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

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1. Title of the project activity:

>>

Project title: Sichuan Muchuan County Huogu Hydropower Project

PDD Version: 4.2

Completion date: 17/05/2012

A.2. Description of the project activity:

>>

Sichuan Muchuan County Huogu Hydropower Project (hereinafter referred to as the "Project") which is located in Lidian Town, Muchuan County, Leshan City, Sichuan Province, P. R. China, is constructed and operated by Sichuan Muchuan County Qixing Huogu Hydropower Development Co., Ltd.

The existing scenario prior to the start of the implementation of the Proposed Project is: electricity delivered to the grid by the existing thermal power plants connected to the Central China Power Grid (CCPG). The baseline scenario as identified in section B.4 is the same as this scenario.

The objective of the project is the generation of zero carbon emission electricity from a renewable source (in this case, hydropower). The Project will install 2 turbine-generator sets each with a unit capacity of 20MW for a total installed capacity of the hydropower station of 40MW. The Project is estimated to generate annually 199294.1 MWh of electricity, of which 165,513.9 MWh is dispatched to the CCPG through the Sichuan provincial grid, a sub-grid of CCPG. The Project is expected to operate annual for 4982 hours corresponding to a Plant Load Factor of 56.8%. The main components of the Project include the dam on the river, factory buildings and substation.

Carbon dioxide (CO_2) emissions from fossil fuel-fired electricity generating plants connected to the CCPG are reduced due to the project activity and the CO_2 is the main emission source in the baseline. The Project will lead to an estimated annual greenhouse gases (GHG) emission reductions of 141,158.5 tCO_2e and a total of 988,109.7 tCO_2e of GHG emission reductions during its first 7-year crediting period.

The Project contribute to the sustainable development of the local area and the Host Country by enhancing the electricity supply capacity and improving the power infrastructure for the area as well as by bringing positive social and environmental benefits to local communities. The specific sustainable development benefits of the Project are listed as follows:

- Reducing the reliance of the CCPG on exhaustible fossil fuels for power generation;
- Reducing air pollution by fossil fuel based electricity by clean, renewable power ;
- Improving the local energy generation infrastructure, bridging the gap between power supply and demand by increasing the electricity generation capacity to the local grid;
- Creating job opportunities for the local communities. The Project will bring 45 job opportunities throughout the operating period, and these employment opportunities are helpful for the local people to improve their living standards.

In views mentioned above, the Project strongly contributes to the sustainable development in local area.

A.3. Project participants:

>>

Name of Party involved (*)((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Sichuan Muchuan County Qixing Huogu Hydropower Development Co., Ltd.	No
The United Kingdom	Deutsche Bank AG, London branch	No

Please see Annex 1 for detailed contact information.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>

People's Republic of China

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

>>

Sichuan Province

A.4.1.3. City/Town/Community etc.:

>>

Lidian Town, Muchuan County, Leshan City

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

>>

The Project is located in Lidian Town, Muchuan County, Leshan City of Sichuan Province, P. R. China. The straight-line distance from the location of the dam to Mabian County and Muchuan County are respectively 18km and 21km. The geographical coordinates of the Project site are 103°40′27"E and 28°55′23"N. The location of the Project is indicated in the maps below:

Figure A-1: Location of the Project

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

>>

Sectoral scope 1: energy industries (renewable / non-renewable sources)

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

>>

The Proposed Project aims to generate electricity from hydropower resources and to displace the same amount of electricity from the CCPG whose generation mix is dominated by coal-fired, electricity generating power plants.

The existing scenario prior to the start of the implementation of the Project is: electricity delivered to the grid by the operation of grid connected thermal plants belonging to the CCPG. The CCPG consists of 6 sub-grids: Hunan, Henan, Hubei, Jiangxi, Chongqing and Sichuan provincial grids, which mainly rely on coal-fired power plants[1].The baseline scenario as identified in section B.4 of this PDD is the same as the existing scenario prior to the start of the implementation of the Project. Carbon dioxide (CO_2) emissions from fossil fuel-fired electricity generating plants connected to the CCPG are reduced due to the project activity and the CO_2 is the main emission source in the baseline.

The Project is a run of river hydropower station with a total installed capacity of 40MW. After operating, the gross electricity generated by the Project will reach 199,294.1MWh annually, of which 165,513.9MWh will be delivered to the power grid.

The main manufacturing technology is to convert mechanical energy available in the water flow into electrical energy with the help of hydro turbines and generators. Main components of the Project include the new constructed dam and reservoir, scouring sluice, tail race tunnel, factory buildings and step-up switchyard. The type of the dam is Roller-Compacted Concrete gravity dam. The maximum dam height and crest length are designed to be 55.00m and 175.20m respectively. The Project is a daily regulation hydropower project. The normal water level of the Project is designed to be 458m. Under the normal water level, the reservoir capacity is designed to be 8,570,900m^3. The reservoir area is designed to be 891000m^2. The power density of the Project is 44.89W/m^2 and the power load factor of the project is 56.87%. The project will deliver electricity by one outlet with 110kv voltage to 220kv Jingyun substation and then connected to Sichuan power grid. The length of the transmission line is designed to be 24km

The model of the hydro turbine used in the Project is ZZ550-LH-340 and the model of generator is SF20-30/5500.The key technical specifications of these two equipments are listed as Tables below:

Table A-1 Key technical specifications of Hydro turbines

Parameters Name	Unit	Data
Model	/	ZZ550-LH-340
Quantity	/	2
Rated Output	MW	20.619
Rated Rotation Speed	r/min	200
Rated head	m	26
Rated flow	m^3/s	86.4
Equipment life time	year	40

Table A-2 Key technical specifications of Generators

Parameters Name	Unit	Data
Model	/	SF20-30/5500
Quantity	/	2
Installed capacity	MW	20
Rated Voltage	kV	10.5
Rated current	A	1294
Rated frequency	Hz	50

[1] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2334.pdf

Rated Rotation Speed	r/min	200
Rated Power Factor	%	85
Equipment life time	year	40

China possesses the technological capacity to manufacture all the necessary components, so no technology transfer is involved in the Project.

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

>>

The chosen crediting period for the Proposed Project is 7 years (renewable twice). During its first 7 years crediting period (estimated as 01/06/2012 to 31/05/2019 the Proposed Project is expected to generate a total amount of emission reductions of 988,109.7tCO_2e, with an annual emission reduction of 141,158.5tCO_2e. The estimated amount of emission reductions over the chosen crediting period is provided below.

Table A-3 Estimation of Emission Reductions in the 1st Crediting Period

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
01/06/2012-31/12/2012	82,342.5
2013	141,158.5
2014	141,158.5
2015	141,158.5
2016	141,158.5
2017	141,158.5
2018	141,158.5
01/01/2019-31/05/2019	58,816.1
Total estimated reductions (tonnes of CO_2 e)	988,109.7
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	141,158.5

A.4.5. Public funding of the project activity:

>>

There is no public funding from Annex I Parties for this 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:

>>

The Project applies to the approved methodology: ACM0002 "Consolidated Baseline Methodology for grid-connected electricity generation from renewable sources" (Version 12.3.0).

Information regarding to the methodology could be found at:

http://cdm.unfccc.int/filestorage/4/W/1/4W1SCKX3EMPO6AYGRJUTD7BQ8IVN0H/Consolidated%20baseline%20methodology%20for%20gridconnected%20electricity%20generation%20from%20renewable%20sources.pdf?t=NHB8bTByODhvfDC0IsNSUgQ5buvHLanTtX6Z

In line with the approved methodology, the Project applies to the following tools: "Tool for demonstration and assessment of additionality" (Version 05.2.1) and "Tool to calculate the emission factor for an electricity system" (Version 02.2.1).

Information regarding to the tools could be found respectively at:

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.1.pdf

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf

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

>>

The methodology ACM0002 is applicable to the Proposed Project, because the Proposed Project meets all the applicability criteria stated in the methodology with relevance to hydro power plant:

- The Proposed Project is the installation of a grid-connected renewable power generation project activity (i.e. hydropower project with a run-of-river reservoir);
- The Project results in new single reservoir and the power density of the reservoir, as per definitions given in the Project Emissions section, is greater than 4 W/m^2;
- The Proposed Project does not involve an on-site switch from fossil fuels to a renewable source.
- The project is a hydro power plant, but not a biomass fired plants.

Therefore, the Project activity is in accordance with the applicability of ACM0002 (Version 12.3.0).

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

>>

As referred to the approved methodology ACM0002, the project boundary includes the Project plant itself and all the power plants connected to CCPG. According to the Baseline Emission Factors for Regional Power Grids in China published by China NDRC[2], CCPG covers Henan, Hubei, Jiangxi, Hunan, Sichuan and Chongqing power grids.

