**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:

Sichuan Jialingjiang River Cangxi Hydropower Project
Document version: PDD, version 05
Completion date:21/09/2010

### A.2. Description of the project activity:

Sichuan Jialingjiang River Cangxi Hydropower Project (hereafter referred to as the "Project") is developed by Sichuan Jialingjiang Cangxi Hydroelectric Power Development Co., Ltd. The project is located on the Jialingjiang River in the Cangxi County of Sichuan province, P.R.China.

✧ The scenario existing prior to the start of the implementation of the project activity
Prior to the start of the implementation of the proposed project, electricity demand in the absence of the project is supplied by Sichuan provincial grid, which is one of sub-grids of the Central China Power Grid ("CCPG") dominated by thermal power.

✧ The project scenario
Within the project activity, a new reservoir will be built with a total surface area of 5.09 $km^2$ and power density of 12.97 $W/m^2$, and 3 sets of turbine and generating units, which are supplied by a domestic company, will be installed at the site with a total capacity of 66MW (3 units× 22MW). The project is expected to generate an annual average of 255,024MWh electricity and to supply 232,727MWh[1] to the CCPG via Sichuan Grid by utilizing water sources of Jialingjiang River.

✧ The baseline scenario
The baseline scenario, as identified in section B.4, is the same as the scenario prior to the start of implementation of the project activity.

The purpose of the project is to produce electricity with clean and renewable water sources and to displace part of the electricity from fossil fuel-fired plants connected to the CCPG. Thus, greenhouse gas ("GHG") emission reductions can be achieved. The estimated annual GHG emission reductions are 198,481 $tCO_2$ equivalents by the project activity.

The proposed project will contribute to sustainable development to the local society with the following aspects.
- Supply clean electricity to the grid and reduce GHG emissions.
- Create job opportunities during the project construction and operation period.
- Support underprivileged and the poverty-stricken region and increase local incomes.

[1] The electricity delivered to the Grid by the Project=Maximum theoretical electricity generation*Effective coefficient*(1-Internal Consumption)*(1-Transmission Line Loss)=255,024MWh*0.92*(1-0.3%)*(1-0.5%)=232,727MWh

- Reduce emissions of environmental pollutants, such as the $CO_2$, CO, $SO_2$ and dust derived from thermal power plants.

## 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 Jialingjiang Cangxi Hydroelectric Power Development Co., Ltd | No |
| Japan | Sumitomo Corporation | No |

## A.4. Technical description of the project activity:

### A.4.1. Location of the project activity:

#### A.4.1.1. Host Party(ies):

People's Republic of China

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

Sichuan Province

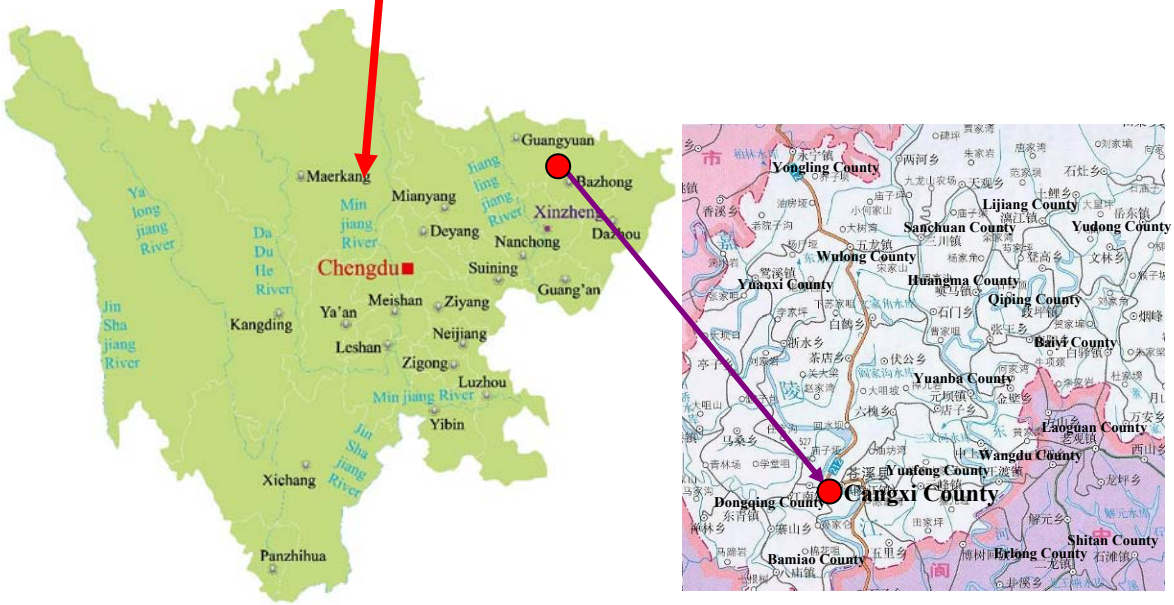
#### A.4.1.3. City/Town/Community etc:

Cangxi County

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

The project is located on Jialingjiang River in the Cangxi County, 3 km from Cangxi County. It is situated at 105°52'05"~ 105°56'53" east longitude, and 31°45'42"~31°48'45" north latitude. The geographical location of the project is shown in the following figure:


**Map of China**




**Map of Sichuan Province** **Project Location**

Figure 1. Location of Cangxi Hydropower Project

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

Sectoral scope 1: energy industries (renewable sources)

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

Prior to the start of implementation of the project activity, local electricity demand is supplied by the CCPG which is dominated by thermal power, which is also the baseline scenario to the project activity.

The project is a run-of-river hydropower station with a new built reservoir, the power density of the project is 12.97 W/m$^2$. Within this project, 3 sets of domestic tubular turbine and generating units, which are designed to operate 3864 hours annually, will be installed at the site with a total capacity of 66MW (3 units×22MW). The project consists of left-bank earth-rock dam, factory pivot, sluice flushing gate, right-bank lock and etc. The factory pivot mainly includes a powerhouse which is located at the left base and houses three turbine and generator units. Electricity generated by the project will be delivered to CCPG via transformer substations. Electricity metering systems will be installed both at the outlet of the project and the inlet of the transformer substation. The specific technical data of the project are listed in the table below.

Table A.4.3.-1 Technical data

| Parameter | Unit | Data |
|---|---|---|
| Station type | Riverbed type | |
| **Reservoir** | | |
| Normal water level | m | 373 |
| Power density | W/m$^2$ | 12.97 |
| **Turbine** | | |
| Units | | 3 |
| Model | | GZ-WP-720 |
| Rated rotational speed | r/min | 75 |
| Rated head | m | 6.1 |
| Rated flow | m$^3$/s | 412.57 |
| Life | Year | 40 |
| **Generator** | | |
| Units | | 3 |
| Model | | SFWG22-80/7260 |
| Rated Power | MW | 22 |
| Rated Voltage | kV | 10.5 |
| Life | Year | 40 |
| **Hydroturbine-generator aggregate** | | |
| Plant Load factor | % | 44.1[2] |
| efficiency of the hydroturbine-generator aggregate | % | 89.6 |

[2] *The operator hours 3864h was chosen from the PDR prepared by the authorized design institute which is the third party contracted by the project owner and was provided to the government while applying the project activity for implementation approval, therefore the plant load factor of 44.1% (3864/8760*100%=44.1%) was defined according to method (a)-"or to the government while applying the project activity for implementation approval" and method (b)-"the plant load factor determined by a third party contracted by the project participants" in paragraph 3, Annex 11, EB 48.*

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A new reservoir with a total surface area of 5.09km$^2$ will be built within this project, so the power density of the project is 12.97W/m$^2$, according to the applicable methodology, there are no emission sources and the GHG involved in the project activity. The electricity generated by the project will be delivered to the CCPG except a small quantity will be utilized in-situ for equipment operation or maintenance, or during shut down period.

The project will use the advanced equipments manufactured and supplied by domestic manufacturers. There is no overseas technology introduced for the project.

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

The project applies a renewable crediting period. The first 7-year renewable crediting period is expected to start on July 1st 2010 till June 30th 2017. But the starting date of the crediting period specified may be adjusted once the date of registration is determined.

Emission reductions to be achieved by the project during the first crediting period are shown in the table below.

Table A.4.4.-1 Project Emission Reductions

| **Years** | **Annual estimation of emission reductions in tonnes of $CO_2e$** |
|---|---|
| 2010 (01/07~31/12) | 99,240.5 |
| 2011 | 198,481 |
| 2012 | 198,481 |
| 2013 | 198,481 |
| 2014 | 198,481 |
| 2015 | 198,481 |
| 2016 | 198,481 |
| 2017 (01/01~30/06) | 99,240.5 |
| **Total estimated reductions** (tonnes of $CO_2e$) | **1,389,367** |
| **Total number of crediting years** | **7** |
| **Annual average over the crediting period of estimated reductions** (tonnes of $CO_2e$) | **198,481** |

### A.4.5. Public funding of the project activity:

There is no public fund from parties included in Annex I of the UNFCCC involved in this project activity.

## SECTION B. Application of a baseline and monitoring methodology:

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

- ACM0002 Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable sources (version 10)

- Tool for the demonstration and assessment of additionality (version 05.2)
- Tool to calculate the emission factor for an electricity system (version 02)
- Combined tool to identify the baseline scenario and demonstrate additionality (version 02.2)

Above methodologies and Tools are available 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:**

The project meets all the applicability criteria as set out in the methodologies.
- It is a 66MW grid-connected run-of-river hydropower plant;
- It results in a new reservoir and the power density of the project is 12.97 W/m$^2$, greater than 4 W/m$^2$.
- It is not an activity that involves switching from fossil fuels to renewable energy at the project site.
- The geographic and system boundaries for the CCPG can be clearly identified and information on the characteristics of the grid is available.

The project activity corresponds to the criteria described above and is therefore applicable to ACM0002.

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

The project plant will generate electricity with water source and will be connected with the CCPG which exports electricity to other regional grids and imports electricity from Northwest China Power Grid (NWCPG) in 2006 and 2007. As a result, the project boundary includes the project activity and all power plants connected to the CCPG, covering Henan, Hubei, Hunan, Jiangxi, Sichuan and Chongqing provincial grids. Furthermore, NWCPG as a connected electricity system is also included in the project boundary.

The project boundary is shown in the figure 2 and table B.3.-1 below.

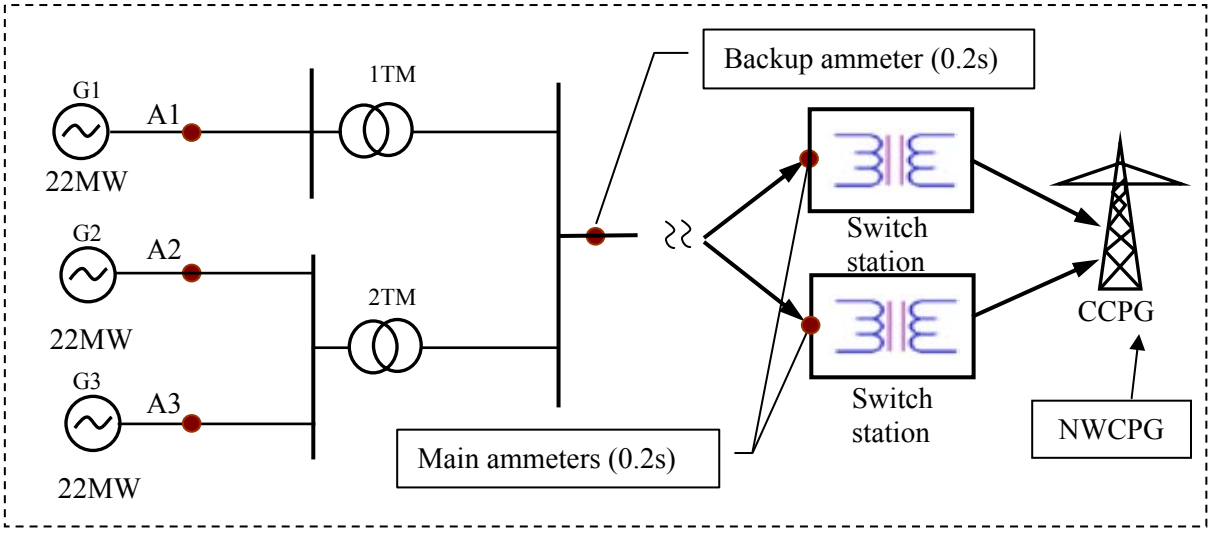


Figure 2 Project boundary

Table B.3.-1: Sources and gases included in 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 sources |
| | | $CH_4$ | No | Not emission sources |
| | | $N_2O$ | No | Not emission sources |
| **Project Activity** | For hydropower plants, emissions of $CH_4$ from the reservoir. | $CO_2$ | No | Not emission sources |
| | | $CH_4$ | No | The power density of the project is 12.97W/$m^2$, greater than 10 W/$m^2$. Therefore, emissions of $CH_4$ from the reservoir is zero. |
| | | $N_2O$ | No | Not emission sources |

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

According to ACM0002 (version 10), the proposed project activity 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 be 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*.

