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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
The title of the project: Shuanghekou 16.6MW Hydropower Project in Chongqing City, P.R. China
Version: 05
Date: 31/07/2009

The history of the previous PDD versions:
Version 01: 12/12/2007, submit for validation by DOE (start GSP)
Version 02: 11/07/2008, update the PDD according to the DOE
Version 03: 28/10/2008, revised with updated methodology version 7.
Version 04: 05/07/2009, revised by the comments from the DOE
Version 05: 31/07/2009, revised by the comments from the DOE

A.2. Description of the project activity:

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Shuanghekou 16.6 MW Hydropower Project (here after referred to as “the project”) is a new-build hydropower project, located on the up stream of Dongli River, Kai County, Chongqing Municipality, P.R. China. The owner of the project is Kai county Dongli River Hydropower Co., Ltd (hereinafter referred to as “the Project Entity”).

The project is a run-of-river hydropower project with the total installed capacity of 16.6 MW. It is estimated that the annual electricity generated will be 70,540MWh and the annual net electricity generated will be 65,541 MWh[1]. The surface area at the full reservoir level of the project will be 272,800 m^2, thus the power density of the project will be 60.85 W/m^2. The electricity generated will be supplied to regional power grid i.e. Central China Power Grid (CCPG). The baseline scenario to the project is the same as the scenario existing prior to the start of implementation of the project. The baseline scenario of the project is equivalent to annual generated electricity supplied by CCPG (continuation of current practice).

The purpose of the project is to generate electricity by using Dongli River water resources to alleviate electricity shortage in Central China. The project will contribute to the reduction of GHG emission by displacing part of the electricity from the fossil fuel fired power plants of the CCPG, and the expected annual GHG emission reductions over the first crediting period is 63,873tCO_2e/yr.

The project will bring good environmental and economic benefits, at the same time contribute to the local and China’s sustainable development listed as followings:

- Supply of reliable, zero-emission renewable energy to the CCPG;
- Improvement in generation and reliability of electricity to local areas. The Project will act as a direct supplement to local electricity capacity, and thus would supply reliable power for the local community;
- Reduction of greenhouse gas emissions (GHG), especially CO_2, as well as other atmosphere pollutants, e.g. SO_2, NOx and particles etc.

[1] Shuanghekou Hydropower Project Preliminary Design Report (Page 280), dated August, 2005. The electricity generation annual is 70540 MWh. The coefficient of effective generation is 95%. The coefficient of generation used by station is 0.2%. The losing coefficient of transmission is 2%.

- The project developer will construct roads and other traffic infrastructures. It will be greatly convenient for local residents and will ultimately promote the local business development.
- The project can increase temporary and permanent employment opportunities for local residents during construction and operation of the project, which will increase income of the local residents. It is helpful to local economic development.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (Host)	Kai county Dongli River Hydropower Co., Ltd	No
Japan	Marubeni Corporation	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.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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People's Republic of China (the "Host Country")

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

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Kai County, Chongqing Municipality

A.4.1.3. City/Town/Community etc:

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Guangmian town

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

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The project is located in the Guangmian town, Kai County, Chongqing Municipality, P. R. China. The project is about 75 km away from Kai County. The central geographic coordinate of powerhouse is at the longitude of 108°34′54"E and the latitude of 31°33′12"N. The location of the project is shown in the map of Figure A-1.

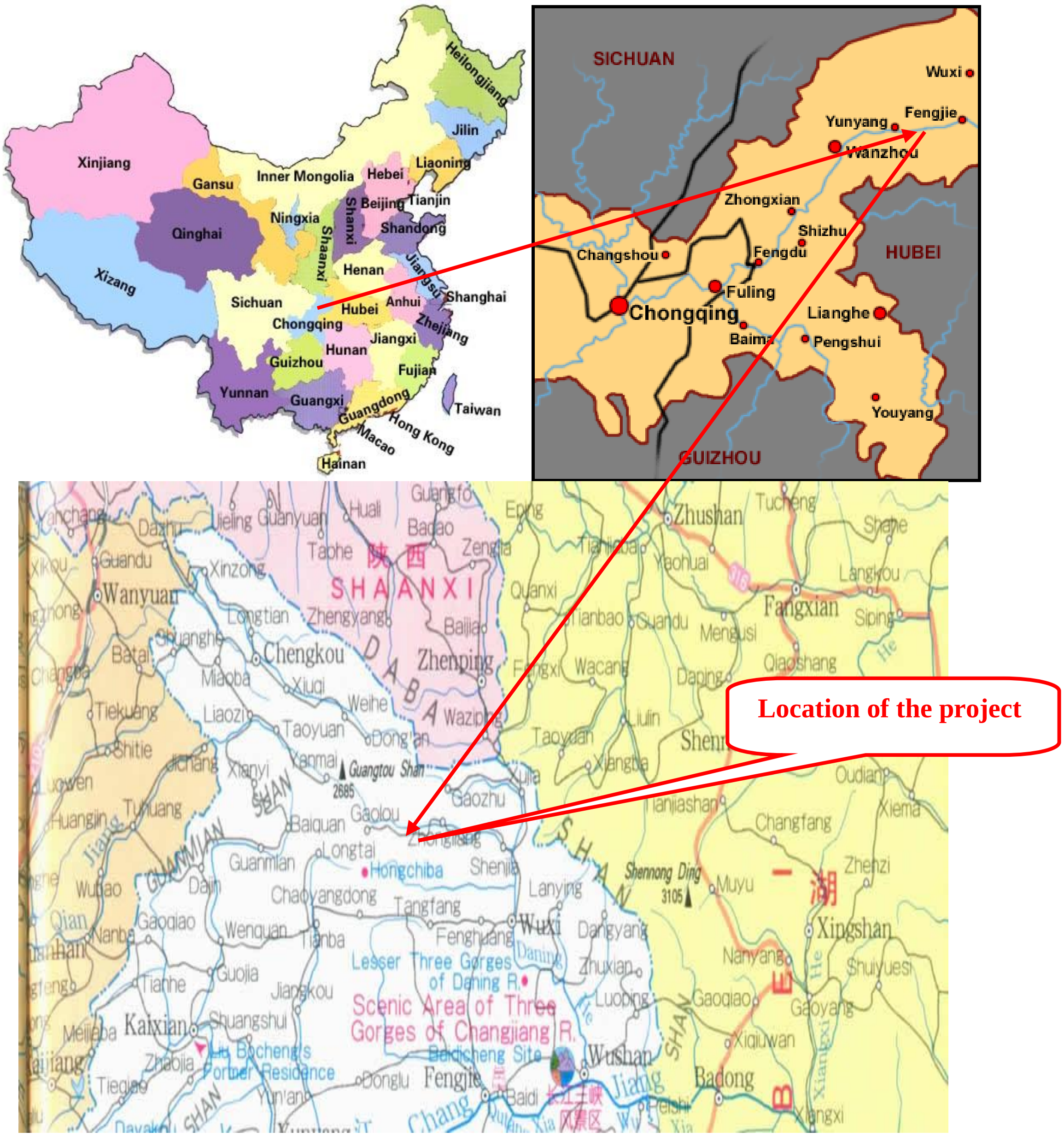

Figure A-1 Geography location of Shuanghekou hydropower project

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

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

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

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Prior to the implementation of the project, the electricity is supplied by the CCPG which is dominated by thermal power, which is the baseline scenario to the project.

The project is a run-of-river plant, and the total installed capacity is 16.6MW(2×6.3MW+4MW). The main purpose of the Project is to generate electricity. The production process can be described as follows: Water is taken by the channel and then enters into the turbine through the high pressure pipeline to produce electricity by driving the generators. The electricity generated will be supplied to CCPG. The electricity exported by the project and imported from the grid will be monitored by a bidirectional gateway meter.

The main constructions of the project includes gate dam, power house and switch station etc. Table A-1 below shows the design features and characteristics of the project.

Table A-1 Design features & characteristics of the project[2]

Installed capacity（MW）		16.6	
Electricity generated annually (MWh)		70,540	
Expected annual electricity supplied to the grid（MWh）		65,541	
Operational hours		4,249	
Hydraulic turbine	Model	HLA575C-LJ-84	HLA542-LJ-100
	Unit	2	1
	Rated head(m)	168.4	168.4
	Rated power(kw)	6596.8	4210
	Rated flow(m^3/s)	4.3	2.73
	Rated speed(r/min)	1000	750
	efficiency	93	92.2
	Manufacturer	Hangzhou electric power equipment plant	
Hydraulic generator	Model	SF-J6300-6/2400	SF-J4000-8/2150
	Unit	2	1
	Rated power(kw)	6300	4000
	Rated voltage(kv)	10.5	10.5
	Rated current(A)	433	274.9
	Rated speed(r/min)	1000	750
	Power factor	0.8	0.8
	Manufacturer	Hangzhou electric power equipment plant	

The project uses state of the art technology with all the equipment produced domestically. The main equipments' lifetime, such as hydro turbine and generation, are 30 years. The technology of hydro plant of China is mature and advanced and there is no technology transfer from abroad.