The emissions sources included and excluded from the Project boundary for determination of both baseline and project emissions are listed below:

[2]China NDRC (02/07/2009), 2009 Baseline Emission Factors for Regional Power Grids in China. http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Table B-1 Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	No	The power density of the Project is 44.89W/m^2. According to ACM0002, if the power density is greater than 10 W/m^2, there is no need to calculate emission from water reservoirs.
		N_2O	No	Minor emission source

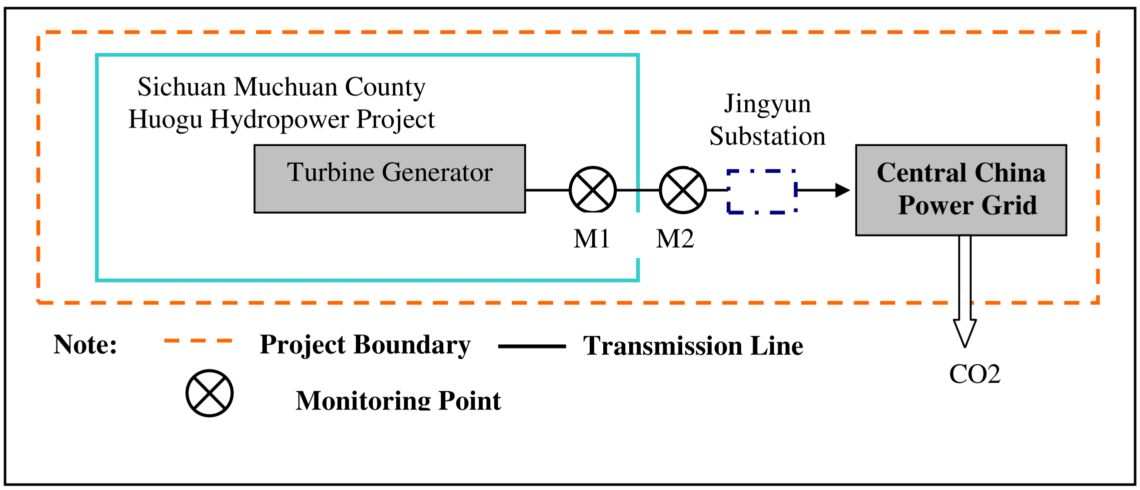


Figure B-1 Diagram of the project boundary

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

>>

The Project involves the construction and operation of a new electricity generation facility, and does not involve the modification or retrofitting of an existing electricity generation facility; therefore, as described in the methodology, the baseline is as follows:

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 in B.6. Section which follows "Tool to calculate the emission factor for an electricity system".

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

>>

Prior CDM consideration

On 22/11/2006, after the project owner learn from draft Preliminary Design Report (PDR) that Internal Return Rate (IRR) of the Project is 6.93%, far below the benchmark 10%, a board meeting was held to discuss this issue and finally members of board decided to take the Project as a CDM project, therefore came accordingly the interim board decision for the project to apply for CDM. Based on analysis and former consideration, the project owner held another board meeting on 02/03/2007 and decided to find CDM support in developing the Project. Then the project owner started to contact with some consulting companies and finally signed consulting agreement with Hangzhou Carbon Trade Environment Engineering Co., Ltd (HCTEE) on 04/04/2007. On 06/06/2007, the project owner signed generator purchase agreement which marked the starting date of the project as a CDM project. With the help of the consulting company, the project owner signed Term sheet (TS) with first buyer ORBEO on 31/01/2008 but then terminated it on 08/10/2008. On 03/04/2009 the project owner signed formal TS with new buyer Deutsche Bank AG, London branch.

Here followed a general implementation schedule of the Project to illustrate main events. An overview of key event is given in Table B-2.

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

Date	Key events
22/11/2006	Board Decision for the Project to apply for CDM
12/2006	Preliminary design report was completed
12/2006	Environmental Impact Assessment was completed
07/02/2007	Environmental Impact Assessment was approved
13/02/2007	Preliminary design report was approved
02/03/2007	Board Decision for the project to search for CDM consultant
04/04/2007	The project owner and HCTEE signed Consulting Agreement
06/06/2007	Main equipments purchase contract[3] (the earliest starting date of the Project)
20/07/2007	Stakeholder meeting was held
29/08//2007	Stakeholder results meeting was held
08/10/2007	Construction contract
31/01/2008	TS was signed with ORBEO
26/03/2008	A meeting was held in the NDRC
11/06/2008	LOA from NDRC
08/10/2008	TS signed with ORBEO was terminated
03/04/2009	TS was signed with Deutsche Bank AG, London branch

[3] The contract was signed between the project owner and Sichuan Dongfeng Electric Machinery Works Co., Ltd on 06/06/2007. It was the purchase contract of generators and turbines. According to Glossary of CDM terms, the starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. Therefore, date of signing main equipment contract is considered as the earliest starting date of the Project. As we can see from the timetable that the construction contract was signed later than equipment contract, equipment contract was taken as the earliest starting date of the Project.

Additionality

The following steps demonstrate additionality for the Project according to *Tool for the demonstration and assessment of additionality (Version 05.2.1)* as required by the methodology:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulation

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

Credible and feasible alternatives to the Project are as follow:

1) The proposed project activity undertaken without being registered as a CDM project activity;
2) Continuation of the current situation (import of electricity from the CCPG);

Outcome of Step 1a: Both options described above are credible and feasible.

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

Both the continued supply of electricity from the grid and the Project are in line with current laws and regulations.

Outcome of step 1b: Both options described above are carried forward to Step 2.

Step 2: Investment Analysis

The purpose of investment analysis is to determine whether the Project is economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, following sub-steps are adopted:

Sub-step 2a: Determine appropriate analysis method

The *Tools for the Demonstration and Assessment of Additionality (Version 05.2.1)* recommends three investment analysis methods, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

The Project generates financial and economic benefits through the sales of electricity therefore the simple cost analysis (Option I) cannot be taken. The investment comparison analysis (Option II) is only applicable to projects where alternatives should be similar investment projects. The alternative baseline scenario of the Project is the electricity import from Central China Power Grid rather than a new investment project. Therefore the benchmark analysis (Option III) has been chosen.

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

According to *Economic Evaluation Code for Small Hydropower Project SL16-95*[4], the total investment Internal Return Rate (IRR) should be higher than the sectoral benchmark IRR which is fixed as 10%. A small hydropower project will be financially acceptable when its IRR is higher than the sectoral benchmark IRR 10%. Although *Economic Evaluation Code for Small Hydropower Project SL16-95* is applied to small hydropower project, it also indicated that hydropower station with a capacity of 50MW or below in rural area could take it as reference. Therefore, the project applied a benchmark of 10%.

---

[4] *Economic Evaluation Code for Small Hydropower Project SL-16-95* was published by *Ministry of Water Resource* in1995. Please refer to followed website: www.cws.net.cn/guifan/bz%5CSL16-95/

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

Followed parameters and financial analysis are all taken from Preliminary Design Report[5] (PDR) which was completed in December 2006. Basic data and parameters for the calculation of financial indicator of the Project are summarized in TableB-3:

TableB-3 Main parameters for the financial analysis

Parameters	Value	Source
Total Investment	286,844,800 CNY	PDR
Fixed Asset Investment	263,481,700 CNY	PDR
Installed Capacity	40 MW	PDR
Annual Electricity Generation	199294.1MWh	PDR
Effective Coefficient	0.85[6]	PDR
The electricity consumed on transmission line	2%	PDR
The electricity consumed on site	0.3%	PDR
Net electricity delivered to grid	165513.9MWh	PDR
Annual Operational costs	8,145,500 CNY	PDR
Electricity Tariff	0.288CNY/kW(with VAT)	PDR
Value Added Tax	17%	PDR
City maintenance construction fee	5%	PDR
Educational additional fee	3%	PDR
Income Tax	33%	PDR
Annual emission reductions	141,158.5 tCO_2	Calculated in PDD
Operational lifetime	20y	PDR
Expected CERs price	8.5 Euro /tCO_2	TS

TableB-4 shows the Project IRR with and without the revenue of CERs. Without the revenue of CERs, the Project IRR is 6.93% which is clearly lower than benchmark IRR, which indicates that the Project is not financially attractive in normal investment fields. However, taking into account the CDM revenues, the Project IRR is 10.37%, which is higher than the benchmark IRR. Therefore, to make a conclusion, the CDM revenues could improve the economic feasibility of the Project.

TableB-4 IRR with and without the CERs revenues

	Without CERs	With CERs
IRR	6.93%	10.37%

Sub-step 2d: Sensitivity analysis

[5] Preliminary Design Report was completed by *Engineering Design and Research Institute of Sichuan University* in December 2006.

[6] In the PDR, 0.85 of effective coefficient has been chosen for that it is a project with daily regulation ability. According to SL16-95, effective coefficient for a daily regulation ability hydropower connected to power grid is ranged from 0.80 to 0.90, thus it is reasonable to choose 0.85 as effective coefficient for the Project by design institute.

The sensitivity analysis shall show whether the conclusion regarding financial attractiveness is robust to reasonable variations in the critical assumptions.

