operate during 4,255 hours per years, which corresponds to an average annual power generation of 85,100MWh and a net electricity supply to the grid amounting to 76,513.41MWh. The generated power will be transmitted to the Liupanshui Grid, which connects to Guizhou Grid and finally to the South China Grid. The proposed project will dislocate 6 families with a total of 28 individuals. All dislocated residents will be compensated.

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, the project will carry environmental benefits for the country's air, soil and water sources. The project activity will displace the power 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 will promote 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 both the construction and the operation 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)	The Party involved wishes to be considered as project participant (Yes/No)
China (host)	Shuicheng County Jinshizi Hydropower Development Co., Ltd. (as the project owner)	No
Germany	RWE Power AG (as the CER buyer)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Peoples' Republic of China

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

Guizhou Province

A.4.1.3. City/Town/Community etc:

Shuicheng County, Liupanshui City

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

The project site is located on the middle reach of Sancha River in Bide Town, Shuicheng County, Liupanshui City, Guizhou Province, China. The dam site is on the exit of Shizikou gorge, 45km from Shuicheng County Seat and 60km from Liupanshui City. The exact location of the dam site is at the latitude of 26°35′48″N and the longitude of 105°05′36″E. Figure A.1 shows the location of the project.

Figure A.1: Map of Guizhou Province and the project location

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

Sectoral Scope: Scope Number 1, Energy industries (renewable -/ non-renewable sources)

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 construction of the power station mainly consists of a barrage, a diversion system, a power house, and a transformer station.

The proposed project is a diversion type hydropower station with daily regulating capacity, the installed capacity is 20MW. The normal water level of the reservoir is 1,440m above the sea level, the dead water level is 1,435m above sea level, the total reservoir storage capacity is 11,370,000 m^3, and the surface area of reservoir at full water level is $0.95km^2$. The specific technical data of turbines and generators is listed in Table A.1.

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

Key Technology Parameter		Value	
Turbine	Designation	HLA551-LJ-175	
	Units	2	
	Manufacturer	Jiangxi Electrical Machinery Co., Ltd.	
	Rated Water Head	46.5m	
	Rated Flow Rate	$24.38m^3/s$	
	Capacity	10.365 MW	
	Rated Rotational Speed	333.3r/min	
Generator	Designation	SF10-18/3250	
	Units	2	
	Manufacturer	Jiangxi Electrical Machinery Co., Ltd.	
	Capacity	10 MW	
	Rated Power Coefficient	0.8（lagging）	
	Rated Rotational Speed	333.3r/min	
	Rated Voltage	6.3kV	
Main Transformer	Manufacturer	Sanbian Technology Co., ltd	
	Designation	SC9-250kVA 6.3/0.4;	SC9-25000kVA 35/0.4
	Rated Capacity	250kVA	25000kVA

The project will connect to the Laoyingshan 110 kV transformer substation, which connects to the local grid, then to the Guizhou Grid and finally to the South China Grid.

The project started construction activities in June 2005 and started operation in April 2007.

Both the construction party and the manufacturer of the technology are experienced in their area of business and are considered reliable partners. The project entity has been trained by the Liupanshui City Power Supply Bureau Sandian Office during the period May 16th to May 27th, 2007. Besides visiting several hydropower stations, the training course covered among other subjects: generator and excitation system information; information on transformers; maintenance and repair of turbines and generators; operation structures, safety regulations, monitoring systems, management experience and other rules for hydropower stations.

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

A 7-year renewable crediting period (renewable twice) is selected for the proposed project activity. The estimation of the emission reductions in the crediting period is presented in Table A.2.

Table A.2 The estimation of the emission reductions in first crediting period

Year	**The estimation of annual emission reductions (tCO_2e)**
Year 1: 1 April 2008 - 31 March 2009	58,279
Year 2: 1 April 2009 - 31 March 2010	58,279
Year 3: 1 April 2010 - 31 March 2011	58,279
Year 4: 1 April 2011 - 31 March 2012	58,279
Year 5: 1 April 2012 - 31 March 2013	58,279
Year 6: 1 April 2013 - 31 March 2014	58,279
Year 7: 1 April 2014 - 31 March 2015	58,279
Total estimated reductions (tonnes of CO_2e)	**407,953**
Total number of crediting years in 1st crediting period	7
Annual average over the 1st crediting period of estimated reductions (**tonnes** of CO_2e)	58,279

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline and monitoring methodology:

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

Following methodology is used:

Baseline methodology:

Approved consolidated baseline methodology ACM0002: *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources",* Version 6, approved on 24th CDM EB conference on the 19th of May, 2006.

The *"Tool for the Demonstration and Assessment of Additionality",* Version 3, approved at EB 29 is used to demonstrate the additionality of the project activity.

Monitoring methodology:

Approved consolidated monitoring methodology ACM0002 (Version 6): "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources".

Reference: UNFCCC website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

The baseline and monitoring methodology ACM0002 is applicable to the proposed project, because the project meets all the applicability criteria stated in the methodology:

- The proposed project is a grid-connected renewable power generation project.
- The project is a capacity addition from a renewable energy source, i.e. a new hydro electric power project.
- The project has a power density greater than 10 W/m^2 (see also section B.3.)
- The project does not involve an on-site switch from fossil fuels to a renewable source.
- The geographic and system boundaries for the relevant electricity grid, the South China Grid, can be clearly identified and information on the characteristics of the grid is available.
- The methodology will be used in conjunction with the approved consolidated monitoring methodology ACM0002 (Consolidated monitoring methodology for grid-connected electricity generation from renewable sources).

The latest version of ACM0002 (version 6) has been applied.

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

The sources and gases included in the project boundary are described in Table B.1 as below:

Table B.1 Inclusion of gases and sources in the calculation of the emission reductions

	Source	Gas	Included?	Justification / explanation
Baseline	Fossil fuel-fired Power plants connected to the South China Grid	CO_2	Yes	Included as per the ACM0002 methodology
		CH_4	No	Excluded as per ACM0002.
		N_2O	No	Excluded as per ACM0002.
Project Activity	Guizhou Jinshizi Hydropower Station	CO_2	No	Excluded, the project activity is a renewable energy project which will not create emission itself.
		CH_4	No	Excluded, the project activity is a renewable energy project which will not create emission itself. The power density is above 10 W/m^2, and reservoir emissions do not have to be taken into account.
		N_2O	No	Excluded, the project activity is a renewable energy project which will not create emission itself.

In line with the methodology, the only greenhouse gas accounted for in the calculation of the emission reductions is CO_2.

In accordance with the ACM0002 methodology, project emissions from the reservoir have to be taken into account in case the power density of the project is between 4 and 10 W/m^2. The power density of the proposed project activity can be calculcated as follows:

Reservoir surface area at full reservoir level: 950,000 m^2
Total installed capacity: 20,000,000 W
Power Density: Installed capacity / Surface level = 20,000,000 / 950,000 = 21.05 W/m^2

From above calculation it is clear that the power density is substantially greater than 10 and therefore, in accordance with the ACM0002 methodology, emissions from the reservoir are not taken into account in the calculation of emission reductions. In agreement with the methodology, other leakage (arising from power plant construction, fuel handling, etc.) is ignored. The project participants also do not claim emission reductions resulting from a reduction of these emissions under the baseline level.

According to the ACM0002 (version 6) methodology, the relevant grid definition should be based on the following considerations:
1. Use the delineation of grid boundaries as provided by the DNA of the host country if available; or
2. Use, where DNA guidance is not available, the following definition of boundary:
In large countries with layered dispatch system (e.g. state/provincial/regional/national) the regional grid definition should be used.

The spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the proposed project is connected to. According to ACM0002 (version 6) requirements, the regional grid (South China Grid) is selected as the project electricity system. The South China Grid imports electricity from the Central China Grid. Accordingly, we have selected the Central China Grid as the connected electricity system. For ease of reference, when we refer throughout this PDD to the South China Grid, this will take account of the emissions associated with the imports of power from the connected electricity system (i.e. Central China Grid).

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The project is connected to the Guizhou Power Grid. The Guizhou Power Grid is part of the South China Grid, which includes the provinces Guangdong, Guangxi, Yunnan and Guizhou.

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

The baseline scenario of the Guizhou Shuicheng Jinshizi Hydropower Station Project is the continued operation of the existing power plants and the addition of new generation sources on the South China Grid to meet electricity demand. The project activity involves the construction of a zero-emission power source. Thus, the emission reductions are equal to the baseline emissions.

In accordance with the ACM0002 methodology, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. The baseline emission factor is equal to the combined margin: a weighted average of the operating margin emission factor and the build margin emission factor. See Section B.6 for details.

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 additionality of the project activity is demonstrated using the steps described in *the Tool for the Demonstration and Assessment of Additionality (version 3)* as developed by the EB.
See UNFCC website:
http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

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

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

The methodology requires a number of sub-steps to provide realistic and credible alternatives to the project activity. There are only a few alternatives that are prima facie realistic and credible in the context of the South China Grid:

1. Scenario 1. The electricity is supplied by the proposed project activity undertaken without being registered as a CDM project activity;
2. Scenario 2. The electricity is supplied by the thermal power plant with equivalent installed capacity or equivalent annual power generation;
3. Scenario 3. The electricity is supplied by a renewable energy project with equivalent installed capacity or equivalent annual power generation;
4. Scenario 4. The electricity is supplied by the South China Grid.

These alternatives are in accordance with the description of the methodology (the additionality tool requires that the proposed project activity be included as an alternative, without the benefit from CDM).

Thermal power generation is the dominant power supply option in China. There is not enough other renewable energy, such as biomass, solar sources, wave and tidal sources or geothermal sources, to provide equivalent power generation in local area. The project area is also poor in wind energy resources[1], so it is not provided with conditions for constructing wind power plant with the equivalent installed capacity. At present, there are no wind farms in this area. Furthermore, note that the windparks that have been constructed in China generally do so with the support of CDM, soft loans provided by foreign governments, or (previously) support measures by the Chinese government. Therefore, the third scenario is not feasible.

Continuation of the present situation (no capacity addition to the project electricity system) is not realistic in the context of this project, because power demand has been increasing rapidly over the last few years. China has experienced severe power shortages, spurned by fast demand for power; and hence the grids have been expanding rapidly. For example, the total supply to the South China Grid (including imports from Central China Grid) grew by 49% between 2002 and 2004 (173,292,685 MWh in 2002 to 258,317,469 MWh in 2004).[2] A part of this increase was due to increased imports from the Central China Grid, which increased from zero in 2002 to 10,951,240MWh in 2004, illustrating the power shortage of the South China Grid.

<u>Sub-step 1b: Consistency with mandatory Laws and Regulations</u>
The second sub-steps involve the confrontation of the alternatives with China's applicable laws and regulations. Scenario 2 is not consistent with Chinese laws and regulations. According to Chinese regulations, coal-fired power plants of less than 135MW are prohibited for construction in the areas covered by the large grids such as provincial grids, while construction of thermal power units under 100MW is strictly controlled. As the proposed project's capacity is 20 MW, we conclude that the second scenario is not in accordance with Chinese laws and regulations and therefore is not a feasible alternative to the propose project activity. All other scenarios, all except for scenario 2, identified above are in compliance with China's relevant laws and regulations.[3] This may be demonstrated by referring to statistics, which show that each of these power supply options is used in China.

The proposed project activity is consistent with national policies for environmental protection, energy conservation and sustainable development. However, there are no binding legal and regulatory requirements for this project type. The Renewable Energy Law adopted by the National People's Congress on 28 Feb. 2005 encourages and supports renewable-based power generation, but does not stipulate specific goals for local air quality improvement.

<u>Conclusion</u>: We conclude that three of the alternatives are in compliance with the relevant Chinese laws and regulations. As there are alternatives to the project activity that are in compliance with the relevant Chinese laws and regulations, the project may be additional. However, the third scenario, power to be delivered by other renewable energy sources is not credible in absence of sufficient renewable resources in Guizhou and the first scenario is not feasible as a baseline scenario due to insurmountable economic barriers as we will argue in B.5, step 2.

Step 2. Investment analysis

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1 The China new energy net: http://www.newenergy.org.cn/html/2006-2/2006217_7650.html

2 China Statistical Press (2005) 'China Electric Power Yearbook' p. 472-474, and China Statistical Press (2003) 'China Electric Power Yearbook' p. 591-592.