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[2] Shuanghekou Hydropower project Preliminary Design Report, dated August, 2005.

In order to operate well, the workers of the project would be trained professionally. A detailed training plan has been made by the owner of the project[3].

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

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The ex-ante estimated amount of emission reductions over the first crediting period of the project are listed in table A-2 below:

TableA-2 Ex-ante estimation of emission reductions over the first crediting period

Years	**Annual estimation of emission reductions in (tCO_2e)**
2010	63,873
2011	63,873
2012	63,873
2013	63,873
2014	63,873
2015	63,873
2016	63,873
Total estimated reductions (tones of CO_2e)	447,111
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tones of CO_2e)	63,873

A.4.5. Public funding of the project activity:

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There is no public funding for the project.

[3] Training plan of Shuanghekou Hydropower 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:

>>
1. The approved consolidated baseline and monitoring methodology ACM0002: "Consolidated methodology for grid-connected electricity generation from renewable sources" Version 07, in effect as of EB36; and
2. The approved "Tool for demonstration and assessment of additionality", Version 05.2, in effect as of EB39, and
3. The approved "Tool to calculate the emission factor for an electricity system", Version 01.1, in effect as of EB35 are applied to the Project activity[4].

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 7) 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 the installation of a hydro power plant with an run-of-river reservoir.
- The project activity results in a new reservoir and the power density of the power plant is greater than 4W/m^2 (see section B6.3 for the calculation of the power density).
- 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 is available.
- The project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- 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.

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

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

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According to the definition of project boundary by ACM0002, the spatial extent of the project boundary includes the project power plant and all power plants connected to the electricity system that the project is connected to. The boundary is showed in Fig.B-1

[4] The "Tool to calculate project or leakage CO2 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.

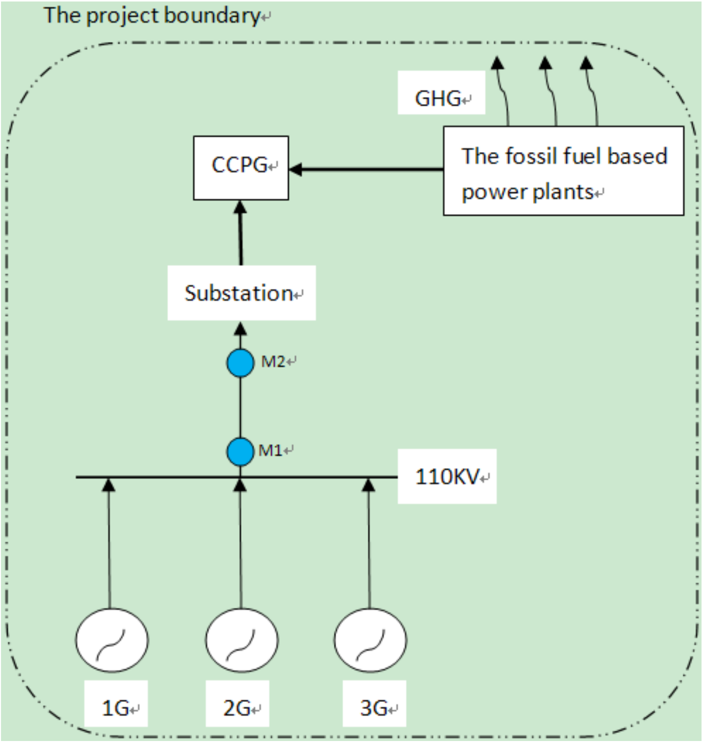

Figure B-1. Flow diagram of the project boundary

The electricity system is defined according to *"Tool to calculate the emission factor for an electricity system" Version 01.1*.

In this specific case, the hydropower plant will be transferred to the Chongqing Grid which is connected to the Central China Grid. The Central China Grid is a larger regional grid, which consists of six sub-grids: Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan Grids. According to the guidance given above, and considering the substantial inter grid power exchange throughout the Central China Grid, it is justifiable to identify the Central China Grid as the correct project boundary for this specific project.

The main emission sources and type of GHGs in project boundary are listed in table B-1 below:

Table B-1 Sources and gases in project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Fuel-fired Power Plants in CCPG	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
Project Activity	Chongqing Shuanghekou Hydropower Project	CO_2	Excluded	Excluded for simplification.
		CH_4	Excluded	As the power density of the project is more than $10W/m^2$, no greenhouse gas emissions from the project have to be considered according to ACM0002
		N_2O	Excluded	Excluded for simplification.

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

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According to methodology ACM0002, for project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described below.

The proposed project is the installation of a new grid-connected renewable power plant and do not modify or retrofit an existing electricity generation facility, and the electricity generated by the proposed project will be delivered to the Central China Power Grid. So the baseline scenario of the proposed project can be identified as the following:

Electricity delivered to the grid by the proposed project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources within the Central China Power Grid, as reflected in the combined margin (CM) calculated described in B.6.

The analysis and description in B.5 and B.6 will support the baseline scenario shown above.

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) : >>

Consideration of the CDM before the starting date of the project activity:

Before the project started construction, the project developer recognized that the project was not financially attractive due to the reasons below.

Firstly, the cost of transmit electricity engineering increase from RMB 6,510,000(PDR) to RMB 13,980,000(supplementary PDR)[5], as the project owner need build a new 110 KV transmission line to transmit the power directly to Xianba substation[6], and in PDR, the power was planned to be transmitted from the project station to Honghua station, and then to Xianba substation, but now the existing transmission line from Honghua substation to Xianba substation has been overloaded. Moreover, the actual tariff is less than the tariff of Original PDR (0.254 Yuan/KWh (including VAT) in loan repayment period, 0.228 Yuan/KWh (including VAT) after loan repayment period). According to the purchase and sell electricity contract signed by the Project Entity and Chongqing Kai County Power Supply Co., Ltd, the actual tariff (including VAT) is only 0.205Yuen/KWh, and the tariff of the contract is decided by the Chongqing Municipal Bureau of Prices[7]. Besides, the water

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[5] Investment appraisal of transmit electricity engineering of the Shuanghekou hydropower station, issued by Chongqing City Three-gorge Hydropower Reconnaissance Design Institute, dated Nov, 2006.

[6] Letter on the electricity transmission from Kai Count Shuanghekou Hydropower station, No 145Yu Dian Han [2006], issued by Chongqing City Power Supply Co., Ltd., dated Sep., 2006.

[7] Purchase and sell electricity contract between Kai county Dongli River Hydropower Co., Ltd. and Chongqing Kai County Power Supply Co., Ltd. dated November 15th, 2006.

resource fee of the project increases from 0.001 Yuan/KWh to 0.005 Yuan/KWh[8]. From those reasons, the project is impossible to start as the IRR of the project is lower than the benchmark (Table B-4). Hence, the project developers held a board meeting[9] on December 1st, 2006, in which they decided to develop the project as a CDM activity in order to reduce the financial risk. Starting on 17 January 2007 the project developer consulted Shanghai Yanminjiu International Trade Co. Ltd with regard to issues about CDM[10].

In conclusion the CDM helps alleviate the economic and financial hurdles faced by the project. CDM revenues will help to mitigate the project's financial unattractiveness by providing additional cash flow and improving the IRR. As a result, the bank agreed to grant a loan to the project developer in April 2007 only after considering these additional CDM revenues[11]. Only after the loan was agreed could construction start in June 2007. And the bank loan has been approved in Jan. 18th, 2008[12]. CDM financing also brings many other additional benefits including international participation in the project, greater investor confidence, and an enhanced sustainability image and profile for the project developer.

The time schedule of the proposed project is as follows:

Table B-2: Time schedule of the implementation of the project

Date	Key Event
08/2005	Shuanghekou Hydropower project Preliminary Design Report
11/2005	Environment Impact Assessment
11/04/2006	Approval of Environment Impact Assessment, by Chongqing District Environment Protection Bureau
05/09/2006	Letter on the electricity transmission from Kai Count Shuanghekou Hydropower station, by Chongqing City Power Supply Co., Ltd.
25/10/2006	Approval of Preliminary Design Report, by Kai County Water Conservancy and Agricultural Machinery Bureau
15/11/2006	Purchase and sell electricity contract between Kai county Dongli River Hydropower Co., Ltd. and Chongqing Kai County Power Supply Co., Ltd.
28/11/2006	Investment appraisal of transmission electricity engineering of the project
01/12/2006	Made a board decision to apply CDM project.
17/01/2007	CDM confirmation letter to Shanghai Yanminjiu International Trade Co. Ltd
18/04/2007	The proof of the bank agreeing to grant a loan for the project
25/06/2007	The main construction started[13]
18/12/2007	Purchase contract of turbines and generators
18/01/2008	Approval of the bank loans
01/01/2010	Start to operation

The plant load factor is (in %) the number of hours of production at full load divided by 8760 hours (total hours in a year). In the project the total estimated production per year is 70,540MWh, and the

8 Circular of Price bureau, finance bureau and water conservancy bureau in Chongqing city on the adjustment charge standard of water resources fee in 2006.