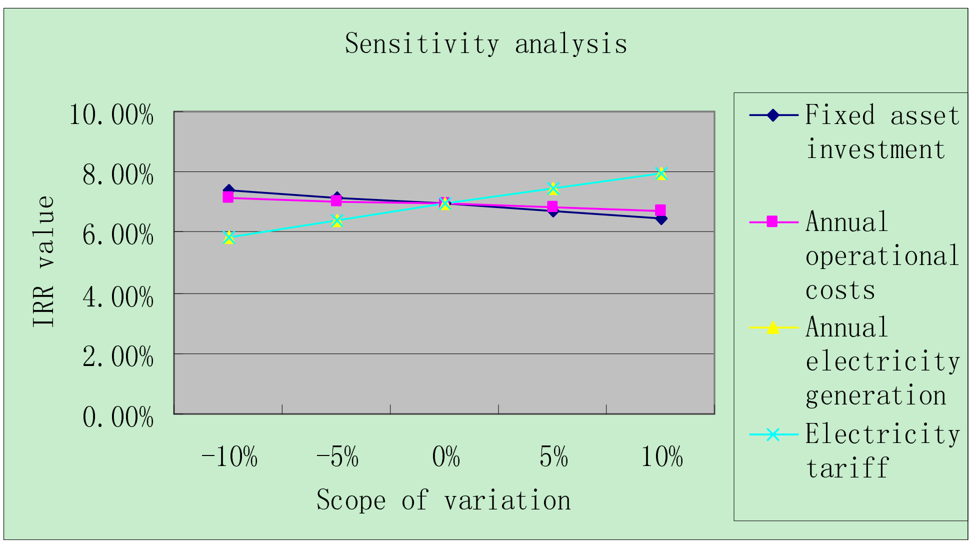
The following key parameters have been selected as sensitive indicators to test the financial attractiveness of the Project.

(1) Fixed asset Investment
(2) Annual Operational costs
(3) Annual Electricity generation
(4) Electricity tariff

As we can see in TableB-5 followed, the above four financial indicators are varied in a range of ±10%. Although relative IRRs vary to different extent, they do not exceed benchmark IRR 10%.

TableB-5 IRR Sensitivity to Different Financial Indicators of the Project

Factors	Range				
	-10%	-5%	0	5%	10%
Fixed asset Investment	7.39%	7.16%	6.93%	6.71%	6.49%
Annual Operational costs	7.15%	7.04%	6.93%	6.81%	6.70%
Annual Electricity generation	5.83%	6.39%	6.93%	7.45%	7.96%
Electricity tariff	5.81%	6.38%	6.93%	7.46%	7.98%



	Benchmark	Percentage variation to benchmark
Total static investment	10%	-55.2%
Annual electricity connected to the grid	10%	+31.3%
Electricity Tariff	10%	+30.7%
Annual O&M cost	10%	-146.5%

The project IRR of the proposed project varies to different degrees in accordance with the fluctuation of four parameters within the range of -10% to +10%.

- **Fixed asset Investment:** It could be seen that the project IRR fluctuates from 6.49% to 7.39%, always below the benchmark IRR 10%. It needs to reduce fixed asset investment 55.2% to reach benchmark IRR 10% which is rarely possible. It is hard for the fixed asset investment to reduce because the construction materials prices in China have increased during the last few years. Please see followed TableB.5-5 which taken from China Statistical Yearbook 2009[7] in accordance with Purchasing Price Indices for Raw Materials, Fuels and Power kept rising from 2004. It predicted that prices had a strong tendency to rise.

TableB-6 Purchasing Price Indices for Raw Materials, Fuels and Power

(Preceding year=100)

Year	General Index	Fuel and Power	Ferrous Metals	Nonferrous Metals	Raw Chemical Materials	Timber and Paper Pulp	Building Materials
2004	111.4	109.7	120.4	120.1	108.9	102.8	105.1
2005	108.3	115.0	107.5	114.0	108.3	103.5	103.1
2006	106.0	111.9	98.3	130.8	102.1	102.6	101.9
2007	104.4	104.3	105.4	111.6	103.6	102.7	103.0
2008	110.5	120.6	118.4	98.6	105.2	105.2	109.5

Form what we analysis above, it can be concluded that there were few possibilities of crossing the bench-mark ratio (10%) because a decline of investment cost was unlikely to happen.

- **Annual Operational costs:** The project IRR varies from 6.70% to 7.15% which is far below benchmark IRR. Assumed the Annual Operation costs decreased 146.5%, the project IRR could reach 10%. Obviously, such decrease is impossible to happen. Therefore, the project can't become commercially attractive through decrease of Annual Operational costs.

- **Annual Electricity generation:** The Annual Electricity Generation should increase 31.3% to reach benchmark IRR 10%. However, the Annual Electricity Generation was estimated based on 47 years of hydrological data which comes from adjacent hydrological measuring stations mentioned in the PDR will change little. The Annual Electricity Generation was estimated and calculated by the designing institute based on the on-site situation, including social environment, hydrological condition and power requirement which are relatively stable. Therefore, it is unlikely that the project IRR will reach 10% due to it is impossible for the Annual Electricity Generation of the project to increase 31.3%.

- **Electricity tariff:** With a variation range (±10%) of the electricity tariff, the IRR of the project fluctuates from 5.81% to 7.98%; this does not exceed the benchmark IRR 10%. When the project IRR reaches the bench mark 10%, the tariff should increase 30.7% that is 0.376CNY/KWh. However,

[7] China Statistical Yearbook 2009, "http://www.stats.gov.cn/tjsj/ndsj/2009/indexeh.htm"

according to Chuanjiadianfa[2009]58, the tariff of hydropower stations in Sichuan is 0.288yuan/kWh[8]. Therefore, it is impossible for the tariff to increase 30.7% to 0.376CNY/kwh.

To conclude, the sensitivity analysis shows that without CER revenue, IRR of the project is difficult to reach the benchmark 10%, which supports the conclusion, that the proposed project is unlikely to be financially attractive.

Outcome of Step2: According to the sensitivity analysis, within the reasonable range of each indicator, the Project IRR is always lower than the investment benchmark IRR, thus it can be confirmed that the Project is unlikely to be financially attractive.

Step 3: Barriers Analysis

This step is not used for Project.

Step 4: Common practice analysis

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

To identify similar projects, three conditions are considered to comply with requirements: a) same province: Sichuan province, b) operational year: after 2002, c) capacity: varied in a range of ±50%.

a) Same province: Sichuan province

In China, there are significant differences in policies, regulation and economic conditions, as well as geological and hydrological conditions. Therefore, the selection of similar projects is based on consideration of same province. And we believe that within the same province, the differences will be more comparable than among different provinces. The selection is also in line with *Tool for the demonstration and assessment of addtionality (Version 05.2.1)*, in which stated that projects considered similar shall in the same region and rely on similar technology, and take place in a comparable environment.

b) Operational year: after 2002

The projects taken into common practice analysis are limited to projects operated after year 2002 due to the sweeping changes brought by *Electricity Reform Program*[9]. These reforms substantially changed the regulatory framework and investment environment of hydro power development. The major changes include reforming ownership of power grids and power plants, initiating a competitive bidding mechanism for new entities wishing to supply power to the grid and building a competitive and open market. Therefore, only projects which were operated after 2002 were chosen in common practice analysis.

c) Capacity: varied within the range of 15MW~50MW

---

[8] Chuandianjiafa[2009]58 was isssued by Price Bureau of Sichuan province.

More information please refer to : http://www.sc.sgcc.com.cn/upload/chache/2010-01/a180d0fa4738dac2988c.pdf

[9] *Electricity Reform Program* was implemented by the State Council.
http://www.ndrc.gov.cn/xwfb/t20050708_28096.htm

In order to adequately and conservatively consider more projects, project capacities within the range of 15MW to 50MW are selected in the common practice analysis.

A research was performed based on official statistics of *Yearbooks of China Water Resources 2006 & 2007*[10] . Non-CDM Hydro power projects with installed capacity between 15MW and 50MW within Sichuan Province and operated since 2002 are presented as follow. See TableB-6 for details.

TableB-7 Similar Hydropower Stations in Sichuan Province

Project name	Capacity	Operational year	Operational hours	Investment per kilowatt (CNY/KW)
Niujiaowan Cascade-3 hydropower project [11]	25MW	2003	6782h	3320[12]
Tongkouhe hydropower project[13]	45MW	2004	5140h	5111
Shazui hydropower project[14]	38MW	2004	6373h	N/A

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

There are essential distinctions between the Project and projects listed in above table.

Niujiaowan Cascade-3 hydropower station is developed by Sichuan Xichang Power generational Inc. From Table B-6, we can see that Niujiaowan Cascade-3 hydropower project's operational hour is much higher than the Project while its investment per kilowatt is lower than the Project. The two factors indicate that Niujiaowan Cascade-3 hydropower station has better economic benefits than the Project.

Tongkouhe hydropower project is developed by Sichuan Bashu Power Development Co., Ltd. The project IRR for Tongkouhe hydropower project which is 18% is more attractive[15] than the proposed project IRR. Thus, we could conclude that, with its annual operational hour higher than the Project and project IRR much higher than the Project, Tongkouhe hydropower project is more financially attractive than the Project.

Shazui hydropower project is developed by Sichuan Hongchang Power generation Company. Its annual operational hour is 6373h, much higher than the Project which is only 4982 hours. Rich water resources enabled Shazui hydropower to get a high operating hour which directly raises the annual electric output, from that the project owner got a better income.