The proposed project will be connected to the CCPG. In this case, the only realistic and reasonable baseline scenario is to provide the same amount of electricity by the CCPG.

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

The following steps from the "*Tools for the demonstration and assessment of additionality* (version 05.2)" are taken to demonstrate additionality of the project.

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

***Sub-step 1a. Define alternatives to the project activity:***
Four possible alternatives are identified as follows:

1) Implementing the proposed project, but not as a CDM project;
2) Adding a new thermal plant providing the same annual electricity output;
3) Adding a new renewable power plant other than hydropower providing the same annual electricity output.

4) Providing the same amount of electricity by the CCPG

Where the project is located is lacking of other renewable sources except water source. According to the analysis on the wind power and solar sources in China, Sichuan province is one of the regions where available wind power and solar sources are limited. In Sichuan basin, the annual frequency of zero wind speed is more than 60%[3], and the annual average sunshine time is only 1152.5h, relative sunshine is 26%[4]. According to the latest statistics, there is neither windmill nor solar facility constructed in Sichuan province by the end of 2006[5]. In the aspect of biomass power plant, China is still in the starting period and facing all kinds of difficulties, such as the difficulties of raw material collection, high investment and operation cost, immature technology and lack of correlative standards and regulations[6]. All these difficulties limit the development of biomass power plant in Sichuan. Furthermore, electricity generation from geothermal also faces the difficulties and barriers of technology and investment in China. Therefore, Alternative 3 is not the baseline scenario.

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

According to Chinese power regulations, thermal power plants of less than 135MW are prohibited for construction[7]. Therefore, Alternative 2 is not in compliance with Chinese regulations on construction of a thermal plant and is not the realistic alternative to the project.

**Step 2. Investment analysis**

***Sub-step 2a. Determine appropriate analysis method***

The proposed project will have proceeds from power sales as well as from emission reduction credits, so Option I-Simple Cost Analysis stated in *Tool for the Demonstration and Assessment of Additionality* is not applicable.

Furthermore, the alternative of providing the same amount of electricity by the CCPG is not a specific investment project. Therefore, Option II-Investment Comparison Analysis is not applicable.

As a result, Option III-Benchmark Analysis must be used, where the project IRR of total investment is compared with the benchmark IRR of total investment applicable to the power industry sector in China. Here, the benchmark analysis is selected.

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

With reference to the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project*[8], the financial benchmark IRR of power industry is issued to be 8% (after tax) of the total investment. 8% as the benchmark for total investment FIRR has been the common practice and becomes the consensus in the field of electric power.

[3] http://www.newenergy.org.cn/html/2003-9/2003991.html
[4] http://www.scaqw.com/articles/?contentid=1866
[5] China Electric Power Yearbook (2007)
[6] http://www.bmlink.com/bst/14176/
[7] http://www.gov.cn/gongbao/content/2002/content_61480.htm.
[8] China Power Press, 2003.

Therefore, the benchmark IRR of total investment of 8% is selected for financial analysis of the project.

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

The following parameters and values are applied for calculation and comparison of financial indicators, IRR.

Table B.5.-1 Parameters to determine the project IRR

| Item | Value | Unit | Source |
|---|---|---|---|
| Capacity | 66 | MW | Preliminary Design Report |
| Total Static investment | 668.99 | million CNY | Revised Preliminary Design Report |
| Operational and maintenance costs per year | 12.93 | million CNY | Preliminary Design Report |
| Annual output | 232,727 | MWh | Preliminary Design Report |
| Tariff (without VAT) | 0.32 | CNY/kWh | Preliminary Design Report |
| Value Added Tax (VAT) | 17 | % | Preliminary Design Report |
| City construction and maintenance tax, and Educational surcharge | 8 | % | Preliminary Design Report |
| Income tax | 25 | % | Income tax policy |
| Project operational lifetime | 30 | year | Preliminary Design Report |
| Estimated CER price | 9.0 | Euro/CER | Assumption |
| Exchange Rate | 10.80 | (€/￥) | |

The financial analysis for the proposed project is shown in the table below, with and without CERs taken into account. The calculated IRR value of the project without CERs would be 6.41%, which is below the financial benchmark 8%. Thus without CERs revenue, it is evident that this project will face substantial financial hurdles and cannot be implemented.

After taking CERs revenue into consideration, the project's IRR of total investment can reach 8.34%, greater than the benchmark 8%. Therefore, this project is feasible and can be implemented.

Table B.5.-2 Financial analysis results of the proposed project

| | IRR (%) |
|---|---|
| Without CERs | 6.41 |
| With CERs | 8.34 |

***Sub-step 2d. Sensitivity analysis:***

A sensitivity analysis is conducted by altering the parameters:

- ✧ Investment
- ✧ Operation & maintenance costs
- ✧ Electricity sales.

✧ Electricity tariff

The above parameters are selected as being most likely to fluctuate over time. Financial analysis is performed altering each of these parameters by 10%, and assessing the impact on the project IRR as shown in the Table B.5.-3 and Figure 3. below.

Table B.5.-3: Sensitivity analysis of the project

| | -10% | +10% |
|---|---|---|
| Investment | 7.33% | 5.60% |
| Operation & maintenance costs | 6.57% | 6.25% |
| Electricity sales | 5.51% | 7.23% |
| Electricity tariff | 5.51% | 7.24% |

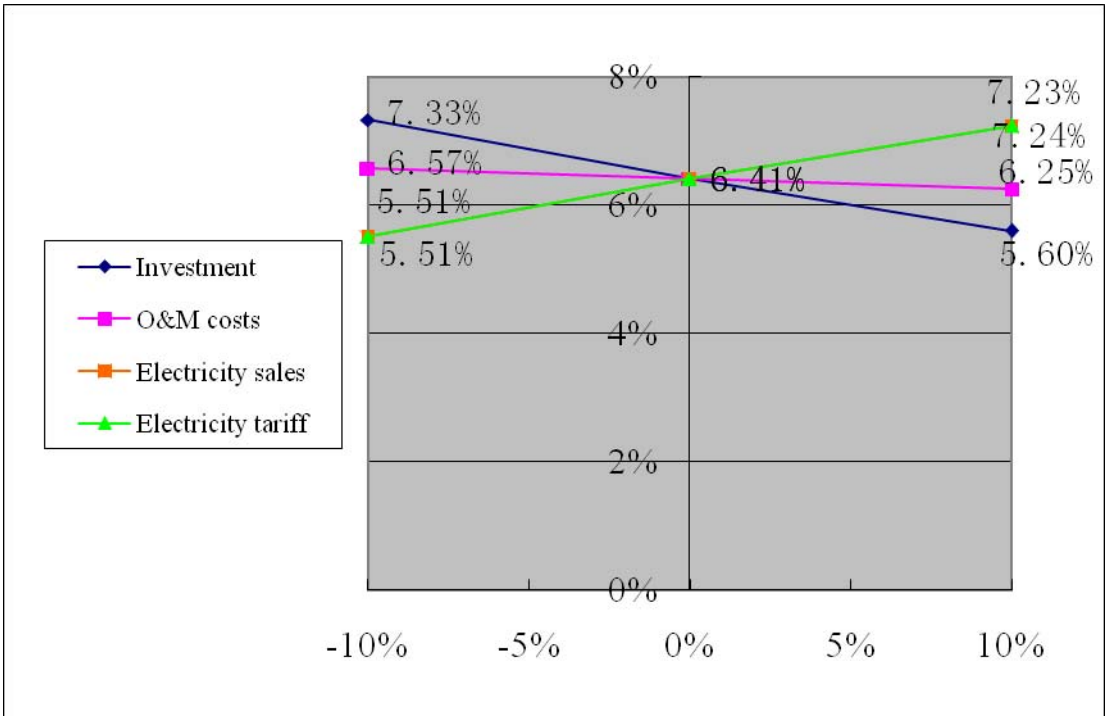


Figure 3. Sensitivity analysis of the project

Table B.5.-3 and Figure 3. show that in the case of the decrease in investment by 10%, or the decrease in operation & maintenance costs by 10% or the increase in electricity sales or electricity tariff by 10%, the project IRR is still much lower than the 8% benchmark. In addition, even if the effective coefficient equals to 100%, that means 255,024MWh*(1-0.3%)*(1-0.5%)=252,988MWh electricity will be delivered to the Grid, the project IRR is 7.13% which is still lower than the benchmark.

Therefore this sensitivity analysis concludes that the proposed project activity is unlikely to be implemented due to the lacking of financial attractive if without CERs revenue taken into account.

From another point of view, when the project IRR is equal to the benchmark, the changes of critical parameters are shown in the table below.

Table B.5.-4: Parameter changes when project IRR is equal to the benchmark

| Change of parameters | Investment | O&M costs | Elec. Sales | Elec. Tariff |
|---|---|---|---|---|
| Project IRR = Benchmark | -16.4% | below-100% | 19.5% | 19.4% |

It shows that when the project IRR is equal to the benchmark, the investment decreased by 16.4%, or electricity sales or electricity tariff increased by 19.5% and 19.4% respectively, which are unlikely to occur. Furthermore, even the decrease in O&M costs by 100% which is unreasonable and impossible, the project IRR is still lower than the benchmark.

As for the decrease in investment by 16.4%, it is unlikely to occur due to the continuous increase in material and labor costs etc. in the host country of the proposed project. According to the National Bureau of Statistics of China, the procurement price index for material, fuel and power was increased by 8.3%[9], 6.0%[10], 4.4%[11] and 10.5%[12] nationwide, during 2005, 2006, 2007 and 2008 respectively. In Sichuan province these procurement price index rose to levels of 9.3%[13], 4.3%[14] and 5.7%[15].

As for the electricity sales, based on the water resource data collected during the past 46 years (1955~2000)[16], the amount of electricity sales is most unlikely to be increased in the project activity. All water data which were used for the design of the project capacity came from the Tingzikou Hydrometrical Station, which is possessed by Water Reconnaissance Bureau of Sichuan[17].

As for the electricity tariff, if it increases by 19.4% the project IRR would be equal to the benchmark 8%. In 2002, China implemented the policy "Separate Power Plants from Network and Compete in price to Enter Network", and power plants are encouraged to lower cost for electricity generation, and thus on-grid tariff. Since then, electricity tariff in China is determined mainly by market, and negotiated between the project owner and the grid company according to government instructive documents[18]. Once the electricity tariff is determined, little change will occur during the whole operating period. In addition, *Notice on Questions Relevant to Coal and Electricity Price Linkage in CCPG*[19] was issued by NDRC on 30th April 2005, in which the guided tariff for newly built hydropower plant in Sichuan Province is 0.288 CNY/kWh (with VAT). Furthermore, the actual tariff approved by Sichuan Pricing Bureau for hydropower plants operated from 2005 ((2005) No.239[20], (2006) No.186[21], (2007) No.308[22], (2008) No.174[23]) was also 0.288CNY/kWh (with VAT), which is lower than the estimated tariff 0.32CNY/kWh

[9] http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20060227_402307796.htm
[10] http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20070228_402387821.htm
[11] http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20080228_402464933.htm
[12] http://www.gov.cn/gzdt/2009-02/26/content_1243547.htm
[13] http://www.stats.gov.cn/was40/gjtjj_detail.jsp?channelid=4362&record=101
[14] http://www.stats.gov.cn/was40/gjtjj_detail.jsp?channelid=4362&record=72
[15] http://www.stats.gov.cn/tjgb/ndtjgb/dfndtjgb/t20080219_402468477.htm
[16] Preliminary Design Report
[17] http://www.schwr.com
[18] http://www.ndrc.gov.cn/xwfb/t20050708_28096.htm
[19] http://scjc.scpi.gov.cn/flfg-content.asp?id=1205
[20] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=1443
[21] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=2034
[22] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=2870
[23] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=3158

(without VAT) of this project. Therefore, it is demonstrated that the increase in the project electricity tariff by 19.4% is unlikely to occur and the proposed project is firmly lacking of financial attractiveness within the reasonable range of tariff.