9 The minutes of the fifth session of the first meeting of board of directors in Shuanghekou hydropower station, dated Dec. 1st, 2006.

10 The letter of commission to Shanghai Yanminjiu International Trade Co. Ltd, dated Jan. 17th, 2007.

11 Load proof of Kai County Rural Credit Cooperative, dated April 2007.

12 Approval of the Application of the Loan to Kai County Dongli River Hydropower Co.,Ltd, dated Jan. 2008.

13 Approval on starting construction of Kai County Shuanghekou hydropower station by Kai County Water Conservancy and Agricultural Machinery Bureau, dated June 25th, 2007.

installed capacity is 16.6MW, so the number of hours of production at full load is 4249.398 hours, and the plant load factor is 48.5%. The PDR with plant load factor of 48.5% has been approved by Kai County Water Conservancy and Agricultural Machinery Bureau, which is applicable to paragraph 3 (a) of Annex11 in EB 48.

The following steps are used to demonstrate the additionality of the project according to the "Tool for the demonstration and assessment of additionality", the additionality of the project is demonstrated and assessed through the following steps:

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

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

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

1. The project activity not undertaken as CDM project activity;
2. Construct a fossil fuel-fired power plant with equivalent annual electricity generation;
3. Construct an alternative renewable power plant with equivalent annual electricity generation;
4. Equivalent annual generated electricity supplied by CCPG (continuation of current practice).

There is neither potential for wave or tidal energy nor for geothermal energy in the project's area. No biomass based power plant with a similar scale to the project has previously been built in the region. Moreover, other renewable energy alternatives, such as solar PV is considered to be too cost intensive for generating the equivalent annual output. The region where the proposed project is located is poor in terms of wind resources with very low wind energy potential.[14] Thus there are no favorable conditions for the construction of power plants based on other renewable sources. Therefore, this scenario is not a feasible scenario.

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

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

The second scenario is not consistent with Chinese laws and regulations. According to Chinese regulations, construction of thermal power plants of capacity less than 135MW is prohibited[15]. A fossil fuel power plant providing equivalent power with the proposed project would have an installed capacity less than 60MW, considering that the average utilization hours of thermal units in China in 2005 was 5,876 hours[16]. Therefore, it is concluded that the second alternative does not comply with Chinese relevant laws and regulations, and hence it is not a feasible scenario.

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

Step 2. Investment analysis

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[14] http://www.newenergy.org.cn/html/2006-2/2006217_7650.html

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

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

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

Sub-step 2a. Determine appropriate analysis method

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

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

Option II: Investment comparison analysis. This analysis method can be only used if the alternatives to the project are similar investment projects. However, this option is not applicable to the project because the alternative to the proposed project is expansion of existing power plants or construction of new fuel-fired power plants in CCPG, and investing in a new fuel-fired power plant is irrelevant for the project to make business decision of the project owner.

Option III: benchmark analysis. The project will bring incomes from generating electricity, so it is viable to compare the project financial date with the related financial standard. So this option is available.
Therefore, the only applicable analysis method is **benchmark analysis (Option III).**

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

According to <Economic Evaluation Code for Small Hydropower Projects > (SL16-95, June 1995) decreed by the Ministry of Water Resources (No. [1995]186), the benchmark IRR on total investment for small hydropower projects is 10%. In the document as referred to, the small hydro is defined as the hydropower installation capacity lower than 25 MW, and thus this project falls into the range of small hydropower station. And the proposed project adopts this benchmark economic indicator to analyse the economics of the project activity.

Sub-step 2c. Calculation and comparison of financial indicators
The main assumptions for the investment analysis are shown in table B-3 below:

Table B-3 Basic parameters for financial evaluation

Parameter	Unit	Value	Data source
Installed capacity	MW	16.6	Preliminary Design Report
Net electricity generation	MWh	65,541	Preliminary Design Report
Total static investment	Ten thousand RMB￥	9373.34	Amendment to Budget of Preliminary Design Report[17]
Tariff (including VAT)	RMB￥/kWh	0.205	Purchase and sell electricity contract[18]

[17] The total static investment of Preliminary Design Report was 86,263,400 Yuan, while the financing of transmit electricity engineering increased from 6,510,000 Yuan to 13,980,000 Yuan. So the total static investment of the project is 93,733,400 Yuan now.
[18] Purchase and sell electricity contract between Kai county Dongli River Hydropower Co., Ltd. and Chongqing Kai County Power Supply Co., Ltd. dated November 15th, 2006.

Valued-added tax	%	6	Preliminary Design Report
Sales tax（Based on VAT）	%	8	Preliminary Design Report
Income tax	%	33	Preliminary Design Report
Annual O&M	Ten thousand RMB￥	259.06	Calculated based on Preliminary Design Report[19]
Project lifetime	Year	33	Preliminary Design Report

The financial indicators (IRR) with and without income from CERs sales are shown in Table B-4:

Table B-4 Comparison of financial indicators of different scenarios with benchmark

Items	Unit	Without CERs	Benchmark	With CERs
IRR on total investment	%	7.58	10	10.98

As shown above, the project IRR is lower than the benchmark rate without income from CERs sales, then the proposed project is financially unacceptable because of its low profitability; the project IRR is above the benchmark with income from CERs sales, hence becomes financially viable because of the dramatically improved financial performance.

Sub-step 2d. Sensitivity analysis

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

Because the "Economic Evaluation Code for Small Hydropower Projects" does not limit the range for sensitive analysis, in fact, the range from -10% to 10% is widely used in financial analysis in China and it is also used in Preliminary Design Report of the project. So, the range from -10% to 10% is proper for the proposed project.

Assuming the above four factors vary in the range of -10% to +10%, the total investment IRR of the proposed project (without income from CERs sales) varies to different extent, and the sensitivity analysis is shown in table B-5 and figureB-2 below:

Table B-5 Sensitivity analysis

Change scope / **Critical assumption**	**-10%**	**-5%**	**0%**	**+5%**	**+10%**
Annual O&M	7.96%	7.80%	7.58%	7.47%	7.30%
Total static investment	8.71%	8.12%	7.58%	7.09%	6.63%
Grid tariff	6.48%	7.04%	7.58%	8.12%	8.64%
Annual net electricity generation	6.48%	7.04%	7.58%	8.12%	8.64%

[19] Calculation of IRR by Microsoft Excel

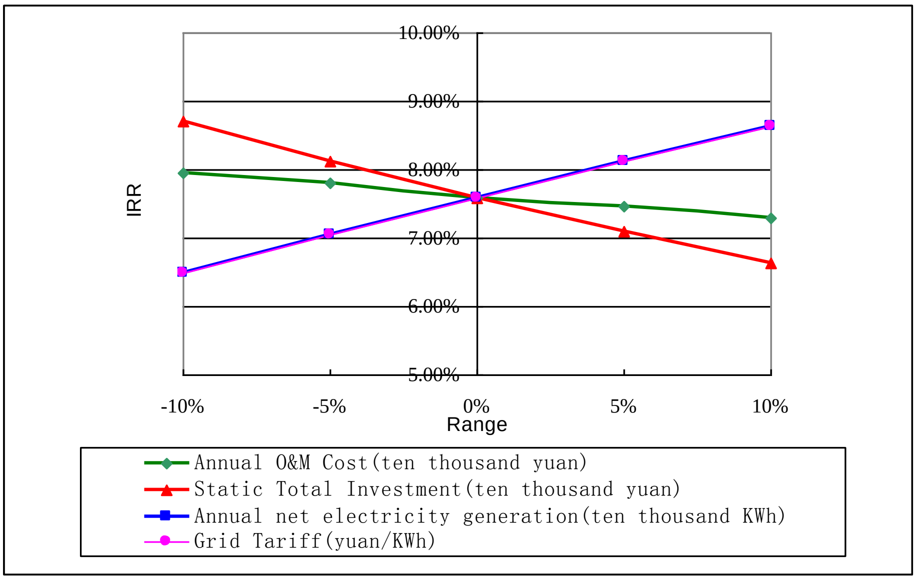

Fig.B-2 Sensitivity analysis

From the above table B-5 and figure B-2, it can be shown that IRR can be decreased with the increase of total investment and O&M cost, and can be increased with the raising of annual net electricity generation and grid tariff.

If the IRR achieves 10%, the total investment or the O&M cost need to decrease by more than 10%, but the proposed project has been in construction and the contract of main equipment i.e. turbines and generators have been signed[20], and the prices of the industrial products[21] and the labour force[22] have kept rising up rapidly for the past several years. So it is impossible of decrease 10% of total investment or the O&M cost.