3 Conventional coal-fired power plants are consistent with regulations although the construction of small-scale power plants with a capacity under 135 MW has been prohibited, see *General Office of the State Council (2002), Notice of the General Office of the State Council concerning the Strict Prohibition of the Construction of Thermal Power Units with a Capacity of 135MW or Below*, Guo Ban Fa Ming Dian (2002) Document No.6. The construction of thermal power units under 100MW is strictly controlled; see *The Temporary Stipulation of the construction management of Small Scale Units of Fuel-fired Power Generation* (August, 1997).

Sub-step 2a: Determine appropriate analysis method

The analysis will be analyzed through Option III of the additionality tool, i.e. Benchmark analysis. This method is applicable because:

- Option I: Simple cost analysis, does not apply as the project generates economic returns through the sales of electric power to the grid.
- Option II: Investment comparison analysis is not appropriate as, the only realistic alternative to the project not being implemented as a CDM project activity involves the delivery of power by the grid, which is not a project.
- Option III, benchmark analysis is appropriate. It provides the simplest method of analysis which is the least demanding in terms of data availability. This method has also been used in other PDDs of grid connected renewable energy projects in China.

Conclusion: We conclude that only option III is appropriate for the analysis of the additionality of the project activity.

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

Based on the benchmark IRR rate from the Chinese *Economic evaluation code for small hydropower projects*, the IRR of electric power projects in range of 25MW should not be lower than the threshold of 10%, which imposes a barrier for implementation of the project activity without CDM, Since the project activity does not reach the 10% IRR benchmark without CDM revenues, it would not receive clearance from the Chinese Government. Therefore, the proposed project is not feasible without CDM.

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

The project faces a barrier to implementation due to the poor returns on investment. The project's returns on investment are below the benchmark of 10%. To illustrate this, we performed a benchmark analysis. Table B.2 summarizes the data used in the calculation of the project IRR.

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Table B.2 Main parameters used in the calculation of the project IRR.

Parameter	Value	Source
Installed capacity (MW)	20	Feasibility Study Report
Annual Power supplied to the Grid (MWh)	76,513.41	Feasibility Study Report
Static Investment (Ten thousand Yuan RMB)	14,430	Feasibility Study Report
Estimated Grid Price (Yuan RMB / kWh, with VAT)	0.2184	Notice from Guizhou Province Price Bureau [4]
Operation Period (years)	30	Feasibility Study Report
VAT	6%	Feasibility Study Report
Corporate Income Tax	33%	Feasibility Study Report
Annual Operation & Maintenance Cost 1st 10 years (Ten thousand Yuan RMB)	290	Feasibility Study Report
Annual Operation & Maintenance Cost after 10 years (Ten thousand Yuan RMB)	275	Feasibility Study Report

Based on the benchmark revenue rate in the financial evaluation of Chinese *Economic evaluation code for small hydropower projects*, the IRR of a small power project's total investment should not be lower than the threshold of 10%. The IRR of the project is 6.64% without CDM revenue which is lower than the benchmark rate of 10%. Based on a CER price of €8/tCO_2e, we calculate an IRR of 10.23% including CDM revenues.[5] So the project faces obvious financial barriers without CDM revenue.

Sub-step 2d. Sensitivity analysis:

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

- Static total investment
- Annual operational & maintenance cost
- Estimated Grid price

Variations of ±10% (the sensitivity analysis in the Feasibility Study Report also uses ±10% as variation, in compliance with the Chinese requirements) have been considered in the critical assumptions. Table B.4 summarizes the results of the sensitivity analysis, while Figure B.1 provides a graphic depiction.

4 This notice, together with the FSR was known at the time of making the decision to apply for CDM (see Table B.5 below). The expected power price was confirmed later by the Power Purchase Agreement (see also Table B.5 below) and electricity sales invoices.

5 The Chinese DNA has set a minimum price necessary to obtain host country approval for CDM projects. Although the minimum price has not been published, commonly €8/tCO_2e is regarded as the minimum price the NDRC will accept. The CER price agreed for this project is either equal to or above €8/tCO_2e, but is considered a commercial secret. Based on this minimum price, the IRR of the project with CDM financing reaches the benchmark.

Table B.3 Impact of Variations in Critical Assumptions on IRR

Parameter	-10%	-5%	0%	5%	10%
Estimated grid price	5.54%	6.10%	6.64%	7.18%	7.71%
Static total investment	7.77%	7.18%	6.64%	6.15%	5.70%
Annual operational & maintenance cost	6.84%	6.74%	6.64%	6.54%	6.45%

Figure B.1 Results of the sensitivity analysis for the IRR

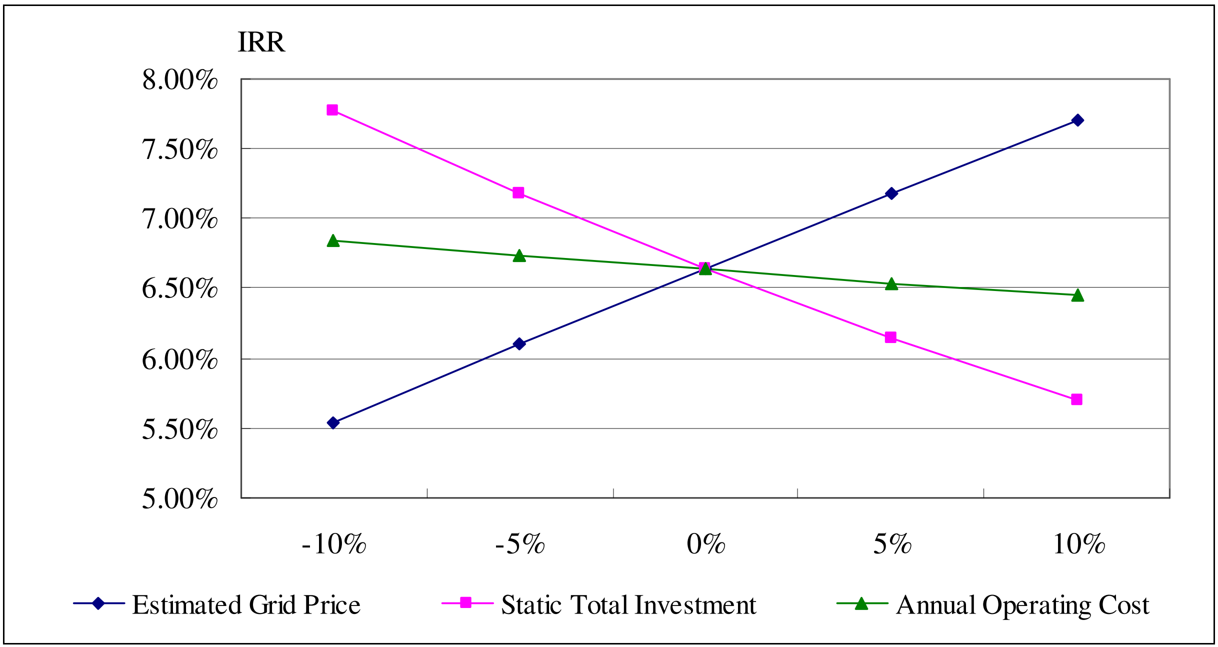

Fig B.1 shows that none of variations can raise the IRR of the proposed project higher than the threshold of 10% and the sensitivity of the annual operation and maintenance cost is very low. Therefore, the results of the sensitivity analysis confirm that the project faces significant economic and financial barriers without CDM revenues, so the project is not economically attractive.

Step 3 Barrier analysis

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity

There are additional barriers to the implementation of the project without CDM revenues. These barriers include:

Uncertainty of Electricity Sale

Hydropower could be affected to a large extent by hydrological conditions causing power generation to be unstable. This will make it difficult to achieve the estimated annual operating hours. In addition, the generation of power will be the highest during the flood season, at a time electricity supply to the grid operating company will exceed demand and the station will have to adjust the electricity supply according to arrangements taken by the grid company. Therefore, the station cannot be operated at full capacity. The uncertainty of the sale of electricity further reduces the commercial attraction.

Uncertainty of Grid Price
The price of electricity differs greatly between peak and valley periods. The Grid Company will adjust the grid price according to the actual demand. At the same time, the power generated will be greater during the flood season, so the Grid Company will adjust the grid price according to the demand. The uncertainty of the grid price further increases the financial risk.

We conclude that without CDM, the project faces several barriers, preventing the normal implementation of the proposed project activity. CDM financing lowers these barriers. If the project would not have been implemented normally, electrical power would have been supplied by the South China Grid, which partly depends on thermal power as its energy source. Thermal power has GHG emissions associated with it.

The proposed project activity would not have been implemented normally without the prospects of registration as a CDM project activity and will reduce GHG emissions below the baseline. Therefore, the proposed project activity is additional.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The barriers to implementation mentioned in sub-step 3a impact the economic attractiveness of investments in hydropower in Guizhou Province, China. All alternatives identified in step 1, except for the proposed project activity undertaken without the support through CDM, will not be affected by this barrier.

Step 4. Common Practice Analyses

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

For the common practice analyses, we have analysed all projects in Guizhou Province with an installed capacity between 15 and 50 MW that have started operations since 2000 or are still under construction. We have selected projects with an installed capacity between 15MW and 50MW because UNFCCC considers hydropower projects above 15MW as normal scale projects, and the Chinese government classifies hydropower stations below 50MW as small scale projects[6]. Table B.4 lists all relevant information regarding these hydropower stations.

Table B.4 Some Hydropower Stations of Guizhou similar to the Proposed Project

Name of hydropower station	Location	Installed Capacity (MW)	Operation date	Project Owner	Remark
Zhenyuan Hongqi Hydropower Station	Zhenyuan County	16	2001	Water Resource Bureau of Southeastern Guizhou	State owned
Tianbianzhai Hydropower Station	Pan County	25	2001	Pan County Water Resource Bureau	State owned
Zhongshanbao Hydropower Station	Anlong County	40	2001	Guizhou Zhongshanbao Hydropower Development Co., Ltd.	6,725 annual operating hours[7]
Jiaokou Hydropower Station	Zunyi	18.9	2004	Water Resource Bureau of Zunyi	State owned

[6] Almanac of China's Water Power (2005), page 141

[7] 2006 China Water Resources Yearbook, P577

	City			City	
Wengyuan Hydropower Station	Zhenning County	20	2007	Zhenning Yuefeng Hydropower Development Co., Ltd.	CDM
Qilitang Hydropower Station	Sinan County	30	Not yet started	Guizhou Sinan Zhongshui Hydropower Co. Ltd.	CDM
Sanchawan Hydropower Station	Zhenning County	32	Under Construction	Guizhou Anshun Sanchwan Hydropower Co., Ltd.	CDM
Luojiaohe Hydropower Station	Dafang County	20	Under Construction	Guizhou Zhongshui Energy Development Co., Ltd.	CDM
Guizhou Taijiang Yanzhai Hydropower Station	Taijiang County	25	Under Construction	Guizhou Huiming Electronics Taijiang Co., Ltd.	CDM
Baishuquan Hydropower Project, Guizhou Province, China	Dejiang County	20	Under Construction	Guizhou Dejiang Baishuiquan Power Generation Co., Ltd.	CDM
Tongren Tianshengqiao Hydropower Project, Guizhou Province, China	Tongren City	22	Under Construction	Tongren Tianshengqiao Power Generation Co., Ltd.	CDM
Jinshizi 1st Hydropower Station	Sancha River	18	Not yet started	Shuicheng County Jinshizi Hydropower Development Co., Ltd.	CDM
Azhu Hydropower Station	Sancha River	27	Under Construction	Liupanshui Tuoyuan Group Co., Ltd.	CDM

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

Of the thirteen projects in total, nine are receiving or applying for CDM support in order to overcome the barriers they are facing. Of the remaining four, three (i.e. the Jiaokou, Tianbianzhai and Zhenyuan Hongqi hydropower stations) are developed by public entities and therefore enjoy certain benefits in the areas of financing and policy support. The final (i.e. Zhongshanbao hydropower station) has significantly higher annual operating hours compared to the proposed project (it has 6,725 annual operating hours, 59% higher than the proposed project’s 4,225 annual operating hours) and is therefore able to generate more electricity and be more profitable.