In sum, the above analysis by altering four critical parameters clearly demonstrates that without CDM support, the proposed project cannot be implemented.

**Step 4. Common practice analysis**

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

For common practice analysis, only the projects similar to the proposed project in terms of installed capacity, regulatory framework, similar investment climate, access to technology, access to financing etc. were evaluated. Basically, the hydropower projects with installed capacity in the range of 50MW~300MW and started construction after 2002 in Sichuan Province were selected for the following reasons.

- China Hydraulics Yearbook (2006): All data on hydropower stations are taken from the best available and authoritative China Hydraulics Yearbook (2006).

- Year 2002: This is one of the selection criteria we used because during 2002 a reform for electric power system in China, *Electric Power System Reform* was issued by China State Council dated 10 February 2002, which breaks the State-monopoly of the electric supply system, separates electric power generation and electric grid operation into sectors, and promotes market competition and other benefits. Therefore, the investment climate of the power plants was significantly changed in 2002.

- 50MW~300MW capacity: According to *Classification & design safety standard of hydropower projects* (DL5180-2003) issued by State Economic and Trade Commission of People's Republic of China in 2003, hydropower plant, with capacity less than 50MW, is defined as small scale hydropower projects; hydropower plant, with capacity less than 300MW and more than 50MW, is defined as middle scale hydropower projects; hydropower plant, with capacity more than 300MW, is defined as large scale hydropower projects. The proposed project is a middle scale hydropower station with a total installed capacity of 66MW.

- Sichuan Province：The common practice analysis is limited to provincial level as the investment environment, such as industrial development, technology development, availability of engineers and technical workers, availability of transportation and so forth, for each province differs

Three projects each with an installed capacity in the range of 50MW~300MW that started construction in Sichuan province after 2002, but not undertaken as CDM projects are identified in the table below.

Table B.5.-5 Hydropower projects with similar capacity

| No. | Name of Hydro Station | Installed capacity (MW) | Start of construction | Location | Investment Per kilowatt (CNY/kW) | Operation hours (h) |
|---|---|---|---|---|---|---|
| 1 | Jiangsheba Hydropower Station [24] | 128 | 2006 (operation year) | Minjiang | 5992 | - |
| 2 | Huilongqiao Hydropower Station [25] | 50 | 2002 | Mengdonghe | 5000 | - |
| 3 | Kehe Hydropower Station [26] | 72 | 2003 | Shenyuhe | 4819 | 5200 |

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

There are major distinctions between the proposed project and the above already existing hydropower projects with similar installed capacity.

The investment per kilowatt of Jiangsheba Hydropower Station, Huilongqiao Hydropower Station and Kehe Hydropower Station are 5992 CNY/kW, 5000 CNY/kW and 4819 CNY/kW, respectively, far below than 10,149 CNY/kW of the proposed project. This is caused by a number of reasons, including the increased fee for the compensation for residential relocation of those affected by the project activity, and a higher land acquisition fee. The project site is a less advantageous location and requires a great deal more construction work, such as a long road for the transportation of construction material and equipments, a wider river requires a longer dam, more enforcement is required for the river banks. Also a less favourable hydrodynamic condition, which limits the amount of electricity generated by the project plant. Higher prices of hydroelectric turbine-generators and materials for construction and higher wages for engineers and workers are also important reasons.

Furthermore, the annual operation hour of Kehe Hydropower Station is 5200h, longer than 3864h of the proposed project. Consequently, significantly less electricity will be generated annually by the proposed project, which makes the project financially less attractive and more financially risky than the other projects.

There are obvious distinctions of investment condition and water resource between the proposed project and the above hydropower stations. The project is therefore not common practice.

It is therefore concluded that the proposed project is additional.

**Considering of CDM**

The Preliminary Design Report (PDR) of the project was completed on November 2004 by Chengdu Hydroelectric Investigation & Design Institute and approved by Sichuan Development & Reform Commission on December 13th 2004. In 2007, before preparing to start the

[24] http://www.abjc.gov.cn/ViewInfo.asp?id=1367
[25] http://www.chinarein.com/qkhc/detail.asp?id=3984
[26] http://www.chinapower.com.cn/article/1017/art1017274.asp

construction of the project, the project owner entrusted the design institute to revise the PDR of the project according to the latest situation of the project. The Revised PDR was prepared and approved by Sichuan Development & Reform Commission (FDRC) on December 27th 2007. It showed that the original estimate of 556.64 million CNY in the previous PDR had increased by112.35 million CNY. With the increased investment, the FIRR of the project cannot reach the benchmark. The project faced serious financial barrier to push through.
In order to overcome the financial barriers that the project faced, the project owner seriously considered the incentive of CDM and decided to proceed with the project with the support of CDM in the Board Meeting held on 12th February 2008. In April 2008, the project owner signed a CDM Development Agreement with Chengdu Jinhe Technology Co., Ltd.—a CDM consultant company. After taking CDM into consideration, the construction of the project started from May 2008.

A timeline of the main events involved in the implementation of the proposed project is described below.

| Date | Milestone |
|---|---|
| December 13th 2004 | PDR has been approved. |
| December 2007 | The revised PDR has been completed. |
| December 27th 2007 | According to the approved Revised PDR, the project IRR is lower than the benchmark 8%. The project face financial difficult to construction. |
| February 2008 | In order to overcome the financial barrier the project faced, the project owner decided to look for help from CDM. |
| April 2008 | The project owner signed CDM Development Agreement with Chengdu Jinhe Technology Co., Ltd. |
| May 30th 2008 | The project owner signed the main Equipment Procurement Contract. It is the starting date of the project. |
| June 3rd 2008 | The project owner signed the construction contract with the construction company. |
| October 2008 | After a comprehensive and lengthy negotiation between the project owner and several potential CER buyer candidates, the project owner reached an agreement with Sumitomo Corporation to fund the CDM transaction costs. |
| April 2009 | The CDM application was submitted to NDRC. |
| June 2009 | LoA from NDRC for this project was issued. |
| October 2009 | The on-site assessment done by JCI. |

The details in the above timeline clearly demonstrate that the project owner took CDM into serious consideration before commencing with the construction of the project. And the project owner took successive actions to secure the CDM application in parallel with the construction works for the project.
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## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

According to the approved consolidated baseline methodology ACM0002 (version 10), the

emission reductions of the proposed project are determined as following steps:

**1. Project Emissions $PE_{HP,y}$**

According to ACM0002, the project emission is related to the value of the power density. For hydropower project activities that result in new reservoirs, the project emissions of the project activity are calculated as follows:

(a) If the power density (PD) of power plant is greater than 4 W/m$^2$ and less than or equal to 10 W/m$^2$:

$$PE_{HP,y} = EF_{Res} \times TEG_y/1000 \quad (1)$$

Where:

$PE_{HP,y}$ Project emissions from water reservoirs ($tCO_2e$/year)

$EF_{Res}$ Default emission factor for emissions from reservoirs of hydro power plants in year y (kg $CO_2e$/MWh), and the default value as per EB23 is 90kg $CO_2e$/MWh.

$TEG_y$ Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to the internal loads, in year y (MWh)

(b) If the power density (PD) of the power plant is greater than 10W/m$^2$:

$$PE_{HP,y} = 0 \quad (2)$$

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (3)$$

Where:

PD Power density of the project activity, in 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.

**2. Baseline Emissions $BE_y$**

Baseline emissions include only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

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

Where:

| | |
|---|---|
| $BE_y$ | Baseline emissions in year y ($tCO_2$/year). |
| $EG_{PJ,y}$ | 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 with the latest version of the *Tool to calculate the emission factor for an electricity system* ($tCO_2$/ MWh). |

*Calculation of $EG_{PJ,y}$*

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:

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

| | |
|---|---|
| $EG_{PJ,y}$ | 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). |

**※ Calculation of $EF_{grid,CM,y}$ for CCPG based on the *Tool to calculated the emission factor for an electricity system***

The electricity generated by the project activity will be transferred to the CCPG. The generation capacity installed will be 66MW throughout the first crediting period. The project electricity system will be connected with the CCPG. Data from the *China Electric Power Yearbook* and *China Energy Statistical Yearbook* are publicly available to calculate the Emission Factor of the CCPG. The default values for the calculation of calorific values for fuel types came from the *China Energy Statistical Yearbook (2008)*, the potential emission factor and fuel oxidation came from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Moreover, the Chinese DNA published emission factor of CCPG on its website[27] which is also available.

- **Step 1. Identify the relevant electricity system**

The electricity generated by the project will be transferred to the CCPG, covering Hunan, Hubei, Jiangxi, Sichuan and Chongqing provincial grids. Therefore, the CCPG is identified as the relevant electricity system. In addition, the CCPG exports electricity to other regional grids and imports electricity from NWCPG. Therefore, the NWCPG is also identified as the relevant electricity system and will be taken into account for calculating OM emission factor of the CCPG. But, the other regional grids which imports electricity from the CCPG are not identified as the relevant electricity system and the electricity exports from the CCPG is not subtracted from electricity generation data used for calculating the emission factor.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

[27] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Option Ⅰ: Only grid power plants are included in the calculation.
Option Ⅱ: Both grid power plants and off-grid power plants are included in the calculation.

Option Ⅰ is chosen for the project.

- **Step 3. Select a method to determine the operating margin (OM)**

For recent years (2003-2007) where data are available, the low-cost/must run resources constituted less than 50% of total power generation of the CCPG and the relevant ratios are respectively 34.4%, 38.5%, 38.6%, 35.1% and 35.5% for year 2003, 2004, 2005, 2006 and 2007[28]. Therefore, the simple OM method is applicable and used for the project.

A 3-year generation-weighted average OM, 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.

For this project, a 3-year generation-weighted average OM, based on the data from 2005 to 2007 is used.

- **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 ($tCO_2e/MWh$) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated:

Option A: Based on the net electricity generation and a $CO_2$ emission factor of each power unit;, or

Option B: Based 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.

The project adopts Option B due to the following three reasons:

a. The data required in Option A belong to commercial secret and not publicly available in China; and
b. The power resources of the low-cost/must-run power plants/units serving the CCPG are nuclear and renewable resources, and the data of electricity sales of these resources are publicly available.
c. Off-grid power plants are not included in the calculation.

According to Option B, it may be calculated using following equation:

[28] China Electric Power Yearbook (2004~2008)

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

Where:

| | |
|---|---|
| $EF_{grid,OMsimple,y}$ | Simple operating margin $CO_2$ emission factor in year y ($tCO_2e/MWh$) |
| $FC_{i,y}$ | Amount of fossil fuel type i consumed in the project electricity system in year *y* (mass or volume unit). Using country specific data from China Energy Statistical Yearbook (2006-2008) |
| $NCV_{i,y}$ | Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit). Using country specific data from China Energy Statistical Yearbook (2008) |
| $EF_{CO2,i,y}$ | $CO_2$ emission factor of fossil fuel type *i* in year *y* ($tCO_2/GJ$). Using 2006 IPCC Guidelines for default values |
| $EG_y$ | 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 is Step 3 |

Since CCPG imports electricity from NWCPG in 2006 and 2007, NWCPG is addressed as one of the power plant in OM calculation for CCPG.

According to the above steps and the emission factor of CCPG published by Chinese DNA on its website, a 3-year average Simple OM emission factor of the CCPG is:

$EF_{grid,OM,y}$ = 1.1255 $tCO_2e/MWh$

The detailed calculation is in Annex 3.

- **Step 5. Identify the group 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:

(1) The set of five power units that have been built most recently, or
(2) 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.

Project participants should use the set of power units that comprise the larger annual generation.

According to *Tool to calculate the emission factor for an electricity system*, in terms of vintage of data, two options can be used.

*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 *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.

*Option 2.* For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units build 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 unite build up to the latest year for which information is available. For the second crediting period, the build margin emissions factors shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Because detailed data on grid and grid-connected power plants are difficult to be obtained in China, Option 1 is selected.

