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:

>>
Sichuan Liangtan Hydropower Station Second Phase Project
Version 10
10/02/2009

A.2. Description of the project activity:

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The Sichuan Liangtan Hydropower Station Second Phase Project (hereafter, the "Project") is being developed by Sichuan Guang'an AAA Public Co., Ltd (hereafter referred to as the "Project Developer").

The Project will utilise resources from an existing reservoir, which was built for an existing hydropower plant. The installed capacity of the original Liangtan Hydroelectric Station (LHS) prior to the implementation of the project activity was approximately 8.6MW. The original plant started operation in 1985 and is expected to continue operating until 2032 [1]. The average electricity production of LHS (in the period 2002 to 2006) [2] was 47,893 MWh per year.

Although this Project is a newly built power station with an independent powerhouse, new channel, new turbines and new generators, the project is considered to be an extension project as it utilizes the same water resources as the original plant (LHS). The Project will generate certified emission reductions (CERs) by displacing electricity generation from grid connected fossil fuel-fired power plants. Note that emission reductions will only be claimed for electricity production above the average historic electricity generation amount from the original LHS.

The total installed capacity of the Project will be 20 MW, consisting of two 10 MW turbines, with a predicted supplied electricity to the grid of 84,544 MWh/year. The Project Developer has obtained permission to sell the generated electricity to the Guang'an Power Grid, connecting to the Sichuan Power Grid which is an integral part of the Central China Power Grid, a power grid with relatively high carbon intensity. The electricity currently generated by the grid is relatively carbon intensive, with an operating margin emission factor of 1.2899 tCO_2/MWh and a build margin emission factor of 0.6592 tCO_2/MWh.

The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity: The original LHS would continue to generate electricity and that electricity generated by the units installed as part of the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

The Project is contributing to sustainable development of the Host Country. Specifically, the project:

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[1] See the Project Certificate by Institute of Water Conversation & Hydroelectric Engineering Exploration & Design, Nanchong.

[2] See the Power Generation and Operating Hours statistics in 2002-2006 from Liangtan Station

- Increases employment opportunities in the area where the project is located (approximately 65 persons will be permanently employed for the project operation and the construction of the project secures jobs in the construction sector)
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from diesel and coal-supplied electricity generation
- Makes greater use of hydroelectric renewable energy generation resources for sustainable energy production.

A.3. Project participants:

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Table A.3 Project Participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Sichuan Guang'an AAA Public Co., Ltd.	No
Sweden	EcoSecurities Group Plc.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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The Project is located near Guangxing Town, Guang'an City in Sichuan Province, People's Republic of China.

A.4.1.1. Host Party(ies):

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People's Republic of China (P. R. China)

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

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Sichuan Province

A.4.1.3. City/Town/Community etc:

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Guangxing town, Guang'an City

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

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The exact location of the Project is defined using geographic coordinates obtained with a Global Positioning System (GPS) receiver: N30°38′56″, E106°54′28″. These geographic coordinates are for the power house.

Figure A.4.1 Geographical Location of Sichuan Liangtan Hydropower Station Second Phase Project

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

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According to Annex A of the Kyoto Protocol, this project fits in Sectoral Category 1, Energy Industries (renewable/non renewable).

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

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The purpose of the Project is to utilise resources from an existing reservoir, constructed to serve an existing hydropower plant. The installed capacity of the Project is 20MW (2 * 10MW), with a designed operating lifetime of 23 years [3]. The main technical parameters of the Project are shown in Table A.4.

The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity: The original LHS would continue to generate electricity and that electricity generated by the units installed as part of the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. Equipment and systems in operation in the scenario existing prior to the start of the implementation include the original LHS and all other power plants connected physically to the Grid to which the Project is connected.

[3] Preliminary Design Report Page 15-3

The existing power station consisted of two 3.5MW units (installed in 1985) and one 1.6MW unit (installed in 1997). In the absence of the project activity it is expected that the power station would have continued operating until 2032 [1].

Table A.4 Main technical parameters of the Project

NAME	DATA	SOURCE
Forecast installed capacity of the Project(MW)	20	Preliminary Design Report : P1-2
Installed capacity of the baseline units (i.e. the original LHS) (MW)	8.6	Equipment nameplates
Forecast annual electricity supplied to the grid by the Project (MWh/y)	84,544	Preliminary Design Report:P15-2
Average electricity supplied to the grid by the baseline unit (between 2002 and 2006) in MWh/y	47,893	Historical production data of the original LHS
Forecast feed water flow rate (m^3/s)	159.8	Preliminary Design Report:p6-4
Water head (m)	7.1	Preliminary Design Report:P6-4
Existing reservoir storage capacity (m^3)	3,060,000	Preliminary Design Report:P4-9

*The Preliminary Design Report was written by The Institute of Water Resource & Hydroelectric Engineering Exploration & Design, Nanchong, Sichuan Province and approved by The Development and Reform Commission of Sichuan in 2005

This Project does not involve construction of a new dam or reservoir. The scope of the activities/measures that are being implemented within the project activity includes an open channel that will be built to divert water from the reservoir to the new generation units. This open channel will be 417.3m long and will transfer water to the power house containing two turbine-generator sets as detailed in Table 4.2.

The electricity generated from the Project will be connected to the Guang'an Power Grid via three transformer substations (beginning with the Qianfeng substation, through the Yuanmen substation, and finally connected to grid at the Daishi substation), connecting to the Sichuan Power Grid which is an integral part of the Central China Power Grid. Details of the monitoring equipment and their location are given in section B.7.2. of the PDD.

Table A.4.2. Technical characteristics of the generating equipment[4]

Turbine		Generator	
Turbine Type	GZ9995-WP-460	Generator Type	SFWG10-60/5130
Rated Head	7.1m	Designed Capacity	10 MW
Discharge	159.8 m^3/s	Rated Voltage	10.5 kV
Rated speed	100 rpm	Rated Current	611A
Diameter of Turbine	4.6m	Capacity Factor	0.9
Designed Capacity	10.3MW	Age	0 years

[4] All the technical characteristics of the generating equipment are from Preliminary Designing Report, but it will be finally decided when the actual installation is implemented.

Age 0 years Average lifetime 20 years	Average lifetime 20years

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

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Years	Annual estimation of emission reductions in tonnes of CO_{2e}
2009*	82,392
2010	82,392
2011	82,392
2012	82,392
2013	82,392
2014	82,392
2015	82,392
Total estimated reductions (tonnes of CO_{2e})	**576,746**

*The whole year from June to June.

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

Please refer to section B.6.3 for further details on the quantification of GHG emission reductions associated with the project.

A.4.5. Public funding of the project activity:

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The Project will not receive any public funding from Parties included in Annex I of the UNFCCC.

SECTION B. Application of a baseline and monitoring methodology

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

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1. The approved consolidated baseline and monitoring methodology ACM0002: "Consolidated methodology for grid-connected electricity generation from renewable sources" Version 8, in effect as of 28/11/2008; and
2. The approved "Tool for demonstration and assessment of additionality", Version 5.2, in effect as of EB 39
3. The approved "Tool to calculate the emission factor for an electricity system", Version 1.1, in effect as of EB 35 are applied to the Project activity[5].

More information about the methodology can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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ACM0002 (Version 8) is chosen and applicable to the proposed project due to the following reasons:

- The project activity is a grid-connected renewable power generation project activity that involves electricity capacity additions.
- The project activity is implemented in an existing reservoir, with no change in the volume of reservoir.
- The project activity is connected to the Central China Power Grid. The geographic and system boundaries for this grid can be clearly identified and information on the characteristics of this grid are available.
- The project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- The project activity is not a biomass fired plant
- The project activity meets the applicability conditions of the Tool to calculate the emission factor for an electricity system and the Tool for the demonstration and assessment of additionality.

The applicability criteria stated in methodology ACM0002 (Version 8) are met on the basis of the reasons above.

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

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The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the Central China Power Grid to which the Project is connected.

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[5] The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" Version 1, in effect as of EB 32, is not applied to this Project, since ACM0002 refers to this Tool for geothermal projects and the proposed Project is a hydropower project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table B.3 below.