From the investment and barrier analysis it is clear that the proposed project is not profitable. The common practice analyses confirm this argument, as nine of the thirteen hydropower stations are applying for CDM support, three are developed by public entities, and the remaining hydropower station has operating hours of 59% higher than the proposed project.

Impact of CDM Registration

The main impact the CDM registration is an increase in the expected IRR of the proposed project, raising the IRR from 6.64% to 10.23%, above the benchmark rate for the sector. From the barrier analysis above, it can be concluded that the proposed project is an ambitious challenge and can not be considered business as usual. On the contrary, CDM is crucial for this project to overcome the barriers as described above. The project entity considered CDM in an early stage as is shown in table B.5. From table B.5 it is clear that at the time of signing the main equipment purchase contact (October 2005) and the start of construction activities (June 2005), the two events that can be considered the irreversible decision to implement the proposed CDM project activity, the project entity was well aware of the prospects of CDM and had amongst others decided CER revenues were crucial for the implementation of the project (board decision March 2005), asked the local government to support its CDM application (April 2005), and signed a development contract with

CDM advisors (May 2005). The decision that CER revenues were required to implement the project was taken on the basis of data in the FSR and a notice on the power price the project would received, both known long before any of the above mentioned dates.

Table B.5 Overview of key events in the development of the project

Date	Key Event
October 2003	Completion of Feasibility Study Report (FSR) by the “Guiyang Hydro-electric Investigation and Design Research Institute” (a subsidiary of the “State Power Corporation of China”).
December 2003	Approval of FSR by the “Liupanshui City Water Resource Bureau”
January 2004	Completion Environmental Impact Assessment (EIA)
September 2004	Notice from the Guizhou Province Price Bureau stating the power price for the proposed project activity would be 0.2184 Yuan RMB/kWh
October 2004	Approval of EIA by the Environment Protection Bureau of Guizhou Province
March 2005	Board of directors of the proposed CDM project activity made a formal decision to only pursue implementation of the project when simultaneously applying for CDM project status due to the low economic attractiveness of the project.
April 2005	Project owner requested support from the local government for their CDM application.
May 2005	Project owner signed development contract with CDM advisors and started preparations for CDM application
June 2005	Project owner received a “CDM application support letter” from the local Development and Reform Commission
June 2005	Received approval from the local Development and Reform Commission to start construction activities and the project activity started construction activities.
October 2005	Signing of main equipment (i.e. generators/turbines) purchase contract
May 2006	Preparation of first carbon asset documentation (PIN) by CDM advisors
December 2006	Received final project approval from the Development and Reform Commission of Guizhou Province
January 2007	Preparation of signing of Emission Reductions Purchase Agreement (ERPA) with RWE Power AG
February 2007	Chinese DNA stated on its website that the project has been approved.
March 2007	Signing of the PPA, confirming the expected power price of 0.2184 Yuan RMB/kWh. This power price is also confirmed by current sales records.
April 2007	Start of operation
May 2007	Received formal Host Country Approval of Chinese DNA

In general, the project faces several barriers which would prevent the normal implementation of the proposed project activity without CDM revenues. CDM revenues will raise the project’s IRR to above the industry benchmark, making the project financially attractive and helping to overcome other barriers. The CER revenues have been taken into account by the project owner when making the investment decision. If the project would not have been implemented normally, electric power would have been delivered by the South China Grid. Therefore the proposed project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

In accordance with the ACM0002 methodology, the baseline emission factor is calculated as a combined margin: a weighted average of the operating margin emission factor and the build margin emission factor. The latter is in this particular case calculated *ex ante* on the basis the latest additions to the grid.

This PDD refers to the Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor published by the Chinese DNA on 15 December 2006. We will refer to these emission factors as the 'published emission factors'.

For more information on the published OM and BM emission factors, please refer to:

http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144550669.pdf: calculation result of the baseline emission factor of Chinese power grid.
http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144641643.xls: calculation process of the baseline OM emission factor of Chinese power grid
http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144747182.pdf: calculation process of the baseline BM emission factor of Chinese power grid

The description below focuses on the key elements in the calculation of the published emission factors and the subsequent calculation of emission reductions. The full process of the calculation of the emission factors and all underlying data are presented in English in Annex 3 to this PDD.

Selection of values for net calorific values, CO_2 emission factors and oxidation rates of various fuels.

As mentioned above, the Chinese DNA has entrusted key experts with the calculation of the grid emission factors. In these calculations choices have been made for the values of net calorific values, CO_2 emission factors, and oxidation rates. The net calorific values are based on the China Energy Statistical Yearbook, and the oxidation rates and the CO_2 emission factors are based on IPCC default values. Their use in the calculation of the published emission factors means that these values are deemed appropriate by the Chinese authorities for the calculations of the Chinese emission factors. The following table summarizes the values used. Note that the table lists the carbon emission factor of the fuels, the CO_2 emission factor has been obtained by multiplying with 44/12. Rounded figures have been reported but exact figures have been used in the calculations in this PDD.

Table B.6. Default values used for net calorific values, oxidation factors, and CO_2 emission factors of fuels

Fuel	Unit	NCV	Oxidation factor	Carbon emission factor	CO_2 emission factor
		(TJ/unit)	(Fraction)	(TC/TJ)	(TCO_2/TJ)
Raw coal	10^4 Tons	209.08	0.980	25.8	94.6
Clean coal	10^4 Tons	263.44	0.980	25.8	94.6
Other washed coal	10^4 Tons	83.63	0.980	25.8	94.6
Coke	10^4 Tons	284.35	0.980	29.5	108.2
Coke oven gas	10^8 m^3	1672.6	0.995	13.0	47.7
Other gas	10^8 m^3	522.7	0.995	13.0	47.7
Crude oil	10^4 Tons	418.16	0.990	20.0	73.3
Gasoline	10^4 Tons	430.7	0.990	18.9	69.3
Diesel	10^4 Tons	426.52	0.990	20.2	74.1
Fuel oil	10^4 Tons	418.16	0.990	21.1	77.4
LPG	10^4 Tons	501.79	0.995	17.2	63.1
Refinery gas	10^4 Tons	460.55	0.995	18.2	66.7
Natural gas	10^8 m^3	3893.1	0.995	15.3	56.1
Other petroleum products	10^4 Tons	383.69	0.990	20.0	73.3
Other coking products	10^4 Tons	284.35	0.980	25.8	94.6
Other E (standard coal)	10^4 Tce	292.7	0.980	0.0	0.0

Data source: All data are from the files mentioned above, and have been crosschecked against the original sources cited, as follows:

- Net calorific values: China Energy Statistical Yearbook, 2004 p. 302;
- Oxidation factors: IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8;
- Carbon emission factors: IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6;
- CO_2 emission factors: calculated from carbon emission factors.

<u>Description of the calculation process</u>

The key methodological steps are:

1. Calculation of the Operating Margin (OM) Emission Factor
2. Calculation of the Build Margin (BM) Emission Factor
3. Calculation of the Baseline Emission Factor
4. Calculation of the Baseline emissions
5. Calculation of Emission Reduction

The methodology is applied to the South China Grid which is defined as including the grids of Guangdong, Guangxi, Yunnan and Guizhou, as is further elaborated in Section B.3. Section B.3 also describes how the project boundary is decided.

<u>Step 1. Calculation of the Operating Margin Emission Factor</u>

The ACM0002 methodology offers several options for the calculation of the OM emission factor. Of these, the methodologically preferred one, dispatch analysis, cannot be used, 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 average OM cannot be used, because low cost/must run resources (hydropower and windpower) constitute less than 50% of total grid generation (see Table B.7). Based on data included in the China Electric Power Yearbook, low cost/ must run resources account for 36.93% in 2000, 36.86% in 2001, 35.99% in 2002, 33.53% in 2003, 29.95% in 2004 of total grid generation. Therefore, the calculation method of simple OM is suitable for this project activity.

Table B.7 Installed capacity and electricity generation of the South China Grid, 2000-2004[8]

Year	Installed capacity (MW)					Electricity generation (GWh)				
	Thermal	Hydro	Others	Total	% Low cost/must run	Thermal	Hydro	Others	Total	% Low cost/must run
2000	32,440.6	21,004.0	1,866.9	52,791.5	41.35%	149,597	72,742	14,838	237,177	36.93%
2001	34,715.9	21,471.7	1,866.9	58,054.5	40.20%	162,910	79,971	15,135	258,016	36.86%
2002	35,969.2	22,921.0	2,866.8	61,757.1	41.76%	185,168	83,093	21,012	289,273	35.99%
2003	40,444.1	25,409.3	3,863.4	69,716.8	41.99%	222,780	83,271	29,089	335,140	33.53%
2004	46,659.7	27,580.1	3,863.4	78,103.2	40.26%	263,574	84,072	28,530	376,277	29.95%

Source: China Electric Power Yearbook (editions 2001, 2002, 2003, 2004 and 2005).

Accordingly, the OM emission factor is calculated as the generation-weighted average emissions per unit of electricity (measured in tCO_2/MWh) of all generating sources serving the system, excluding the low-operating cost and must run power plants.

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

With:

- $F_{i,j,y}$ the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*. *j* refers to the power sources delivering electricity to the grid, not including low operating costs and must-run power plants. Imports (from Central China Grid) are considered a power source, and the relevant emissions are determined using the average emission factor of the Central China Grid.[9]
- $COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/ mass or volume unit of the fuel), taking into account the carbon content of fuels used by relevant power sources *j* and the percentage oxidation of the fuel in year(s) *y*;
- $GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission coefficient is equal to the net calorific value of fuel i, multiplied by the oxidation factor of the fuel and the CO_2 emission factor per unit of energy of the fuel i.

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

With:

8 Numbers are calculated on the basis of data for Guangdong, Guangxi, Yunnan and Guizhou. The same is true in other places where we refer to South China Grid.

9 There is net imported power transmitted from the Central China Grid to the South China Grid. From 2002 to 2004, the ratio of net imported power from the Central China Grid versus the power supplied by the South China Grid is 0.000%, 0.004%, and 3.040 % respectively, far lower than 20%, and since it is not possible to identify the specific power plants exporting electricity from the Central China Grid to the South China Grid, the average emission factor of the Central China Grid will be taken into account

- NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*,
- $OXID_i$ is the oxidation factor of the fuel,
- $EFC_{O2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

Data vintage selection

In accordance with the ACM0002 methodology and the choice for an ex ante calculation of the OM Emission Factor, the formula (B.1) is applied to the three latest years for which data are available, and a full-generation weighted average value is taken for the OM Emission Factor.

Choice of aggregated data sources

The published OM emission factor calculates the emission factor directly from published aggregated data on fuel consumption, net calorific values, and power supply to the grid and IPCC default values for the CO_2 emission factor and the oxidation rate. According to the ACM0002 methodology, the selection of aggregated data for the calculation of the emission factors should be used, but the disaggregated data needed for all three more preferred methodological choices is not publicly available in China.

Calculation of the OM emission factor as a three-year full generation weighted average

On the basis of these data, the Operating Margin emission factors for 2002, 2003 and 2004 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we refer to the publications cited above and the detailed explanations and demonstration of the calculation of the OM emission factor provided in Annex 3. We calculate the Operation Margin Emission Factor as 0.95408tCO_2e/MWh.[10]

The calculation of the OM emission factor is done once (*ex ante*) and will *not* be updated during the first crediting period. The ex ante approach has been used to increase the predictability of the total amount of emission reductions to be generated by the project. This is of value to both the project owner and the buyer of the CERs. Furthermore, the ex ante approach minimizes the amount of work required for the preparation of the monitoring report, and thus minimizes the transaction costs involved in the CER transaction as part of this CDM project activity.

Step 2. Calculation of the Build Margin Emission Factor ($EF_{BM,y}$)

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

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

$F_{i,m,y}$, $COEF_{i,m}$ *and* $GEN_{m,y}$ in the formula above are analogous to those in equation 1, except for the fact that the index *m* is over specific power plants rather than types of power plants, and that low

[10] The published Operation Margin Emission Factor (0.9853) is higher than our calculation. We have used our own calculated OM emission factor rather than the higher published value. This is conservative.

cost/must run sources are not excluded. The sample, according to the methodology, should be over the latest 5 power plants added to the grid, or over the last added power plants accounting for at least 20% of power generation, whatever is the greater.