- **Step 6. Calculate the build margin emission factor**

The build margin emission factor is the generation-weighted average emission factor ($tCO_2e/MWh$) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (7)$$

Where:

| | |
|---|---|
| $EF_{grid,BM,y}$ | Build margin $CO_2$ emission factor in year y ($tCO_2e/MWh$) |
| $EG_{m,y}$ | Net quantity of electricity generated and delivered to the grid by power unit m in year y(MWh) |
| $FE_{EL,m,y}$ | $CO_2$ emission factor of power unit m in year y ($tCO_2e/MWh$) |
| m | Power units included in the build margin |
| y | Most recent historical year for which power generation data is available |

In China, data on either the five power plants that have been built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation are classified as business confidential and are not publicly available. Therefore, EB accepted the following deviations[29]:

- Use of capacity additions during last 1~3 years for estimating the build margin emission factor for grid electricity.
- Use of weights estimated using installed capacity in place of annual electricity generation.

EB also suggests using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

According to the data published by Chinese DNA[30], the subcritical generating system with a

[29] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

[30] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

capacity of over 600MW share 54% of total installation capacity and represents the most advanced technology commercially used in domestic coal-fired plants. The combined cycle technology with a capacity of 200MW stands for the most advanced technology used in thermal plants fired by gas or oil in China. Therefore, the BM emission factor of the CCPG is calculated using the data from 2005~2007, based on the above best technology commercially available at the time of this PDD submission. The calculation procedures are shown below.

Step a Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year.

$$\lambda_{coal},= \frac{\sum_{i\in COAL\ ,j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \quad (8)$$

$$\lambda_{oil} = \frac{\sum_{i\in OIL,j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \quad (9)$$

$$\lambda_{gas} = \frac{\sum_{i\in GAS,j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \quad (10)$$

Where:

$\lambda_{coal}$, $\lambda_{oil}$ and $\lambda_{gas}$ represent the proportion of $CO_2$ emission of the solid, liquid and gas fuel in the total emission, respectively.

$F_{i,j,y}$ Amount of fuel i consumed by relevant power sources *j* in year *y* (mass or volume).

$COEF_{i,j,y}$ $CO_2$ emission coefficient of fuel *i* ($tCO_2$ /mass or volume), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year *y*.

COAL, OIL and GAS are the mark aggregation of solid fuel, liquid fuel and gas fuel, respectively.

Step b. Calculate emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China.

$$EF_{thermal} = \lambda_{coal} * EF_{coal,Adv} + \lambda_{oil} * EF_{oil,Adv} + \lambda_{gas} * EF_{gas,Adv} \quad (11)$$

$EF_{thermal}$ is the emission factor of thermal power plant. $EF_{coal,Adv}$, $EF_{oil,Adv}$ and $EF_{gas,Adv}$ represent the $CO_2$ emission factor of the most advanced technology commercially used in coal-, oil- and gas-fired plants in China, respectively.

Step c. Calculate BM of the grid based on the result of Step b. and the share of thermal power of recent 20% capacity additions.

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (12)$$

$CAP_{Total}$ Total newly capacity addition on different power sources connected to the CCPG.
$CAP_{Thermal}$ Newly capacity addition on thermal power sources connected to the CCPG.

According to the above steps and the emission factor of CCPG published by Chinese DNA on its website, the BM emission factor of the CCPG is:

$EF_{grid,BM,y}$ = 0.5802 $tCO_2e/MWh$
The detailed calculation is in Annex 3.

- **Step 7. Calculate the combined margin emissions factor**

$EF_{grid,CM,y}$ is the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$) is expressed as:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \quad (13)$$

Where:
$w_{OM}$ Weighting of operating margin emission factor (%)
$w_{BM}$ Weighting of build margin emission factor (%)

For hydropower project the weights $w_{OM}$ and $w_{BM}$, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$).

**3. Leakage Emissions $L_y$**

According to ACM0002, no leakage emissions ($L_y$) are considered.

**4. Emission Reductions $ER_y$**

Therefore, the emission reductions of the project is

$$ER_y = BE_y - PE_y \quad (14)$$

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

| **Data / Parameter:** | $FC_{i,y}$ |
|---|---|
| Data unit: | Mass or volume |
| Description: | Amount of fossil fuel type i consumed by power plants connected to the CCPG in year y |
| Source of data used: | China Energy Statistical Yearbook (2006~2008) |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | China Energy Statistical Yearbook is an authoritative publication. |
| Any comment: | |

| **Data / Parameter:** | $NCV_{i,y}$ |
|---|---|
| Data unit: | TJ/volume or TJ/mass |
| Description: | net calorific value (energy content) per mass or volume unit of fuel i in year y |
| Source of data used: | China Energy Statistical Yearbook 2008 |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | China Energy Statistical Yearbook is an authoritative publication. |
| Any comment: | |

| **Data / Parameter:** | $EF_{CO2,i}$ |
|---|---|
| Data unit: | $tCO_2/GJ$ |
| Description: | $CO_2$ emission factor per unit of energy of fuel i in year y |
| Source of data used: | Default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2, page 1.23 |
| Value applied: | See Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | No local specific value available, therefore using default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories. |
| Any comment: | |

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Net electricity generated by power plant/unit j in year y |
| 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 : | China Electric Power Yearbook is an authoritative publication. |
| Any comment: | |

| **Data / Parameter:** | $EC_y$ : Electricity used on-site |
|---|---|
| Data unit: | % |
| Description: | Average on-site electricity usage by all power plants connected to the CCPG |
| 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 : | China Electric Power Yearbook is an authoritative publication |
| Any comment: | |

| **Data / Parameter:** | $GENE_{best,coal}$ |
|---|---|

| | |
|---|---|
| Data unit: | % |
| Description: | Best power supply efficiency by the most advanced technology commercially used in coal-fired plants in China |
| Source of data used: | Bulletin on Baseline Emission Factors of the China's Regional Grids- the calculation of baseline Build Margin emission factor for the China's Regional Grids |
| Value applied: | 38.10% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official data from Chinese DNA |
| Any comment: | |

| **Data / Parameter:** | $GENE_{best,oil,gas}$ |
|---|---|
| Data unit: | % |
| Description: | Best power supply efficiency by the most advanced technology commercially used in oil- and gas-fired plants in China |
| Source of data used: | Bulletin on Baseline Emission Factors of the China's Regional Grids- the calculation of baseline Build Margin emission factor for the China's Regional Grids |
| Value applied: | 49.99% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official data from Chinese DNA |
| Any comment: | |

| **Data / Parameter:** | $CAP_y$ |
|---|---|
| Data unit: | MW |
| Description: | Installed generation capacity on different power sources connected to the CCPG |
| 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 : | China Electric Power Yearbook is an authoritative publication. |
| Any comment: | |

| **Data / Parameter:** | **$GWP_{CH4}$** |
|---|---|
| Data unit: | $tCO_2e/tCH_4$ |
| Description: | Global warming potential of methane valid for the relevant commitment period |
| Source of data used: | IPCC |
| Value applied: | For the first commitment period/ 21 $tCO_2e/tCH_4$ |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | - |

| Any comment: | - |
|---|---|

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

The parameters and their corresponding values used to calculate the baseline emissions and project emissions are shown in the table below.

Table B.6.3-1 Calculation Parameters

| Parameters | | Value |
|---|---|---|
| $EG_y$ (MWh) | Electricity supplied by the project activity to the grid in year y | 232,727 |
| $EF_{grid,CM,y}$ ($tCO_2e$ /MWh) | Baseline emissions factor of CCPG | 0.85285 |

According to the equations listed in Section B.6.1 and the default values of parameters in Section B.6.2 and Table B.6.3.-1, the project emissions, baseline emissions and leakage are shown below.

(1) Baseline emissions

The baseline emission factor is:

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} = 1.1255 \times 0.5 + 0.5802 \times 0.5$$
$$= 0.85285 \text{ tCO}_2\text{e/MWh}$$

Therefore, the baseline emissions of the project is:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} = 232,727 \times 0.85285 = 198,481 \text{ tCO}_2\text{e/year}$$

(2) Project emissions

According to the data in Preliminary Design Report, the power density of the proposed project is calculated as:

$$PD = \frac{Cap_{PJ}}{A_{PJ}} = 66,000,000 / 5,090,000 = 12.97 \text{ W/m}^2$$

The power density of the proposed project is 12.97W/$m^2$, more than 10 W/$m^2$. Therefore, $PE_y$ =0.

The methodology does not require to take into account the leakage from the proposed project activity. Therefore, $L_y$=0. So emission reductions are as follows:

$$ER_y = BE_y - PE_y - L_y = 198,481 - 0 - 0 = 198,481 \text{ tCO}_2\text{e/year}$$

**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 overall emission reductions (tonnes of $CO_2e$) |
|---|---|---|---|---|
| 2010 (01/07~31/12) | 0 | 99,240.5 | 0 | 99,240.5 |
| 2011 | 0 | 198,481 | 0 | 198,481 |
| 2012 | 0 | 198,481 | 0 | 198,481 |
| 2013 | 0 | 198,481 | 0 | 198,481 |
| 2014 | 0 | 198,481 | 0 | 198,481 |
| 2015 | 0 | 198,481 | 0 | 198,481 |
| 2016 | 0 | 198,481 | 0 | 198,481 |
| 2017 (01/01~30/06) | 0 | 99,240.5 | 0 | 99,240.5 |
| **Total (tonnes of $CO_2e$)** | 0 | **1,389,367** | 0 | **1,389,367** |

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

**B.7.1. Data and parameters monitored:**

Based on the ACM0002, the following data and parameters will be monitored during the project crediting period.

| **Data / Parameter:** | **$EG_{facility,y}$** |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the CCPG in year y |
| Source of data to be used: | Metering system readings |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 232,727MWh/year |
| Description of measurement methods and procedures to be applied: | Directly measured by the metering devices with an accuracy level of 0.2S installed at the inlet of the connected substations.<br>The recording frequency will be continuously measured and recorded on a monthly basis..<br>The measurement will be carried out by the representatives of the grid company and the project owner jointly.<br>Detailed monitoring procedures will be established later between the project owner and the grid company in line with the Power Purchase Agreement. |
| QA/QC procedures to be applied: | The metering equipments will be properly calibrated periodically according to *Technical Administrative Code of Electric Energy* |

| | |
|---|---|
| | *Metering* (DL/T448-2000) by an accredited third party. Sales invoices to the grid. Furthermore, the electricity purchase settlement notice from the grid company will be available to double check this parameter. |
| 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 site. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 66,000,000 |
| Description of measurement methods and procedures to be applied: | Yearly. Determine the installed capacity according to the nameplate of each generator. |
| 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 | 5,090,000 |
| Description of measurement methods and procedures to be applied: | Yearly. Measured from topographical surveys, when the reservoir is full. |
| QA/QC procedures to be applied: | The measurement will be carried out by the design institute yearly according to reservoir area-elevation curves. |
| Any comment: | |

| **Data / Parameter:** | **$TEG_y$** |
|---|---|
| Data unit: | MWh |
| Description: | Total quantity of electricity generated by the project in year y |
| Source of data to be used: | Metering system readings |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | - |
| Description of measurement | Directly measured by the metering devices with an accuracy |

| | |
|---|---|
| methods and procedures to be applied: | level of 0.5S installed at the outlet of the plant. The recording frequency will be continuously measured and recorded on a monthly basis.<br>The measurement will be carried out by the representatives of the grid company. |
| QA/QC procedures to be applied: | The metering equipments will be properly calibrated periodically according to *Technical Administrative Code of Electric Energy Metering* (DL/T448-2000) by an accredited third party.<br><br>Sales invoices to the grid and purchase receipt will be available to double check this parameter. |
| Any comment: | This parameter is only needed to be monitored if the Power Density less than 10W/$m^2$. |

**B.7.2. Description of the monitoring plan:**

The objective of the monitoring plan is to assure the complete, consistent, clear, and accurate monitoring and calculation of the project emission reductions during the whole crediting period. The project owner is responsible for the implementation of the monitoring plan, and the grid company cooperates with the project owner.

**1. Monitoring organization**

This monitoring plan will be carried out by a CDM team, designated by the project owner, which consists of a team leader, an assistant and four operators who are responsible for recording the metering readings (Figure 4). This team leader has the overall responsibility for the monitoring and verification process, training and managing all CDM team members, and acting as the focal point for DOE, DNA and other organizations relating to CDM.