Or the annual net electricity generation may be increased by more than 10%, but the equipped capacitor has already been an optimization according to the PDR, and the runtime is impossible to increase or reduce to 10% according to the monitoring data surveyed by the Wenquan hydrometric stations over the past 36 years (1967 to 2003)[23.] So it is impossible to increase 10% of the sales from electricity.

According to approval by Chongqing City Price Bureau (the approval document number is "NDRC Price No. [2006] 1233"), the electricity tariff will hardly increase 10% under reasonable estimate,as the adjustment of electricity tariff needs to negotiation with Chongqing Kai County Power Supply Co.,Ltd and several government departments. In order to ensure the stability of electricity tariff for the whole electricity generation industry in Chongqing City, the Chongqing Kai County Power Supply Co.,Ltd and Government Price bureau can hardly increase tariff for one specific power generation enterprise. So it is relative fixed and is difficult for the tariff of the proposed project to be increased in the near future.

This result shows that even under very favorable circumstance the IRR of proposed project is still

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20 Purchase contract of turbines and generators

21 http://www.stats.gov.cn/tjfx/jdfx/t20080310_402466888.htm

22 http://www.ce.cn/cysc/fz/fzgd/200712/27/t20071227_14047051.shtml

23 Hydrological analysis from Preliminary Design Report

lower than the 10% benchmark, then lack financial attractiveness.

In addition, there are geographical difficulties with the project site as a run-of-river hydro development which requires a tunneling component. It was expected the site would be uniformly granite. However, this was not the case and the geology was a mixture of rock types. This incurs additional costs because of the higher risk of rock fracture associated with working with a mixture of rock types, and the time required to work with this geology. So, the completion date of the project was put off until late May, 2009[24]. Such additional costs and the cost of time delay have not been factored into the project plan as they were not foreseen by the PDR.

It can be concluded from above analysis that the project can not be put into construction without CERs revenue.

Step 3. Barrier analysis

The "Tool for the demonstration and assessment of additionality" (Version 05.2) states that project participants may choose to apply Step 2 (Investment analysis) or Step 3 (Barrier analysis) to demonstrate the additionality of the Project.

Because the IRR of the project is far below the standard 10%, step 3 is not used to prove the additionality of the proposed Project.

Step 4. Common practice analysis

The proposed project is a small scale hydropower station with a total installed capacity of 16.6MW. According to <Economic Evaluation Code for Small Hydropower Projects > (SL16-95, June 1995) decreed by the Ministry of Water Resources (No. [1995]186) (clause1.2), the installed capacity under 25MW is small scale hydropower station; the installed capacity under 50MW in rural area is middle scale hydropower station. Those selected power plants similar to the proposed project have been built in Chongqing City with installed capacity 0~50MW (the projects with the installed capacity larger than 50MW were excluded).

Chongqing City is a very large municipality divided into 40 districts and counties. The total area of Chongqing is 82,000 km^2, which is 2.39 times of the total area of the three other municipalities (Beijing, Shanghai and Tianjin). Chongqing Municipality is so large that it is very different from the neighbouring provinces such as Sichuan Province in water resource, tariff, and hydropower policy. The water resource of Sichuan Province is the first of China[25], which is more than water resource of Chongqing Municipality. The technical developed installed capacity in Sichuan Province is more ten times than in Chongqing Municipality[26]. The basis tariff is 0.288 Yuan/KWh[27] in Sichuan Province while 0.205 Yuan/KWh[28] in Chongqing Municipality. Besides, Sichuan Provincial Party Committee

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[24] Report on the delay of completion date of the project

[25] http://www.china5e.com/news/water/200504/200504180145.html

[26] http://www.powerfoo.com/news/slzy/slzy.html

[27] http://www.chengdu.gov.cn/gov_open/detail.jsp?id=162327

[28] http://www.cqwlsl.com/list.asp?id=671&mname=%E8%83%BD%E6%BA%90%E4%B8%8E%E7%
94%B5%E5%8A%9B&quname=%E7%94%B5%E5%8A%9B%E7%AE%A1%E7%90%86

and Provincial Government take the hydropower as one of the pillar industries[29], but the hydropower isn't one of the pillar industries in Chongqing municipality[30]. So Chongqing municipality can be the geographical boundary of the project.

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

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

The development of hydropower projects greatly relies on the hydrological resources available. The existing hydropower plants (0~50MW) similar to the proposed activity in Chongqing (the total area of Chongqing is 82,000 km2 with a population of 31.14 million) and not undertaken as CDM projects) are shown in the Table B-6 below.

Table B-6 Existing hydropower plants in Chongqing province[31]

Name	Installed capacity (MW)	Generated energy annually (MWh)	Operation start date	Project owner
Shuanghe hydropower station	27	124,820	1997[32]	Chongqina Sanxia Hydropower (Group) Co., Ltd.
Honghua hydropower station	12.6	62,005	2003[33]	Water Conservancy Bureau of Kai country(local government)
Tianshui hydropower station	9.22	38,493	2002[32]	Water Conservancy Bureau of Kai country(local government)
Ganchang hydropower station	37.5	180,550	1997[31]	Chongqina Sanxia Hydropower (Group) Co., Ltd.
Daxihe hydropower station	48	170,000	2001[34]	Water Conservancy Bureau of Nanchuan country(local government)
Xiaosai hydropower station	18.9	113,192	2003[35]	Water Conservancy Bureau of Fengjie country(local government)
Laoguashi hydropower station	9	39,996	2004[36]	Water Conservancy Bureau of Shizhu country(local government)
An'ju hydropower station	30	178,300	1995[37]	Anju Hydro Power Company (stated owned)
Weituo hydropower station	30	177,300	1993[38]	Chongqing Shipping

29 http://www.china5e.com/news/water/200504/200504180145.html

30 http://www.cq.xinhuanet.com/xhbb/2007-11/08/content_11620758.htm

31 Chongqing Water Conservancy Bureau &Yearbook of China Water Resources 2006&2007.

32 http://stockdata.stock.hexun.com/stock_detail_600116_039880.shtml

33 http://www.xzqh.org/html/cq/0306.html

34 http://www.cqncnews.com/News/Show.asp?id=5254

35 http://www.powerproduct.com/user1/mmtdocs.html?u=131222

36 http://www.cq.xinhuanet.com/zfwq/shizhu/top06/top06-03.htm

37 http://emuch.net/journal/article.php?id=CJFDTotal-SCSL1993S1002

				Development Department(province level)
Tizidong Hydro Power Station	36	192,790	2003[39]	Chongqing Wujiang Industry Group Co.,Ltd

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

As China began undertaking significant electric power sector reform including dividing the former single national power company into regional companies and separating generation and distribution responsibilities after 2002, we define the similar projects as small scale hydropower projects in Chongqing City commissioned after 2002. As the result, five power plants, i.e. Honghua, Tianshui, Xiaosai, Laogushi and Tizidong, remain.

All those remaining projects excluding Tizidong Hydro Power Station are developed by state-invested organizations which have larger capital reserves and larger operational capacities that allow them a better (more and easier) access to project finance. State-invested organizations therefore are better placed to deal with project risks. They also have stronger negotiating power with grid operating companies.

There is an essential distinction between the proposed project and Tizidong Hydropower Project. Compared to the proposed project, Tizidong Hydropower Project is located in the rivers with much better water resource to allow the owners better (more and easier) access to project finance. The annual operation time of Tizidong Hydropower Project is about 5355 hour/year, which is 26% higher than the one of the proposed project (4249 hour/year). Consequently, significantly less electricity will be generated, which makes the project less financially attractive and more exposed to financial risks than Tizidong Hydropower Project. Besides, the Tizidong project was developed by Chongqing Wujiang Industry Group, a leading enterprise with large investment scale and extensive radiation, which is under direct operation of CPC Committee of Qianjiang District, Chongqing Municipality40. Moreover, the owner of Tizidong Hydro Power station is a listed company41. There exists obviously different financing environment between Wujiang Group and the Project owner. The Tizidong hydro power stations therefore do not face the same barriers as the proposed project.

It can therefore be concluded that the Project can't be considered common practice.

The above analysis has shown that the proposed project meets with the requirements of *Tool for Demonstration and Assessment of Additionality*. In conclusion, the proposed project is additional according to ACM0002.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Project Emissions

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[38] http://jda.cq.gov.cn/templet/default/ShowArticle.jsp?id=4598

[39] http://www.cqan.com.cn/content/detail_c.php?cid=15&id=1450

[40] http://share.jrj.vnet.cn/cominfo/ggdetail_2002-08-14_000975_51996.htm

[41] http://www.wjep.com/gb/aboutus/content.asp?id=218&stype=7&title=大事记

According to the methodology ACM0002, project emissions from the reservoir do not have to be taken into account in case the power density of the project is above 10 W/m2. The power density can be calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity, in W/m2.
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
APJ = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m2).
ABL = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero.