[10] *Yearbooks of China Water Resources 2006&2007* are issued by China Water Conservancy and Hydro Power Press.

[11] http://www.chinapower.com.cn/article/1004/art1004225.asp

[12] http://finance.sina.com.cn/gsgg/20040409/sh600505-3.html

[13] http://www.my.gov.cn/MYGOV/145812859798945792/20040809/8654.html

[14] http://baike.baidu.com/view/3065598.htm

[15] http://www.chinaqw.com/node2/node116/node120/node334/node336/userobject6ai4672.html

Compared to the existing projects described above, the Project is less financially attractive. The Project IRR couldn't reach benchmark IRR without CDM revenues, which is the essential distinction between the Project and other similar projects. Thus, CDM revenues is crucial important for the development of the Project. Thus, it can be concluded that the Project is additional and not (part of) baseline scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The project is the installation of a new grid-connected renewable power plant/unit; therefore the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system(Version 02.2.1).*

According to ACM0002, project emissions, baseline emissions, leakage emissions and emission reductions are calculated as follows:

Project emissions

According to ACM0002, the project emission is calculated as follows:

$$PE_y=PE_{FF,y}+PE_{GP,y}+PE_{HP,y} \tag{1}$$

Where:

PE_y = Project emissions in year y (tCO_2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

The project is a hydro project, so $PE_{FF,y}$ and $PE_{GP,y}$ are considered zero according to methodology ACM0002(Version 12.3.0). Moreover, as described in the methodology, hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir.

In order to define calculation method, the power density is calculated bellow:

$$PD=\frac{Cap_{PJ}-Cap_{BL}}{A_{PJ}-A_{BL}}=\frac{40000000w-0w}{891000m^2-0m^2}=44.89w/m^2 \tag{2}$$

Where:

PD = Power density of the project activity (W/m^2)

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

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

According to the ACM0002, if the power density of the project activity is greater than 10 W/m^2, the Project emissions ($PE_{HP,y}$) is zero. Through above calculation, the power density of the Project is 44.89W/m^2, therefore:

$$PE_y = 0 \quad (3)$$

Baseline emissions

The baseline scenario of the Project is: Equal amount of electricity delivered to Central China Power Grid. The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad (4)$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr)

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

$EF_{grid,CM,y}$ = Combined margin CO_2 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* (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ for greenfield plants is described below:

(a) Greenfield renewable energy power plants

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y} \quad (5)$$

Where:

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

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

According to ACM0002, *Tool to calculate the emission factor for an electricity system (Version 02.2.1)* is used in the PDD. The following procedure is adopted to determine $EF_{grid, CM, y}$.

Step 1: Identify the relevant electricity systems

The DNA of China has published a delineation of the project electricity system and connected electricity systems, therefore these delineations will be used in the Project. The electricity generated by the Project is connected to the Central China Power Grid, which includes Hubei province, Hunan province, Sichuan province, Jiangxi province, Henan province and Chongqing city. Power plants within the Central China Power Grid can be dispatched without significant transmission constraints but transmission to the grid has significant transmission constrains. Therefore the Central China Power Grid can be determined as the connected electricity system of the Project. And the Project electricity system is the spatial extent of the power plants including in the Central China Power Grid.

Step 2: Choose whether to include off-grid power plants in the project electricity system

Option I: Only grid power plants are included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

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

In China, the dispatch information is not available to the public, further from the most recent 5 years (2002-2006) the low-cost/must run resources constituted less than 50% of total power generation of the Central China Power Grid and the relevant ratios are respectively 38%, 36.8%, 36%, 34.2%, and 32.4%. Hence, 'Simple OM' option has been chosen.

In between *Ex ante* option and *Ex post* option, *Ex ante* option of a 3-year generation-weighted average is chose. For the calculation, data in 2006, 2007 and 2008 are chose as these are the most recent available data.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. In the Project, it is calculated based on the total net electricity generation of all power plants serving the system, the fuel types and total fuel consumption of the project electricity system (option B). The reason for choosing option B is presented below:

(a) The necessary data for Option A is not available; and
(b) 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; and
(c) Off-grid power plants are not included in the calculation.

Under option B, 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:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y} \right)}{EG_y} \qquad (6)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)

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

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

$EF_{CO2,i,y}$ = 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 relevant year as per the data vintage chosen in Step 3

For this approach (simple OM) to calculate the operating margin, the subscript *m* refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid. Electricity imports should be treated as one power plant *m*.

In this PDD, $NCV_{i,}$ y and $EF_{CO2,\ i}$ for different fuels *i* was taken from the Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 02/07/2009. (Refer to Annex 3 for detailed values).

Based on the formulae and data, the values for $EF_{grid,\ OMsimple,\ y}$, in tCO_2e/MWh, are:

Table B-8 Operating Margin Emission Factor of the Project

2005	2006	2007	Weighted Average 2004-2006
1.1614	1.1215	1.1019	1.1255

Therefore, the weighted average operating margin emission factor is:

$$EF_{grid,\ OMsimple,\ y} = 1.1255\ tCO_2/MWh \tag{7}$$

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, Option 1 which presented below is chose in this PDD.

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

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:

$$EF_{grid,\ BM,\ y} = \frac{\sum_m EG_{m,\ y} \times EF_{EL,\ m,\ y}}{\sum_m EG_{m,y}} \tag{8}$$

Where

$EF_{grid,\ BM,\ y}$ =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)
$EF_{EL,m,y}$ =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

Currently in China, the build margin data of sample plants group *m* are not available publicly. Taking notice of this situation, CDM Executive Board accepts the following deviation in application of methodology ACM0002 in China.

1) Calculate the build margin emission factor $EF_{grid,BM,y}$ ex-ante based on the recent years available data at the time of PDD submission.

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

Taking into account of data availability, the following conservative calculation has been approved by the CDM Executive Board. Using this modified method, newly-built capacity is weighted by the composition of power generation technologies and then emission factors are calculated using the efficiencies of the best available technologies.

Because capacities of technologies using coal, oil and gas cannot be separated from the total thermal power generation from publicly available statistics, the following method is used for the calculation: first, use the energy balance data of the most recent year available and calculate the percentages of CO_2 emissions of power generation using solid, liquid and gas fuel in the total CO_2 emission. Second, calculate grid thermal power emission factors, using the percentages (as weights) and emission factors of technologies corresponding to best available efficiencies. Last, the thermal power emission factor is multiplied by the percentage of thermal power in the newest 20% capacity in the grid, and the result is the Build Margin emission factor of the grid.

The steps and equations are as follows:

a) Percentage of CO_2 emitted, λ, for each solid, liquid and gas power generation:

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co2,i,j,y}} \tag{9}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co2,i,j,y}} \tag{10}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{co2,i,j,y}} \tag{11}$$

Where:

$F_{i,j,y}$ =the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y, while j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.

$NCV_{i,y}$ =the fuel i net caloric value in the year y (for solid and liquid fuel for the GJ / t, for fuel gas for GJ/m3)

$EF_{CO2,i,j,y}$ =the fuel emission factors (tCO_2/GJ)

COAL, OIL and *GAS* are footnote group for solid fuels, liquid fuels and gas fuels.

b) Calculate $EF_{Thermal,y}$

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (12)$$

Where $EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$ and $EF_{Gas,Adv,y}$ respectively represent the efficiency level of the best coal-based, oil-based and gas-based power generation technology commercially available in China.

Therefore:

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.8213 \text{ tCO2/MWh} \quad (13)$$

c) Calculate $EF_{grid,BM,y}$

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (14)$$

Where CAP_{Total} is total capacity additions while $CAP_{Thermal}$ is capacity additions to thermal power.

The calculation of the $EF_{grid,BM,y}$ is done as indicated in the Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 02/07/2009. The result is followed:

$$EF_{grid,BM,y} = 0.5802 \text{ tCO}_2\text{/MWh} \quad (15)$$

Step 6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (16)$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

* $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period.

$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$ (17)

$= 1.1255\ tCO_2/MWh \times 0.5 + 0.5802\ tCO_2/MWh \times 0.5$

$= 0.85285\ tCO_2/MWh$

Leakage emissions

According to ACM0002, no leakage emissions are considered.

$L_y = 0\ CO_2e/yr$ (18)

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (19)$$

Where:
ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2/yr)
PE_y = Project emissions in year *y* (t CO_2e/yr)

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

(Copy this table for each data and parameter)

Data / Parameter:	$FC_{i,y}$
Data unit:	Mtons, Mm^3
Description:	Amount of fossil fuel type *i* comsumed in the project electricity system in year *y*
Source of data used:	*Chinese Energy Statistical Yearbook*, 2006-2008 editions Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 02/07/2009. (http://cdm.ccchina.gov.cn)
Value applied:	Varies for each fuel and year, see Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is official released statistic. The data source is reliable.
Any comment:	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	TJ/ton or TJ/m^3
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	*Chinese Energy Statistical Yearbook* 2006-2008 Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 02/07/2009. (http://cdm.ccchina.gov.cn)
Value applied:	See Annex 3 for detail.