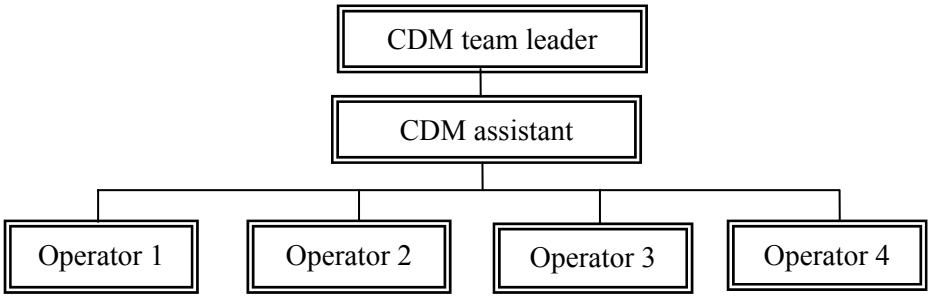


Figure 4 Monitoring organization

The team leader has the overall responsibility for the monitoring and verification process, training and managing all CDM team members, and acting as the focal contact for DOE, DNA and other organizations relating to CDM.

The assistant will help the team leader to supervise the operation of the project, including data monitoring, negotiations with the grid company, and to collect financial data such as receipts of electricity sales.

The operators will be responsible for calibrating and maintaining the electricity meters, measuring and recording relevant readings, collecting, checking, archiving and managing data, and making summary according to the CDM project's requirements in a regular basis.

**2. Training**

Before the formal operation of the proposed project, CDM training for relevant people will be organized by the team leader of CDM team. Furthermore, during the crediting period, CDM training will be organized at regular intervals.

**3. Data to be Monitored**

1) Electricity delivered to/import from the CCPG

Electricity delivered to/imported from the CCPG will be monitored by main metering devices installed at transformer substations. The representatives of the grid company and the project owner will jointly read the main metering devices monthly. The electricity purchase settlement notice will be provided by the grid company for the project owner's double check of the amount of electricity delivered to and accepted by the CCPG.

Moreover, backup metering devices will be also installed at the outlet of the project to measure electricity output and usage supplied by the grid. The measurement of the backup metering devices will be carried out by the project owner. The recording frequency will be continuously measured and recorded on an hourly basis, and monthly aggregated.

Detailed monitoring procedures of measuring electricity supplied to the CCPG by the project will be established later between the project owner and the grid company in line with the Power Purchase Agreement.

2) Installed capacity of the hydropower

The installed capacity of the hydropower plant shall be monitored yearly according to the nameplate of each generator.

3) Surface area of the reservoir

The surface area of the reservoir will be measured yearly from topographical surveys.

Above monitored data will be provided to DOE by the project owner during the verification period.

**4. Installation of Metering Devices**

Three sets of metering systems will be equipped separately at transformer substations and at the project site. They are classified as main system and backup system, respectively. All systems are capable of metering the import and export of electricity by the project simultaneously.

Three sets of metering systems (A1,A2 and A3) will be equipped separately at outlet line of three generators for metering electricity generated by each generator.

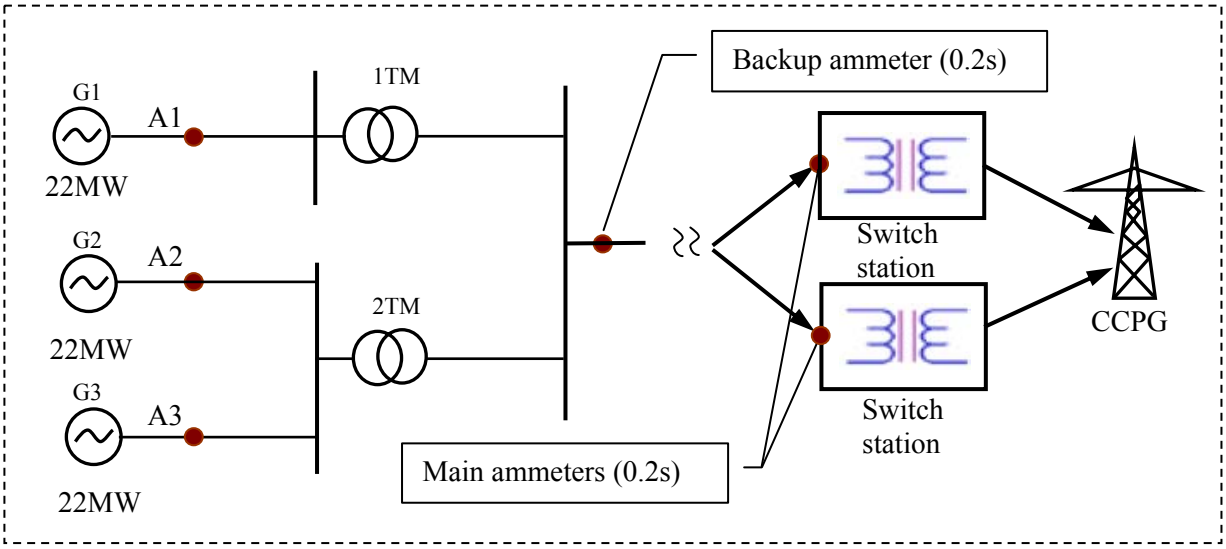


Figure 5 Location of metering systems

The metering equipments will be properly calibrated periodically and checked annually for accuracy. The calibration will be done according to *Technical Administrative Code of Electric Energy Metering* (DL/T448-2000) by an accredited third party.

## 5. Data Reading

1) Electricity delivered to/import from the CCPG

The recording frequency at the project site will be hourly measured and recorded, and monthly aggregated.

Electricity sales invoices provided by the project owner and the electricity purchase settlement notice provided by Grid Company should be available to check the electricity export to/import from the CCPG monthly. The electricity sales invoices and the electricity purchase settlement notice will be provided to DOE during the verification period.

2) Installed capacity of the hydropower

Before verification, operators will read and record the data of nameplate of each generator. This record will be checked by the CDM group leader and provided to DOE during the verification period.

3) Surface area of the reservoir

The surface area of the reservoir will be measured by correlative design institute yearly.

## 6. Data Management System

Data will be archived in electronic spreadsheet at the end of each month. The electronic files will be stored on hard disk or other media. In addition, a hard copy printout will be archived.

Hard copy documentation such as paper maps, diagrams and environmental assessment will be

collated in a central place, together with this monitoring plan. In order to facilitate auditor's reference, monitoring results will be indexed. All hard copy information will be stored by the project owner with at least one copy.

All data records will be kept until 2 years after the end of the crediting period.

**7. Disposing process of abnormity**

If any previous months reading of the main metering system be inaccurate by more than the allowable error (±0.2%, which is in line with *Technical Administrative Code of Electric Energy Metering* (DL/T448-2000)), or otherwise functioned improperly, the grid-connected electricity generated by the project shall be determined by:

- Firstly, by reading the backup meter while considering transmission line loss to get the data on electricity delivered to the grid, unless a test by either party reveals it is not accurate.
- If the backup system is not within the acceptable limits of accuracy or it otherwise performing improperly the project owner and the power company shall jointly prepare an estimate of the correct reading, and
- If the project owner and the grid company fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to agreed procedures.

The electricity recorded by the main metering system alone will suffice for the purpose of billing and emission reduction verification as long as the error in the main system is within the permissible limits.

If the error of data, especially the error of electricity sales, is caused by accidents during the crediting period, the project owner and grid company will deal with it as contingency. Meanwhile, CDM team should be informed about the accidents occurred at power station in time. The CDM team leader and assistant will analyze the rationality of data according to conservative rules of CDM projects. The data should be recorded and archived.

**8. Verification of monitoring results**

The responsibilities for verification of the projects are as follows:

- The project owner will make the arrangements for the verification and will prepare for the audit and verification process to the best of its abilities.
- The project owner will facilitate the verification through providing the DOE with all required necessary information, before, during and in the event of queries, after the verification.
- The project owner will fully cooperate with the DOE and instruct its staff and management to be available for interviews and respond honestly to all questions from the DOE.

**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)**

Completion date: 08/07/2009

Name of entity/person determining the baseline and monitoring plan:

Ms. Joney chncdm@gmail.com
Mr. Zeno mrdoos@gmail.com

Shanghai Yiqing Environmental Technology Co., LTD
Address：Room 802, No. 25, Lane 1080, North Huting Road, Shanghai 201615, China
Tel: +86-21-37690215
Fax: +82-21-37690215

None of the responsible persons / entity mentioned above belongs to 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:

30/05/2008(The date when the main Equipment Procurement Contract was signed)

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

30 years and 0 month.

### 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:

01/07/2010

##### 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:

An Environmental Impact Assessment (EIA) was conducted to ensure that the project complies with national, regional and local environmental regulations during its construction and operation period. The EIA, prepared by Chengdu Investigation & Design Research Institute which is a certified organization, has already been approved by Sichuan Province Environmental Protection Bureau on October 18th 2004.

The following is the summary of the EIA.

**Potential environmental impacts and the mitigation measures**

**In Construction Stage**

***Water*** Wastewater and sewage generated by site construction activities will be treated in the sedimentation tank after collection and then discharged; wastewater with oil will be treated by oil separator before discharged; and wastewater generated by construction workers will be treated using wastewater treatment equipment and then discharged.

***Air*** The main air pollutant is particulates (dust) which is released from construction activities and transportation and the emission from vehicles and construction machinery. Measures will be taken to mitigate this pollutant, such as spraying water at construction sites and on dusty roads, transporting material in covered vehicles or in closed containers, installing and using a wheel washing system, controlling vehicle speeds and operating with proper maintenance and in compliance with relevant emission standards.

***Noise*** Vehicles, construction machinery and explosion of dynamite will generate noise. The mitigation measures include: installing in-site sound barriers, selecting suitable equipment, correct operation and maintenance; limiting the speed of vehicles, and the explosion activities will be carried out strictly in compliance with safety regulations for explosion issued by the nation.

***Solid waste*** The main solid waste from this project includes: refuse generated on construction site and waste generated by construction workers. These solid wastes will be collected and then transported out to landfill.

***Ecology*** Measures for water and soil conservation are prepared and complied by the project owner for minimize the adverse impact on the ecological environment during the project construction. Rehabilitation of vegetation will be conducted after the construction work.

***Social*** The project owner made Reservoir Inundation and Resettlement Plan and set special fund for compensation as per *The Land Administration Law of the*

*People's Republic of China, Regulation on Land Requisition Compensation and Resettlement of Migrants for Large and Medium Water Conservation and Power Construction Projects, Specification for planning and design of reservoir submergence treatment of hydroelectric engineering (DL/T5064-1996)*, etc. to ensure that long-term livelihood of the project-affected people is protected. These reservoir resettlements will be resettled backward. Hence, the administrative region will not change and will not cause any pressure on education, medical and etc. The resettlements income will also be increased by exploiting land resources, reclaiming low-yield fields and so on.

**In Operation Stage**

***Water*** Sewage water will be treated in the treatment plant and then discharged.

***Air*** There is no air pollution caused by hydropower plant during operation stage.

***Noise*** Noise is generated mainly by machine during operations. The mitigation measures are: selecting low noise machines, locating noisy equipment in close workshop.

***Solid waste*** The main solid waste during operation period is waste generated by construction workers. These solid wastes will be collected and then transported out to landfill.

The project has no great adverse impact on the local people and environment.

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

The EIA of the Project has been approved by Sichuan Province Environmental Protection Bureau. Strict environmental monitoring and mitigation measures will be carried out during the construction and operation phase of the project. No significant environmental impacts are identified for the project.

## SECTION E. Stakeholders' comments

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

The project owner carried out the public consultation for the social, economic and environmental effects of the project before its implementation in April 2008.

During the survey a total of 120 questionnaires were handed out and 110 copies were returned. 92% participation was noted.

The conditions of the participants are as follows:

Table E.1.-1 Survey participants

| Item | Content | Vote | Proportion |
|---|---|---|---|
| Ethnic | Zang | 0 | 0% |
| | Han | 110 | 100% |
| | others | 0 | 0% |
| Education | Elementary school | 19 | 17% |
| | Junior high school | 35 | 32% |
| | senior high school | 33 | 30% |
| | University or above | 23 | 21% |
| Occupation | Governmental staff | 28 | 25% |
| | Worker | 11 | 10% |
| | Farmer | 66 | 60% |
| | Others | 5 | 5% |
| Age | ≤30 | 39 | 35% |
| | 30-40 | 49 | 45% |
| | 40-50 | 9 | 8% |
| | ≥50 | 13 | 12% |

The main questions include:

- Whether can the project create more job opportunities and incomes for local people?
- What is the project impact on local ecological and social environment?
- What is the main impact caused by the construction of the project?
- What is the impact on local vegetation by the project?
- What do you think is the main negative impact caused by the project?
- What do you think is the main positive impact caused by the project?
- What is the general trend on local environment by the project?
- What is your attitude to the construction of the project?