Table B.3. Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants connected to the Central China Power Grid	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	Emissions of CH_4 from the reservoir	CO_2	No	As there is no new reservoir associated with the project activity, greenhouse gas emissions from the project do not have to be considered according to ACM0002
		CH_4	No	
		N_2O	No	

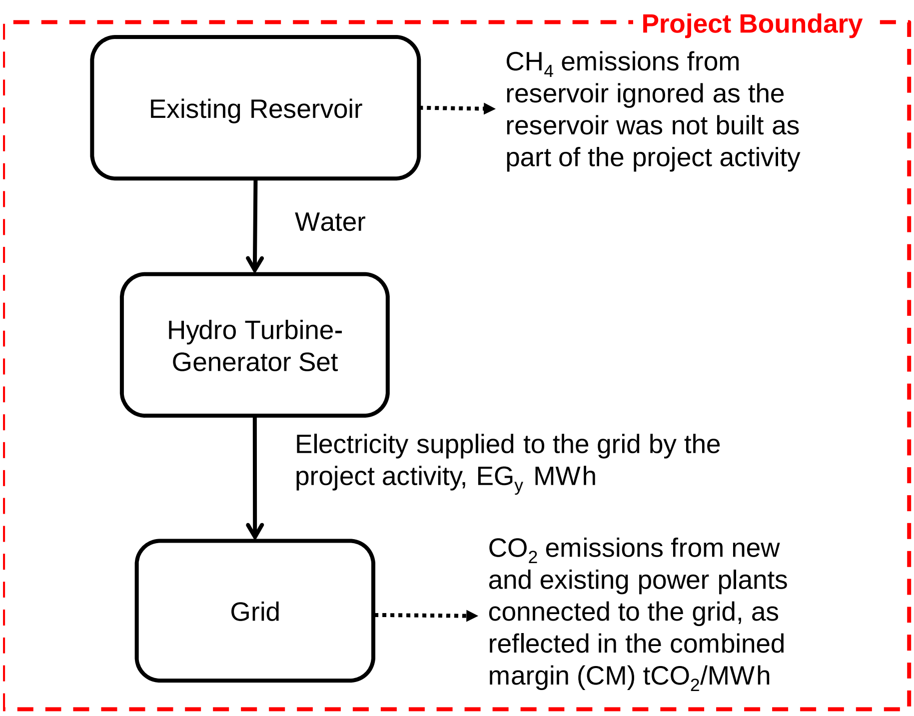

Figure B.1 Flow diagram of the project boundary

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

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The baseline scenario is the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid ($EG_{baseline}$, in MWh/year) at historical average levels ($EG_{historical}$, in MWh/year), until the time at which the generation facility would be likely be replaced or retrofitted in the absence of the CDM project ($DATE_{BaslineRrtrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production ($EG_{Baseline}$) is assumed to equal project electricity production (EG_y, in MWh/year), and no emission reductions are assumed to occur. All project electricity generation above baseline levels ($EG_{baseline}$) would have otherwise been generated by other power plants currently operating in the grid (see the OM calculation) and by the addition of new generation sources, as reflected in the combined margin (CM) calculations in B.6.1.

Table B.4.1: Key Information and Data Used to Determine the Baseline Scenario

Variable	Unit	Source
Operating Margin Emissions factor	1.2899 tCO_2/MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2003-2005
Build Margin Emissions Factor	0.6592tCO_2/MWh	Calculated from the China Energy Statistics Yearbook 2006 and the China Electric Power Yearbooks 2002-2006
Combined Margin Emissions Factor	0.97455tCO_2/MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2002-2006
Electricity supplied to the grid by the project in year y	84,544MWh	Preliminary Design Report: P15-2

In the absence of the project, electricity will continue to be generated by the existing generation mix operating in the grid.

Four realistic and credible alternatives to the project activity are considered to investigate the baseline:

Alternative 1: The Project activity without CDM, i.e. construction of an upgrade hydroelectricity generation plant with installed capacity of 20 MW connected to the local grid, implemented without considering CDM revenues.

Alternative 2: Continuation of the current situation, i.e. electricity will continue to be generated by the existing generation mix operating in the grid.

Alternative 3: Construction of a thermal power plant with the same installed capacity or the same annual power output.

Alternative 4: Construction of a power plant using another renewable energy resource with the same installed capacity or the same annual power output.

Sichuan Province lacks readily exploitable renewable energy resources, except hydrological resources. According to the China Electric Power Yearbooks (2003-2006), the installed capacity of wind farms and other renewable energy technologies is 0 MW. Therefore, *Alternative 4* is not considered to be realistic and credible and is not considered further in the assessment of the alternatives.

Alternative 2 is identified as the baseline scenario: in the absence of the Project activity, electricity will continue to be generated by the existing generation mix operating in the grid. For the full assessment of alternatives see section B.5, according to the Tool for the demonstration and assessment of additionality. Alternatives 1, 2 and 3 will be discussed in section B.5.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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CDM consideration and Timeline

This Project started construction in September 2005 after serious CDM consideration. Due to obvious financial barriers and unrealistic electricity tariff estimated in PDR which was completed in July 2005, the project developer decided to look for CDM revenue. A board meeting was held on July 15th, 2005 during which the Board of Directors decided to start applying for CDM financial aid immediately[6]. Considering the benefits of CDM revenue can help paying back the loan, China Agricultural Bank Guang'an Branch Bank agreed to provide a loan to the Project developer in August, 2005[7]. Following this, the Project developer signed the Equipment Purchase Contract on September 13th, 2005. Construction approval was received on September 5th, 2005.

After attending a CDM conference held by the Sichuan Local Electric Power Bureau[8], the project developer engaged an intermediary named Sichuan Huayuan Country Electrization Development Co., Ltd to introduce a Carbon Credit Buyer in December, 2005. Since then, there were several months of negotiations between project developer, intermediary and Carbon Credit Buyers, as well as several months of investigation of the project. In October, 2006, a CDM Emission Reduction Purchase Agreement (ERPA) was signed between the project developer and EcoSecurities Group PLC.. From then on, the PDD work started, and The Chinese PDD was submitted to NDRC in May, 2007 and LOA was obtained in August, 2007. On August 21st, 2007, a contract was signed with the DOE to start validation of the project. The English PDD was submitted to the DOE in October, 2007.

Table A.4.2. Timeline for the development of the proposed Project

Stage	**Date**
Preliminary Design Report	July, 2005
Board Meeting minutes stating CDM application decision	July 15th, 2005

[6] Minutes of Sichuan Guang'an AAA. Public Co., Ltd board meeting, stating CDM application decision, July 15th, 2005

[7] See the letter from Guang'an Branch Bank of China Agricultural Bank.

[8] See Sichuan Local Electric Power Bureau CDM conference – 11.2005

Letter from China Agricultural Bank showing that CDM was considered before loan was approved	August 6th, 2005
Construction approval	06/09/2005
Equipment Purchase Contract	13/09/2005
Contract with intermediary	08/12/2005
ERPA	October, 2006
NDRC application	May, 2007
NDRC approval	August, 2007
Commercial operation Start	06/09/2007

The following steps are used to demonstrate the additionality of the project according to the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board (Version 5.2, EB 39):

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

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

Three realistic and credible alternatives to the project activity are considered:

Alternative 1: The project activity without CDM, i.e. construction of an upgrade hydroelectricity generation plant with an installed capacity of 20 MW connected to the local grid, implemented without considering CDM revenues.

Alternative 2: Continuation of the current situation, i.e. electricity will continue to be generated by the existing generation mix operating in the grid.

Alternative 3: Construction of a thermal power plant with the same installed capacity or the same annual power output

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

The main sectoral policy relevant to this project activity is the promotion of renewable energy in the People's Republic of China, the Renewable Energy Law, which came into effect on 1 January 2006. This Law demonstrates the Chinese Government's commitment to renewable energy development as part of its overall energy development strategy, and its goal to encourage grid-connected power generation using renewable sources. However, there are no direct incentives such as financial grants, higher tariffs or subsidised loans available for these types of renewable energy projects. In addition, although energy efficiency and renewable energy development was included in China's 11th Five-Year Plan, there is no legislative requirement in regards to renewable energy development.