A direct application of this approach is difficult in China. The Executive Board (EB) has provided guidance on this matter with respect to the application of the AMS-Ⅰ.D and AM0005 methodologies for projects in China on 7 October 2005 in response to a request for clarification by DNV on this matter. The EB accepted the use of capacity additions to identify the share of thermal power plants in additions to the grid instead of using power generation.

The calculation of the published BM Emission Factor is based on this approach and is described below:

First we calculate the newly–added installed capacity and the share of each power generation technology in the total capacity. Second, we calculate the weights of newly-added installed capacity for each power generation technology. Third, an advanced efficiency level for each power generation technology is defined and used to calculate Emission Factors.

Since the exact data are aggregated, the calculation will apply the following method: We calculate the share of the CO_2 emissions of solid fuel, liquid fuel and gas fuel in total emissions respectively by using the latest energy balance data available; the calculated shares are the weights.

Using the emission factor for advanced efficient technology we calculate the emission factor for thermal power; the BM emission factor of the power grid will be calculated by multiplying the emission factor of the thermal power with the share of the thermal power in 20% of the newly-added capacity of the power grid.

Detailed steps and formulas are as below:

First, we calculate the share of CO_2 emissions of the solid, liquid and gaseous fuels in total emissions respectively.

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

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

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

with:

- $F_{i,j,y}$ the amount of the fuel i consumed in y year of j province (measured in tce;

- $COEF_{i,j,y}$ the emission factor of fuel i (measured in tCO2/tce) while taking into account the carbon content and oxidation rate of the fuel *i* consumed in year *y*;
- *COAL,OIL* and *GAS* subscripts standing for the solid fuel, liquid fuel and gas fuel

Second, we calculate the emission factor of the thermal power

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

While $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ represent the emission factors of advanced coal-fired , oil-fired and gas-fired power generation technology, see detailed parameter and calculation in Annex 3.

Third, we calculate BM of the power grid

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

While CAP_{Total} represents the total newly-added capacity and $CAP_{Thermal}$ represents newly-added thermal power capacity. The λs are calculated on the basis of the weight of CO_2 emissions of each type of fuel in the total CO_2 emissions from thermal power.

We obtain a Build Margin emission factor value of 0.5693tCO_2e/MWh.[11] For details we refer to Annex 3.

The calculation of the BM emission factor is done once (*ex ante*) and will *not* be updated during the first crediting period. This has the advantage of simplifying monitoring and verification of emission reductions.

Step 3. Calculation of the Baseline Emission Factor (EF_y)

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

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

The latest version of ACM0002 (version 6) provides the following default weights: Operating Margin, w_{OM} = 0.5; Build Margin, w_{BM} = 0.5

Applying the default weights and the published emission factors, we calculate a Baseline Emission Factor of **0.761689** tCO_2e / MWh.[12]

Step 4. Calculation of Baseline Emissions

[11] The published Build Margin Emission Factor (0.5714) is higher than our calculation. We have used our own calculated BM emission factor rather than the higher published value. This is conservative

[12] The Baseline Emission Factor based on the published OM and BM emission factors (0.77835) is higher than our own calculation. We have used our own calculated Baseline Emission Factor. This is conservative.

Baseline Emissions are calculated by multiplying the Baseline Emission factor by annual power generation.

$$BE_y = (EG_y - EG_{baseline}) \times EF_y \quad \text{(B.10)}$$

With:

- BE_y the baseline emissions in year *y*, EG_y the electricity supplied by the project activity to the grid,
- $EG_{baseline}$, the baseline electricity supplied to the grid in the case of modified or retrofit facilities and
- EF_y the emission factor in year *y*, calculated according to formulas (B.1)-(B.5). As the project involves the construction of a new hydropower station, $EG_{baseline}$ is zero and formula B.10 can be simplified as:

$$BE_y = EG_y \times EF_y \quad \text{(B.11)}$$

The estimated baseline emissions (see Section A.4.4) are based on expected power generation and an *ex ante* calculation of the emission factor, and will hence be revised during the implementation of the project activity on the basis of actual power supply to the grid. The baseline emission factor, however, is left unchanged during the first crediting period.

Step 5. Calculation of emission reductions

Emission reductions are calculated according to the following formula:

$$ER_y = BE_y - PE_y - L_y \quad \text{(B.12)}$$

With:

- ER_y, emission reductions in year *y*,
- BE_y, baseline emissions in year *y*,
- PE_y, project emissions in year *y*,
- L_y, leakage in year *y*

The project does not involve leakages as further explained in section 6.3, and therefore emission reductions are equal to baseline emissions minus project direct emissions. Using the results of the preceding sections, we can calculate the emission reductions using formula B.13.

$$ER_y = EG_y \times 0.761689 \quad \text{(B.13)}$$

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

Data / Parameter:	**Power generation by source**
Data unit:	GWh (per annum)
Description:	Provincial level power generation data by source
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Electric Power Yearbook (Editions 2003, 2004 and 2005).

Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	**Internal power consumption of power plants**
Data unit:	Percentage
Description:	Internal consumption of power by source
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Electric Power Yearbook (Editions 2003, 2004 and 2005)
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	**Primary fuel input for thermal power supply**
Data unit:	10^4 tons, 10^8 m^3, 10^4 tce, depending on the specific fuel. We refer to Annex for details.
Description:	Physical amount of fuel input, for 18 different fuels
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Energy Statistical Yearbook 2000-2002, 2004 and 2005 editions
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	**Efficiency of advanced thermal power plant additions**
Data unit:	%
Description:	
Source of data used:	See the downloadable files mentioned above for the full data set. Data are based on the best technologies available in China.
Value applied:	Coal: 36.53%; Oil: 45.87%; Gas: 45.87%
Justification of the choice of data or description of measurement methods and procedures actually	These data are the best data available, and have been published by the Chinese authorities.

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applied :	
Any comment:	

Data / Parameter:	**Capacity by power generation source**
Data unit:	MW
Description:	For the different power generation sources, installed capacity in 2002, 2003 and 2004 in the South China Grid. Calculated by summing provincial data.
Source of data used:	China Electric Power Yearbook (Editions 2003, 2004 and 2005)
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	**Oxidation Factor**
Data unit:	Percentage
Description:	Oxidation factors for 18 different fuels
Source of data used:	1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is the same data as used by the Chinese authorities for climate change.
Any comment:	

Data / Parameter:	**Fuel Emission Coefficients**
Data unit:	Tons C/TJ
Description:	Carbon emission factors for 18 different fuels
Source of data used:	Data used are IPCC default values. See 1996 IPCC Guidelines for National Greenhouse Gas Inventories, p. 1.6
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is the same data as used by the Chinese authorities for climate change.
Any comment:	

Data / Parameter:	**Net Calorific Value**
Data unit:	$TJ/10^4$ tons; $TJ/10^4$ tce; $TJ/10^8m^3$
Description:	Net calorific values of 18 different fuels in TJ per unit.
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Energy Statistical Yearbook, (2004) p. 302.

Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	**Electricity imports from connected grids**
Data unit:	MWh (per annum)
Description:	Electricity imports of power from other grids
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Electric Power Yearbook (Editions 2003, 2004 and 2005)
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

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

The annual net power supply to the South China Grid is estimated to be 76,513.41 MWh.

Application of the formulae presented in Section B to the baseline data presented in Annex 3 yields the following results:
EFOM = 0.95408 tCO_2e/MWh
EFBM = 0.5693 tCO_2e/MWh
EFy = 0.5*0.95408 + 0.5*0.5693 = 0.761689 tCO_2e/MWh

We obtain the values for the baseline emissions during the first crediting period provided in Table B.8:

Table B.8 The estimation of the baseline emissions in crediting period

Year	Year	Annual net power supply to the grid (EGy) (MWh)	Baseline emission factor (tCO_2/MWh)	Baseline emissions (tCO_2e)
1	1 April 2008 - 31 March 2009	76,513.41	0.761689	58,279
2	1 April 2009 - 31 March 2010	76,513.41	0.761689	58,279
3	1 April 2010 - 31 March 2011	76,513.41	0.761689	58,279
4	1 April 2011 - 31 March 2012	76,513.41	0.761689	58,279
5	1 April 2012 - 31 March 2013	76,513.41	0.761689	58,279
6	1 April 2013 - 31 March 2014	76,513.41	0.761689	58,279
7	1 April 2014 - 31 March 2015	76,513.41	0.761689	58,279
	Total			**407,953**
	Average			58,279

For details we refer to the publications cited above.

In a given year, the emission reductions realized by the project activity (ER_y) is equal to baseline GHG emissions (BE_y) minus project direct emissions and leakages during the same year:

$$ER_y = BE_y - PE_y - L_y$$

Leakage:

The project activity involves the construction of a new hydropower station with a power density greater than 10 W/m^2 and therefore emissions from the reservoir do not have to be taken into account.

The project will install an on-site diesel generator with a capacity of 100 kW which will be maintained for emergency purposes in case generation by the project itself fails, and all power lines to the grid are cut off. Government regulations require that the diesel generator is started up before every flood season.[13] The emissions of the diesel generator are significantly less than 1% of total emission reductions and are considered negligible.[14] In case of emergencies the project will not claim emission reductions and the use of the generator will be monitored. We conclude that the project does not involve leakage due to the presence of the emergency diesel generator.

In accordance with the ACM0002 methodology, leakage and project emissions are equal to zero, and hence, the emission reductions due to the project are equal to the baseline emissions. The emission reductions will be calculated *ex post* on the basis of actual power supply to the grid, using the baseline emission factor presented above in Section B.6.1.

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

13 The *Hydropower Operation Safety Management Regulations (SERC document No.3),* issued by the State Electricity Regulatory Commission of the People's Republic of China states that "The back-up power sources should be re-commissioned before each flood season annually”. The regulation does not provide a guideline on the duration that the diesel generator should run each year, but the project entity has decided to operate the generator for one hour annually.

14 Emissions by the diesel generator associated with the start-up for annual re-commissioning and maintenance requirements can be calculated as follows: The diesel generator will have a capacity of at most 100 kW. The project owner will run the diesel generator for 1 hour annually; the expected annual power generation can be calculated to be 100 kWh. For the emission factor of the diesel generator we refer to the AMS-Ⅰ.D (version 11) methodology which provides emission factors for diesel generator systems. We apply the highest value listed in the methodology which is 2.4 $kgCO_2e/kWh$ (generators below 15 kW), which is conservative considering the size of the generator used on-site. We estimate the annual emissions by the diesel generator as 0.24 tCO2e, which would reduce annual emission reductions with about 0.00006% and can therefore be considered negligible.