## E.2. Summary of the comments received:

The results of this survey are as follows:

- About 91.5% of the participants think the construction of the project will create more working opportunity and increase local incomes.
- About 85% of the participants think that the impact on local ecological and social environment would be positive.
- About 80% of the participants think that the main negative impact caused by the construction of the project the impact on local residences caused by reservoir, and 15% think it is water and soil loss caused by the construction activity.
- About 85% of the participants think that the main positive impact caused by the project is that the local economy would be notably promoted.
- 30% of the participants think that the construction of the project can improve the quality of local environment, 65% think that there would be some impact but the impact is controllable, 5% think that no impact would caused by the project.
- 98% of the participants sustain the construction of the project.

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

The project owner takes the comments and feedback seriously and takes the prompt and proper action to the stakeholders' comments and suggestions, especially on the protection of ecological environment during the construction and operation period.

As per the stakeholder's comments on reservoir inundation and the loss of water and soil, the project owner made Reservoir Inundation and Resettlement Plan and set special fund for compensation to ensure that long-term livelihood of the project-affected people is protected. These reservoir resettlements will be resettled backward. Hence, the administrative region will not change and will not cause any pressure on education, medical and etc. The resettlements income will also be increased by exploiting land resources, reclaiming low-yield fields and so on. Furthermore, for conserving water, soil and protection of ecological environment, the project owner prepared Scheme of Water and Soil Conservation for Sichuan Jialingjiang River Cangxi Hydropower Project which was approved by Water Resources Bureau of Sichuan Province on August 31st 2004. Accordingly, the project owner will take proper and effective measures to prevent the loss of water and soil, and protect the environment. For instance, barricade and other protective facilities will be built during and after the construction works; the temporary occupied land during the construction will be rehabilitated by soil covering, trees planting and other greening measures.

The survey also showed that local residents were very supportive for the project, thinking that the implementation of the project would boost local economy and popularize rural electrification.

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Owner/Host

| | |
|---|---|
| Organization: | Sichuan Jialingjiang Cangxi Hydroelectric Power Development Co., Ltd. |
| Street/P.O.Box: | Lingjiang Town, Cangxi County |
| Building: | |
| City: | Chengdu City |
| State/Region: | Sichuan Province |
| Postfix/ZIP: | |
| Country: | China |
| Telephone: | +86-28-87025713 |
| FAX: | +86-28-87044888 |
| E-Mail: | bwl0809@163.com |
| URL: | |
| Represented by: | Mr. He Xiaochun |
| Title: | Director |
| Salutation: | Mr. |
| Last Name: | Cheng |
| Middle Name: | |
| First Name: | Wei Min |
| Department: | CDM office |
| Mobile: | |
| Direct FAX: | +86-28-87044888 |
| Direct tel: | +86-28-87025713 |
| Personal E-Mail: | bwl0809@163.com |

Annex I Project Participant

| | |
|---|---|
| Organization: | Sumitomo Corporation |
| Street/P.O.Box: | 1-8-11 Harumi, Chuo-Ku |
| Building: | |
| City: | Tokyo |
| State/Region: | |
| Postfix/ZIP: | 104-8610 |
| Country: | Japan |
| Telephone: | +81-3-5166-4272 |
| FAX: | +81-3-5166-8753 |
| E-Mail: | |
| URL: | www.sumitomocorp.co.jp |
| Represented by: | |
| Title: | Team leader |
| Salutation: | Mr. |
| Last Name: | Ogata |
| Middle Name: | |
| First Name: | Tsuyoshi |
| Department: | Environmental Solution Business Task Force |
| Mobile: | |
| Direct FAX: | +81-3-5166-8753 |
| Direct tel: | +81-3-5166-4272 |
| Personal E-Mail: | cdm-project@sumitomocorp.co.jp |

## Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

There is no public fund from parties included in Annex I of the UNFCCC involved in this project activity.

## Annex 3

## BASELINE INFORMATION

**Emission Factor of Central China Power Grid[31,32,33,34]**

**I. Operating Margin**

Table 1. Fuel consumed by the CCPG in year 2005

| Fuel type | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Sub-total | Emission Factor (tc/TJ) | Oxid. Factor (%) | Emission Factor ($kgCO_2/TJ$) | LCV (MJ/t,m3) | $CO_2$ emission ($tCO_2e$) L=G×J×K/100000 (for mass) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G=A+B+C+D+E+F | H | I | J | K | L=G×J×K/10000 (for volume) |
| Raw coal | $10^4$t | 1869.29 | 7638.87 | 2732.15 | 1712.27 | 875.4 | 2999.77 | **17827.75** | 25.8 | 100 | 87,300 | 20,908 | 325,404,287 |
| Cleaned coal | $10^4$t | 0.02 | | | | | | **0.02** | 25.8 | 100 | 87,300 | 26,344 | 460 |
| Other washed coal | $10^4$t | | 138.12 | | | 89.99 | | **228.11** | 25.8 | 100 | 87,300 | 8,363 | 1,665,408 |
| Coke | $10^4$t | | 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 | $10^4$t | | 0.82 | 0.36 | | | | **1.18** | 20 | 100 | 71,100 | 41,816 | 35,083 |
| Gasoline | $10^4$t | | 0.02 | | | 0.02 | | **0.04** | 18.9 | 100 | 67,500 | 43,070 | 1,163 |
| Diesel oil | $10^4$t | 1.3 | 3.03 | 2.39 | 1.39 | 1.38 | | **9.49** | 20.2 | 100 | 72,600 | 42,652 | 293,861 |
| Fuel oil | $10^4$t | 0.64 | 0.29 | 3.15 | 1.68 | 0.89 | 2.22 | **8.87** | 21.1 | 100 | 75,500 | 41,816 | 280,035 |
| LPG | $10^4$t | | | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | $10^4$t | 0.71 | 3.41 | 1.76 | 0.78 | | | **6.66** | 15.7 | 100 | 48,200 | 46,055 | 147,842 |
| Natural gas | $10^8m^3$ | | | | | | 3 | **3** | 15.3 | 100 | 54,300 | 38,931 | 634,186 |
| Other petro product | $10^4$t | | | | | | | **0** | 20 | 100 | 75,500 | 41,816 | 0 |
| Other coking product | $10^4$t | | | | 1.5 | | | **1.5** | 25.8 | 100 | 95,700 | 28,435 | 40,818 |
| Other energy | $10^4$tce | | 2.88 | | 1.74 | 32.8 | | **37.42** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | **Sub-total** | 332,420,496 |

[31] China Energy Statistical Yearbook 2006~2008
[32] China Electric Power Yearbook 2006~2008
[33] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[34] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Table 2. Electricity generation and supply by the CCPG in year 2005

| Province | Generation (MWh) | On-site use (%) | Supply (MWh) |
|---|---|---|---|
| Jiangxi | 30,000,000 | 6.48 | 28,056,000 |
| Henan | 131,590,000 | 7.32 | 121,957,612 |
| Hubei | 47,700,000 | 2.51 | 46,502,730 |
| Hunan | 39,900,000 | 5 | 37,905,000 |
| Chongqing | 17,584,000 | 8.05 | 16,168,488 |
| Sichuan | 37,202,000 | 4.27 | 35,613,475 |
| **total** | | | 286,203,305 |

Table 3. Fuel consumed by the CCPG in year 2006

| Fuel type | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Sub-total | Emission Factor (tc/TJ) | Oxid. Factor (%) | Emission Factor ($kgCO_2/TJ$) | LCV (MJ/t,m3) | $CO_2$ emission ($tCO_2e$) L=G×J×K/100000 (for mass) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G=A+B+C+D+E+F | H | I | J | K | L=G×J×K/10000 (for volume) |
| Raw coal | $10^4$t | 1926.02 | 8098.01 | 3179.79 | 2454.48 | 1184.3 | 3285.22 | **20127.82** | 25.8 | 100 | 87,300 | 20,908 | 367,386,738 |
| Cleaned coal | $10^4$t | | | | | 5.79 | | **5.79** | 25.8 | 100 | 87,300 | 26,344 | 133,160 |
| Other washed coal | $10^4$t | 4.51 | 104.12 | | 8.59 | 79.21 | | **196.43** | 25.8 | 100 | 87,300 | 8,363 | 1,434,116 |
| Coal briquettes | $10^4$t | | | | | | 0.01 | **0.01** | 26.6 | 100 | 87,300 | 20,908 | 183 |
| Coke | $10^4$t | | 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 | $10^4$t | | 0.49 | | | | | **0.49** | 20 | 100 | 71,100 | 41,816 | 14,568 |
| Gasoline | $10^4$t | | 0.01 | | | | | **0.01** | 18.9 | 100 | 67,500 | 43,070 | 291 |
| Diesel oil | $10^4$t | 0.91 | 2.23 | 1.41 | 1.78 | 0.96 | | **7.29** | 20.2 | 100 | 72,600 | 42,652 | 225,737 |
| Fuel oil | $10^4$t | 0.51 | 1.26 | 1.31 | 0.8 | 0.57 | 3.49 | **7.94** | 21.1 | 100 | 75,500 | 41,816 | 250,674 |
| LPG | $10^4$t | | | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | $10^4$t | 0.86 | 8.1 | 1 | 0.97 | | | **10.93** | 15.7 | 100 | 48,200 | 46,055 | 242,630 |
| Natural gas | $10^8m^3$ | | | 0.28 | | 0.16 | 18.63 | **19.07** | 15.3 | 100 | 54,300 | 38,931 | 4,031,309 |
| Other petro product | $10^4$t | | | | | | | **0** | 20 | 100 | 75,500 | 41,816 | 0 |
| Other coking product | $10^4$t | | | | | | 0.01 | **0.01** | 25.8 | 100 | 95,700 | 28,435 | 272 |
| Other energy | $10^4$tce | 17.45 | 37.36 | 31.55 | 18.29 | 29.35 | | **134** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | **Sub-total** | 375,028,077 |

Table 4. Electricity generation and supply by the CCPG in year 2006

| Province | Generation (MWh) | On-site use (%) | Supply (MWh) |
|---|---|---|---|
| Jiangxi | 34,449,000 | 6.17 | 32,323,497 |
| Henan | 151,235,000 | 7.06 | 140,557,809 |
| Hubei | 54,841,000 | 2.75 | 53,332,873 |
| Hunan | 46,408,000 | 4.95 | 44,110,804 |
| Chongqing | 23,487,000 | 8.45 | 21,502,349 |
| Sichuan | 44,193,000 | 4.51 | 42,199,896 |
| **total** | | | 334,027,226 |

Table 5. Fuel consumed by the CCPG in year 2007

| Fuel type | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Sub-total | Emission Factor (tc/TJ) | Oxid. Factor (%) | Emission Factor ($kgCO_2/TJ$) | LCV (MJ/t,m3) | $CO_2$ emission ($tCO_2e$) L=G×J×K/100000 (for mass) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G=A+B+C+D+E+F | H | I | J | K | L=G×J×K/10000 (for volume) |
| Raw coal | $10^4$t | 2200.57 | 9357 | 3479.81 | 2683.81 | 1547.7 | 3239 | **22507.89** | 25.8 | 100 | 87,300 | 20,908 | 410,829,404 |
| Cleaned coal | $10^4$t | | 3.07 | | | 3.8 | | **6.87** | 25.8 | 100 | 87,300 | 26,344 | 157,998 |
| Other washed coal | $10^4$t | 0.04 | 87.16 | | 2.06 | 96.42 | | **185.68** | 25.8 | 100 | 87,300 | 8,363 | 1,355,631 |
| Coal briquettes | $10^4$t | | | | | | 0.01 | **0.01** | 26.6 | 100 | 87,300 | 20,908 | 183 |
| Coke | $10^4$t | | | | | | | **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 | $10^4$t | | 0.43 | | | | | **0.43** | 20 | 100 | 71,100 | 41,816 | 12,784 |
| Gasoline | $10^4$t | | | | 0.04 | 0.01 | | **0.05** | 18.9 | 100 | 67,500 | 43,070 | 1,454 |
| Diesel oil | $10^4$t | 0.98 | 3.21 | 2.51 | 2.83 | 1.93 | | **11.46** | 20.2 | 100 | 72,600 | 42,652 | 354,863 |
| Fuel oil | $10^4$t | 0.42 | 1.25 | 1.33 | 0.63 | 0.64 | 1.74 | **6.01** | 21.1 | 100 | 75,500 | 41,816 | 189,742 |
| LPG | $10^4$t | | | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | $10^4$t | 1.43 | 10.01 | 0.97 | 0.7 | | | **13.11** | 15.7 | 100 | 48,200 | 46,055 | 291,022 |
| Natural gas | $10^8m^3$ | | 0.12 | 0.18 | | 0.2 | 1.87 | **2.37** | 15.3 | 100 | 54,300 | 38,931 | 501,007 |
| Other petro product | $10^4$t | | | | | | | **0** | 20 | 100 | 75,500 | 41,816 | 0 |
| Other coking product | $10^4$t | | | | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other energy | $10^4$tce | 23.43 | 63.65 | 35.95 | 29.46 | 23.21 | | **175.7** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | **Sub-total** | 415,974,066 |