The Chinese power sector has undergone a transformation to a market-oriented system. Therefore, it is an individual project developer's decision whether or not to invest in a power generation project, based on the project return and risk profile[9]. There are no laws compelling the project developer to develop hydro

[9] Source: State Council's Decision on Reforming Investment Approval Process, July 16, 2004. State Council. Refer to page 20 of Xiaogushan Hydro Project PDD, China.

power plants, thus Alternatives 1 and 2 identified above are in line with all applicable laws and regulations.

According to regulations for the People's Republic of China's electricity development industries, it is forbidden to build a thermal power station with an installed capacity lower than 135MW[10]. Therefore Alternative 3 above is not in line with mandatory applicable laws and regulations and will not be considered further in the assessment of alternatives.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

Since this Project will generate financial/economic benefits other than CDM-related income, through the sales of generated electricity, Option I (Simple Cost Analysis) is not applicable.

According to the Additionality Tool, if the alternative to the CDM project activity does not include investments of comparable scale to the project, then Option III must be used.

Given that the project developer does not have alternative and comparable investment choices, therefore the benchmark analysis (Option III) is more appropriate than investment comparison analysis (Option II) for assessing the financial attractiveness of the project activity.

Sub-step 2b: Option III – Application of benchmark analysis

The likelihood of the development of this project, as opposed to the continuation of the purchase of grid electricity from the current electricity generation mix (i.e. its baseline) will be determined by comparing the project IRR (without CDM financing) with benchmark rates applicable to a local investor, i.e. those provided by national authorities, local banks, or investment bonds in the Host Country.

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

In China, the project IRR value must be higher than the benchmark IRR for investing hydropower projects, and the IRR benchmark rate for hydro power project with installed capacity below 25MW is 10%[11]. The project IRR is calculated over the full expected lifetime of the project activity.

Table B.5.1 below shows the financial analysis for the project activity with and without CDM financing. As shown, the project IRR without CDM is less than the benchmark rate of 10%. This therefore indicates that the project would not be financially attractive in the absence of CDM financing.

Table B.5.1 . Summary of project financial analysis

IRR without CDM	8.43%
IRR with CDM	10.97%

[10] See *the announcement about strictly forbid the construction of the thermal power station with the installed capacity lower than 135WM published by the state council office,* Guo Ban Fa Ming Dian[2002] No.6

[11] "*Economic Evaluation Code for Small Hydropower Projects SL16-95*" issued by the Ministry of Water Resources in 1995 (Document No. SL16-95) (http://www.cws.net.cn/guifan/bz%5CSL16-95)

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Electricity Tariff
- Investment Costs
- Operational Costs
- Operating Hours

The required alteration needed in each parameter in order to reach the benchmark was assessed. Table B.5.2 summarizes the results of the sensitivity analysis, in showing the variations needed to reach the IRR benchmark.

Table B.5.2. IRR results of sensitivity analysis

	Variation of the parameter needed to reach the IRR benchmark
Operating costs	- 103.85%
Investment costs	- 12.01%
Electricity tariff	+ 11.58%
Operating hours	+ 11.34%

Significant variations in the key parameters in favour of the project would be needed in order to generate a positive NPV. These variations do not reflect a realistic range of assumptions for the input parameters of the financial analysis.

- **Operating costs:** The results of the sensitivity analysis demonstrate that even if the project incurred zero operating costs - which is not feasible - the project IRR would remain below the benchmark.
- **Investment costs:** A 12.01% decrease in investment costs is very unlikely to happen, as it is much more likely that hydro power projects will experience cost *increases* rather than cost decreases during construction, because unexpected events and natural disasters (such as floods) will increase investment costs. For example, in the proposed project activity, additional investment was needed for a new road to the hydro station that was not envisaged in the planning stage[12]. These increases demonstrate that a decrease in investment costs is extremely unrealistic and that consequently the NPV is not likely to reach the IRR benchmark .
- **Electricity tariff:** The Project developer has signed a Letter of Intent for the Grid Connection of Liangtan Hydro Power Station (LIGC) with the grid company, which fixed the tariff as 0.36 RMB/kWh[13]. The electricity tariff in LIGC is much higher than the electricity tariff of other hydro stations in Guang'an city[14]. Moreover, since 2002, P. R. China has been applying a new electricity

[12] See the report submitted of compensation investment for repairing the road to power station on August 9,2005.

[13] See the Letter of Intent for Grid Connection of Liangtan Hydro Power Station

[14] the notice forwarded by Gunag'an Price Buraeu.No.[2005]101.

tariff control policy, known as the "Price Competition for Power Supply to the Grid" policy[15], in the power industry. Free competition between power plants is encouraged in order to lower cost of power production and thereby electricity tariffs. As a result, the electricity tariff of the proposed Project is unlikely to be increased by 11.58% and the IRR benchmark unlikely to be reached.

- **Operating hours:** The expected operating hours of the proposed Project indicated in the Preliminary Design Report were calculated based on a long time series of hydrological statistics made by Institute of Water Resource & Hydroelectric Engineering Exploration & Design, Nanchong, Sichuan Province. As these calculations are based on historical data, the operating hours are likely to fluctuate only within a small range. Assuming a 11.34% of increase in annual operating hours is thus unrealistic, and the IRR is therefore not likely to reach the benchmark value from an increase in operating hours

These results show that very favourable circumstances, which are not realistic, would be needed for the Project IRR to reach the benchmark. We can conclude that the project IRR is lower than the benchmark for a realistic range of assumptions for the input parameters of the financial analysis, and therefore that the project is also not financially attractive. This demonstrates that the project activity would not be implemented without the CDM.

Table B.5.3: Economic parameters used in the project

Name	Value	Source
Installed capacity (MW)	20	Preliminary Design Report
Expected power supplied to the grid (MWh)	84,544	Preliminary Design Report P15-2
Income tax (%)	33%	Preliminary Design Report:P15-3
VAT (%):	17%	Preliminary Design Report:P15-3
Project lifetime (Year)	23	Preliminary Design Report:P15-3
Tariff, excluding VAT (RMB/MWh)	360	From the Letter of Intent for Grid Connection of Liangtan Hydro Power Station
Total investment (RMB)	172,429,200	Preliminary Design Report:P15-8
Operating costs (RMB/MWh)	33.15	Preliminary Design Report table 15-2

Step 3. Barrier Analysis

[15] the Notice of the State Council on Printing and Distributing the Plan Regarding the Restructuring of the Power Industry (No.5 [2002] of the State Council)

The "Tool for the demonstration and assessment of additionality" states that project participants may choose to apply Step 2 (Investment analysis) OR Step 3 (Barrier analysis) to demonstrate the additionality of the project.

Given the low IRR of the project, Step 3 is not used to prove the additionality of the proposed project.

Step 4. Common Practice Analysis

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

Table B.5.4 below shows all other upgrade projects with installed capacity between 15MW to 25MW, which were implemented previously or are currently underway in Sichuan Province.

The common practice analysis is limited to the provincial level as the investment environment for each province differs (e.g. with regards to taxes, loan policy and electricity tariffs). 2002 was a landmark year for the power industry in China, and therefore only the projects which were developed after 2002 are considered in the common practice analysis below.

The power industry in China underwent a significant suite of reforms in 2002[16]. First of all, under the reforms, the China State Power Corporation was diversified into five separate regional grids in 2002[17], consequently changing the tariffs and allowable amounts of electricity supplied to the grid[18]. Secondly, under the reform, there were changes to the existing electricity tariff mechanisms[19]. As a result, the investment environment of power production projects in China changed significantly in 2002.

Table B.5.4 Upgrade Hydro Power Stations constructed after 2002 with installed capacity 15-25 MW in Sichuan Province

Name of Power Plant	Capacity (MW)	Operating Hours	Investor
Niujiaowan Third- lever Hydro Power	25	6127	Sichuan Xichuan Electric Power

[16] See "Electric Power Reform", 2003 Yearbook of China Electric Power, Page 10-14.