Table B.9 ***Ex ante*** **estimate of emission reductions due to the project**

Year	Project Emissions (tCO_2)	Baseline emissions (tCO_2)	Leakage (tCO_2)	Emission Reductions (tCO_2)
Year 1: 01/04/2008 - 31/03/2009	0	58,279	0	58,279
Year 2: 01/04/2009 - 31/03/2010	0	58,279	0	58,279
Year 3: 01/04/2010 - 31/03/2011	0	58,279	0	58,279
Year 4: 01/04/2011 - 31/03/2012	0	58,279	0	58,279
Year 5: 01/04/2012 - 31/03/2013	0	58,279	0	58,279
Year 6: 01/04/2013 - 31/03/2014	0	58,279	0	58,279
Year 7: 01/04/2014 - 31/03/2015	0	58,279	0	58,279
Subtotal	**0**	**407,953**	**0**	**407,953**

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

B.7.1. Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	(Net) Electricity supplied to the grid by the project
Source of data to be used:	Directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	76,513.41 MWh
Description of measurement methods and procedures to be applied:	The supply of power to the grid by the proposed project is measured through national standard electricity metering instruments. The metering instruments will be calibrated annually in accordance with the *"Technical administrative code of electric energy metering (DL/T448－2000)"*.
QA/QC procedures to be applied:	These data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to ensure the consistency.
Any comment:	See also Section B.7.2 for more details

Data / Parameter:	**surface area reservoir**
Data unit:	m^2
Description:	Surface area at full reservoir level
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	950,000 m^2
Description of measurement methods and procedures to be applied:	The surface area will be calculated at the beginning of each crediting period using the design schematics and area maps. Photographs of the reservoir at several key locations will be taken at the beginning of each crediting period to check whether the actual reservoir does not deviate substantially for the design.
QA/QC procedures to be applied:	The power density of the project is well above 10 W/m^2 and therefore substantial deviations from the calculated design surface area will not affect the calculation of emission reductions by the project. Therefore no further QA/QC procedures will be applied.
Any comment:	

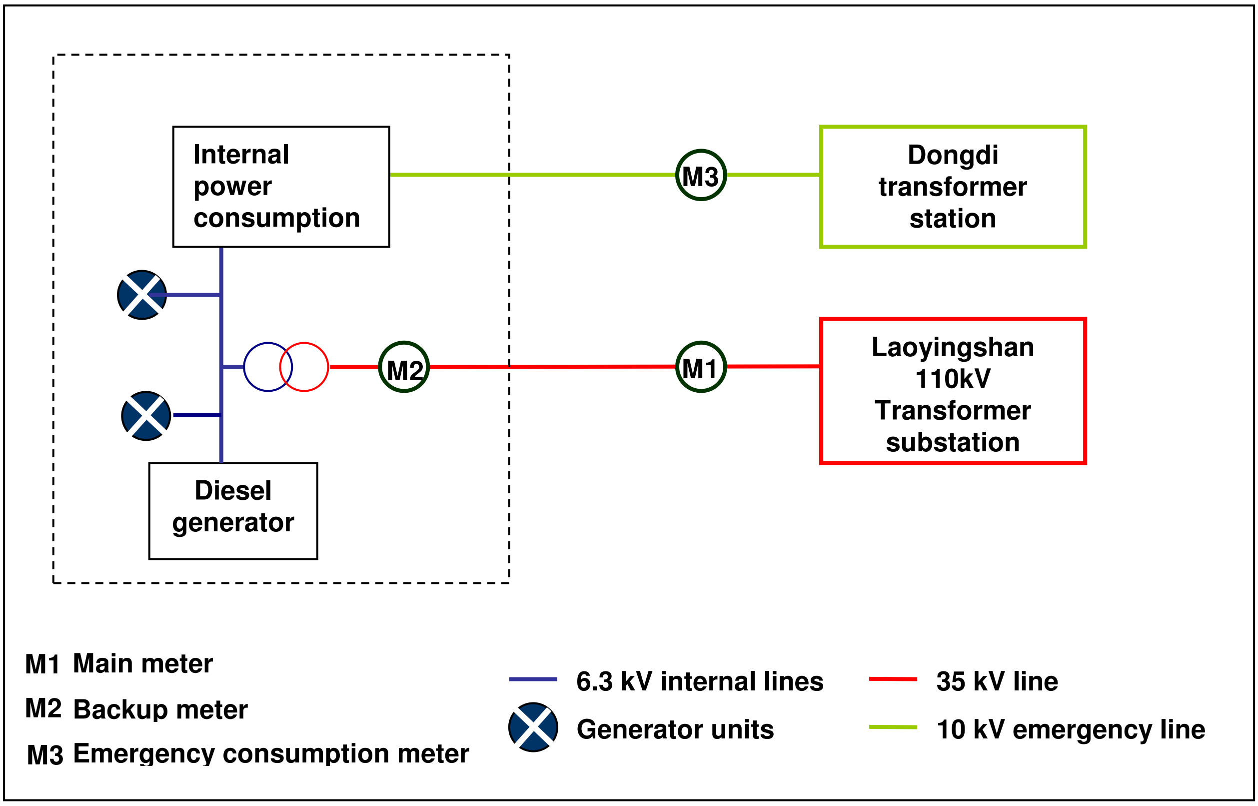
Data / Parameter:	**Operational hours of emergency back-up diesel generator**
Data unit:	Hours / year
Description:	Annual hours that the emergency back-up diesel generator is running either for the purpose of commissioning/maintenance or actual emergencies
Source of data to be used:	Estimated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1 hour / year. The Hydropower Operation Safety Management Regulations (SERC document No.3), issued by the State Electricity Regulatory Commission of the People's Republic of China states that "The back-up power sources should be re-commissioned before each flood season annually". The regulation does not provide a guideline on the duration that the diesel generator should run each year. The project entity has decided to operate the generator for one hour annually.
Description of measurement methods and procedures to be applied:	The project entity will record the operational hours in the daily operation logs.
QA/QC procedures to be applied:	The expected annual emissions associated with the operation of the emergency back-up diesel generator amount to about 0.00006% of total emission reductions and are therefore considered negligible. In case of actual emergencies the project entity will not claim emission reductions (see section B.7.2). Further QA/QC procedures are therefore not considered necessary.
Any comment:	

B.7.2. Description of the monitoring plan:

The project is connected to the grid through an on-site booster transformer station which increases the voltage from 6.3 kV to 35 kV. The project is then connected to the Laoyingshan 110 kV transformer substation which connects the project to the grid. The power supplied to the grid is metered by the project entity at a point after power has been transformed to 35 kV (see figure B.2). The grid company will pay for the electricity according to meter M1, also located on the 35kV power line.[15] In case of emergencies, the hydropower station could also receive power for auxiliary power consumption from the Dongdi transformer station. Power supplied by the grid will be metered and deducted from gross power supply. If both options fail, the project has a back-up diesel generator to provide power for auxiliary power consumption.

Figure B.2. Simplified electrical grid connection diagram

[15] If significant losses would occur after measurement, the grid company would account for this and not purchase the electricity supply as recorded on the 35kV power line. It is therefore reasonable to assume losses to be zero after measurement.



The power supply of the project to the grid will be metered with meter M2, which is located at the high-voltage side of the step-up transformer station that will be constructed at the project site. The metering instrument M2 will record two readings, i.e. power delivered to the grid and power received from the grid. The project entity will log both readings and the difference, i.e. power delivered minus power received, will be taken as power supply through the main power line (note that for the calculation of total net supply).

The grid company will meter the power supply at Laoyingshan 110 kV transformer substation with its own metering equipment, i.e. meter M1. The grid company will issue on the basis of the readings of M1 a sales receipt for power received from the project and a billing invoice for power supplied to the project. The regulations of the grid company require annual calibrations of both locations. Calibrations are carried out by the Grid Company and the results will be submitted to the project entity. After calibration, meters M1 and M2 will be sealed. The accuracy of the metering instruments M1 and M2 is Accuracy Class 0.2S. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated.

Power supplied by the grid to the project through the Dongdi transformer station will monitored by the grid company with meter M3, which will also be calibrated annually and has a Accuracy Class of 0.2S. The grid company will provide billing invoices to the project owner for power supplied to the project.

The project entity will collect the sales receipts for power supplied to the grid and billing receipts for power received from the grid as evidence for the readings of meters M1 and M3. The net supply (i.e. gross supply minus supply by the grid to the project) will be used in the calculations. In case of discrepancies between the metering instruments of the grid company and the project entity, the readings of the grid company will prevail. All records of power delivered to the grid, sales receipts and the results of calibration will be collated in a central place by the project entity. The project entity will in principle report the monitoring data annually but may deviate to report at intervals corresponding to agreed verification periods and will ensure that these intervals are in accordance with CDM requirements. Data record will be archived for a period of 2 years after the crediting period to which the records pertain.

An overview of the recording frequency, calibration procedures and available documentation is provided in Table B.10. The numbering of the metering equipment refers to Figure B.2 which shows the location of each meter.

In addition to the monitoring of net power supply the project entity will also monitor the use of an emergency back-up diesel back-up by logging its operational hours in daily logs. The generator will be started-up for one hour every year for maintenance purposes in accordance with government regulations. The emissions associated with the diesel generator are calculated as 0.00006% of total emission reductions and are therefore considered negligible (see section B.6.3).

The project entity will monitor the surface area of the reservoir at the start of each crediting period(s) by collecting photographic evidence of the surface level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

Table B.10 Details of metering instruments

Meter	Operated by	Electronic measurement	Manual measurement	Recording	Calibration	Accuracy	Documentation
M1	Grid company	-	-	Monthly	Grid Company (Annually)	Accuracy Class 0.2S or more accurate	Monthly sales receipts (for power delivered to grid) and billing invoices (for power received from the grid)
M2	Project entity	Hourly	Daily (optional)[16]	Monthly	Grid Company (Annually)	Accuracy Class 0.2S or more accurate	Print out of electronic record and optional paper log. Data will consist of two readings, i.e. power delivered to and power received from the grid.
M3	Grid company	-	-	Monthly	Grid Company (Annually)-	Accuracy Class 0.2S or more accurate	Monthly billing receipt by grid company

16 The project entity intends to log the readings of meter M2 manually in daily logs, but these logs will not form a formal requirement during verification. The ACM0002 methodology only requires hourly electronic measurement and these manual log records will only be maintained for back-up purposes. The project entity may deviate from this procedure during actual operation of the project. Manual daily paper logs are only required in case the diesel generator has been operated during a specific day.

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PROCEDURES IN CASE OF DAMAGED METERING EQUIPMENT / EMERGENCIES

Damages to metering equipment:

In case metering equipment is damaged and no reliable readings can be recorded the project entity will estimate net supply by the proposed project activity according to the following procedure:

1. **In case metering equipment operated by project entity is damaged only:**
   The metering data logged by the grid company, evidenced by sales receipts will be used as record of net power supplied to the grid for the days for which no record could be recorded.
2. **In case both metering equipment operated by project entity and grid company is damaged:**
   The project entity and the grid company will jointly calculate a conservative estimate of power supplied to the grid. A statement will be prepared indicating
   ► the background to the damage to metering equipment
   ► the assumptions used to estimate net supply to the grid for the days for which no record could be recorded
   ► the estimation of power supplied to the grid
   The statement will be signed by both a representative of the project entity as well as a representative of the grid company.

The project entity will furthermore document all efforts taken to restore normal monitoring procedures.

Emergencies:

In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the following procedure for declaring the emergency period to be over:

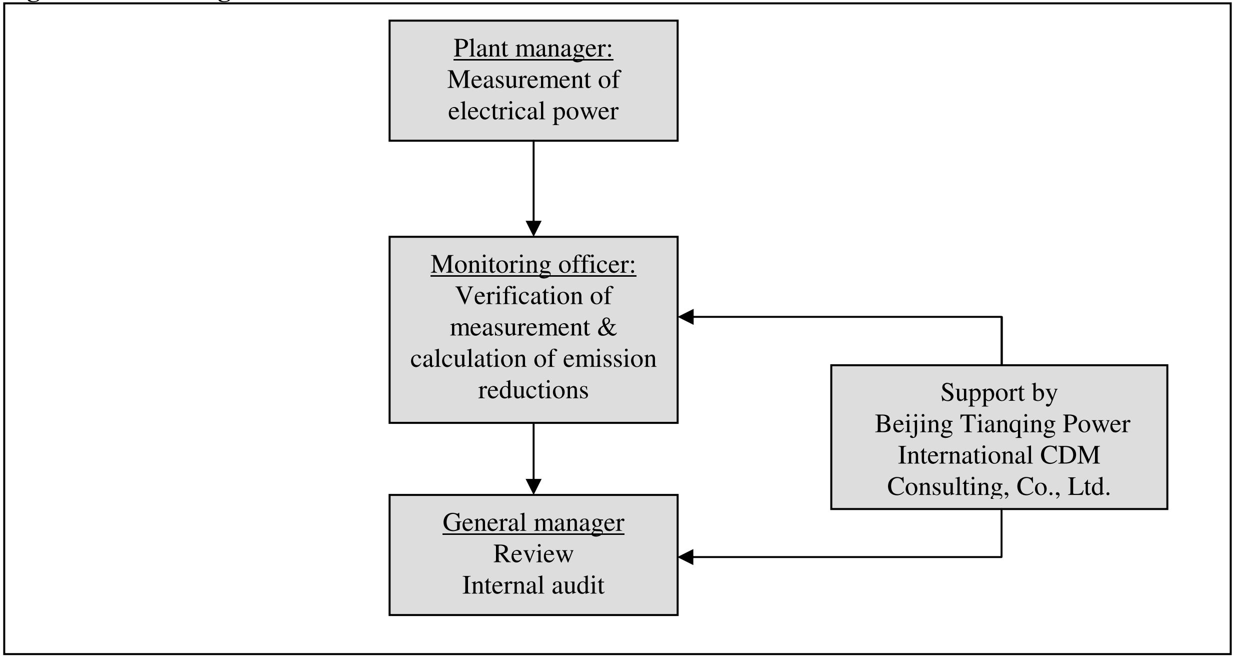
1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure B.3. The General Manager will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the electrical energy supplied to the grid and reporting of daily operations, which will be carried out by the plant manager.