As the proposed project activity does not involve the retrofitting or modification of an existing hydropower plant and the project involves the creation of a new reservoir, we can simplify the calculation by assuming Cap_{BL} and *ABL* as zero and calculate the power density as follows:

Surface area of the reservoir at full capacity[42]: 272,800 m^2
Total installed capacity after implementation: 16,600,000 W
Power Density (Installed capacity / Surface area): 16,600,000 / 272,800 = 60.85 W/m^2

From above calculation it is clear that the power density is 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.

Baseline Emissions

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

$$BE_y = \left(EG_y - EG_{baseline}\right) \cdot EF_{grid,CM,y}$$

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). For the proper project is a new power plant, this value is taken as zero.
$EF_{grid,CM,y}$ = 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".

[42] Shuanghekou Hydropower Project Preliminary Design Report (Page 4), dated Augest, 2005.

According to the "*Tool to calculate the emission factor for an electricity system*", the baseline emission factor ($EF_{grid,CM,y}$) is calculated as combination of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).

This PDD uses the calculations published by the DNA of P. R. China[43] to determine the Operating Margin (OM) emission factor[44] and the Build Margin (BM) emission factor[45] 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.

Step 1 Identify the relevant electric power system

According to instructions of Chinese DNA[46], the relevant electric power system is the Central China Power Grid consists of five provinces and one city, i.e. Hubei, Henan, Hunan, Jiangxi and Sichuan provinces as well as Chongqing city.

Step 2 Select an operating margin (OM) method

The Operating Margin emission factor(s) (*EF OM, y*) is calculated based on one of the four following methods:

1. Simple OM, or
2. Simple adjusted OM, or
3. Dispatch Data Analysis OM, or
4. Average OM.

'Simple OM' (1) method is applicable to this project activity because that in the last five years the low cost/ must run resources constituted less than 50% of generation in the project electricity system, the Central China Grid.

Without any nuclear source, the Central China Power Grid only possesses 35.84% of its total electricity generation that come from renewable energy sources in 2006, 38.18% in 2005, 38.37% in 2004, 34.43% in 2003 and 35.95% in 2002[47].

According to the result, the 'Simple OM' (1) method can be applied to this project activity. The simple OM can be calculated using either of the two following data vintages:

• **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, or

• **Ex post option:** The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only

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

[44] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1888.pdf for the EF_{OM}

[45] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.pdf for the EF_{BM}

[46] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf

[47] China Electric Power Yearbook (2003-2007)

available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Based on the most recent statistics available of the project activity at the time of PDD submission, the first data vintages (**ex-ante**) for the calculation of the OM emission factor was chosen for this project.

Step 3 Calculate the operating margin emission factor according to the selected method

This PDD adopts the (a) Simple OM. The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

Based on data on fuel consumption and net electricity generation of each power plant / unit[48] (**Option A**), or

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 B**), or

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 (**option C**)

Option C was chosen based on the following reasons:

The necessary data for option A and option B is not available in China;

Only nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known.

When **Option C** is used, the simple OM emission factor 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:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:

$EF_{grid,OM,simple,y}$ = 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);

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ);

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

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

y = the three most recent years (2003, 2004 and 2005) for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option);

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

$EF_{OM,y}$ is calculated according to the statistics information of recent 3 years (from 2002to 2006), the data are the newest and available at the time of this PDD submission, the detailed calculation is shown in Annex 3.

Step4: Identify the cohort of power units to be included in the build margin

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;

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 , EB guidance on the estimation of the build margin in P.R. China can be applied for the purpose of defining the sample group[49]. 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), so option(b) is used to calculate 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, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available.

This PDD chooses the **Option 1.** 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. These 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

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{BL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{gird,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh);

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

$EF_{BL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m = Power units included in the build margin;

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

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in step 3 (a) for the simple OM, using options B1, B2 or B3, using for y the most recent

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

historical year for which power generation data is available, and using for m the power units included in the build margin.

In China, because some data can't be available, the BM calculation in this PDD adopts the modifications methods agreed by the CDM EB[50]. First, calculate the newly added installed capacity and the various component technologies, then calculation of the weight of newly added installed capacity of each power generation technology. Finally the commercial and efficient level of each power generation technology is adopted to calculate BM emission factor.

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

Concrete steps and the formula for BM are as follows:

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

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

Where:

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

$COEF_{i,m}$ is the CO_2 emission coefficient (tCO_2e / a mass or volume unit) of fuel *i*, taking into account the carbon content of the fuels used by plant *m* and the percent oxidation of the fuel in year *y*;

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

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

$$EF_{Thermal} = \lambda_{Coal} * EF_{Coal,Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas,Adv}$$

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

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

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} * EF_{Thermal}$$

Where:

CAP_{Total} is the total added installed capacity;

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

Based on the above calculation principle for BM, basic data and parameter, the calculation process for BM is shown in annex 3.

Step 6: Calculate the combined margin emissions factor (EFy)

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

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

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

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

Leakage

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

Emission Reductions

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

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

However, the project emission and leakage are both zero.

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

Data / Parameter:	***FC*** $_{i,y}$
Data unit:	**t, m³**
Description:	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
Source of data used:	China Energy Statistics Yearbooks 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; 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 the CCPG.
Source of data used:	China Electric Power Yearbooks 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of	Official released statistics; publicly accessible and reliable data source

measurement methods and procedures actually applied :	
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 the SCPG.
Source of data used:	China Electric Power Yearbooks 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	NCV_i
Data unit:	**MJ/t, kJ/m^3**
Description:	The net calorific value (energy content) per mass or volume unit of fuel *i*.
Source of data used:	China Energy Statistics Yearbooks 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; 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 Yearbooks 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$EF_{i,Adv}$
Data unit:	%
Description:	the efficiency of generating electricity by the optimized commercial coal-fired, oil-fired and gas-fired plants
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

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Project Emissions

The proposed project is a run-of-river hydro power plant. According to baseline methodology ACM0002, it is not needed to calculate project emissions, $PE_y = 0$

Baseline Emissions

According to formulaes in section B.6.1, the calculation results of EF_{OM} , EF_{BM} and EF_y are listed in table B-7, the detailed calculation processes are shown in Annex 3.

Table B-7 EF_{OM} , EF_{BM} and EF_y calculation results of CCPG[51]

EF_{OM} (tCO_2e/MWh)	EF_{BM} (tCO_2e/MWh)	EF_y (tCO_2e/MWh)
1.2899	0.6592	0.97455

According to formula (2) in section B.6.1, the annual baseline emission (BE_y) of the project in a typical year is calculated as follow:

BEy=EGy×EFy
=65,541 MWh×0.97455 tCO2/MWh
=63,873(tCO2/yr)

Leakage

According to baseline methodology ACM0002, $L_y = 0$

Emission Reductions

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

$$ER_y\ (tCO_2e/yr) = 63,873 - 0 - 0 = 63,873\ tCO_2e/yr$$

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

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

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The summary of the ex-ante estimation of emission reductions are listed in table B-8 below:

Table B-8 Summary of the ex-ante estimation of emission reductions

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2010	0	63,873	0	63,873
2011	0	63,873	0	63,873
2012	0	63,873	0	63,873
2013	0	63,873	0	63,873
2014	0	63,873	0	63,873
2015	0	63,873	0	63,873
2016	0	63,873	0	63,873
Total (tonnes of CO_2e)	0	447,111	0	447,111

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 generated electricity delivered to CCPG
Source of data to be used:	Measured onsite
Value of data applied for the purpose of calculating expected emission reductions in section B.5	65,541MW for a typical year
Description of measurement methods and procedures to be applied:	Net Electricity generated is read by the grid operator once per month using the main meter, and there is also a backup meter to crosscheck the on-grid energy in substation.
QA/QC procedures to be applied:	The monitoring data will be directly used for emission reductions calculation. Sales receipts and other records will be used for double checking to ensure the consistency. The meters will be calibrated every year by qualified organization to ensure the normal operation.
Any comment:	

Data / Parameter:	$EG_{pj,y}$
Data unit:	MWh
Description:	Electricity imports to the project from CCPG
Source of data to be	Measured onsite

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	As measured
Description of measurement methods and procedures to be applied:	The data is read by the grid operator once per month using the main meter as it is double-way gateway meter, and there is also a backup meter to crosscheck the data in substation.
QA/QC procedures to be applied:	Sales receipts and other records will be used for double checking to ensure the consistency. The meters will be calibrated every year by qualified organization to ensure the normal operation.
Any comment:	

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Project onsite
Value of data applied for the purpose of calculating expected emission reductions in section B.5	16,600,000W, This data is from the PDR.
Description of measurement methods and procedures to be applied:	Preliminary Design Report and the nameplate of the generation units
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	272,800 m^2. This data is from the PDR.
Description of measurement methods and procedures to be	The data will be measured from water stage recorder and topographical survey by professional design institute when the reservoir is full.

applied:	
Monitoring frequency:	yearly
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

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

1. Monitoring subject

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

2. Monitoring management structure

The monitoring management structure is as follow:

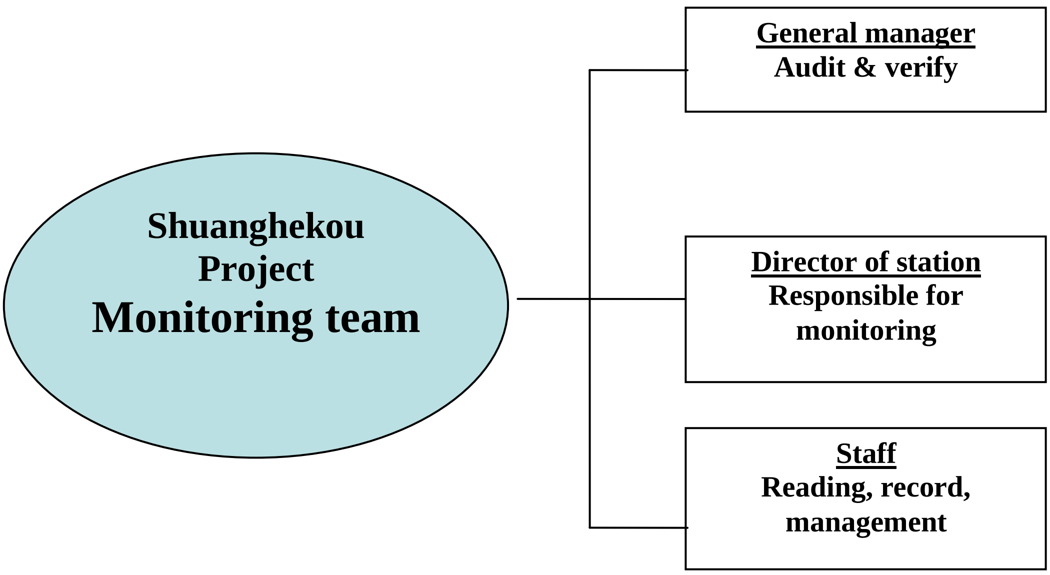

Fig.B-3 Structure of management of the project

The responsibilities of the project staff are as follow:

General Manager is responsible for the overall management of the project.

Director of station verifies if the monitored data is normal. To calculate the emission reductions regularly and write the monitoring report.

Staff/Monitoring Personnel: To conduct the monitoring task strictly based on the monitoring manual and registered PDD. To record required monitored parameters. To report the monitoring results to director of station, each shift is responsible for the works.

3. Monitoring apparatus and installation:

Two bidirectional meters will be installed and the accuracy of the meters will be 0.5s in accordance with <Technology & Management Regulations for Power Metering Devices> (DL/T448-2000). Both of them can record the import and export electricity. As shown in Fig.B-4, M1 is the main meter while M2 is backup meter. When the main meter is out of order, the reading from the backup meter will be used for reference. The main meter belongs to the Power Grid Company; the project owner, Power Grid Company and quality supervision organization will check and accept the main meter. The meters must be pasted with seal after installation or calibration. The seal is forbidden to rip by either party independently.

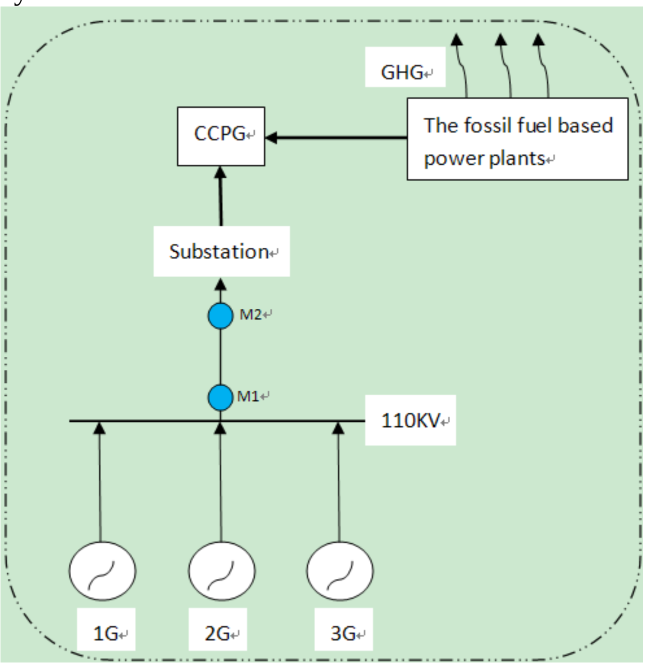

Fig.B-4 location of the meters

4. Data monitoring

1) Date of electricity
The readings of main Meter are used for calculating the emission reductions when the Meter is in normal operation state. The monitoring steps are as follows:

(1) The project owner and the grid corporation will get and record the readings of the key point meter and check meters within the 24 hours of the last day of every month and check the two reading;
(2) The Power Grid Company provides the project owner with the net electricity generation data;
(3) The project owner provides the Power Grid Company with sales receipts and preserves the copies of the sales receipts.
(4) The project owner records the net electricity generation of the project.

2) Date of installed capacity
Installed capacity will be checked every year according to the nameplates of generators.

3) Data of area of reservoir at the full water level
The data will be measured from water stage recorder and topographical survey by professional design institute after water storage age yearly.

5. Quality control

1) Calibration of meters

The calibration of meters conducted by qualified organization must comply with national standard and branch regulations to ensure the accuracy every year. The meters must be pasted with seal after calibration. The calibration records must be archived together with other monitoring records.

When the following situations occurred, the meters should be tested by a qualified organization in 3 days:

(1) The Master Meter reading is beyond the allowable error.
(2) If there is any malfunction situation happened to meters, then displace it.

2) Emergency treatment

The project owner should inform the Power Grid Company immediately if Master Meter occur malfunction situation. The net generated electricity during this period should be recorded by backup meter.

6. Data management

All monitoring data and records will be archived in electronic document as well as paper document. The electronic documents will be backed up in Compact Disc or Hard Disc form. The project owner will also keep the copies of sales receipts and prepare a monitoring report at the end of each year, which includes the net generated electricity, the monitoring data summary, the calibration records, the emission reductions calculation, meters' corrective action records and emergency report (if applicable).

All the electronic and paper documents will be archived during the crediting period and for two years after the last crediting period.

7. Training program

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

More information can be obtained from <The CDM Monitoring and Management Handbook of Shuanghekou Hydropower Plant>.

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

>>

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

28/11/2007

Members of the Methodology and Application Research team are:

Ms. Tu Xin, Senior Engineer
Mr. Luo Yuejun, Senior Engineer

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Above mentioned individuals / entities who determined the baseline are not project participants

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
25/06/2007（The main construction started）
Approval on starting construction of Kai County Shuanghekou hydropower station by Kai County Water Conservancy and Agricultural Machinery Bureau, dated June 25th,2007

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

>>
30 years

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

C.2.1. Renewable crediting period

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

>>
01/01/2010 or the date of registration, whichever is later

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

>>
Not applicable

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Environmental impacts

>>

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

>>

According to clauses 13 and 19 of the Environmental Evaluation Law of the People's Republic of China, the project entity must analyse the environmental impacts of project activities in China before utilising natural resources and beginning project construction. The Project Developer therefore commissioned a third party to conduct the required environmental impact assessment (EIA) in 2006, and the EIA report was approved by the Environmental Protection Bureau of Chongqing City in April 2006.

Where impacts of the Project were identified, mitigation measures were suggested and defined. There is no resettlement or relocation of population, buildings or public services required, therefore social and environmental influences are partial, short-term and reversible.

Identified environmental impacts	Measures taken
Water pollution	
On the construction site	Collect the water and discharge after the sedimentation treatment.
Wastewater from the staff	build WC near the living area of the staff
Air pollution	
Dust during the blast	Wet blast. 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.
Noise pollution	
Blast and excavation during construction	Choose equipment with low noise, arrange construction time, and construction activity is banned in the evenings.
Transportation during the construction	Adjust transportation car's speed while passing residential areas. Plant trees alongside the traffic roads to lower the noise.
Solid waste	
Waste from the construction	Transported to the specific dumping site.
Waste from the staff	Collected and sent to local waste dumping site and landfilled.
Biodiversity and ecosystems	
Part and short-time affect to the ecosystems in the construction time	The project will bring a beneficial effect to the Xuebao Mountain national park after finishing 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 implementation of measures such as effective monitoring and site reclamation and 90% of the area surrounding the hydro station and the diversion dams should be re-vegetated. The vegetation coverage rate should be higher after finishing the construction.

A stakeholder consultation with 50 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 will promote the social and economic development of the local area and also will 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 residual impacts associated with the Project.

SECTION E. Stakeholders' comments

>>

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

>>

In October, 2007, the project owner put up a notice in Kai town, related countrysides and some villages about the development of Shuanghekou Hydropower project[52]. That was to introduce the project to the public and aimed to gain the feedback of the public about the project. And then the project owner held a stakeholders' meeting of Shuanghekou Hydropower Plant in Nov., 2007, as showed in figure E-1.