[17] The first reform consisted of the reorganisation of the power companies in order to break the monopoly of the China State Power Corporation and ensure fair competition, and to separate generation from transmission. The second one consisted in the bureaucratic centralisation of the power sector through the inclusion of the State Economic and Trade Commission in the National Development and Reform Commission (NDRC), which then opened a renewable energy department under the Energy Bureau, thereby enabling the creation of coherent policies in the power sector. *Source*: Lemaa, A and Rubyb K. (2007) Between fragmented authoritarianism and policy coordination: Creating a Chinese market for wind energy, Energy Policy, 35, 3879-3890. Also see: http://english.people.com.cn/200204/12/eng20020412_93913.shtml

[18] Sections 5-7, 2003 Yearbook of China Electric Power, Page 14.

[19] Electricity tariff was made up according to local demands and grid structure and is divided into tariff of electricity to grid, transmission tariff, distribution tariff and sales tariff. Sections 17-22, 2003 Yearbook of China Electric Power, Page 11-12.

Station			Co., Ltd
Guanyinyan Hydro Power Station	17.5	5654	Liangshan Anning Electric Power Co.,Ltd
Jiangjunpo Hydro Power Station	16	5160	Sichuan Ya'an Electric Power Co., Ltd
Fengtan Hydro Power Station	18.8	4450	Sichuan Bahe Electric Power Development Co.,Ltd

Data source: Sichuan Local Electricity Power Bureau[20]

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

There are distinctions between this proposed project activity and other operating hydropower projects with similar installed capacity in Sichuan Province. The annual operating hours of the Niujiaowan Third-lever Hydro Power Station, Guanyinyan Hydro Power Station, and Jiangjunpo Hydro Power Station are higher than the operating hours of the proposed project activity (more than 5000 hours). The project's shorter annual operating hours imply that the proposed project will generate less income from less electricity generated, making it less financially attractive and more exposed to financial risks than the other four projects.

Similar to this proposed project, Fengtan Hydro Power station has met many barriers as a non-financially attractive project developed by a private entity. The use of CDM has been considered and applied for this project to alleviate the barriers before construction.

Therefore, apart from the above project which has also applied for CDM, the current existing hydropower upgrade projects in Sichuan Province did not face the same barriers as the proposed project. In light of the above, it can be concluded that this proposed project cannot be considered common practice and should be deemed additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the latest version of ACM0002, since the project activity is modification/retrofit of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

> In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid (EGbaseline, in MWh/year) at historical average levels (EGhistorical, in MWh/year), until the time at which the generation facility would likely be replaced or retrofitted (DATEBaselineRetrofit). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production (EGbaseline) is assumed to equal project electricity production (EGy , in MWh/year), and no emission reductions are assumed to occur.

20 The Paper of Upgrade Hydro Power Station constructed after 2002 in Sichuan Province provided by Sichuan Local Electricity Power Bureau

According to the latest version of ACM0002, baseline emissions (BE_y) are obtained as:

$$BE_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO2/yr)
EG_y	=	Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$	=	Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh).
$EF_{grid,CM,y}$	=	Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

According to the latest version of ACM0002, $EG_{baseline}$ should be calculated as follows:

$$EG_{baseline} = \mathrm{MAX}\left(EG_{historical}, EG_{existing}\right), \quad \text{until DATE}_{BaselineRetrofit}$$

$$EG_{baseline} = EG_y, \quad \text{on/after DATE}_{BaselineRetrofit}$$

Where:

$EG_{baseline}$	=	Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh).
$EG_{existing}$	=	The actual, measured electricity production[21] of the existing units in year y (MWh).
$EG_{historical}$	=	Average of historical electricity delivered by the existing facility to the grid (MWh).
EG_y	=	Electricity supplied by the project activity to the grid (MWh).
$DATE_{BaselineRetrofit}$	=	Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).

$EF_{grid,CM,y}$ is calculated in accordance with the procedures in the "Tool to calculate the emission factor for an electricity system" for calculating the Combined Margin (CM) emission factor of an electricity system.

This PDD uses the calculations published by the DNA of P. R. China[22] to determine the Operating Margin (OM) emission factor[23] and the Build Margin (BM) emission factor[24] using the most recent data available.

The description below follows the steps of the latest version of the "Tool to calculate the emission factor for an electricity system" and focuses on the key process of the calculation of the emission factors. Please see Annex 3 for the baseline data underlying the calculations.

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[21] Electricity production here means electricity supplied to the grid, as stated in the monitoring table for $EG_{existing}$ in ACM0002 version 8

[22] National Coordination Committee on Climate Change – National Development and Reform Commission (NDRC)

[23] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls for the EF_{OM}

[24] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf for the EF_{BM}

Step 1. Identify the relevant electric power system

P. R. China is divided into regional electricity systems which are defined by the DNA of P. R. China[25]. The Project is located in Sichuan Power Grid which belongs to the Central China Power Grid (CCPG). Therefore, the relevant electric power system is identified as the CCPG.

Step 2. Select an operating margin (OM) method

The "Tool to calculate the emission factor for an electricity system" offers four methods to calculate the OM emission factor ($EF_{grid,OM,y}$):

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or
d) Average OM.

Of these procedures, Option (a) (Simple OM) is applied. This is because low-cost / must run resources constitute less than 50% of total grid generation in average of the five most recent years. From 2001 to 2005 respectively, 37%, 36%,33%, 32% and 31% of the electricity generated in the CCPG came from low-cost / must run resources[26].

Power plants registered as CDM project activities are included in the sample group that is used to calculate the OM as long as the criteria for including the power sources in the sample group apply.

The "Tool to calculate the emission factor for an electricity system" offers the choice between two data vintages calculate the Simple OM emission factor ($EF_{grid,OMsimple,y}$):

- *Ex-ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.
- *Ex-post* option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

$EF_{grid,OMsimple,y}$ is calculated *ex-ante* using the data from 2002 to 2005, available in the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2002-2006. This data vintage remains fixed during the crediting period.

Step 3. Calculate OM emission factor according to the selected method

The "Tool to calculate the emission factor for an electricity system" offers three options to calculate $EF_{grid,OMsimple,y}$:

- *Option A*: Based on data on fuel consumption and net electricity generation of each power plant / unit

[25] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

[26] China Electric Power Yearbooks 2002-2006; see Annex 3 for detailed calculation.

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

Detailed data on the individual power plants connected to the CCPG necessary for applying option A and option B is not available; therefore, options A and B cannot be used. Since only nuclear and renewable power generation are considered as low-cost / must-run power sources and since the quantity of electricity supplied to the grid by these sources is known, option C is applicable and used to calculate the Simple OM emission factor.

$EF_{grid,OMsimple,y}$, using option C is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{y,grid}} \qquad \textbf{(1)}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit) (country-specific values are used)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{y,grid}$[27]	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

$EF_{grid,OMsimple,y} = 1.2899\ tCO_2/MWh$

For detailed information, please see Annex 3.

Step 4. Identify the cohort of power plants to be included in the build margin

According to the "Tool to calculate the emission factor for an electricity system", the sample group of power units m used to calculate the build margin consists of either:

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

[27] $EG_{y,grid}$ = GEN x (1-rate of internal use by the power station). See Annex 3 and section B.6.2. for details.

However, due to the fact that data on electricity generation of each power plant / unit in the grid is currently not available in P. R. China (see Step 3), EB guidance on the estimation of the build margin in P.R. China can be applied for the purpose of defining the sample group[28]. In accordance with the guidance, the build margin consists of the set of power capacity additions in the electricity system that comprises 20% of the system generation capacity (in MW) and that have been built most recently and is The set of power capacity additions included in the build margin is determined as follows:

$$\frac{\sum_j CAP_{j,y-n}}{\sum_j CAP_{j,y}} \geq 20\% \qquad \textbf{(2)}$$

$\sum_j CAP_{j,y-n}$	=	The aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in year *y-n*
$\sum_j CAP_{j,y}$	=	The aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in year *y*
n	=	The number of years (y-1, y-2, …, y-n) which have to be considered to comprise 20% of the system generation capacity (in MW) and that have been built most recently

From 2002 to 2005 (2005 being the most recent year for which data is available), the amount of capacity additions made up over 20% of the total capacity in 2005 in the Central China Power Grid. Therefore "n" = 3.

Since data on the electricity generation of each individual power plant / unit in the grid is not available in P. R. China, power plants registered as CDM project activities cannot be isolated and are taken into account in the build margin.