Justification of the choice of data or description of measurement methods and procedures actually applied :	This is official released statistic. The data source is reliable.
Any comment:	-

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2
Description:	CO_2 emission factor of fossil fuel type *i* used in year *y*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy
Value applied:	See Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is IPCC default value.
Any comment:	-

Data / Parameter:	$EF_{i,Adv,,y}$
Data unit:	tCO_2/MWh
Description:	Emission Factor of the best available commercial power plants for fuel *i* power Plants in year *y*, *i* = coal, oil and gas.
Source of data used:	Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 02/07/2009. (http://cdm.ccchina.gov.cn)
Value applied:	See Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is official released statistic. The data source is reliable.
Any comment:	-

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity generated in the project electricity system in year *y*
Source of data used:	"Chinese Electricity Yearbook" 2005~2008 editions Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 02/07/2009. (http://cdm.ccchina.gov.cn)
Value applied:	Varies with province and year, see Annex 3 for detail.
Justification of the	This is official released statistic. The data source is reliable.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	$CAP_{total,y}$
Data unit:	MW
Description:	Total capacity(including more than 20% of capacity addition)
Source of data used:	China Electric Power Yearbook(2006~2008)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; public accessible and reliable data source
Any comment:	

Data / Parameter:	$CAP_{thermal,y}$
Data unit:	MW
Description:	Capacity additions to thermal power
Source of data used:	China Electric Power Yearbook(2006~2008)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; public accessible and reliable data source
Any comment:	

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Due to it is a new hydro power plant, according to ACM0002, this value is zero.
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2).
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Due to it is a new reservoir, according to ACM0002 (Version 12.3.0), this value is zero.
Any comment:	-

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

>>

As explained in B.6.1, the project emissions and leakage emissions of the Project are all considered as zero. The baseline emissions in year *y* (BE_y) are calculated as

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

The net electricity of the project is 165,513.9MWh as estimated in PDR.

The emission factor of CCPG is 0.85285tCO_2e/MWh.

Thus the baseline emission is

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} = 141{,}158.5 tCO_2e$$

The emission reductions for a given year are calculated as baseline emissions minus the project emissions:

$ER_y = BE_y - PE$ =141,158.5tCO_2e-0 tCO_2e=141,158.5tCO_2e

Therefore, the Project will have an emission reduction estimated at 141,158.5tCO_2e.

B.6.4 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 emission reductions (tonnes of CO_2e)**
01/06/2012-31/12/2012	0	82,342.5	0	82,342.5
2013	0	141,158.5	0	141,158.5

2014	0	141,158.5	0	141,158.5
2015	0	141,158.5	0	141,158.5
2016	0	141,158.5	0	141,158.5
2017	0	141,158.5	0	141,158.5
2018	0	141,158.5	0	141,158.5
01/01/2019-31/05/2019	0	58,816.1	0	58,816.1
Total (tonnes of CO_2 e)	0	988,109.7	0	988,109.7

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year y
Source of data to be used:	Meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	165,513.9
Description of measurement methods and procedures to be applied:	Measured directly by electricity meter. The exact data will be the electricity delivered to the power grid minus the electricity supplied by the power grid. The data will be measured continuously, recorded hourly and monthly aggregated.
QA/QC procedures to be applied:	According to Technical administrative code of electric energy metering (DL/T448 – 2000), meters will be calibrated annually by an independent inspection authority. Data measured by meters will be cross checked by the electricity sales documents.
Any comment:	100% of data will be kept for two years after the end of the last crediting period or the last issuance of CERs for this Project, whichever occurs later.

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 site
Value of data applied for the purpose of	40,000,000

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	It is determined based on nameplate and will be verified on site yearly.
QA/QC procedures to be applied:	The data will be crosschecked using specification manual.
Any comment:	Data are to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.

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	891,000
Description of measurement methods and procedures to be applied:	Measured from topographical surveys. It will be monitored yearly. The measurement will be carried out by a qualified third party following latest national standard.
QA/QC procedures to be applied:	-
Any comment:	Data are to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.

B.7.2. Description of the monitoring plan:

>>

The monitoring plan is made according to *ACM0002 Consolidated Baseline Methodology for grid-connected electricity generation from renewable sources"*. Monitoring procedure should be implemented firmly according to monitoring plan to ensure real, measurable and long-term greenhouse gas (GHG) emission reduction of the Project is monitored and reported.

1. Monitoring Objective

Since the emission factor is calculated as *ex-ante* and according to the Monitoring Methodology ACM0002, the following data should be monitored:

a) Quantity of net electricity generation supplied by the project plant to the grid in year y ($EG_{facility,y}$)

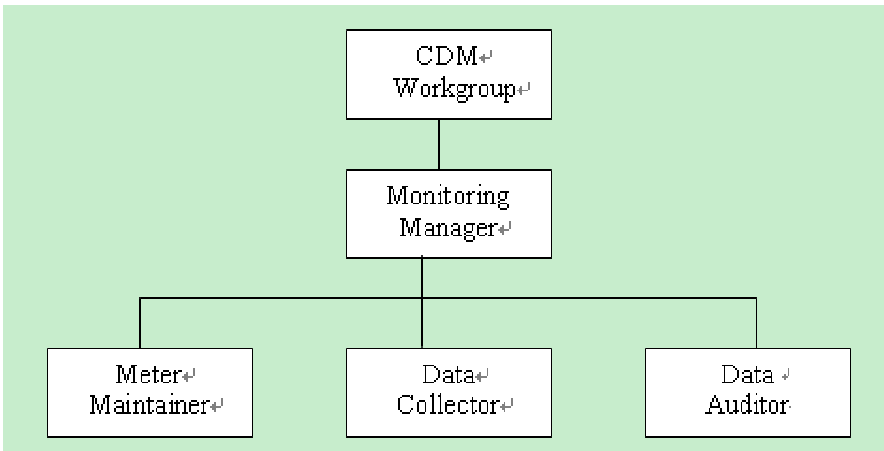
b) Installed capacity of the hydro power plant after the implementation of the project activity (Cap_{pj})

c) Area of the reservoir measured in the surface of the water, after the implementation of the Project activity, when the reservoir is full (A_{pj}).

2. Monitoring Organization

A CDM group will be established to carry out the monitoring plan. The project owner will designate a CDM manager to responsible for daily monitoring and reporting. Under the CDM manager, there will be three positions involved, respectively referred as meter maintainer, data collector and data auditor.

Followed figure shows the CDM group structure:



The CDM Manager is fully responsible for implementing monitoring plan and reviewing monitoring results.

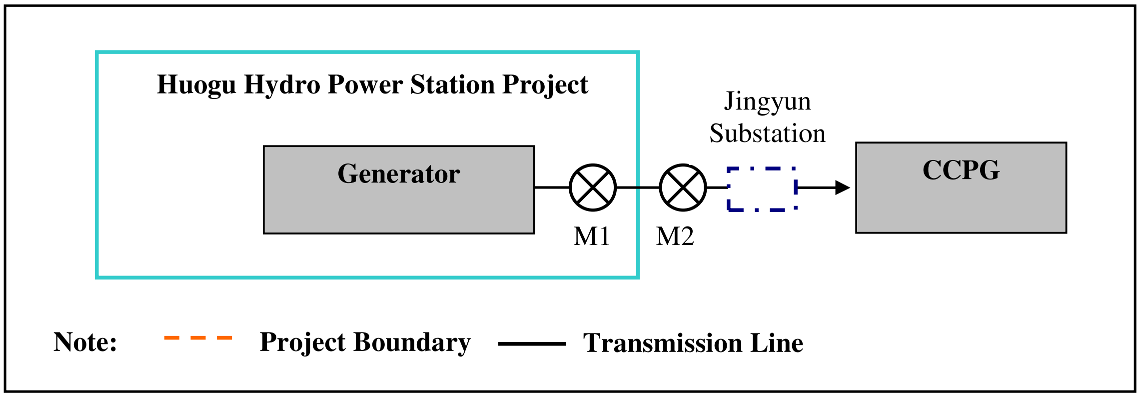
The maintainer is in charge of the organization of calibration tasks and regular maintenance of the meters equipped in the Project. The meters will be calibrated by specific technical staff and third party verification in accordance to relevant regulation and standard. The surface area of the reservoir at full reservoir level and installed capacity will be measured by competent Authority yearly.

The Data collector is responsible for regular collecting of the financial data, including meters reading records and the electricity sales invoices or receipts. Those data will be audited and verified by the CDM group.

The Data Auditor will check the validity of the data by comparing with previous recorded data and data from third party such as the Power Corporation. If an obvious discrepancy does exist, it should be reported to Monitoring Manager. The validated data will be archived electronically in CDM data management system by the Data auditor.

3. Installation of meters

The metering equipment will be properly configured and checked annually according to the requirement from Technical administrative code of electric energy metering (DL/T448－2000).The metering equipment will be checked by the Project owner and Grid Company before operation. The diagram of the meters' position is shown as following:



Two meters with accuracy of 0.2s will be installed in order to ensure maximum availability of CDM data, and to improve the appropriate level of quality. Total electricity produced by the project activity will be recorded by M_1 which installed at the output end of the station. M_2 installed at the substation is a bidirectional meter that measures quantity of net electricity generation supplied by the Project to the Grid and the electricity deliver to the Project from the Grid, and the difference of the two readings is the net electricity supplied by the Project ($EG_{facility,y}$). Above data will be measured continuously, recorded hourly and monthly aggregated.