Fig.E-1 the stakeholders' meeting of Shuanghekou Hydropower Plant

The stakeholders are local residents and government officials, and they are in different occupation, different ages and different level of education with extensive representative. The project owner introduced general situation of the project and expressed their expectations of receiving comments from stakeholders in the symposium. After those introductions, all the representatives made their comments about the project 's impact. All the comments were formed a meeting note in paper.

E.2. Summary of the comments received:

>>

The main comments from local stakeholders have been sought in the following aspects:

Mr. Liu Xiaoqing, Village leader of Guangmian village of Kai town, supports the construction of the hydropower station, since the construction of the project will benefit local economic development. However, he expressed his concern about the effect that the land expropriation will have on the villagers. Furthermore, he hopes that the project will support local employment.

Mr. Zhou Xinshuang, the representatives of the Guangmian village, hoped the project owner to rebuild the road which is not convenience for traffic.

Mr. Li Ming, the representatives of the Guangmian village, stated that the project might benefit the local residents, however he is worried that the project will cause an accumulation of sediment in the local riverbank and that this would lead to damaging of the vegetation. They fears that the

[52] <New Village>2007-10-25

construction material might be taken from the mountain and the quarrying of stones will cause landslides and damage to the mountain. They questioned whether the project might cause the disappearance of local fish species.

Mr. Qiu Xupei, general director of the Kai county Environmental Protection Bureau, confirmed that the environmental protection measures had been strictly obeyed and were carefully implemented by the project site to ensure that the regulations were strictly obeyed. He pointed out that the construction of an open channel is more beneficial, since it has led to less waste and usage of grits and clay.

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

>>

After the project owner made quick response in views of question reflected by the meeting. Following are the corresponding replies towards the problems shown in the previous section:

It was explained that the villagers will be financially compensated for the expropriated land in accordance with the national laws and regulations. In addition, the plot of expropriated land is relatively small; therefore, the lives of the local villagers will not be greatly affected.

Because of the laggard economy and mountainous geography of Guanmian town, the road from Zaitou to Yaocheng villager is only two meters wide. The project will organize a construction team to rebuild and level off the bumpiness road for the heavy trucks. At the same time, the road can provide the villagers convenience to go out.

During the construction period, stones and grits will be supplied by the local villagers, which will benefit local employment and increase local income. When the project becomes operational, the project will need higher-educated people with the necessary skills to operate the hydropower station which will provide limited opportunities for local residents as their education level is generally not sufficient.

The project’s environmental impacts have been carefully assessed by the Environmental Protection Bureau. During the construction period, the concentration of sediment in the water will increase slightly, however, when the project construction is finalized the concentration of sediment will disappear. In addition, during the design of the project, the accumulation of sediment was taken into consideration. Therefore, the project design has a sluice that should prevent the accumulation of sediment and possible negative effects for the environment. Moreover, the vegetation on the permanent and temporary expropriated land is sparse. The stone that used as construction material are provided by the local villagers and are not extracted from the mountain. Therefore, the mountain is not damaged and landslides will not more frequently than normally.

The overall comments with regards to the project were positive; the project will benefit the local residents by replacing fossil fuel power by hydropower. The environmental damages are limited, since the effects on the vegetation are minimal.

The project entity provided satisfactory explanations and answers to the questions/comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY
Project owner

Organization:	Kai County Dongli River Hydropower Co., Ltd.
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State/Region:	Chongqing
Postfix/ZIP:	405400
Country:	China
Telephone:	023-85878160
FAX:	023-85878160
E-Mail:	lxt2116530@163.com
URL:	
Represented by:	Mr. Lian Xingtan
Title:	Chairman of the board, Legal person
Salutation:	/
Last Name:	Lian
Middle Name:	/
First Name:	Xingtan
Department:	Project Manager
Mobile:	13906780007
Direct FAX:	/
Direct tel:	/
Personal E-Mail:	/

CERs Buyer

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State/Region:	
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Fax:	+81- 3-3282-2616
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Represented by:	
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Appellation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the project.

Annex 3

BASELINE INFORMATION[53]

The baseline information for calculation of OM and BM emission factor of China Central Power Grid is shown in the Report on Determination of Baseline Grid Emission Factor by China DNA NDRC at http://cdm.ccchina.gov.cn.

The concrete process is shown in the following tables.

[53] Chinese DNA's Guideline of emission factors of Chinese grids

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

Simple OM Emission Factors Calculation of CCPG for Year 2003

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	(MJ/t,km3)	K=G*H*I*J*44/12/10000 (for mass unit)
		A	B	C	D	E	F	G=A+B+C+D+E +F	H	I	J	K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	**13851.66**	25.8	100	20908	273971539.89
Cleaned coal	10^4 t							**0**	25.8	100	26344	0.00
Other washed coal	10^4 t	2.03	39.63			106.12		**147.78**	25.8	100	8363	1169146.40
coke	10^4 t				1.22			**1.22**	25.8	100	28435	32817.40
Coke oven gas	10^8 m^3			0.93				**0.93**	12.1	100	16726	69013.15
Other gas	10^8 m^3							**0**	12.1	100	5227	0.00
Crude oil	10^4 t		0.5	0.24			1.2	**1.94**	20	100	41816	59490.23
Gasoline	10^4 t							**0**	18.9	100	43070	0.00
Diesel oil	10^4 t	0.52	2.54	0.69	1.21	0.77		**5.73**	20.2	100	42652	181015.94
Fuel oil	10^4 t	0.42	0.25	2.17	0.54	0.28	1.2	**4.86**	21.1	100	41816	157229.00
LPG	10^4 t							**0**	17.2	100	50179	0.00
Refinery dry gas	10^4 t	1.76	6.53		0.66			**8.95**	18.2	100	46055	275069.63
Natural gas	10^8 m^3					0.04	2.2	**2.24**	15.3	100	38931	489222.52
Other oil production	10^4 t							**0**	20	100	38369	0.00
Other coke production	10^4 t							**0**	25.8	100	28435	0.00
Other energy	10^4 t standard coal		11.04			16.2		**27.24**	0	100	0	0.00
											Total	**276404544.15**

Data Source: <China Energy Statistical Yearbook 2004>

Fuel-fired Electricity Generation of CCPG for Year 2003

Province	Electricity Generation	Electricity Generation	Auxiliary Power Ratio	Supplied Electricity
	（100GWh)	（MWh)	（%）	（MWh)
Jiangxi	271.65	27165000	6.43	25,418,291
Henan	955.18	95518000	7.68	88,182,218
Hubei	395.32	39532000	3.81	38,025,831
Hunan	295.01	29501000	4.58	28,149,854
Chongqing	163.41	16341000	8.97	14,875,212
Sichuan	327.82	32782000	4.41	31,336,314
Total				225,987,719

Data Source: <China Energy Statistical Yearbook 2004>

Total emissions t(	**276,404,5**
Total power generati	**225,987,7**
OM EF 2003	**1.2230**

Simple OM Emission Factors Calculation of CCPG for Year 2004

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	(MJ/t,km3)	K=G*H*I*J*44/12/10000 (for mass unit)
		A	B	C	D	E	F	G=A+B+C+D+E +F	H	I	J	K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	**17144.1**	25.8	100	20908	339,092,605
Cleaned coal	10^4 t		2.34					**2.34**	25.8	100	26344	58,316
Other washed coal	10^4 t	48.93	104.22			89.72		**242.87**	25.8	100	8363	1,921,441
coke	10^4 t		109.61					**109.61**	25.8	100	28435	2,948,455
Coke oven gas	10^8 m^3			1.68		0.34		**2.02**	12.1	100	16726	149,900
Other gas	10^8 m^3					2.61		**2.61**	12.1	100	5227	60,527
Crude oil	10^4 t		0.86	0.22				**1.08**	20	100	41816	33,118
Gasoline	10^4 t		0.06			0.01		**0.07**	18.9	100	43070	2,089
Diesel oil	10^4 t	0.02	3.86	1.7	1.72	1.14		**8.44**	20.2	100	42652	266,627
Fuel oil	10^4 t	1.09	0.19	9.55	1.38	0.48	1.68	**14.37**	21.1	100	41816	464,893
LPG	10^4 t							**0**	17.2	100	50179	0
Refinery dry gas	10^4 t	3.52	2.27					**5.79**	18.2	100	46055	177,950
Natural gas	10^8 m^3						2.27	**2.27**	15.3	100	38931	495,775
Other oil production	10^4 t							**0**	20	100	38369	0
Other coke production	10^4 t							**0**	25.8	100	28435	0
Other energy	10^4 t standard coal		16.92		15.2	20.95		**53.07**	0	100	0	0
											total	**345,671,697**

Data Source: <China Energy Statistical Yearbook 2005>

Fuel-fired Electricity Generation of CCPG for Year 2004

Province	Electricity Generation (100GWh)	Electricity Generation (MWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Jiangxi	301.27	30127000	7.04	28,006,059
Henan	1093.52	109352000	8.19	100,396,071
Hubei	430.34	43034000	6.58	40,202,363
Hunan	371.86	37186000	7.47	34,408,206
Chongqing	165.2	16520000	11.06	14,692,888
Sichuan	346.27	34627000	9.41	31,368,599
Total				249,074,186