Table 6. Electricity generation and supply by the CCPG in year 2007

| Province | Generation (MWh) | On-site use (%) | Supply (MWh) |
|---|---|---|---|
| Jiangxi | 42,100,000 | 7.72 | 38,849,880 |
| Henan | 177,300,000 | 7.55 | 163,913,850 |
| Hubei | 60,900,000 | 6.69 | 56,825,790 |
| Hunan | 54,200,000 | 7.18 | 50,308,440 |
| Chongqing | 28,800,000 | 9.2 | 26,150,400 |
| Sichuan | 45,100,000 | 8.68 | 41,185,320 |
| **total** | | | 377,233,680 |

Table 7. Net electricity imported from Northwest of China Power Grid (NWCPG) in year 2006 and 2007

| | 2006 | 2007 |
|---|---|---|
| Net electricity imported from NWCPG (MWh) | 3,028,950 | 3,005,400 |
| Average Emission Factor of NWCPG | 0.99148 | 1.01129 |

Therefore, OM emission factor of the CCPG is the weighted average value of 2005~2007.

$$EF_{OM} = \Sigma F_{i,m,y} * COEF_{i,m} / \Sigma GEN$$

$$= (332,420,496+375,028,077+3,028,950*0.99148+415,9746,066+3,005,400*1.01129) / (286,203,305+334,027,226+377,233,680+3,028,950+3,005,400)$$

$$= 1.1255\ tCO_2e/MWh$$

**II. Build Margin**

According to the recent research[35] undertaken by National Development and Reform Commission ("NDRC", Chinese DNA), the generating systems with a capacity of over 600MW shares of 54% of total installed capacity and represents the most advanced technology commercially used in domestic coal-fired plants. The weighted value based on the coal consumption by 30 sets of 600MW generating units installed in 2007 is calculated as 322.5 gce/kWh, which also means the power supply efficiency of these plants is weighted as 38.10%.
The combined cycle technology with a capacity of 200MW stands for the most advanced technology used in thermal plants fired by gas or oil in China. Based on the statistics in 2007, the thermal plant with the maximum power supply efficiency 49.99% consumed the equivalent fuel of 246 gce/kWh.

Table 8. Emission factor of most advanced technology commercially used in China's domestic thermal power plants

| | Parameters | Power supply efficiency | EF of fuel ($kgCO_2/TJ$) | Oxidation | Emission Factor ($tCO_2e/MWh$) |
|---|---|---|---|---|---|
| | | A | B | C | D=3.6/A/1,000,000*B*C |
| Coal fire plant | $EF_{Coal,Adv}$ | 38.10% | 87.300 | 1 | **0.8249** |
| Gas fire plant | $EF_{Gas,Adv}$ | 49.99% | 75.500 | 1 | **0.5437** |
| Oil fire plant | $EF_{Oil,Adv}$ | 49.99% | 54.300 | 1 | **0.3910** |

[35] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Table 9. Fuel consumption and emission on the CCPG in 2007

| Fuel type | | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Sub-total | LCV（MJ/t,m3） | Emission Factor (kgCO2/TJ) | Oxid. Factor（%） | CO2 emission（tCO2e） |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Unit | A | B | C | D | E | F | G=A+…+F | H | I | J | K=G×H×I×J/100,000 |
| Raw coal | $10^4$t | 2,200.57 | 9,357 | 3,479.81 | 2,683.81 | 1,547.7 | 3,239 | 22,507.89 | 20,908 | 87,300 | 1 | 410,829,404 |
| Cleaned coal | $10^4$t | 0 | 3.07 | 0 | 0 | 3.8 | 0 | 6.87 | 26,344 | 87,300 | 1 | 157,998 |
| Other washed coal | $10^4$t | 0.04 | 87.16 | 0 | 2.06 | 96.42 | 0 | 185.68 | 8,363 | 87,300 | 1 | 1,355,631 |
| Coal briquettes | $10^4$t | 0 | 0 | 0 | 0 | 0 | 0.01 | 0.01 | 20,908 | 87,300 | 1 | 183 |
| Coke | $10^4$t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28,435 | 95,700 | 1 | 0 |
| Other coking product | $10^4$t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28,435 | 95,700 | 1 | 0 |
| **Sub-total** | | | | | | | | | | | | **412,343,216** |
| Crude oil | $10^4$t | 0 | 0.43 | 0 | 0 | 0 | 0 | 0.43 | 41,816 | 71,100 | 1 | 12,784 |
| Gasoline | $10^4$t | 0 | 0 | 0 | 0.04 | 0.01 | 0 | 0.05 | 43,070 | 67,500 | 1 | 1,454 |
| Diesel oil | $10^4$t | 0.98 | 3.21 | 2.51 | 2.83 | 1.93 | 0 | 11.46 | 42,652 | 72,600 | 1 | 354,863 |
| Fuel oil | $10^4$t | 0.42 | 1.25 | 1.33 | 0.63 | 0.64 | 1.74 | 6.01 | 41,816 | 75,500 | 1 | 189,742 |
| Other petro product | $10^4$t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41,816 | 75,500 | 1 | 0 |
| **Sub-total** | | | | | | | | | | | | **558,843** |
| Natural gas | $10^7m^3$ | 0 | 1.2 | 1.8 | 0 | 2 | 18.7 | 23.7 | 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 | 1,036.3 | 5,227 | 37,300 | 1 | 2,020,444 |
| LPG | $10^4$t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50,179 | 61,600 | 1 | 0 |
| Refinery gas | $10^4$t | 1.43 | 10.01 | 0.97 | 0.7 | 0 | 0 | 13.11 | 46,055 | 48,200 | 1 | 291,022 |
| **Sub-total** | | | | | | | | | | | | **3,072,007** |
| **Total** | | | | | | | | | | | | **415,974,066** |

$$\lambda_{coal} = \frac{\sum_{i \in COAL, j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \qquad \lambda_{oil} = \frac{\sum_{i \in OIL, j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \qquad \lambda_{gas} = \frac{\sum_{i \in GAS, j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}}$$

$\lambda_{coal} =$ 412,343,216 / 415,974,066= 0.9913

$\lambda_{oil} =$ 558,843 / 415,974,066 = 0.0013

$\lambda_{gas} =$ 3,072,007 / 415,974,066 = 0.0074

**$EF_{thermal} = \lambda_{coal} * EF_{coal,Adv} + \lambda_{oil} * EF_{oil,Adv} + \lambda_{gas} * EF_{gas,Adv}$**
**= 0.8249*0.9913 + 0.0013*0.5437 + 0.0074*0.3910**
**= 0.8213 ($tCO_2e$/MWh)**

**Capacity addition during the 2005~ 2007 on the CCPG**

Table 10. Generation capacity of the CCPG installed in year 2005

| Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal | MW | 5,906 | 26,267.8 | 9,526.3 | 7,211.6 | 3,759.5 | 7,496 | 60,167.2 |
| Hydro | MW | 3,019 | 2,539.9 | 17,888.9 | 7,905.1 | 1,892.7 | 14,959.6 | 48,205.2 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind and other | MW | 0 | 0 | 0 | 0 | 24 | 0 | 24 |
| Total | MW | 8,925 | 28,807.7 | 27,415.2 | 15,116.7 | 5,676.2 | 22,455.6 | 108,396.4 |

Table 11. Generation capacity of the CCPG installed in year 2006

| 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 other | MW | 0 | 0 | 0 | 17 | 24 | 0 | 41 |
| Total | MW | 9,856 | 35,156 | 29,943 | 19,380 | 7,597 | 27,285 | 129,217 |

Table 12. Generation capacity of the CCPG installed in year 2007

| 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 other | MW | 0 | 0 | 10 | 17 | 24 | 0 | 51 |
| Total | MW | 12,840 | 41,280 | 37,070 | 22,597 | 8,634 | 31,860 | 154,281 |

Therefore, the Build Margin of the CCPG is calculated as the table below:

Table 13. Capacity addition of the CCPG during 2005~2007

| | 2005 | 2006 | 2007 | Capacity addition 2005-2007 | Share in the capacity addition |
|---|---|---|---|---|---|
| | A | B | C | D=C-A | |
| Thermal | 60,167.2 | 76,658 | 92,580 | 32,412.8 | 70.64% |
| Hydro | 48,205.2 | 52,518 | 61,650 | 13,444.8 | 29.30% |
| Nuclear | 0 | 0 | 0 | 0 | 0.00% |
| Wind | 24 | 41 | 51 | 27 | 0.06% |
| Total | **108,396.4** | **129,217** | **154,281** | **458,84.6** | **100.00%** |
| Share in the capacity of 2007 | 70.26% | 83.75% | 100% | | |

**$EF_{BM}$ = 0.8213 * 70.64% = 0.5802 $tCO_2e$/MWh**

Taking the default value of weights $w_{OM}$ and $w_{BM}$, 50% respectively, the emission factor of the CCPG is calculated as follows:

EFy = 1.1255* 50% + 0.5802 * 50% = 0.85285 tCO2e/MWh

**The low-cost/must run resources ratios for 2003~2007.**

Table 14 Electricity generation of the CCPG in year 2003

| Province | Total | Hydro | Thermal | Nuclear | Wind | other |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Henan | 1009.75 | 54.57 | 955.18 | 0 | 0 | 0 |
| Hubei | 783.07 | 387.75 | 395.32 | 0 | 0 | 0 |
| Hunan | 539.02 | 244.01 | 295.01 | 0 | 0 | 0 |
| Jiangxi | 310.29 | 38.64 | 271.65 | 0 | 0 | 0 |
| Sichuan | 827.82 | 500 | 327.82 | 0 | 0 | 0 |
| Chongqing | 202.92 | 39.51 | 163.41 | 0 | 0 | 0 |
| Electricity generation of the CCPG in year 2003（$10^8$kWh） | 3672.87 | 1264.48 | 2408.39 | 0 | 0 | 0 |
| The low-cost/must run resources ratio in year 2003 (%) | (B+D+E+F)/A | 34.4% | | | | |

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Table 15 Electricity generation of the CCPG in year 2004

| Province | Total | Hydro | Thermal | Nuclear | Wind | other |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Henan | 1162.36 | 68.84 | 1093.52 | 0 | 0 | 0 |
| Hubei | 1125.46 | 695.12 | 430.34 | 0 | 0 | 0 |
| Hunan | 614.22 | 242.36 | 371.86 | 0 | 0 | 0 |
| Jiangxi | 340.17 | 38.9 | 301.27 | 0 | 0 | 0 |
| Sichuan | 935.29 | 589.02 | 346.27 | 0 | 0 | 0 |
| Chongqing | 229.15 | 56.7 | 165.2 | 0 | 0 | 7.25 |
| Electricity generation of the CCPG in year 2004（$10^8$kWh） | 4406.65 | 1690.94 | 2708.46 | 0 | 0 | 7.25 |
| The low-cost/must run resources ratio in year 2004 (%) | (B+D+E+F)/A | 38.5% | | | | |

China Electric Power Yearbook 2005

Table 16 Electricity generation of the CCPG in year 2005

| Province | Total | Hydro | Thermal | Nuclear | Wind | other |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Henan | 1381.84 | 70.54 | 1311.30 | 0 | 0 | 0 |
| Hubei | 1289.8 | 813.65 | 476.15 | 0 | 0 | 0 |
| Hunan | 646.64 | 243.56 | 403.08 | 0 | 0 | 0 |
| Jiangxi | 373.49 | 67.88 | 305.61 | 0 | 0 | 0 |
| Sichuan | 1018.76 | 653.34 | 365.42 | 0 | 0 | 0 |
| Chongqing | 253.77 | 66.51 | 186.69 | 0 | 0 | 0.57 |
| Electricity generation of the CCPG in year 2005（$10^8$kWh） | 4964.30 | 1915.48 | 3048.25 | 0 | 0 | 0.57 |
| The low-cost/must run resources ratio in year 2005 (%) | (B+D+E+F)/A | 38.6% | | | | |