M_1 will be owned and maintained by the project owner, and M_2 will be owned and maintained by Sichuan Power Grid which belongs to CCPG. In addition, in case of a conflict between M_1 and M_2 the latter should govern. Meanwhile, if one of the meters exceeds the allowable range specified in the national standards, then it should be replaced by a new meter. If a breakdown of M_2 happened, the net electricity data should be data from M_1 minus line loss and internal consumption. The calculation of line loss should be the average of at least three months' data.

4. Data Collection

The main meter data collection process is presented as follow:

a) The project owner read M_1 on site hourly and record the data everyday
b) The power gird read M_2 monthly and recorded
c) At a fixed day of each month, Grid Company sends the project owner notification of net electricity generation. Then, the project owner offers the electricity sales invoices to Grid Company. After that, the Project owner records the net electricity generation of the Project.

The surface area of the reservoir at full reservoir level and installed capacity will be measured by competent Authority yearly. The data will be recorded and archived in electronic form annually.

Data and records will be checked prior to being stored and archived. Data from the project will be checked to identify possible errors or omissions. The data checks will include cross checks of the two electricity meters, and checks of the electricity figures on the receipts.

5. Calibration

The Power Interchange Agreement between the owner and the Grid Company defines the metering arrangements and the required quality control procedures to ensure accuracy.

The metering equipments are calibrated and checked annually for accuracy. Calibration of the two meters will be carried out by a third party who appointed by the Project owner. ‚Both the calibration records will be maintained by Project owner and designated third party. The entire meter records shall be jointly inspected and sealed with the present of all parties involved, and shall not be interfered with by either party except the other party or its accredited representatives are present.

6. Data management system

All the data monitored under the monitoring plan will be kept in electronic and hard copy format for 2 years after the end of the last crediting period or the last issuance of CERs for this Project, whichever occurs later. The monitored data will be presented to DOE to for verification.

7. Monitoring Report

At the end of each crediting year, a monitoring report will be compiled including the metering results and evidence (i.e. sales receipts).

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

>>

The study of the baseline and monitoring methodology was concluded on 17/05/2012 by the following organization and person.

Hangzhou Carbon Trade Environment Engineering Co., Ltd

Room 1525 of Buynow Keji Mansion, No.23 Jiaogong Rd, West Lake District, Hangzhou City, Zhejiang Province, China

Tina Wang, General Manager

Tel: +86 0571 5683 4629

Fax: +86 0571 5683 4630

Email: wmn1432000@yahoo.com.cn

The entity above is not the Project participants in the Annex 1.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

06/06/2007 (the signature date of the Turbine-Generator Purchase Contract[16])

[16] The contract was signed between the project owner and Sichuan Dongfeng Electric Machinery Works Co., Ltd on 06/06/2007. It was the purchase contract of generators and turbines. According to Glossary of CDM terms, the starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. Therefore, date of signing main equipment contract is considered as the earliest

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

>>
20 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:

>>
01/06/2012 or the registration date whichever the later one

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Environmental impacts

>>

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

>>

According to China Environmental Protection Law, the Project owner entrusted Institute of Environmental of Science & Technology of Chengdu Science & Technology University to compile Environmental Impact Assessment (EIA) report for the Project. The Project EIA report was completed in 12/2006 and approved by the Sichuan Environmental Protection Bureau on 07/02/2007[17]. The main assessment conclusions are provided below:

Water Environment

The impact on water environment is divided into two parts, respectively construction period and operation period. In construction period, there are mainly four impacts, respectively rock excavation and foundation trench drainage, processing wastewater of sandstone, oily sewage and sanitary waste. Excavation and foundation trench drainage will change water quality in the downstream obviously,

starting date of the Project. As we can see from the timetable that the construction contract was signed later than equipment contract, equipment contract was taken as the earliest starting date of the Project.

[17] The EIA Approval of the Project issued by Sichuan Environmental Protection Bureau (07/02/2007),No. [2007]172.

mainly manifesting as suspended substance increased in the water contents and thus the water become muddy.

Mitigation measures:

Before excavation and foundation trench drainage, digging pit to sedimentate suspended substance and filtering sandstone are necessary to reduce impact on water quality. As to waste water from processing sandstone, oily sewage, and sanitary waste, the wastewater will be recycled or discharged after being treated. In operation period, the project has no impact on water environment except sanitary waste from operation staff. However, the sanitary waste will be treated before discharged, so there is little impact on the water environment.

Air environment

The impact on air environment mainly happens during the construction period. Those pollutant sources are from construction machinery, fuel, coal, explosive, sandstone break up, cement concrete and vehicle transport. However, there are a few sensitivity points in ambient air; the construction area is located on valley terrace where limits the spread of the waste gas; the impacts concentrate in construction period which is pretty small compare with operation period. All of which will alleviate the impact.

Mitigation measures:

Corresponding measures will be adopted to reduce the impacts. In addition, focus will be put on the construction personnel. Protective measures, such as wearing dust masks, ear plugs, etc., will be equipped to prevent health hazards from dust. These impacts will disappear after the completion of the Project.

Acoustical Environment

Noise source of the Project is mainly from earthwork during the construction phase and motor vehicles.

Mitigation measures:

In order to minimize the impact, the project owner will adopt machines and vehicles with lower noises. Besides, there are little noise-sensitive points near the project site, so the impacts are mainly on the construction personnel. In order to protect construction personnel, earplugs, earmuffs, or helmets etc. will be provided for the sake of personnel.

Ecological environment

Impact on species such as terrestrial vegetation, terrestrial animal and aquatic biodiversity is presented bellow. And also, impact on ecological flow is included.

a) Impact on terrestrial vegetation

Terrestrial vegetation will be affect from two parts, one is from perpetual land occupation, and the other one is from temporary land occupation.

Mitigation measures (natural autoregulation):

Investigation showed that there is no vegetation under special State protection. The vegetation types affected are very simple, mostly are common types with few and scattered distribution. Although the construction of the plant will reduce the number of vegetation, it will do no harm to its species group.

b) Impact on terrestrial animal

After the completion of reservoir, the raised water level will flood habitation of terrestrial animals. In order to find new habitation, terrestrial animal will migrate to higher place. However, new place will force terrestrial animals to find new baits sources and get accustomed to new environment, which might give negative impacts on their reproduction and decrease their population quantity.

Mitigation measures (natural autoregulation):

Fortunately, there are lots of tributaries and brooks near the new reservoir which provide similar habitation for migrated terrestrial animals, therefore, the population quantity will return to normal after short fluctuation.

c) Impact on aquatic biodiversity

Aquatic plants include vascular plants, phytoplankton, zooplankton will be impacted in a certain degree. Their population density and biomass will increase. The build of the reservoir will lead to decrease the quantity of low adaptive capacity fishes.

Mitigation measures:

After the reservoir filling, amount of fishes will be put in the reservoir. On the one hand, it could recover the fish resource in the reservoir area; on the other hand, water resource could be fully used.

d) Impact on ecological flow

The Project is a daily regulation hydropower station. Due to the downstream hydropower station owns annual regulation ability, so if the downstream hydropower station operates at dead water level, it may discontinues ecological flow and creates a 4.5km dry river courses between the Project and downstream hydropower station, which may cause negative impacts on aquatic environment.

Mitigation measures:

Therefore, the Project should let-down reasonable water flow to avoid those impacts. According to the design proposal which agreed by project owner later, measures taken to ensure the water for ecological needs are followed. In flood season, water flow will be all let down; the Project operates at full load. In rainless season, if the water flow smaller than 31.0m^3/s, about 15.0m3/s water flow will be let down; if the water flow larger than 31.0m^3/s, the Project will be operated. This measure meets the ecological water demand in the lower reaches, and ensures the continuation of the river flow as well as protects the hydrophytic habitat.

Resettlement

Due to the construction of the reservoir and land occupation, about 63 villagers (59 from Muchuan County and 4 from Mabian County) should be resettled. The way of relocation is concentrated on making adjustment on arable land. However, relocation and reconstruction of houses will destroy and occupy new land, which will disturb the ground and lead to water loss and soil erosion. Even so, the harm of water loss and soil erosion is limited, as there are not many resettled residents caused by the Project.

Mitigation measures:

After the completion of construction, the project owner will arrange tree and grass planting, green form of rehabilitation, and other treatment to restore the work area landscape and vegetation to prevent soil erosion.

Conclusion

To conclude, as presented above, although there are some adverse impacts due to the construction of the Project, those adverse impacts are not very severe and could relieve or get better after the completion of the Project. As a whole, there is no significant impact caused by the Project.

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

>>

According to EIA results and reply from Environmental Protection Bureau, the impact on the environment is not significant.

SECTION E. Stakeholders' comments

>>

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

>>

To investigate the impacts on local socio-economy and environment, the Project owner conducted a public meeting on 20/07/2007[18]. Before that, on 10/07/2007, the project owner has published a notice on its website to invite potential stakeholders to attend the meeting and give comments. The survey was arranged through delivering questionnaires among local residents (especially Lidian Town, Shiliang Village, Rongding Town and Huogu Village) at the project site.