The "Tool to calculate the emission factor for an electricity system" offers the choice between two data vintages to calculate the BM:

- *Option 1*. For the first crediting period, the build margin emission factor is calculated *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation.
- *Option 2*. For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity

The BM emission factor ($EF_{grid,BM,y}$) is calculated *ex-ante* using the data from 2002 to 2005, available in the China Energy Statistics Yearbook 2006 and the China Electric Power Yearbooks 2003-2006. This data vintage remains fixed during the first crediting period and will be updated for the second crediting period.

Step 5. Calculate the build margin emission factor

[28] See: EB guidance on estimating the build margin for AM0005, consolidated in ACM0002 which refers to the Tool to calculate the emission factor for an electricity system
http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM and
http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

According to the "Tool to calculate the emission factor for an electricity system", $EF_{grid,BM,y}$ is the generation-weighted average emission factor of all power units *m* during the most recent year *y* for which power generation data is available. However, data on both electricity generation and emission factor of each power plant / unit in the grid is currently not available in P. R. China (see Step 3). Therefore, EB guidance on the estimation of the build margin in P.R. China can be applied for the purpose of estimating the BM emission factor[29] and $EF_{grid,BM,y}$ is calculated as follows:

$$EF_{grid,BM,y} = \frac{CAP_{thermal,y-n,y}}{\sum_j CAP_{j,y-n,y}} \times EF_{thermal,adv} \qquad \textbf{(3)}$$

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$CAP_{thermal,y-n,y}$	=	The incrementally installed power capacity of thermal power generation sources (MW) in the CCPG in year *y* compared to that of year *y-n*
$\sum_j CAP_{j,y-n,y}$	=	the aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in the CCPG in year *y-n* compared to that of year *y-n*
$EF_{thermal,adv}$	=	The emission factor of thermal power generation sources of the CCPG with the efficiency level of the best commercially available technology in P. R. China, for *y* the most recent historical year for which power generation data is available

$EF_{Thermal,Adv}$ is calculated as follows:

$$EF_{Thermal,Adv} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \qquad \textbf{(4)}$$

Where:

$EF_{i,Adv}$	=	The CO_2 emission factor of fuel *i* (tCO_2/MWh) using the best commercially available technology in P. R. China and taking into account the carbon content and the oxidation factor of fuel *i*[30]
Coal, Oil and *Gas*	=	Solid fuel, liquid fuel and gaseous fuel respectively
λ_i	=	The weight of CO_2 emissions from fuel *i* fired power plants in the total CO_2 emissions from thermal power, using the most recent available data

And

$$\lambda_{Coal} = \frac{\sum_{i=Coal} FC_{i,y} \times EF_{CO2,i,y}}{\sum_i FC_{i,y} \times EF_{CO2,i,y}} \qquad \textbf{(5)}$$

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[29] See: http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM and http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

[30] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.pdf

$$\lambda_{Oil} = \frac{\sum_{i=Oil} FC_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times EF_{CO2,i,y}} \quad \textbf{(6)}$$

$$\lambda_{Gas} = \frac{\sum_{i=Gas} FC_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times EF_{CO2,i,y}} \quad \textbf{(7)}$$

Where $FC_{i,y}$ and $EF_{CO2,i,y}$ are defined as in equation 1.

$EF_{grid,BM,y}$ = 0.6592 tCO_2/MWh

For detailed information, please see Annex 3.

Step 6. Calculate the combined margin emission factor

The combined margin (CM) emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \textbf{(8)}$$

Where:

$EF_{grid,CM,y}$	=	Combined margin CO_2 emissions factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor, which is 0.5 by default
w_{BM}	=	Weighting of build margin emissions factor, which is 0.5 by default

$EF_{grid,CM,y}$= 0.5*1.2899+0.5*0.6592=0.97455 tCO_2/MWh

For detailed information, please see Annex 3.

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

Data / Parameter:	$\boldsymbol{EG_{historical}}$
Data unit:	MWh/year
Description:	Average of historical electricity supplied to grid of the original LHS
Source of data used:	Historical bills and documents provided by the project developer
Value applied:	47,893

Justification of the choice of data or description of measurement methods and procedures actually applied :	Data obtained from the document supplied by project developer
Any comment:	

Data / Parameter:	$DATE_{BaselineRetrofit}$
Data unit:	Years
Description:	The year in which the original LHS would be likely to be replaced or retrofitted in the absence of the CDM project activity.
Source of data used:	The Lifetime assessment for the original LHS (i.e the baseline unit)
Value applied:	2032
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Lifespan for the Power Station was assessed according to the current status of the materials and equipment and the expected operational demands
Any comment:	

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

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.
Source of data used:	Project site.
Value applied:	

Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	

Data / Parameter:	$F_{i,j,y}$
Data unit:	Tonne
Description:	The amount of fuel *i* consumed by relevant power source *j* in years *y*.
Source of data used:	China Energy Statistics Yearbook (2002-2007)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$GEN_{j,y}$
Data unit:	**MWh**
Description:	The electricity generation by source *j* in year *y* of each province connected to CCPG
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	***Internal use rate of power station***
Data unit:	**%**
Description:	The internal use rate of power source *j* in each province connected to CCPG.
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods	Official released statistic; publicly accessible and reliable data source

and procedures actually applied :	
Any comment:	

Data / Parameter:	***NCV_i***
Data unit:	**MJ/t, MJ/km^3**
Description:	The net calorific value (energy content) per mass or volume unit of a fuel *i*.
Source of data used:	China Energy Statistics Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	***$EF_{CO2,i}$***
Data unit:	**tC/TJ**
Description:	The CO_2 emission factor per unit of energy of the fuel *i*.
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	

Data / Parameter:	***$OXID_i$***
Data unit:	**%**
Description:	The oxidation factor of the fuel
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	

Data / Parameter:	$CAP_{m,y,j}$
Data unit:	**MW**
Description:	The installed capacity of power source *j* of province *m* in years *y*.
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante emission reductions calculations are as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER: Emission reduction (t CO_2e)
BE: Baseline emissions (t CO_2e)
PE: Project Emissions (t CO_2e)
L: Leakage emissions (t CO_2e)
y: a given year

According to ACM0002, there are no expected project emissions related to the generation of electricity, as generation is based on a renewable resource. Also, given that there is no flooded area associated with the project activity, consequently it is not necessary to calculate the power density.

Therefore there are no emissions to consider that may have arisen from such a flooded area. Therefore, $PE_y = 0$

According to ACM0002, the leakage of the Project is not considered. No leakage is expected. Therefore, $L_y = 0$.

Therefore: $ER_y = BE_y$

The Baseline Emissions of the Project are calculated as follows:

Baseline Emissions:
Historical Electricity Production ($EG_{historical}$)

The historical electricity generation was determined considering historical generation data for the most recent available 5 years.

Table B.6.1 Historic electricity generation of original LHS[31]

Year	Net Generation (MWh)
2002	45,175
2003	47,456
2004	48,830
2005	49,596
2006	48,408
Average ($EG_{historical}$)	**47,893**

Source: the data collected from the original LHS by Sichuan Guang'an AAA Public Co., Ltd

$$EG_{historical} = 47{,}893\ MWh/year$$

As described in section B.6 $EG_{baseline}$ will be equal to the maximum of the $EG_{historical}$ and $EG_{existing}$ until the time at which the generation facility would likely be replaced or retrofitted in absence of the CDM project activity. ($DATE_{BaselineRetrofit}$).

$DATE_{BaselineRetrofit}$ is determined using option (b) in ACM0002 by providing company documentation for the replacement schedule for the existing equipment.

$$DATE_{BaselineRetrofi} = 2032$$

All project electricity generation above baseline levels ($EG_{baseline}$) would otherwise be generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculation described in B.6.1.

$$BE_y = (EG_y - EG_{baseline}) * EF_y \quad (\text{unitl DATE}_{\text{BaselineRe trofit}})$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO2/yr)
EG_y	=	Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$	=	Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh).
$EF_{grid,CM,y}$	=	Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

Estimated electricity supplied annually to the grid by new and existing power units (EGy) = 132,437 MWh

$EG_{baseline}$ = 47,893 MWh/year

Baseline emission factor with combined margin (*EF*) = 0.97455 tCO_2e / MWh

[31] For the purpose of conservativeness, the historical generation used here also includes the electricity generated by the 1.6 MW unit described in section A.4.3.