The project entity will appoint a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the grid to the hydropower plant, and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the hydropower station including operating periods, power delivered to the grid, equipment defects, operating hours of the diesel generator, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Annex 4. Finally, the monitoring reports will be reviewed by the General Manager of Shuicheng County Jinshizi Hydropower Development Co., Ltd.

Figure B.3. Management structure in order to monitor emission reductions



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: 16/07/2007
Name of persons determining the baseline:

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Beijing Tianqing Power International CDM Consulting, Co., Ltd., Enecore Carbon Limited, and Caspervandertak Consulting are all not project participants.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

June 28, 2005 (this date marks the start of construction activities)

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

30 years 0 months

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:

01/04/2008(or earliest date after registration)

C.2.1.2. Length of the first crediting period:

7 years 0 months

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 laws and regulations, an environmental impact assessment has been carried out, and has been approved by Environment Protection Bureau of Guizhou Province on July 26th, 2006. The main conclusions are provided below:

1. Impact on Aquatic Environment
The wastewater mainly consists of industrial and domestic wastewater. Wastewater produced during the construction and operating periods will be discharged in the Sancha River after deposition treatment and meeting appropriate standards in order to avoid pollution from direct discharge.

2. Impact on Ambient Air
The dust is mainly produced during the process of blasting and excavations for the tunnel, exploitation and machining of the sandstone, agitating the concrete, and the transportation of raw materials, which will have a negative impact on the ambient air. Since the project is located in a gorge which is far from residential areas, the impact on local residents is negligible. Additionally, because the construction period is limited, several impacts are temporary. In addition, the influence on air quality will be also decreased as the project entity will spray water and seal dust generating equipment was possible.

3. Impact on Acoustic Environment
The noise will be produced by equipment operation and transportation. Taking steps such as employing corresponding protective and environmental measures, the environmental impact should be negligible.

4. Impact of Soil and Water Loss
Soil and water loss will mainly result from excavation, stone collecting, waste slag and stacking of building materials. In order to minimize soil and water loss, the construction activity should be controlled within the requisitioned land area. As a result, the impact on the neighbouring land will also be reduced. All of the waste slag will be carried away from the building site. To reduce soil and water loss, measures such as slurry building to protect the slope will be used.

5. Impact of Land Requisition on Land Utilization and Immigration
The flooded land area is 0.71km^2. The land occupied by the project is 13.77ha, of which the temporary occupied land is 8.19ha and the permanently occupied land is 5.58ha. The project involves 28 migrants. Through compensation before construction and support after construction, the production and livelihood will be maintained at the level before the project construction. After construction, the site will immediately be cleaned up and the tilled land and natural sites will be reclaimed.

6. Impact on ecosystem
The project will have some negative impact on local biological organisms but there are no national or provincial protected rare species of fish, local endemic species or migratory fish present. Therefore, the project will have little negative impact on the ecology.

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 both believe that the project causes little negative impact on environment, also evidenced by the fact that the Environmental Impact Assessment has been approved by the Environment Protection Bureau of Guizhou Province.

SECTION E. Stakeholders' comments

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

A special stakeholder consultation meeting of the project was organized from 10:00 to 12:00 on Dec. 6, 2006 at Zhongshan Hotel of Liupanshui City, Guizhou Province to investigate opinions of all the potential stakeholders, such as local residents and so on, aiming at collecting advices on the influence imposed on the local society, economy, daily life etc for the project broadly.

Before the stakeholders' meeting, project owner had distributed questionnaires for local residents to investigate the suggestion of them on the construction of Jinshizi Hydropower Station, including the impact on social, economical and life. In order to make the potential stakeholders to receive information of the meeting, the project owner published a bulletin for the meeting of stakeholders on the newspaper of *Liangdu Evening Paper* on Dec. 1, 2006, and also publicized the meeting bulletin via the website of www.tqcdmchina.com, in the bulletin, the companies noticed that all the potential stakeholders could learn the detailed information on the project. On the meeting, the project owner and the consultant invited the participants in the meeting to express their comments and concerns about the project and CDM. The representatives asked some questions as following:

1. Do the local residents lack electricity?
2. Will the project bring noise impact and other environmental impact? How far the project is away from the nearest local resident?
3. What constitutes the livelihood of local residents? Will the construction of the project have a negative impact on the local residents' income? If there is an increase, how much will be the income increased by now?
4. Before the construction of the project, what is the site used for? Whether the local residents have some following questions, such as tilled land reduction and so on? And if yes, whether it has been resolved? Whether the standard of compensation is accordance with the national regulation?
5. How much migration will be impacted?
6. Whether the infrastructure will be improved? Such as traffic.
7. Whether the project causes impact on cultural relic and historic site?
8. Will the project have any negative impact on the local ecological environment? Such as, animals, fish, vegetation and so on.
9. Whether the local residents know CDM? What are their attitudes for the CDM?
10. Are you agreed with the construction of the project?

E.2. Summary of the comments received:

19 filled in questionnaires have been returned.
The profile of the participants is as follows:

- 100% are graduated from senior high school or lower
- About 31.6% are women
- 100% are elder than 20 years old

The results of the survey are as follows:

- About 95% of the investigated residents know hydropower station
- About 95% of the investigated residents think the traffic conditions communication facilities are very poor, and the others think it commonly.

- About 95% of the investigated residents think the traffic conditions communication facilities are very poor, and the others think it commonly.
- 100% of the investigated residents think the project will improve the local traffic conditions and communication facilities.
- About 53% of the investigated residents think the local environment is very bad, others think it is normal.
- 100% of the investigated residents are not forced migrating people.
- About 90% of the investigated residents think the hydropower station construction has no negative impact on their life.
- About 42% of the investigated residents think the hydropower station construction has no negative impact on local environment, and others think there will be some negative impact caused by exploitation and construction, since the construction period is short, all the negative impact will be reduced.
- 100% of the investigated residents think it will have benefit on their life.
- About 90% of the investigated residents think the project will do no harm for their life.
- 100% of the investigated residents agree with the construction of the project.

From the questionnaires and stakeholders' meeting, we can find that all the local government and residents agree with the construction of the project. All stakeholders think that:
The construction of designed project will accelerate the sustainable economical development of Shuicheng County. It can also develop that *substitute firewood by electricity project*, thus solve the problem of the supply fuel and energy, protect local ecosystem. The project will provide electricity power for life and manufacture, provide low-cost energy to promote the development of local industry, at the same time, improve the communication and transportation condition, increasing employment rate and income of local residents, improve standard of living, and speed up the pace of social progress of overall construction middle-class family. The impact brought by proposed project is favourable, so all of them support the construction of this project.

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

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Owner

Organization:	Shuicheng County Jinshizi Hydropower Development Co., Ltd.
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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

The baseline uses OM and BM emission factors published by the Chinese authorities for climate change on the internet. Full information on the calculation of the baseline and underlying data can be found at:

- http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144550669.pdf: calculation result of the baseline emission factor of Chinese power grid.
- http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144641643.xls: calculation process of the baseline OM emission factor of Chinese power grid
- http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144747182.pdf: calculation process of the baseline BM emission factor of Chinese power grid

Below we provide the main data used in the calculation of the baseline emission factor. Please note that all primary data are from the files downloaded and mentioned above, crosschecked against the data sources mentioned in these documents. For example, if we cite below the China Energy Statistical Yearbook, then that is the primary data source used in the published calculations. Where the primary data source differed from the data used in the calculation of the published emission factor, we have relied on the primary data source. Our calculated emission factor is slightly different from the published emission factor. Because the calculated OM and BM emissions factor is lower than the published OM and BM emission factor, we have used our calculated baseline emission factor in the PDD. This is conservative.

Table A1. Calculation of the Combined Margin Emission Factor

	Emission factor A	Value and Source B	Weight C	Weighted value D = B * C
1	EF_{OM}	0.95408 Table A2	0.5	0.47704
2	EF_{BM}	0.56930 Table A10, C	0.5	0.28465
3	CM			0.761689 D1 + D2

Note that our calculated combined margin emission factor is lower than the combined margin emission factor that can be calculated on the basis of the published Operating Margin (0.9853) and Build Margin emission factor (0.5714). The reason for the difference is that the data published in the files above contain some data that cannot be found in public sources. We have noted in the following tables where the data we used for the calculation differ from the data in the files mentioned above.

Table A2. Calculation of the Operating Margin Emission Factor

	Variable	2002 A	2003 B	2004 C	Total D
1	Supply of thermal power to the South China Grid (MWh)	173,292,685 Table A3c, C7	211,365,399 Table A3b, C7	247,366,229 Table A3a, C7	632,024,313 D1 = A1 + B1 + C1
2	Imports of power from Central China Grid (MWh)	0 Files cited above	11,100 Files cited above	10,951,240 Files cited above	10,962,340 D2 = A2 + B2 + C2

3	Total power supply for calculation EF_{OM} (MWh)	173,292,685	211,376,499	258,317,469	642,986,653
		A3 = A1 + A2	B3 = B1 + B2	C3 = C1 + C2	D3 = D1 + D2
4	CO_2 emissions associated with thermal power generation on South China Grid (tCO_2)	169,456,127	195,023,612	240,090,547	604,570,287
		Table A4c, E	Table A4b, E	Table A4a, E	D4 = A4 + B4 + C4
5	CO_2 emissions associated with power imports from Central China Grid (tCO_2)	0	8,545	8,881,615	8,890,159
		Table A9c, E	Table A9b, E	Table A9a, E	D5 = A5 + B5 + C5
6	Total CO_2 emissions for calculation EF_{OM} (tCO_2)	169,456,127	195,032,157	248,972,162	613,460,446
		A6 = A4 + A5	B6 = B4 + B5	C6 = C4 + C5	D6 = D4 + D5
7	EFOM (tCO_2/MWh)	0.97786	0.92268	0.96382	0.95408
		A6 / A3	B6 / B3	C6 / C3	D6 / D3

Table A3a. Calculation of thermal power supply to the South China Grid, 2004

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Guangdong	169,389,000	5.42	160,208,116
2	Guangxi	20,143,000	8.33	18,465,088
3	Guizhou	49,720,000	7.06	46,209,768
4	Yunnan	24,322,000	7.56	22,483,257
5	South China			***247,366,229***
				C5 = C1 + C2 + C3 + C4

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2005, p. 472-474.

Table A3b. Calculation of thermal power supply to the South China Grid, 2003

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Guangdong	143,351,000	4.99	136,197,785
2	Guangxi	17,079,000	4.09	16,380,469
3	Guizhou	43,295,000	6.57	40,450,519
4	Yunnan	19,055,000	3.77	18,336,627
5	South China			***211,365,399***
				C5 = C1 + C2 + C3 + C4

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2004, p. 670, p. 709.

Table A3c. Calculation of thermal power supply to the South China Grid, 2002

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Guangdong	123,081,000	5.58	116,213,080
2	Guangxi	13,069,000	8.31	11,982,966
3	Guizhou	33,231,000	7.90	30,605,751
4	Yunnan	15,787,000	8.21	14,490,887
5	South China			***173,292,685***
				C5 = C1 + C2 + C3 + C4

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2003, p. 591-592.

Table A4a. Calculation of CO_2 emissions from fuels for thermal power production, South China Grid, 2004. [17]

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	South China Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO_2 emissions (tCO_2)
						A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	6,017.70	1,305.00	2,643.90	697.80	10,664.40	209.08	0.98	25.8	206,712,210
Clean coal	10^4 Tons	0.21	0.00	0.00	0.00	0.21	263.44	0.98	25.8	5,129
Other washed coal	10^4 Tons	0.00	0.00	0.00	45.93	45.93	83.63	0.98	25.8	356,103
Coke	10^4 Tons	0.00	0.00	0.00	0.00	0.00	284.35	0.98	29.5	0
Coke oven gas	10^8 m^3	0.00	0.00	0.00	0.00	0.00	1,672.60	0.995	13	0
Other gas	10^8 m^3	2.58	0.00	0.00	0.00	2.58	522.70	0.995	13	63,960
Crude oil	10^4 Tons	16.89	0.00	0.00	0.00	16.89	418.16	0.99	20	512,754
Gasoline	10^4 Tons	0.00	0.00	0.00	0.00	0.00	430.70	0.99	18.9	0
Diesel	10^4 Tons	48.88	0.00	0.00	0.00	48.88	426.52	0.99	20.2	1,528,722
Fuel oil	10^4 Tons	957.71	0.00	0.00	0.00	957.71	418.16	0.99	21.1	30,673,659
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	501.79	0.995	17.2	0
Refinery gas	10^4 Tons	2.86	0.00	0.00	0.00	2.86	460.55	0.995	18.2	87,460
Natural gas	10^8 m^3	0.48	0.00	0.00	0.00	0.48	3,893.10	0.995	15.3	104,309
Other petroleum products	10^4 Tons	1.66	0.00	0.00	0.00	1.66	383.69	0.99	20	46,241
Other coking products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	284.35	0.98	25.8	0
Other E (standard coal)	10^4 Tce	79.42	0.00	0.00	0.00	79.42	292.70	0.98	0	0
Total										240,090,547
										$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2005, p. 274-281,294-301. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6.