E.2. Summary of the comments received:

>>

50 questionnaires copies were delivered and all of them available. The survey had a 100% response rate.

Details of the stakeholders taken part in the survey are showed in the Table E-1.

Table E-1 Details of the stakeholders for the Project

[18]More information please refer to: http://www.007star.com/Read_Document.php?DocumentID=1341&ItemID=

Item		total	percentage
Age（year）	30	7	14
	39-40	10	20
	40-49	21	42
	50-59	7	14
	above 60	5	10
Profession	Farmer	33	66
	other	17	35
Education level	Preliminary school	12	24
	Junior high school	29	58
	Senior high school	7	14
	other	2	4

Table E-2 Results of the survey

Content		Statistical Results total	Statistical Results %
1. What's your attitude towards the Project?	support	46	92
	Indifference	4	8
	Objection	0	0
2. Do you think the Project has an effect on the local socio-economy and environment?	Positive	36	72
	Passive	2	4
	no effect	12	24
3. Do you think the construction of the Project will bring employment opportunities to local people?	Yes	50	100
	No	0	0
4. What's your opinion about the influence the Project caused?	positive effect	27	54
	Some influence but acceptable	19	38
	no effect	4	8
5. Do you think the project should be built as soon as possible?	Yes	41	82
	No	0	0
	Indifference	9	18
6. Will the Project have impact on your work and life?	large influence	2	4
	little influence	14	28
	no influence	34	68
7. What role do you think CDM plays in	positive	16	32

the Project?	no effect	0	0
	Improve local clean energy usage	34	68

Conclusion

The public investigation shows that most respondents support the construction of the Project, and all of them insist that this Project is beneficial to the local development. There are some concerns on the impacts in the construction phase, but according to the description in EIA all problems can be solved by applying the advanced technology and adopting environmental protection measures.

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

>>

The environmental concerns from the respondents are seriously considered by the Project owner and will be solved by applying the related measures. All the comments received which strongly show a positive attitude in supporting the construction of the Project have been integrated into the Project construction phase plan and earnestly implemented.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Sichuan Muchuan County Qixing Huogu Hydropower Development Co., Ltd
Street/P.O.Box:	Huogu Village, Lidian Town, Muchuan County
Building:	/
City:	Leshan City
State/Region:	Sichuan Province
Postcode/ZIP:	323000
Country:	P.R China
Telephone:	86-0578-2179002
FAX:	86-0578-2179019
E-Mail:	Star002@007star.com
URL:	/
Represented by:	Su Shaojun
Title:	President
Salutation:	/
Last name:	Su
Middle name:	/
First name:	Shaojun
Department:	
Mobile:	13305882008
Direct FAX:	86-0578-2179019
Direct tel:	86-0578-2179001
Personal e-mail:	star001@007star.com

Organization:	Deutsche Bank AG, London branch
Street/P.O.Box:	1 Great Winchester Street
Building:	Floor 2, Winchester House,
City:	London
State/Region:	
Postfix/ZIP:	EC2N 2DB
Country:	United Kingdom
Telephone:	+44 2075473347
FAX:	+44 2033200785
E-Mail:	david.costa-dsa@db.com
URL:	www.db.com
Represented by:	David Costa-D'sa
Title:	Managing Director
Salutation:	
Last Name:	Costa-D'sa
Middle Name:	
First Name:	David
Department:	Environmental Financial Products
Mobile:	+447879 488 489
Direct FAX:	+44 2033200785
Direct tel:	+44 20754 73347
Personal E-Mail:	david.costa-dsa@db.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the Project.

Annex 3

BASELINE INFORMATION

For the calculation of OM and BM, open data is published by National Development and Reform Commission (NDRC) of China on 02/07/2009. Details can be found in the following website.

http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Below we provide the main data used in the calculation of the baseline emission factor. Please note that all primary data is downloaded from above website.

The data among 2005-2007 used in OM calculation of China Southern Power Grid are listed in table A3-1 to table A3-7. Data in table A3-8 to table A3-13 are used in BM calculation.

Tables A3-1 Thermal Power Generation of CCPG in 2005

Province	**Electricity Generation**	**Electricity Generation**	**Rate of station-service Electricity (%)**	**Electricity Supply**
	（10^8kWh)	**（MWh)**	**（%）**	**（MWh)**
Jiangxi	300	30,000,000	6.48	28,056,000
Henan	1315.9	131,590,000	7.32	121,957,612
Hubei	477	47,700,000	2.51	46,502,730
Hunan	399	39,900,000	5	37,905,000
Chongqing	175.84	17,584,000	8.05	16,168,488
Sichuan	372.02	37,202,000	4.27	35,613,475
Total				286,203,305

Data source: China Electric Power Yearbook 2006

Tables A3-2 Calculate the Operating Margin Emission Factor of CCPG in 2005

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Carbon content	$OXID_i$	$EFCO_{2,i}$	NCV_i	Emission of $CO_2(tCO_{2e})$
									（tc/TJ）	（%）	$(kgCO_2/TJ)$	（$MJ/t,m^3$）	L=G*J*K/100000 （quantity）
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K	L=G*J*K/10000 (volume)
Raw coal	10^4t	1869.29	7638.87	2732.2	1712.27	875.4	2999.77	**17827.8**	25.8	100	87,300	20,908	325,404,287
Cleaned coal	10^4t	0.02						**0.02**	25.8	100	87,300	26,344	460
Other washed coal	10^4t		138.12			89.99		**228.11**	25.8	100	87,300	8,363	1,665,408
Coke	10^4t		25.95		105			**130.95**	29.2	100	95,700	28,435	3,563,450
Coke oven gas	10^8m^3			1.15		0.36		**1.51**	12.1	100	37,300	16,726	94,206
Other gas	10^8m^3		10.2			3.12		**13.32**	12.1	100	37,300	5,227	259,696
Crude oil	10^4t		0.82	0.36				**1.18**	20	100	71,100	41,816	35,083
Petrol	10^4t		0.02			0.02		**0.04**	18.9	100	67,500	43,070	1,163
Diesel oil	10^4t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	72,600	42,652	293,861
Fuel oil	10^4t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	75,500	41,816	280,035
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery dry gas	10^4t	0.71	3.41	1.76	0.78			**6.66**	15.7	100	48,200	46,055	147,842
Nature gas	10^8m^3						3	**3**	15.3	100	54,300	38,931	634,186
Other petroleum products	10^4t							**0**	20	100	75,500	41,816	0
Other coking products	10^4t				1.5			**1.5**	25.8	100	95,700	28,435	40,818
Other energy	10^4tce		2.88		1.74	32.8		**37.42**	0	0	0	0	0
												Total	332,420,496

Data Source: China Energy statistical Yearbook2006

Tables A3-3Thermal Power Generation of of CCPG in 2006

Province	Electricity Generation	Electricity Generation	Rate of station-service Electricity (%)	Electricity Supply
	（10^8kWh)	（MWh)	（%）	（MWh)
Jiangxi	344.49	34,449,000	6.17	32,323,497
Henan	1512.35	151,235,000	7.06	140,557,809
Hubei	548.41	54,841,000	2.75	53,332,873
Hunan	464.08	46,408,000	4.95	44,110,804
Chongqing	234.87	23,487,000	8.45	21,502,349
Sichuan	441.93	44,193,000	4.51	42,199,896
Total				334,027,226

Data source: China Electric Power Yearbook 2007

Tables A3-4 Calculate the Operating Margin Emission Factor of CCPG in 2006

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Carbon content	$OXID_i$	$EFCO_{2,i}$	NCV_i	Emission of CO_2(tCO_{2e})
									(tc/TJ)	(%)	($kgCO_2$/TJ)	(MJ/t,m^3)	L=G*J*K/100000 (quantity)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K	L=G*J*K/10000 (volume)
Raw coal	10^4t	1926.02	8098.01	3179.8	2454.48	1184.3	3285.22	**20127.82**	25.8	100	87,300	20,908	367,386,738
Cleaned coal	10^4t					5.79		**5.79**	25.8	100	87,300	26,344	133,160
Other washed coal	10^4t	4.51	104.12		8.59	79.21		**196.43**	25.8	100	87,300	8,363	1,434,116
Briquette	10^4t						0.01	**0.01**	26.6	100	87,300	20,908	183
Coke	10^4t		17.23		0.32			**17.55**	29.2	100	95,700	28,435	477,576
Coke oven gas	10^8m^3		0.52	1.07	4.24	0.38	0.01	**6.22**	12.1	100	37,300	16,726	388,053
Other gas	10^8m^3	12.69	3.95		1.7	4.36	0.01	**22.71**	12.1	100	37,300	5,227	442,770
Crude oil	10^4t		0.49					**0.49**	20	100	71,100	41,816	14,568
Petrol	10^4t		0.01					**0.01**	18.9	100	67,500	43,070	291
Diesel oil	10^4t	0.91	2.23	1.41	1.78	0.96		**7.29**	20.2	100	72,600	42,652	225,737
Fuel oil	10^4t	0.51	1.26	1.31	0.8	0.57	3.49	**7.94**	21.1	100	75,500	41,816	250,674
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery dry gas	10^4t	0.86	8.1	1	0.97			**10.93**	15.7	100	48,200	46,055	242,630
Nature gas	10^8m^3			0.28		0.16	18.63	**19.07**	15.3	100	54,300	38,931	4,031,309
Other petroleum products	10^4t							**0**	20	100	75,500	41,816	0
Other coking products	10^4t						0.01	**0.01**	25.8	100	95,700	28,435	272
Other energy	10^4tce	17.45	37.36	31.55	18.29	29.35		**134**	0	0	0	0	0
												Total	375,028,077