The baseline emissions are obtained by multiplying the generation of the project by the grid emissions factor = 82,392 tCO_2e

By using the approach above and the data shown in Annex 3, the baseline emissions will be 82,392 tCO_2e/year or 576,746tCO_2e for the 7-year crediting period.

See Table B.6.1 for a summary of the values used and the results of the calculation.

Table B.6.1 Key Information and Data Used to Determine the Baseline Scenario

	Per year (average)	**7 years**
Operating Margin Emissions Factor (EF_OM_y in tCO_2/MWh)	1.2873	1.2873
Build Margin Emissions Factor (EF_BM_y in tCO_2/MWh)	0.6592	0.6592
Baseline Emissions Factor (EF_y in tCO_2/MWh)	0.97455	0.97455
Expected combined annual electricity supplied to the grid above historic electricity production levels of OLHS (MWh)	84,544	591,808
Baseline Emissions (*BE* tCO_2)	**82,392**	**576,746**

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

Year	**Estimation of project activity emissions (tonnes of CO_2 e)**	**Estimation of baseline emissions (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of overall emission reductions (tonnes of CO_2 e)**
2009*	0	82,392	0	82,392
2010	0	82,392	0	82,392
2011	0	82,392	0	82,392
2012	0	82,392	0	82,392
2013	0	82,392	0	82,392
2014	0	82,392	0	82,392
2015	0	82,392	0	82,392
Total(tCO_2e)	0	576,746	0	576,746

* the whole year from June to June

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

B.7.1 Data and parameters monitored:

Data / Parameter:	Electricity quantity (*EG_y*)
Data unit:	MWh/year
Description:	Net Electricity supplied to the grid by the project activity
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	132,437
Description of measurement methods and procedures to be applied:	Net Electricity supplied to the grid by Liangtan Hydroelectric Station Second Phase Project and the original Liangtan Hydroelectric Station will be measured by electricity meter(s) and will be recorded on a monthly basis. For a detailed description of the measurement methods see B.7.2
QA/QC procedures to be applied:	Meters will be calibrated regularly according to national standards.
Any comment:	

Data / Parameter:	Electricity quantity (*$EG_{existing,y}$*)
Data unit:	MWh/year
Description:	The actual, measured electricity supplied to the grid by existing units in year y (MWh).
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	47,893
Description of measurement methods and procedures to be applied:	Net Electricity supplied to the grid by the original Liangtan Hydroelectric Station (Phase I) will be measured by meter(s) and will be recorded on a monthly basis. For a detailed description of the measurement methods see B.7.2
QA/QC procedures to be applied:	Meters will be calibrated regularly according to national standards.
Any comment:	

B.7.2 Description of the monitoring plan:

This section details the steps taken to monitor the greenhouse gas emissions reductions on a regular basis from the Liangtan Hydroelectric Station Second Phase Project in the People's Republic of China.

The Monitoring set up for this project has been developed to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data.

1. Monitoring organisation

Roles and responsibilities will be defined for the relevant staff involved in CDM monitoring, and the prospect of nominating a CDM Manager will be considered. If appointed, the CDM Manager will have the overall responsibility for the monitoring system on this project.

A CDM Manager, or an appropriate senior manager, will manage the process of training new staff, ensuring trained staff perform the monitoring duties and that where trained monitoring staff are absent, ensuring that the integrity of the monitoring system is maintained by other trained staff.

Staff involved in the CDM project will receive some relevant training. Records of trained CDM staff will be retained by the Project Developer.

2. Monitoring equipment and installation

Given that the emission factor is calculated *ex-ante*, and referring to the Monitoring Methodology ACM0002, the only data to be monitored is net electricity supplied to the Grid by the project activity (this includes electricity generated by the units installed as part of the project activity and the existing units that will continue to operate after the project activity has been implemented) and net electricity supplied to the Grid by the original Liangtan Hydroelectric Station (Phase I) (detailed in B.7.1). Calibrated electricity meters will be used to obtain this data.

Electricity meters should meet the relevant national standards at the time of installation. Records of the meters (type, make, model and calibration documentation) will be retained in the quality control system.

3. Data recording procedure

In accordance with host nation practise, the project developer will take a cumulative meter reading on a monthly basis. Metering records will be double checked against sales records to ensure accuracy.

At the end of each month the monitoring data needs to be filed electronically. The electronic files need to have print-out and/or CD back-up. The project developer needs to keep electricity sale and purchase invoices.

All written documentation such as maps, drawings, the Environmental Impact Assessment (EIA) and the Preliminary Design Report, should be stored and should be available to the verifier so that the reliability of the information may be checked.

In order to make it easy for the verifier to retrieve the documentation and information in relation to the project emission reduction verification, the project developer should provide a document register. The document management system will be developed as part of an applicable procedure. All the data shall be kept until two years after the end of credit period.

4. Data and records management

The quality of data generated by this project will be maintained through the development of an overarching monitoring system. This system may include procedures used to double check data, for staff training, meter calibration, accreditation of the facility completing calibration, and the adherence to the relevant standards.

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

The application of the baseline study and monitoring methodology was completed in May, 2007. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group Plc., listed in Annex 1 of this document as a project participant.

Contact: Zhang Fan, EcoSecurities Group PLC
Address: Unit 1708, China Resources Building, No.8, JianGuoMen Bei Avenue, Beijing 100005, China
Telephone: +8610-65181081 ext .205 Email: fan.zhang@ecosecurities.com

Detailed baseline information is attached in Annex 3.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
06/09/2005 (Date of Construction Approval [32])

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

>>
23 years

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

C.2.1. Renewable crediting period

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

>>
The crediting period will start on 01/06/2009, or on the date of registration of the CDM project activity, whichever is later.

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

[32] The starting date is choosen from the earlier date of construction approval date (06/09/2005) and the date of equipment purchase agreement signed (13/09/2005).

SECTION D. Environmental impacts

>>

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

>>

According to the Environmental Evaluation Law of the People's Republic of China, the project entity must analyze the environmental impacts of project activities in China before exploiting natural resources and beginning project construction. The project developer therefore commissioned a third party to conduct the required environmental impact assessment (EIA) in 2003, and the EIA report was approved by Guang'an Environmental Bureau in December, 2003.

Where impacts of the project were identified, mitigation measures were suggested and defined. The EIA highlights the following with regards to the Project, as shown in the table below.

Identified environmental impacts	**Measures taken**
Water pollution	
On the construction site	Connect the drain to the sedimentation tank.
Oil water from vehicles	Oil filter and sedimentation tank will be installed.
Wastewater from the staff	Treated in the wastewater treatment system.
Air pollution	
Dust during the blast	Wet blast techniques will be used. Use personal protection equipment (PPE) on site.
Dust during the construction	A showering system is to be installed to dampen and control dust/particulate matter.
Dust during the transportation	Supervision during the material/construction waste's transportation.
Noise pollution	
Blast and excavation during construction	Choose equipment with low noise, arrange construction time, and ban construction activity in the evenings. Use personal protection equipment (PPE) on site.
Transportation during the construction	Adjust transportation car's speed while passing residential areas.
Solid waste	
Waste from the construction	Waste will be sent to the specific landfill.
Waste from the staff	Collect and send to local waste treatment station
Biodiversity and ecosystems	
Parts of agriculture and forest will be removed	Reforest and restore the green lands after the construction.
Erosion impact assessment	
Land erosion in the project area occurring prior to the project activity, e.g. the movement onsite of construction-related vehicles	Additional erosion will be prevented through installation of effective monitoring and site reclamation, some measures also can be used, e.g. re-vegetation.
Resettlement by construction	
172 people were resettled due to power house construction.	A resettlement plan was included as part of the Preliminary Design Report. It was in compliance with

	the national legislation (Specification on Land Requisition and Resettlement Design for Construction of Water Resources and Hydropower Projects (SL290-2003)) and was approved by the local government of Guang'an. The plan has also included a compensation policy for the affected stakeholders, including compensation for houses and land; the local government was responsible for carrying out all resettlement compensation measures.

A stakeholder consultation with 47 people was conducted, as part of the EIA.