Data Source: <China Energy Statistical Yearbook 2005>

Total emissions tCO2	**345,671,697**
Total power generation MWh	**249,074,186**
OM EF 2004	**1.387826**

Simple OM Emission Factors Calculation of CCPG for Year 2005

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	(MJ/t,km3)	K=G*H*I*J*44/12/10000 (for mass unit)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K=G*H*I*J*44/12/1000 (for volume unit)
Raw coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	20908	352614496.76
Cleaned coal	10^4 t	0.02						**0.02**	25.8	100	26344	498.43
Other washed coal	10^4 t		138.12			89.99		**228.11**	25.8	100	8363	1804669.00
coke	10^4 t		25.95		105			**130.95**	25.8	100	28435	3522490.83
Coke oven gas	10^8 m^3			1.15		0.36		**1.51**	12.1	100	16726	112053.61
Other gas	10^8 m^3		10.2			3.12		**13.32**	12.1	100	5227	308896.88
Crude oil	10^4 t		0.82	0.36				**1.18**	20	100	41816	36184.78
Gasoline	10^4 t		0.02			0.02		**0.04**	18.9	100	43070	1193.90
Diesel oil	10^4 t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	42652	299797.78
Fuel oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	41816	286959.09
LPG	10^4 t							**0**	17.2	100	50179	0.00
Refinery dry gas	10^4 t	0.71	3.41	1.76	0.78			**6.66**	18.2	100	46055	204688.68
Natural gas	10^8 m^3						3	**3**	15.3	100	38931	655208.73
Other oil production	10^4 t							**0**	20	100	38369	0.00
Other coke production	10^4 t				1.5			**1.5**	25.8	100	28435	40349.27
Other energy	10^4 t standard coal		2.88		1.74	32.8		**37.42**	0	100	0	0.00
											total	**359887487.74**

Data Source: <China Energy Statistical Yearbook 2006>

Simple OM Emission Factors Calculation of CCPG for Year 2005												
Fuel	**Unit**	**Jiangxi**	**Henan**	**Hubei**	**Hunan**	**Chongqing**	**Sichuan**	**Total**	**EF**	**Oxidation**	**Average Low Calorific Value**	**CO_2 Emission (tCO_2e)**
									(tC/TJ)	**(%)**	**(MJ/t,km3)**	**K=G*H*I*J*44/12/10000 (for mass unit)**
		A	**B**	**C**	**D**	**E**	**F**	**G=A+B+C+D+E+F**	**H**	**I**	**J**	**K=G*H*I*J*44/12/1000 (for volume unit)**
Raw coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	20908	352,614,497
Cleaned coal	10^4 t	0.02						**0.02**	25.8	100	26344	498
Other washed coal	10^4 t		138.12			89.99		**228.11**	25.8	100	8363	1,804,669
coke	10^4 t		25.95		105			**130.95**	29.2	100	28435	3,986,695
Coke oven gas	10^8 m^3			1.15		0.36		**1.51**	12.1	100	16726	112,054
Other gas	10^8 m^3		10.2			3.12		**13.32**	12.1	100	5227	308,897
Crude oil	10^4 t		0.82	0.36				**1.18**	20	100	41816	36,185
Gasoline	10^4 t		0.02			0.02		**0.04**	18.9	100	43070	1,194
Diesel oil	10^4 t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	42652	299,798
Fuel oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	41816	286,959
LPG	10^4 t							**0**	17.2	100	50179	0
Refinery dry gas	10^4 t	0.71	3.41	1.76	0.78			**6.66**	15.7	100	46055	176,572
Natural gas	10^8 m^3						3	**3**	15.3	100	38931	655,209
Other oil production	10^4 t							**0**	20	100	38369	0
Other coke production	10^4 t				1.5			**1.5**	25.8	100	28435	40,349
Other energy	10^4 t standard coal		2.88		1.74	32.8		**37.42**	0	100	0	0
											total	**360,323,575**

Data Source: <China Energy Statistical Yearbook 2006>

Fuel-fired Electricity Generation of CCPG for Year 2005

Province	Electricity Generation （100GWh)	Electricity Generation （MWh)	Auxiliary Power Ratio （%）	Supplied Electricity （MWh)
Jiangxi	300	30000000	6.48	28,056,000
Henan	1315.9	131590000	7.32	121,957,612
Hubei	477	47700000	2.51	46,502,730
Hunan	399	39900000	5	37,905,000
Chongqing	175.84	17584000	8.05	16,168,488
Sichuan	372.02	37202000	4.27	35,613,475
Total				286,203,305

Data Source: <China Energy Statistical Yearbook 2006>

Fuel-fired Electricity Generation of CCPG for Year 2005

Province	Electricity Generation （100GWh)	Electricity Generation （MWh)	Auxiliary Power Ratio （%）	Supplied Electricity （MWh)
Jiangxi	300	30000000	6.48	28,056,000
Henan	1315.9	131590000	7.32	121,957,612
Hubei	477	47700000	2.51	46,502,730
Hunan	399	39900000	5	37,905,000
Chongqing	175.84	17584000	8.05	16,168,488
Sichuan	372.02	37202000	4.27	35,613,475
Total				286,203,305

Data Source: <China Energy Statistical Yearbook 2006>

Total emissions t(	**359,887,4**
Total power generati	**286,203,3**
OM EF 2005	**1.25745**

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

$$EF_{OM} = 1.2899\ CO_2e/MWh$$

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

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

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

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total G=A+…+F	Average Low Calorific Value (MJ/t,km3) H	Emission Factor (tC/TJ) I	Oxidation J	CO_2 Emission (tCO_2e) K=G*H*I*J*44/12/100
Raw Coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	20908	25.8	100%	352614497
Cleaned Coal	10^4 t	0.02	0					0.02	26344	25.8	100%	498
Other Washed Coal	10^4 t		138.12			89.99		228.11	8363	25.8	100%	1804669
Coke	10^4 t		25.95		106.5			132.45	28435	25.8	100%	3562840
Subtotal								0				**357982504**
								0				
Crude Oil	10^4 t		0.82	0.36				1.18	41816	20	100%	36185
Gasoline	10^4 t		0.02			0.02		0.04	43070	18.9	100%	1194
Diesel Oil	10^4 t	1.3	3.03	2.39	1.39	1.38		9.49	42652	20.2	100%	299798
Fuel Oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	41816	21.1	100%	286959
Subtotal								0				**624136**
								0				
Natural Gas	10^7 m^3						30	30	38931	15.3	100%	655209
Coke Oven Gas	10^7 m^3			11.5		3.6		15.1	16726	12.1	100%	112054
Other Gas	10^7 m^3		102			31.2		133.2	5227	12.1	100%	308897
LPG	10^4 t							0	50179	17.2	100%	0
Refinery Dry Gas	10^4 t	0.71	3.41	1.76	0.78			6.66	46055	18.2	100%	204689
Subtotal												**1280848**
Total												**359887488**

Data Source: <China Energy Statistical Yearbook 2006>

The percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions are calculated as:

$$\lambda_{Coal} = 99.47\%,\quad \lambda_{Oil} = 0.17\%,\quad \lambda_{Gas} = 0.36\%$$

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

The emission factors of the coal-fired plants, oil-fired plants and gas-fired plants are shown in table A9 below:

Table A9 Emission Factors of Coal-fired Plants, Gas-fired Plants and Oil-fired Plants

		Coal Consumption Rate	Fuel Emission Factor (tc/TJ)	Oxidation	Emission Factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coal-fired Plant	$EF_{Coal,Adv}$	35.82%	25.8	100%	0.9508
Gas-fired Plant	$EF_{Gas,Adv}$	47.67%	15.3	100%	0.4237
Oil-fired Plant	$EF_{Oil,Adv}$	47.67%	21.1	100%	0.5843

According to formula in section B.6.1, the $EF_{Thermal}$ is calculated as follow:

$$EF_{Thermal} = 0.9482 \, tCO_2e/MWh$$

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

Table A10 Installed Capacities of CCPG

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

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

Table A11 Newly Added Installed Capacity from Year 2000-2005

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

According to formula in section B.6.1, the EF_{BM} is calculated as:

$$EF_{BM} = 0.9482 \times 6952\% = 0.6592\ tCO_2e/MWh$$

Step 3: Calculating the baseline emission factor (EF_y)

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

$$EF_y = 0.5 \times EF_{OM,y} + 0.5 \times EF_{BM,y}$$
$$= 0.5 \times 1.2899 + 0.5 \times 0.6592$$
$$=0.97455\ tCO_2e/MWh$$

Annex 4

MONITORING INFORMATION

Please refer to the section B.7 of the PDD and <The CDM Monitoring and Management Handbook of Shuanghekou Hydropower Project>