[17] Date used in the calculation of the published emission factor are different from ours for Yunnan (we have used the China Energy Statistical Yearbook as source, the published EF uses China Electric Power Yearbook as source. Our choice is conservative.

Table A4b. Calculation of CO_2 emissions from fuels for thermal power production, South China Grid, 2003.

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	South China Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO2 emissions (tCO_2)
						A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	4,491.79	831.84	2,169.11	1,405.27	8,898.01	209.08	0.98	25.8	172,473,586
Clean coal	10^4 Tons	0.05	0.00	0.00	0.00	0.05	263.44	0.98	25.8	1,221
Other washed coal	10^4 Tons	0.00	0.00	36.38	20.37	56.75	83.63	0.98	25.8	439,992
Coke	10^4 Tons	0.00	0.00	0.00	0.50	0.50	284.35	0.98	29.5	15,071
Coke oven gas	10^8 m^3	0.00	0.00	0.00	0.04	0.04	1,672.60	0.995	13	3,173
Other gas	10^8 m^3	3.21	0.00	0.00	11.27	14.48	522.70	0.995	13	358,971
Crude oil	10^4 Tons	6.85	0.00	0.00	0.00	6.85	418.16	0.99	20	207,955
Gasoline	10^4 Tons	0.02	0.00	0.00	0.00	0.02	430.70	0.99	18.9	591
Diesel	10^4 Tons	31.90	0.00	0.00	0.76	32.66	426.52	0.99	20.2	1,021,442
Fuel oil	10^4 Tons	627.22	0.30	0.00	0.00	627.52	418.16	0.99	21.1	20,098,291
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	501.79	0.995	17.2	0
Refinery gas	10^4 Tons	2.85	0.00	0.00	0.00	2.85	460.55	0.995	18.2	87,154
Natural gas	10^8 m^3	0.00	0.00	0.00	0.00	0.00	3,893.10	0.995	15.3	0
Other petroleum products	10^4 Tons	11.35	0.00	0.00	0.00	11.35	383.69	0.99	20	316,164
Other coking products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	284.35	0.98	25.8	0
Other E (standard coal)	10^4 Tce	93.21	0.00	0.00	22.35	115.56	292.70	0.98	0	0
Total										195,023,612
										$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2004, p. 218-225,238-245. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6.

Table A4c. Calculation of CO_2 emissions from fuels for thermal power production, South China Grid, 2002. [18]

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	South China Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO2 emissions (tCO_2)
						A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	4,121.06	711.35	1,430.68	1,144.39	7,407.48	209.08	0.98	25.8	143,582,064
Clean coal	10^4 Tons	0.00	0.00	0.00	0.00	0.00	263.44	0.98	25.8	0
Other washed coal	10^4 Tons	0.00	0.00	35.26	13.58	48.84	83.63	0.98	25.8	378,665
Coke	10^4 Tons	0.00	0.00	0.00	6.44	6.44	284.35	0.98	29.5	194,115
Coke oven gas	10^8 m^3	0.00	0.00	0.00	0.00	0.00	1,672.60	0.995	13	0
Other gas	10^8 m^3	2.63	0.00	0.00	0.00	2.63	522.70	0.995	13	65,200
Crude oil	10^4 Tons	5.80	0.00	0.00	0.00	5.80	418.16	0.99	20	176,079
Gasoline	10^4 Tons	0.01	0.00	0.00	0.00	0.01	430.70	0.99	18.9	295
Diesel	10^4 Tons	73.07	0.67	0.00	0.50	74.24	426.52	0.99	20.2	2,321,856
Fuel oil	10^4 Tons	701.41	0.20	0.00	0.00	701.61	418.16	0.99	21.1	22,471,256
LPG	10^4 Tons	0.09	0.00	0.00	0.00	0.09	501.79	0.995	17.2	2,834
Refinery gas	10^4 Tons	1.42	0.00	0.00	0.00	1.42	460.55	0.995	18.2	43,424
Natural gas	10^8 m^3	0.00	0.00	0.00	0.00	0.00	3,893.10	0.995	15.3	0
Other petroleum products	10^4 Tons	7.91	0.00	0.00	0.00	7.91	383.69	0.99	20	220,340
Other coking products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	284.35	0.98	25.8	0
Other E (standard coal)	10^4 Tce	79.28	0.00	0.00	0.00	79.28	292.70	0.98	0	0
Total										169,456,127
										$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2000-2002, p. 380-383, 392-395,436-439,448-451. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6.

[18] The published emission factor uses 0.63 for 'other gas' in Guangdong. Our number is consistent with the China Energy Statistical Yearbook.

Table A5. Calculation of emissions associated with imports from the Central China Grid

Year	Imports (MWh) A	Average emission factor (tCO_2/MWh) B	Associated CO_2 emissions (tCO_2) C = B * A
2004	10,951,240	0.81101	8,881,615
		Table A6	
2003	11,100	0.76979	8,545
		Table A6	
2002	0	0.72739	0
		Table A6	

Table A6. Calculation of average emission factors of the Central China Grid

		2002	2003	2004
1	Total power supply (MWh)[19]	295,691,681	351,917,335	418,261,666
		Table A7	Table A7	Table A7
2	Total CO_2 Emissions (tCO_2)	215,083,238	270,902,650	339,216,283
		Table A9c	Table A9b	Table A9a
3 = 2/1	Average emission Factor (tCO_2/MWh)	0.72739	0.76979	0.81101

Table A7. Calculation of total power supply on the Central China Grid.

		2002	2003	2004
1	Thermal power supply (MWh)	183,733,385	225,987,719	249,074,186
		Table A8c	Table A8b	Table A8a
2	Non-thermal power supply (MWh) [20]	111,958,296	125,929,616	169,187,480
		Table A8f	Table A8e	Table A8d
3 = 1 + 2	Total power supply (MWh)	295,691,681	351,917,335	418,261,666

Table A8a. Calculation of thermal power supply to the Central China Grid, 2004

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Jiangxi	30,127,000	7.04	28,006,059
2	Henan	109,352,000	8.19	100,396,071
3	Hubei	43,034,000	6.58	40,202,363
4	Hunan	37,186,000	7.47	34,408,206
5	Chongqing	16,520,000	11.06	14,692,888
6	Sichuan	34,627,000	9.41	31,368,599
7	Central China			249,074,186
				C7 = C1 + C2 + C3 + C4 + C5 + C6

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2005, p. 472-474.

19 Date used for total power supply to the Central China Grid differ from those used in the published emission factors.

20 Date used for non-thermal power supply to the Central China Grid differ from those used in the published emission factors. The main difference is that we have assumed losses (%) for hydropower in 2003 to be identical to losses (%) in 2004, whereas the published emission factor assumes no losses.

Table A8b. Calculation of thermal power supply to the Central China Grid, 2003

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Jiangxi	27,165,000	6.43	25,418,291
2	Henan	95,518,000	7.68	88,182,218
3	Hubei	39,532,000	3.81	38,025,831
4	Hunan	29,501,000	4.58	28,149,854
5	Chongqing	16,341,000	8.97	14,875,212
6	Sichuan	32,782,000	4.41	31,336,314
7	Central China			225,987,719 C7 = C1 + C2 + C3 + C4 + C5 + C6

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2004, p. 670, p.709.

Table A8c. Calculation of thermal power supply to the Central China Grid, 2002

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Jiangxi	18,648,000	7.67	17,217,698
2	Henan	84,734,000	8.03	77,929,860
3	Hubei	34,301,000	7.73	31,649,533
4	Hunan	20,058,000	7.73	18,507,517
5	Chongqing	14,727,000	10.21	13,223,373
6	Sichuan	27,879,000	9.59	25,205,404
7	Central China			183,733,385 C7 = C1 + C2 + C3 + C4 + C5 + C6

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2003, p. 591-592.

Table A8d. Calculation of non-thermal power supply to the Central China Grid, 2004

	Grid	Hydropower generation (MWh) A	Losses (%) B	Hydropower supply (MWh) C = A * (100 - B) / 100	Other supply (MWh) D	Total non-thermal power supply E = C + D
1	Jiangxi	3,890,000	1.20	3,843,320	0	3,843,320
2	Henan	6,884,000	0.43	6,854,399	0	6,854,399
3	Hubei	69,512,000	0.12	69,428,586	0	69,428,586
4	Hunan	24,236,000	0.51	24,112,396	0	24,112,396
5	Chongqing	5,670,000	2.09	5,551,497	725,000	6,276,497
6	Sichuan	58,902,000	0.39	58,672,282	0	58,672,282
7	Central China			168,462,480 C7 = C1 + C2 + C3 + C4 + C5 + C6	725,000 D7 = D1 + D2 + D3 + D4 + D5 + D6	169,187,480 E7 = E1 + E2 + E3 + E4 + E5 + E6

Source: China Electric Power Yearbook 2005, p. 472-474.

Table A8e. Calculation of non-thermal power supply to the Central China Grid, 2003

	Grid	Hydropower generation (MWh) A	Losses (%) B	Hydropower supply (MWh) C = A * (100 - B) / 100	Other supply (MWh) D	Total non-thermal power supply E = C + D
1	Jiangxi	3,864,000	1.20	3,817,632	0	3,817,632
2	Henan	5,457,000	0.43	5,433,535	0	5,433,535
3	Hubei	38,775,000	0.12	38,728,470	0	38,728,470
4	Hunan	24,401,000	0.51	24,276,555	0	24,276,555
5	Chongqing	3,951,000	2.09	3,868,424	0	3,868,424
6	Sichuan	50,000,000	0.39	49,805,000	0	49,805,000
7	Central China			125,929,616	0	125,929,616
				C7 = C1 + C2 + C3 + C4 + C5 + C6	D7 = D1 + D2 + D3 + D4 + D5 + D6	E7 = E1 + E2 + E3 + E4 + E5 + E6

Source: China Electric Power Yearbook 2004, p. 670, p.709. Losses are not reported for 2003 and have been assumed identical to 2004 losses.[21]

Table A8f. Calculation of non-thermal power supply to the Central China Grid, 2002

	Grid	Hydropower generation (MWh) A	Losses (%) B	Hydropower supply (MWh) C = A * (100 - B) / 100	Other supply (MWh) D	Total non-thermal power supply E = C + D
1	Jiangxi	6,151,000	0.78	6,103,022	0	6,103,022
2	Henan	4,859,000	0.49	4,835,191	0	4,835,191
3	Hubei	27,854,000	0.26	27,781,580	0	27,781,580
4	Hunan	25,329,000	0.39	25,230,217	0	25,230,217
5	Chongqing	3,748,000	1.62	3,687,282	0	3,687,282
6	Sichuan	44,499,000	0.40	44,321,004	0	44,321,004
7	Central China			111,958,296	0	111,958,296
				C7 = C1 + C2 + C3 + C4 + C5 + C6	D7 = D1 + D2 + D3 + D4 + D5 + D6	E7 = E1 + E2 + E3 + E4 + E5 + E6

Source: China Electric Power Yearbook 2003, p. 591-592.

[21] In the published emission factor, losses are assumed 0.

Table A9a. Calculation of CO_2 emissions from fuels for thermal power production, Central China Grid, 2004.