The results of the survey have shown that the public has a positive attitude toward the construction of the Project. It is the general opinion that the construction of this Project could help to solve the conflict between power supply and demand, and promote sustainable development of the national economy.

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:

>>

With mitigation controls planned as part of the project construction and EIA process, and the contribution made by the project to sustainable development for the local and national area, the project is expected to have an overall positive impact on the local and global environment. Mitigation measures will ensure that there are no significant adverse impacts associated with the project.

SECTION E. Stakeholders' comments

>>

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

>>

The stakeholder consultation for the project activity took place in May, 2007. The local stakeholders were invited to submit comments on the project activity filling a questionnaire sent out by the project developer.

A one page questionnaire, designed to be easily filled in by stakeholders, was sent out. The questions asked were as follows:

Questions on:

- What impacts do you think the CDM project activity will have on the local environment?
- What impacts do you think the CDM project activity will have on employment and social welfare in the local area?
- Are there any negative impacts on your livelihood during the construction of the CDM project?
- What would be the overall positive effects of the construction and operation of the CDM Project?
- What would be the overall negative effects of the construction and operation of the CDM Project?
- What is your attitude towards the construction of the CDM Project?
- Do you support the construction of the CDM Project?

55 questionnaires were sent to the stakeholders by the project developer. The stakeholders included local governmental officials (2 people), local residents (15people) and related employees (33 peoples). A full list of stakeholders consulted is available from the project developer.

E.2. Summary of the comments received:

>>

The survey received 91 % participation (50 questionnaires returned out of 55). The survey shows the stakeholders believe that the CDM project activity will have positive impacts on the local ecological, environmental, employment and social life. Most of the stakeholders expressed their support to the Project.

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

>>

No negative comments have been received on the project.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This Project will not receive any public funding.

Annex 3
BASELINE INFORMATION

Baseline Information for the Central China Power Grid (including Henan, Hubei, Hunan, Jiangxi, Sichuan, Chongqing)

Calculation of the Operating Margin Emission Factor of the Central China Power Grid

Table A1 CO_2 emissions from thermal power plants of the the Central China Power Grid (2003)

Fuel Type	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Subtotal E=A+B+C+D	EF （tC/TJ） F	Oxidation factor (%) G	NCV MJ/t, kJ/m^3） H	CO_2 emissions (tCO_2e） I=G*H*F*E*44/(12*100) （mass unit） I=G*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13851.66	25.8	100	20908	273971539.89
Clean Coal	10000t							0	25.8	100	26344	0.00
Other washed coal	10000t	2.03	39.63			106.12		147.78	25.8	100	8363	1169146.40
Coke	10000t				1.22			1.22	25.8	100	28435	32817.40
Coke Oven Gas	108m3			0.93				0.93	12.1	100	16726	69013.15
Other Coal Gas	108m3							0	12.1	100	5227	0.00
Crude oil	10000t		0.5	0.24			1.2	1.94	20	100	41816	59490.23
Diesel	10000t							0	18.9	100	43070	0.00
Fuel Oil	10000t	0.52	2.54	0.69	1.21	0.77		5.73	20.2	100	42652	181015.94
LPG	10000t	0.42	0.25	2.17	0.54	0.28	1.2	4.86	21.1	100	41816	157229.00
Refinery Gas	10000t							0	17.2	100	50179	0.00
Natural Gas	108m3	1.76	6.53		0.66			8.95	18.2	100	46055	275069.63
Other petroleum products	10000t					0.04	2.2	2.24	15.3	100	38931	489222.52
other coking products	10000t							0	20	100	38369	0.00
Other energy	10000tce							0	25.8	100	28435	0.00
											total	276404544.15

Data source: China Energy Statistics Yearbook 2004

Table A2 Electricity Generation of the Central China Power Grid (2003)

Province	**Electricity generation （MWh)**	**Used by the power station （%）**	**Power output （MWh)**
Jiangxi	27165000	6.43	25,418,291
Henan	95518000	7.68	88,182,218
Hubei	39532000	3.81	38,025,831
Hunan	29501000	4.58	28,149,854
Chongqing	16341000	8.97	14,875,212
Sichuan	32782000	4.41	31,336,314
total			225,987,719

Data source: China Electric Power Yearbook 2004

Table A3 CO_2 emissions from thermal power plants of the Central China Power Grid (2004)

Fuel Type	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Subtotal G=A+B+C+D+E+F	EF (tC/TJ) H	Oxidation Factor (%) I	NCV (MJ/t, kJ/m^3) J	CO_2 emissions（tCO_2e） K=G*H*I*J*44/(12*100)（mass unit） K=G*H*I*J*44(12*10) (volume unit)
Raw Coal	10000t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	**17144.1**	25.8	100	20908	339092605.29
Clean Coal	10000t		2.34					**2.34**	25.8	100	26344	58316.13
Other washed coal	10000t	48.93	104.22			89.72		**242.87**	25.8	100	8363	1921441.23
Coke	10000t		109.61					**109.61**	25.8	100	28435	2948455.29
Coke Oven Gas	10^8m^3			1.68		0.34		**2.02**	12.1	100	16726	149899.53
Other Coal Gas	10^8m^3					2.61		**2.61**	12.1	100	5227	60527.09
Crude oil	10000t		0.86	0.22				**1.08**	20	100	41816	33118.27
Gasoline	10000t		0.06			0.01		**0.07**	18.9	100	43070	2089.33
Diesel	10000t	0.02	3.86	1.7	1.72	1.14		**8.44**	20.2	100	42652	266627.32
Fuel Oil	10000t	1.09	0.19	9.55	1.38	0.48	1.68	**14.37**	21.1	100	41816	464893.14
LPG	10000t							**0**	17.2	100	50179	0.00
Refinery Gas	10000t	3.52	2.27					**5.79**	18.2	100	46055	177950.07
Natural Gas	10^8m^3						2.27	**2.27**	15.3	100	38931	495774.61
Other petroleum products	10000t							**0**	20	100	38369	0.00
other coking products	10000t							**0**	25.8	100	28435	0.00
Other energy	10000tce		16.92		15.2	20.95		**53.07**	0	100	0	0.00
											total	346035810

Data source: China Energy Statistics Yearbook 2005

Table A4 Electricity Generation of the Central China Power Grid (2004)

Province	Electricity generation （MWh)	Used by the power station （%）	Power output （MWh)
Jiangxi	30127000	7.04	28,006,059
Henan	109352000	8.19	100,396,071
Hubei	43034000	6.58	40,202,363
Hunan	37186000	7.47	34,408,206
Chongqing	16520000	11.06	14,692,888
Sichuan	34627000	9.41	31,368,599
total			249,074,186

Data source: China Electric Power Yearbook 2005

Table A5 CO_2 emissions from thermal power plants of the Central China Power Grid (2005)

Fuel Type	**Unit**	**Jiangxi** A	**Henan** B	**Hubei** C	**Hunan** D	**Chongqing** E	**Sichuan** F	**Subtotal** G=A+B+C+D+E+F	**EF** (tC/TJ) H	**Oxidation factor (%)** I	**NCV (MJ/t, kJ/m^3)** J	**CO_2 emissions (tCO_2e)** I=G*H*F*E*44/(12*100) (mass unit) I=G*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	20908	352614496.76
Clean Coal	10000t	0.02						**0.02**	25.8	100	26344	498.43
Other washed coal	10000t		138.12			89.99		**228.11**	25.8	100	8363	1804669.00
Coke	10000t		25.95		105			**130.95**	25.8	100	28435	3522490.83
Coke Oven Gas	10^8m^3			1.15		0.36		**1.51**	12.1	100	16726	112053.61
Other Coal Gas	10^8m^3		10.2			3.12		**13.32**	12.1	100	5227	308896.88
Crude oil	10000t		0.82	0.36				**1.18**	20	100	41816	36184.78
Gasoline	10001t		0.02			0.02		**0.04**	18.9	100	43070	1193.90
Diesel	10000t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	42652	299797.78
Fuel Oil	10000t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	41816	286959.09
PLG	10000t							**0**	17.2	100	50179	0.00
Refinery Gas	10000t	0.71	3.41	1.76	0.78			**6.66**	18.2	100	46055	204688.68
Natural Gas	10^8m^3						3	**3**	15.3	100	38931	655208.73
Other petroleum products	10000t							**0**	20	100	38369	0.00
other coking products	10000t				1.5			**1.5**	25.8	100	28435	40349.27
Other energy	10000tce		2.88		1.74	32.8		**37.42**	0	100	0	0.00
											total	359887487.74