Data Source: China Energy statistical Yearbook2007

Tables A3-5Thermal Power Generation of of CCPG in 2007

Province	Electricity Generation	Electricity Generation	Rate of station-ervice Electricity (%)	Electricity Supply
	（10^8kWh)	（MWh)	（%）	（MWh)
Jiangxi	421	42,100,000	7.72	38,849,880
Henan	1773	177,300,000	7.55	163,913,850
Hubei	609	60,900,000	6.69	56,825,790
Hunan	542	54,200,000	7.18	50,308,440
Chongqing	288	28,800,000	9.2	26,150,400
Sichuan	451	45,100,000	8.68	41,185,320
Total				377,233,680

Data source:China Electric Power Yearbook 2008

Table A3-6 Calculate the Operating Margin Emission Factor of CCPG in 2007

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Carbon content	$OXID_i$	$EFCO_{2,i}$	NCV_i	Emission of $CO_2(tCO_{2e})$
									（tc/TJ）	（%）	($kgCO_2$/TJ)	（MJ/t,m^3）	L=G*J*K/100000（quantity）
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K	L=G*J*K/10000 (volume)
Raw coal	10^4t	2200.57	9357	3479.81	2683.81	1547.7	3239	**22507.89**	25.8	100	87,300	20,908	410,829,404
Cleaned coal	10^4t		3.07			3.8		**6.87**	25.8	100	87,300	26,344	157,998
Other washed coal	10^4t	0.04	87.16		2.06	96.42		**185.68**	25.8	100	87,300	8,363	1,355,631
Briquette	10^4t						0.01	**0.01**	26.6	100	87,300	20,908	183
Coke	10^4t							**0**	29.2	100	95,700	28,435	0
Coke oven gas	10^8m^3	0.08	2.61	0.25	0.31	0.91		**4.16**	12.1	100	37,300	16,726	259,534
Other gas	10^8m^3	29.17	25.79		24.69		23.98	**103.63**	12.1	100	37,300	5,227	2,020,444
Crude oil	10^4t		0.43					**0.43**	20	100	71,100	41,816	12,784
Petrol	10^4t				0.04	0.01		**0.05**	18.9	100	67,500	43,070	1,454
Diesel oil	10^4t	0.98	3.21	2.51	2.83	1.93		**11.46**	20.2	100	72,600	42,652	354,863
Fuel oil	10^4t	0.42	1.25	1.33	0.63	0.64	1.74	**6.01**	21.1	100	75,500	41,816	189,742
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery dry gas	10^4t	1.43	10.01	0.97	0.7			**13.11**	15.7	100	48,200	46,055	291,022
Nature gas	10^8m^3		0.12	0.18		0.2	1.87	**2.37**	15.3	100	54,300	38,931	FALSE
Other petroleum products	10^4t							**0**	20	100	75,500	41,816	0
Other coking products	10^4t							**0**	25.8	100	95,700	28,435	0
Other energy	10^4tce	23.43	63.65	35.95	29.46	23.21		**175.7**	0	0	0	0	0
												Total	415,473,059

Data Source: China Energy statistical Yearbook2008

Table A3-7 The Operating Margin Emission Factor of CCPG in 2005~2007

	2005	2006	2007	
Total emission (tCO_2)	332,420,496	378,031,235	419,013,395	
Total Electricity Supply (MWh)	286,203,305	337,056,176	380,239,080	
Emission factor (tCO_2/MWh)	1.16148	1.12157	1.10197	**1.12553**

Table A3-8 $EF_{Coal, Adv}$, $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$

	Variation	Efficiency (%)	Fuel EF($kgCO_2$/TJ)	Oxidation rate	Emission factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1,000,000×B×C
Coal-fired power plant	$EF_{Coal,Adv,y}$	38..10	87,300	1	0.8249
Gas-fired power plant	$EF_{Oil,Adv,y}$	49..99	75,500	1	0.5437
Oil-fired power plant	$EF_{Gas,Adv,y}$	49..99	54,300	1	0.3910

Table A 3-9 Calculation of power generation using solid, liquid and gas fuels the corresponding total CO_2 emissions in the proportion of emission

		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Calorific value	EF	Oxidation rate	Emission
Fuels	Unit	A	B	C	D	E	F	G=A+…+F	H	I	J	K=G×H×I×J/100,000
Raw coal	10^4t	2,200.57	9,357	3,479.81	2,683.81	1,547.70	3,239	22,507.89	20,908	87,300	1	410,829,404
Cleaned coal	10^4t	0	3.07	0	0	3.8	0	6.87	26,344	87,300	1	157,998
Other washed coal	10^4t	0.04	87.16	0	2.06	96.42	0	185.68	8,363	87,300	1	1,355,631
Briquette	10^4t	0	0	0	0	0	0.01	0.01	20,908	87,300	1	183
Coke	10^4t	0	0	0	0	0	0	0	28,435	95,700	1	0
Other coking products	10^4t	0	0	0	0	0	0	0	28,435	95,700	1	0
Total												**412,343,216**
Crude oil	10^4t	0.00	0	0.00	0.00	0.00	0	0.43	41,816	71,100	1	12,784
Gasoline	10^4t	0	0	0	0.04	0.01	0	0.05	43,070	67,500	1	1,454
Diesel oil	10^4t	0.98	3.21	2.51	2.83	1.93	0	11.46	42,652	72,600	1	354,863
Fuel oil	10^4t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	41,816	75,500	1	189742
Other petroleum products	10^4t	0	0	0	0	0	0	0	41,816	75,500	1	0
Total												558843
Nature gas	10^7m^3	0.00	1	1.80	0.00	2.00	19	23.70	38,931	54,300	1	501,007
Coke oven gas	10^7m^3	0.8	26.1	2.5	3.1	9.1	0	41.6	16,726	37,300	1	259,534
Other gas	10^7m^3	291.7	257.9	0	246.9	0	239.8	1036.3	5,227	37,300	1	2,020,444
LPG	10^4t	0	0	0	0	0	0	0	50,179	61,600	1	0
Refinery dry gas	10^4t	1.43	10.01	0.97	0.7	0	0	13.11	46,055	48,200	1	291022
Total												3072007
Total												**415,974,066**

Data Source: China Energy statistical Yearbook2008

Thus $\lambda_{Coal,y}$ =99.13%， $\lambda_{Oil,y}$ =0.13%， $\lambda_{Gas,y}$ =0.74%；

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

= 0.8213 tCO_2/MWh

Table A3-10 Table 1 Installed Capacity of CCPG in 2007

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal	MW	9,270	38,540	13,040	13,360	6,370	12,000	92,580
Hydro	MW	3,570	2,740	24,020	9,220	2,240	19,860	61,650
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	10	17	24	0	51
Total	MW	12,840	41,280	37,070	22,597	8,634	31,860	154,281

Data source: China Electric Power Yearbook 2008

Table A3-11 Installed Capacity of CCPG in 2006

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal	MW	6,568	32,603	11,623	10,715	5,594	9,555	76,658
Hydro	MW	3,288	2,553	18,320	8,648	1,979	17,730	52,518
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	0	17	24	0	41
Total	MW	9,856	35,156	29,943	19,380	7,597	27,285	129,217

Data source: China Electric Power Yearbook 2007

Table A3-12 Installed Capacity of CCPG in 2005

Installed Capacity	**Unit**	**Jiangxi**	**Henan**	**Hubei**	**Hunan**	**Chongqing**	**Sichuan**	**Total**
Thermal	MW	5,906	26,268	9,526	7,212	3,760	7,496	60,167
Hydro	MW	3,019	2,540	17,889	7,905	1,893	14,960	48,205
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	0	0	24	0	24
Total	MW	8,925	28,808	27,415	15,117	5,676	22,456	108,396

Data source: China Electric Power Yearbook 2006

Table A3-13 BM EF of CCPG

	Installed Capacity of 2005	Installed Capacity of 2006	Installed Capacity of 2007	Added Capacity of 2005-2007	Cumulative increase (%)
	A	B	C	D=C-A	
Thermal	60,167.20	76,658	92,580	32,412.80	70.64%
Hydro	48,205.20	52,518	61,650	13,444.80	29.30%
Nuclear	0	0	0	0	0.00%
Wind	24	41	51	27	0.06%
Total	**108,396.40**	**129,217**	**154,281**	**458,84.6**	**100.00%**
% versus 2007	70.26%	83.75%	100%		

EFBM,y=0.8213×70.64%=0.5802 tCO_2/MWh

Annex 4

MONITORING INFORMATION

- - - - -