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	CentralChina Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO_2 emissions (tCO_2)
								A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	1,863.80	6,948.50	2,510.50	2,197.90	875.5	2,747.90	17,144.10	209.08	0.98	25.8	332,310,753
Clean coal	10^4 Tons	0	2.34	0	0	0	0	2.34	263.44	0.98	25.8	57,150
Other washed coal	10^4 Tons	48.93	104.22	0	0	89.72	0	242.87	83.63	0.98	25.8	1,883,012
Briquettes[22]	10^4 Tons	0	0	0	0.92	0	0	0.92	83.63	0.98	25.8	7,133
Coke	10^4 Tons	0	109.61	0	0	0	0	109.61	284.35	0.98	29.5	3,303,870
Coke oven gas	10^8 m^3	0	0	1.68	0	0.34	0	2.02	1672.6	0.995	13.0	160,244
Other gas	10^8 m^3	0	0	0	0	2.61	0	2.61	522.7	0.995	13.0	64,704
Crude oil	10^4 Tons	0	0.86	0.22	0	0	0	1.08	418.16	0.99	20.0	32,787
Gasoline	10^4 Tons	0	0.06	0	0	0.01	0	0.07	430.7	0.99	18.9	2,068
Diesel	10^4 Tons	0.02	3.86	1.7	1.72	1.14	0	8.44	426.52	0.99	20.2	263,961
Fuel oil	10^4 Tons	1.09	0.19	9.55	1.38	0.48	1.68	14.37	418.16	0.99	21.1	460,244
LPG	10^4 Tons	0	0	0	0	0	0	0.00	501.79	0.995	17.2	0
Refinery gas	10^4 Tons	3.52	2.27	0	0	0	0	5.79	460.55	0.995	18.2	177,060
Natural gas	10^8 m^3	0	0	0	0	0	2.27	2.27	3893.1	0.995	15.3	493,296
Other petroleum products	10^4 Tons	0	0	0	0	0	0	0.00	383.69	0.99	20.0	0
Other coking products	10^4 Tons	0	0	0	0	0	0	0.00	284.35	0.98	25.8	0
Other E (standard coal)	10^4 Tce	0	16.92	0	15.2	20.95	0	53.07	292.7	0.98	0.0	0
Total												339,216,283
												$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2005, p. 254-257, 262-273, 286-293. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6.

[22] This row is absent in the published emission factors.

Table A9b. Calculation of CO_2 emissions from fuels for thermal power production, Central China Grid, 2003.

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Central China Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO_2 emissions (tCO_2)
								A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	1,427.41	5,504.94	2,072.44	1,646.47	769.47	2,430.93	13,851.66	209.08	0.98	25.8	268,492,109
Clean coal	10^4 Tons	0	0	0	0	0	0	0.00	263.44	0.98	25.8	0
Other washed coal	10^4 Tons	2.03	39.63	0	0	106.12	0	147.78	83.63	0.98	25.8	1,145,763
Briquettes	10^4 Tons	0	0	0	0	0	0	0.00	83.63	0.98	25.8	0
Coke	10^4 Tons	0	0	0	1.22	0	0	1.22	284.35	0.98	29.5	36,773
Coke oven gas	10^8 m^3	0	0	0.93	0	0	0	0.93	1672.6	0.995	13.0	73,776
Other gas	10^8 m^3	0	0	0	0	0	0	0.00	522.7	0.995	13.0	0
Crude oil	10^4 Tons	0	0.5	0.24	0	0	1.2	1.94	418.16	0.99	20.0	58,895
Gasoline	10^4 Tons	0	0	0	0	0	0	0.00	430.7	0.99	18.9	0
Diesel	10^4 Tons	0.52	2.54	0.69	1.21	0.77	0	5.73	426.52	0.99	20.2	179,206
Fuel oil	10^4 Tons	0.42	0.25	2.17	0.54	0.28	1.2	4.86	418.16	0.99	21.1	155,657
LPG	10^4 Tons	0	0	0	0	0	0	0.00	501.79	0.995	17.2	0
Refinery gas	10^4 Tons	1.76	6.53	0	0.66	0	0	8.95	460.55	0.995	18.2	273,694
Natural gas	10^8 m^3	0	0	0	0	0.04	2.2	2.24	3893.1	0.995	15.3	486,776
Other petroleum products	10^4 Tons	0	0	0	0	0	0	0.00	383.69	0.99	20.0	0
Other coking products	10^4 Tons	0	0	0	0	0	0	0.00	284.35	0.98	25.8	0
Other E (standard coal)	10^4 Tce	0	11.04	0	0	16.2	0	27.24	292.7	0.98	0.0	0
Total												270,902,650
												$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2004, 2004, p. 198-201, 206-217, 230-237. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6.

Table A9c. Calculation of CO_2 emissions from fuels for thermal power production, Central China Grid, 2002.

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Central China Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO_2 emissions (tCO_2)
								A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	1,062.63	4,679.02	1,710.00	1,113.78	398.57	1,964.32	10,928.32	209.08	0.98	25.8	211,827,874
Clean coal	10^4 Tons	2.72	0	0	0	0	0	2.72	263.44	0.98	25.8	66,431
Other washed coal	10^4 Tons	3.66	26.49	0	0	249.99	0	280.14	83.63	0.98	25.8	2,171,973
Briquettes	10^4 Tons	0	0	0	0	0	0	0.00	83.63	0.98	25.8	0
Coke	10^4 Tons	0	1.15	0	0	0	0	1.15	284.35	0.98	29.5	34,663
Coke oven gas	10^8 m^3	0	0	1.11	0	0	0	1.11	1672.6	0.995	13.0	88,055
Other gas	10^8 m^3	0	2.16	0	0	0	0	2.16	522.7	0.995	13.0	53,548
Crude oil	10^4 Tons	0	0.67	1.17	0	0	0.81	2.65	418.16	0.99	20.0	80,450
Gasoline	10^4 Tons	0	0	0	0	0	0	0.00	430.7	0.99	18.9	0
Diesel	10^4 Tons	1	1.34	1.08	2.19	0.51	0.51	6.63	426.52	0.99	20.2	207,353
Fuel oil	10^4 Tons	0.33	0.16	0.34	0.69	0	1.51	3.03	418.16	0.99	21.1	97,045
LPG	10^4 Tons	0	0.02	0	0	0	0	0.02	501.79	0.995	17.2	630
Refinery gas[23]	10^4 Tons	0.49	0	0	1.96	0	0	2.45	460.55	0.995	18.2	74,922
Natural gas	10^8 m^3	0	0	0	0	0	1.75	1.75	3893.1	0.995	15.3	380,294
Other petroleum products	10^4 Tons	0	0	0	0	0	0	0.00	383.69	0.99	20.0	0
Other coking products	10^4 Tons	0	0	0	0	0	0	0.00	284.35	0.98	25.8	0
Other E (standard coal)	10^4 Tce	0	3.38	0	0	0	0	3.38	292.7	0.98	0.0	0
Total												215,083,238
												$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2000-2002, p. 320-323, 344-347, 356-359, 368-371, 412-415, 424-427. Net calorific values are from the files mentioned above and crosschecked against China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; fuel emission coefficients are from the files mentioned above and crosschecked against IPCC default values, see Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.6.

[23] The published emission factor uses 1.9 for Henan. Our number is consistent with China Energy Statistical Yearbook.

Table A10. Calculation of the BM Emission Factor, South China Grid

$EF_{thermal}$ (tCO_2/MWh)	Share of thermal power in added capacity, 2004-2002	EF_{BM} (tCO_2/MWh)
A	B	C = A * B
0.87048	65.40%	0.56930
Table A11	Table A14	

Table A11. Calculation of EF thermal

		λ A	EF_{adv} B	$EF_{thermal}$ calculation C = A * B
1	Coal	86.25%	0.91363	0.78799
		Table A13	Table A12	
2	Gas	0.11%	0.43809	0.00047
		Table A13	Table A12	
3	Oil	13.65%	0.60112	0.08203
		Table A13	Table A12	
4	$EF_{thermal}$			0.87048

Table A12. Calculation of Emission factors of fuel using advanced technologies

Fuel	Efficiency (%) A	Carbon coefficient (tc/TJ) B	Oxidation factor C	EF_{adv} (tCO_2/MWh) D=(3.6/(A*1000))*B*C*44/12
Coal	36.53%	25.8	0.98	0.9136
Gas	45.87%	15.3	0.995	0.4381
Oil	45.87%	21.1	0.99	0.6011

Source: Files downloaded and mentioned above.

Table A13. Calculation of λs for the calculation of the BM, South China Grid.[24]

Fuel	Unit	South China Grid	NCV (TJ/unit)	Oxidation factor (Fraction)	Carbon coefficient (TC/TJ)	CO_2 emissions (tCO_2)
		A	B	C	D	E = A*B*C*D*44/12
Raw coal	10^4 Tons	10,664.40	209.08	0.98	25.8	206,712,210
Clean coal	10^4 Tons	0.21	263.44	0.98	25.8	5,129
Other washed coal	10^4 Tons	45.93	83.63	0.98	25.8	356,103
Coke	10^4 Tons	0.00	284.35	0.98	29.5	0
Other coking products	10^4 Tons	0.00	284.35	0.98	25.8	0
Coal, total						***207,073,442***
Coke oven gas	10^8 m^3	0.00	1,672.60	0.995	13.0	0
Other gas	10^8 m^3	2.58	522.70	0.995	13.0	63,960
LPG	10^4 Tons	0.00	501.79	0.995	17.2	0
Refinery gas	10^4 Tons	2.86	460.55	0.995	18.2	87,460
Natural gas	10^8 m^3	0.48	3,893.10	0.995	15.3	104,309
Gas total						***255,729***
Crude oil	10^4 Tons	16.89	418.16	0.99	20.0	512,754

24 Data are from Table A4a. As noted in a footnote attached to that table, there are some differences between the data in this table and those used in the calculation of the published emission factors.

Gasoline	10^4 Tons	0.00	430.70	0.99	18.9	0
Diesel	10^4 Tons	48.88	426.52	0.99	20.2	1,528,722
Fuel oil	10^4 Tons	957.71	418.16	0.99	21.1	30,673,659
Other petroleum products	10^4 Tons	1.66	383.69	0.99	20.0	46,241
Oil total						***32,761,376***
Total						***240,090,547***
						$\Sigma(E_i)$

Λcoal	86.25%
Λgas	0.11%
Λoil	13.65%

Note that λ is calculated as the share of coal, gas respectively oil in total CO_2 emissions.

Table A14. Calculation of the share of thermal power in recently added capacity

Installed capacity	**2002** **A**	**2003** **B**	**2004** **C**	**Capacity added in 2002-2004** **D=C-A**	**Share in added capacity**
Thermal (MW)	35,969.2	40,444.1	46,659.7	10,690.5	65.40%
Hydropower (MW)	22,921.0	25,409.3	27,580.1	4,659.1	28.50%
Nuclear (MW)	2,790.0	3,780.0	3,780.0	990.0	6.06%
Other (MW)	76.8	83.4	83.4	6.6	0.04%
Total (MW)	61,757.0	69,716.8	78,103.2	16,346.2	100.00%
Percentage of 2004 capacity	79.07%	89.26%	100%		

Source: China Electric Power Yearbook 2005, p. 472-474; China Electric Power Yearbook 2004, p. 670, p.709; China Electric Power Yearbook 2003, p. 591-592.

Annex 4

MONITORING INFORMATION

Selection procedure:
The monitoring officer will be appointed by the general manager of Shuicheng County Jinshizi Hydropower Development Co., Ltd. The monitoring officer will be selected from among the senior technical or managerial staff. Before he/she commences monitoring duties, he/she will receive training on monitoring requirements and procedures by Beijing Tianqing Power International CDM Consulting, Co., Ltd.

The selection of the initial monitoring officer has taken place and the following person was appointed:
Name: Hu Zhiwen
Position: Engineer

Tasks and responsibilities:
The monitoring officer will be responsible for carrying out the following tasks

- **Supervise and verify metering and recording:**
  The monitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.
- **Collection of additional data, sales / billing receipts:**
  The monitoring officer will collect sales receipts for power delivered to the grid, billing receipts for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the hydropower station.
- **Calibration:**
  The monitoring officer will monitor and ensure that calibration of the metering instruments is carried out periodically in accordance with regulations of the grid company.
- **Calculation of emission reductions:**
  The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.
- **Preparation of monitoring report:**
  The monitoring officer will annually prepare a monitoring report which will include among others a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration and a calculation of emission reductions.

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

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