Data source: China Energy Statistics Yearbook 2006

Table A6 Electricity Generation of the Central China Power Grid (2005)

Province	**Electricity generation (MWh)**	**Used by the power station (%)**	**Power output (MWh)**
Jiangxi	30000000	6.48	28,056,000
Henan	131590000	7.32	121,957,612
Hubei	47700000	2.51	46,502,730
Hunan	39900000	5	37,905,000
Chongqing	17584000	8.05	16,168,488
Sichuan	37202000	4.27	35,613,475
total			286,203,305

Data source: China Electric Power Yearbook 2006

Table A7 Operating Margin Emission Factor of the Central China Power Grid

		2003	2004	2005	**Average EF_{OM}** (tCO_2/MWh)
Total CO_2 emissions	tCO_2e	276,404,544	345,671,697	359,887,488	1.2899
Electricity generation	MWh	225,987,719	249,074,186	286,203,305	

Calculation of the Build Margin Emission Factor for the Central China Power Grid

Table A8 Emission factor of coal-fired plants, gas-fired plants and oil-fired plants in the Central China Power Grid

	Efficiency A	Carbon content (tC/TJ) B	Oxidation factor (%) C	Emission factor (tCO_2/MWh) D=3.6/A/1000*B*C*44/12
EF coal,Adv	35.82%	25.8	100%	0.9508
EF gas,Adv	47.67%	15.3	100%	0.4237
EF oil,Adv	47.67%	21.1	100%	0.5843
Source	Statistics by the State Electricity Regulatory Commission (SERC) on newly built thermal plants in the 10th "Five-Year Plan" period 2000-2005, and Data from the NDRC (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf)	2006 IPCC Guidelines for National Greenhouse Gas Inventories	2006 IPCC Guidelines for National Greenhouse Gas Inventories	

Table A.9. Share of different fossil fuels in the total CO_2 emissions from thermal power plants of the Central China Power Grid

Item	Value
λcoal	99.48%
λoil	0.17%
λgas	0.35%

Therefore $EF_{thermal}$ =99.48%*0.9508 + 0.17%*0.4237+ 0.35%*0.5843 = 0.948 tCO_2e/MWh

Table A10 Installed capacity in the Central China Power Grid in 2005

Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
thermal power	MW	5906.0	26267.8	9526.3	7211.6	3759.5	7496.0	60167.2
hydro power	MW	3019.0	2539.9	8088.9	7905.1	1892.7	14959.6	38405.2
nuclear power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
wind farm and others	MW	0.0	0.0	0.0	0.0	24.0	0.0	24.0
total	MW	8925.0	28807.7	17615.2	15116.7	5676.2	22455.6	98596.4

Data source: China Electric Power Yearbook 2006, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf

Table A11 Installed capacity in the Central China Power Grid in 2003

Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
thermal power	MW	5407.8	17635.5	8173.3	6446.7	3126.2	6104.0	46893.5
hydro power	MW	2307.4	2438.0	7337.2	6603.1	1329.8	12341.5	32357.0
nuclear power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
wind farm and others	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
total	MW	7715.2	20073.5	15510.5	13049.8	4456.0	18445.5	79250.5

Data source: China Electric Power Yearbook 2004, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf

Table A12 Installed capacity in the Central China Power Grid in 2002

Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
thermal power	MW	5128.8	15904.5	8147.8	4975.6	3004.5	6142.0	43303.2
hydro power	MW	2197.4	2438.0	7213.9	6135.3	1195.5	11854.6	31034.7
nuclear power	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
wind farm and others	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
total	MW	7326.2	18342.5	15361.7	11110.9	4200.0	17996.6	74337.9

Data source: China Electric Power Yearbook 2003, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf

Table A13 Determination of the Build Margin of the Central China Power Grid

Type	**installed capacity in 2002** A	**installed capacity in 2003** B	**installed capacity in 2005** C	**new added installed capacity from 2002 to 2005** D = C - A	**Split of new capacity**
Thermal power	43303.2	46893.5	60167.2	16864	69.52%
Hydro power	31034.7	32357.0	38405.2	7370.5	30.38%
Nuclear power	0.0	0.0	0.0	0	0.00%
Wind farm and others	0	0	24.0	24	0.10%
Total	74337.9	79250.5	98596.4	24258.5	100%
Compared to the capacity in 2005	75.40%	80.38%	100.00%		

Therefore, EF_{BM} = 0.948*69.52% = 0.6592tCO_2e/MWh

Table A14 Baseline Emission Factor of the Central China Power Grid (tCO_2/MWh)

A	Operating Margin Emission Factor (tCO_2/MWh)	1.2899
B	Build Margin Emission Factor (tCO_2/MWh)	0.6592
C	Combined Emission Factor (C=0.5*A+0.5*B) (tCO_2/MWh)	**0.97455**

Baseline Calculation

Table A14 Generation of the Central China Power Grid in 2001

	Jiangxi A	**Henan B**	**Hubei C**	**Hunan D**	**Chongqing E**	**Sichuan F**	**Total in China Central Grid G=A+B+C+D+E+F**
Thermal generation (GWh)	16191	76022	32045	19403	13687	20808	178156
Hydro generation (GWh)	5425	3572	27025	21340	3354	42839	103555
Generation from other sources (GWh)	0	0	0	0	0	0	0
Total generation in province (GWh)	21616	79594	59070	40743	17041	63647	281711

Percentage of thermal generation in 2001	63%
Percentage of generation by all other resources in 2001	37%

Data source: China Electric Power Yearbook 2002

Table A15 Generation of the Central China Power Grid in 2002

	Jiangxi A	**Henan B**	**Hubei C**	**Hunan D**	**Chongqing E**	**Sichuan F**	**Total in China Central Grid G=A+B+C+D+E+F**
Thermal generation (GWh)	18648	84734	34301	20058	14727	27879	200347
Hydro generation (GWh)	6151	4859	27854	25329	3748	44500	112441
Generation from other sources (GWh)	0	0	0	0	0	0	0
Total generation in province (GWh)	24799	89593	62155	45387	18475	72379	312788

Percentage of thermal generation in 2002	64%
Percentage of generation by all other resources in 2002	36%

Data source: China Electric Power Yearbook 2003

Table A16 Generation of the Central China Power Grid in 2003

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in China Central Grid G=A+B+C+D+E+F
Thermal generation (GWh)	27165	95518	39532	29501	16341	32782	240839
Hydro generation (GWh)	3864	5457	30168	24401	3951	50000	117841
Generation from other sources (GWh)	0	0	0	0	0	0	0
Total generation in province (GWh)	31029	100975	69700	53902	20292	82782	358680

Percentage of thermal generation in 2003	67%
Percentage of generation by all other resources in 2003	33%

Data source: China Electric Power Yearbook 2004

Table A17 Generation of the Central China Power Grid in 2004

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in China Central Grid G=A+B+C+D+E+F
Thermal generation (GWh)	30127	109352	43034	37186	16520	34627	270846
Hydro generation (GWh)	3890	6884	30372	24236	5670	58902	129954
Generation from other sources (GWh)	0	0	0	0	0	0	0
Total generation in province (GWh)	34017	116236	73406	61422	22190	93529	400800

Percentage of thermal generation in 2004	68%
Percentage of generation by all other resources in 2004	32%

Data source: China Electric Power Yearbook 2005

Table A18 Generation of the Central China Power Grid in 2005

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in China Central Grid H=A+B+C+D+E+F
Thermal generation (GWh)	30000	131590	47700	39900	17584	37202	303976
Hydro generation (GWh)	5000	6700	32467	24100	6036	64498	138801
Generation from other sources (GWh)	0	10	0	0	0	0	10
Total generation (GWh)	35000	138300	80167	64000	23620	101700	442787

Percentage of thermal generation in 2005	69%
Percentage of all other resources in 2005	31%

Data source: China Electric Power Yearbook 2006

Annex 4

MONITORING INFORMATION

Please refer to Section B.7.2

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