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Table 17 Electricity generation of the CCPG in year 2006

| Province | Total | Hydro | Thermal | Nuclear | Wind | other |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Henan | 1572.53 | 70.27 | 1502.26 | 0 | 0 | 0 |
| Hubei | 1312.99 | 750.50 | 562.47 | 0 | 0 | 0 |
| Hunan | 748.31 | 276.40 | 471.82 | 0 | 0 | 0 |
| Jiangxi | 435.77 | 88.32 | 347.46 | 0 | 0 | 0 |
| Sichuan | 1120.38 | 684.45 | 435.93 | 0 | 0 | 0 |
| Chongqing | 288.62 | 53.00 | 234.60 | 0 | 0 | 1.02 |
| Electricity generation of the CCPG in year 2006（$10^8$kWh） | 5478.59 | 1922.96 | 3554.53 | 0 | 0 | 1.02 |
| The low-cost/must run resources ratio in year 2006 (%) | (B+D+E+F)/A | 35.1% | | | | |

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Table 18 Electricity generation of the CCPG in year 2007

| Province | Total | Hydro | Thermal | Nuclear | Wind | other |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F |
| Henan | 1854.83 | 86.00 | 1768.83 | 0 | 0 | 0 |
| Hubei | 1541.33 | 932.81 | 608.48 | 0 | 0.04 | 0 |
| Hunan | 839.73 | 297.21 | 541.41 | 0 | 0 | 1.11 |
| Jiangxi | 494.25 | 73.23 | 421.02 | 0 | 0 | 0 |
| Sichuan | 1226.31 | 775.39 | 450.92 | 0 | 0 | 0 |
| Chongqing | 368.20 | 75.72 | 291.38 | 0 | 1.10 | 0 |
| Electricity generation of the CCPG in year 2006（$10^8$kWh） | 6324.65 | 2240.36 | 4082.04 | 0 | 1.14 | 1.11 |
| The low-cost/must run resources ratio in year 2006 (%) | (B+D+E+F)/A | 35.5% | | | | |

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Project IRR with and without CER

Table 19. Project IRR with CER

| No. | Items \ Year | Total | Construction period | | | | Operation period | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | Cash inflow | 284935 | 0 | 0 | 0 | 0 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 9262 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 10838 |
| 1.1 | Electricity revenue | 223418 | | | | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 |
| 1.2 | CER revenue | 38106 | | | | 0 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 1815 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.3 | Recovered fixed assets | 3345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3345 |
| 1.4 | Recovered circulation fund | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 66 |
| 2 | Cash outflow | 139694 | 11279 | 25288 | 23028 | 7370 | 1412 | 1412 | 1596 | 1627 | 1658 | 1966 | 2029 | 2091 | 2157 | 2238 | 2300 | 2390 | 2484 | 2558 | 2558 | 2558 | 2558 | 2558 | 2558 | 2558 | 1834 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 |
| 2.1 | Fixed assets | 66899 | 11279 | 25288 | 23028 | 7304 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Circulating fund | 66 | | | | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | O&M costs | 38794 | | | | 0 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 |
| 2.4 | VAT and other tax | 3038 | | | | 0 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| 2.5 | Payable account tax | 30890 | | | | 0 | 0 | 0 | 184 | 215 | 246 | 555 | 617 | 678 | 745 | 824 | 915 | 1006 | 1098 | 1174 | 1174 | 1174 | 1174 | 1174 | 1174 | 1174 | 1968 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 |
| 3 | Net cash flow(1-2) | 125241 | -11279 | -25288 | -23028 | -7370 | 7850 | 7850 | 7666 | 7635 | 7604 | 7295 | 7233 | 7171 | 7105 | 7026 | 6962 | 6872 | 6778 | 6702 | 6702 | 6702 | 6702 | 6702 | 6702 | 6702 | 5908 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 7938 |
| 4 | Accumulated net cash flow | 103879 | -11279 | -36567 | -59595 | -66965 | -59115 | -51265 | -43599 | -35964 | -28361 | -21065 | -13832 | -6661 | 444 | 7470 | 14432 | 21304 | 28082 | 34784 | 41485 | 48189 | 54892 | 61594 | 68296 | 74999 | 80907 | 85454 | 90001 | 94548 | 99095 | 103642 | 108189 | 112736 | 117283 | 125241 |
| | IRR | 8.34% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 20. Project IRR without CER

| No. | Items \ Year | Total | Construction period | | | | Operation period | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | Cash inflow | 226829 | 0 | 0 | 0 | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 10838 |
| 1.1 | Electricity revenue | 223418 | | | | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 |
| 1.2 | CER revenue | 0 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.3 | Recovered fixed assets | 3345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3345 |
| 1.4 | Recovered circulation fund | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 66 |
| 2 | Cash outflow | 131965 | 11279 | 25288 | 23028 | 7370 | 1412 | 1412 | 1412 | 1412 | 1412 | 1412 | 1412 | 1473 | 1703 | 1782 | 1847 | 1956 | 2030 | 2106 | 2106 | 2106 | 2106 | 2106 | 2106 | 2106 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 | 2900 |
| 2.1 | Fixed assets | 66899 | 11279 | 25288 | 23028 | 7304 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Circulating fund | 66 | | | | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | O&M costs | 38794 | | | | 0 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 |
| 2.4 | VAT and other tax | 3038 | | | | 0 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| 2.5 | Payable account tax | 27564 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 61 | 291 | 370 | 461 | 550 | 645 | 720 | 720 | 720 | 720 | 720 | 720 | 720 | 1315 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 |
| 3 | Net cash flow (1-2) | 95467 | -11279 | -25288 | -23028 | -7370 | 6035 | 6035 | 6035 | 6035 | 6035 | 6035 | 5974 | 5744 | 5665 | 5601 | 5511 | 5417 | 5341 | 5341 | 5341 | 5341 | 5341 | 5341 | 5341 | 5341 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 4547 | 7938 |
| 4 | Accumulated net cash flow | 411272 | -11279 | -36567 | -59595 | -66965 | -60930 | -54895 | -48859 | -42824 | -36788 | -30753 | -24779 | -19034 | -13369 | -7768 | -2257 | 3160 | 8501 | 13842 | 19183 | 24524 | 29865 | 35206 | 40547 | 45888 | 50435 | 54982 | 59529 | 64076 | 68623 | 73170 | 77717 | 82264 | 86811 | 95467 |
| | IRR | 6.41% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Sensitivity analysis

Table 21. Investment -10%

| No. | Items \ Year | Total | Construction period | | | | Operation period | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | Cash inflow | 226494 | 0 | 0 | 0 | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 10328 |
| 1.1 | Electricity revenue | 223418 | | | | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 |
| 1.2 | CER revenue | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.3 | Recovered fixed assets | 3010 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3010 |
| 1.4 | Recovered circulation fund | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 66 |
| 2 | Cash outflow | 124757 | 10133 | 22759 | 20725 | 6640 | 1328 | 1328 | 1328 | 1351 | 1405 | 1549 | 1618 | 1691 | 1768 | 1850 | 1917 | 2009 | 2107 | 2123 | 2123 | 2123 | 2123 | 2123 | 2123 | 2123 | 2838 | 2838 | 2838 | 2838 | 2838 | 2838 | 2838 | 2838 | 2838 |
| 2.1 | Fixed assets | 60210 | 10133 | 22759 | 20725 | 6574 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Circulating fund | 66 | | | | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | O&M costs | 36785 | | | | 0 | 1227 | 1227 | 1227 | 1227 | 1227 | 1227 | 1227 | 1227 | 1227 | 1227 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 | 1201 |
| 2.4 | VAT and other tax | 3038 | | | | 0 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| 2.5 | Payable income tax | 25139 | | | | 0 | 0 | 0 | 0 | 22 | 77 | 221 | 290 | 363 | 440 | 522 | 613 | 707 | 805 | 820 | 820 | 820 | 820 | 820 | 820 | 820 | 1535 | 1535 | 1535 | 1535 | 1535 | 1535 | 1535 | 1535 | 1535 | 1535 |
| 3 | Net cash flow (1-2) | 101737 | -10133 | -22759 | -20725 | -6640 | 6119 | 6119 | 6119 | 6097 | 6042 | 5898 | 5829 | 5756 | 5679 | 5597 | 5530 | 5438 | 5341 | 5325 | 5325 | 5325 | 5325 | 5325 | 5325 | 5325 | 4610 | 4610 | 4610 | 4610 | 4610 | 4610 | 4610 | 4610 | 7490 |
| 4 | Accumulated net cash flow | 639557 | -10133 | -32910 | -53636 | -60276 | -54156 | -48037 | -41918 | -35822 | -29780 | -23881 | -18052 | -12296 | -6617 | -1019 | 4511 | 9948 | 15290 | 20614 | 25939 | 31264 | 36588 | 41913 | 47238 | 52563 | 57172 | 61783 | 66393 | 71002 | 75611 | 80221 | 84831 | 89441 | 94050 | 101737 |
| | IRR | 7.33% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 22. O&M Costs -10%

| No. | Items \ Year | Total | Construction period | | | | Operation period | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | Cash inflow | 226829 | 0 | 0 | 0 | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 10658 |
| 1.1 | Electricity revenue | 223418 | | | | 0 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 | 7447 |
| 1.2 | CER revenue | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.3 | Recovered fixed assets | 3345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3345 |
| 1.4 | Recovered circulation fund | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 66 |
| 2 | Cash outflow | 128413 | 11279 | 25288 | 23028 | 7378 | 1273 | 1273 | 1273 | 1275 | 1275 | 1275 | 1330 | 1339 | 1416 | 1499 | 1568 | 1661 | 1959 | 2005 | 2005 | 2005 | 2005 | 2005 | 2005 | 2005 | 2799 | 2799 | 2799 | 2799 | 2799 | 2799 | 2799 | 2799 | 2799 | 2799 |
| 2.1 | Fixed assets | 66899 | 11279 | 25288 | 23028 | 7304 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Circulating fund | 66 | | | | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | O&M costs | 34711 | | | | 0 | 1173 | 1173 | 1173 | 1173 | 1173 | 1173 | 1173 | 1173 | 1173 | 1173 | 1173 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 | 1150 |
| 2.4 | VAT and other tax | 3038 | | | | 0 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| 2.5 | Payable income tax | 23601 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 | 264 | 342 | 424 | 517 | 610 | 708 | 754 | 754 | 754 | 754 | 754 | 754 | 754 | 1548 | 1548 | 1548 | 1548 | 1548 | 1548 | 1548 | 1548 | 1548 | 1548 |
| 3 | Net cash flow (1-2) | 98598 | -11279 | -25288 | -23028 | -7378 | 6173 | 6173 | 6173 | 6173 | 6173 | 6173 | 6097 | 5908 | 5831 | 5749 | 5678 | 5587 | 5488 | 5442 | 5442 | 5442 | 5442 | 5442 | 5442 | 5442 | 4648 | 4648 | 4648 | 4648 | 4648 | 4648 | 4648 | 4648 | 8059 |
| 4 | Accumulated net cash flow | 477245 | -11279 | -36567 | -59595 | -66973 | -60799 | -54626 | -48453 | -42279 | -36105 | -29931 | -23833 | -17924 | -12094 | -6345 | -666 | 4920 | 10409 | 15851 | 21294 | 26736 | 32179 | 37621 | 43063 | 48506 | 53154 | 57802 | 62449 | 67097 | 71745 | 76393 | 81041 | 85689 | 90337 | 98396 |
| | IRR | 6.57% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 23. Electricity sales +10%

| No. | Items \ Year | Total | Construction period | | | | Operation period | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | Cash inflow | 249170 | 0 | 0 | 0 | 0 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 11603 |
| 1.1 | Electricity revenue | 245739 | | | | 0 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 |
| 1.2 | CER revenue | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.3 | Recovered fixed assets | 3345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3345 |
| 1.4 | Recovered circulation fund | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 66 |
| 2 | Cash outflow | 137750 | 11279 | 25288 | 23028 | 7370 | 1424 | 1424 | 1473 | 1508 | 1545 | 1744 | 1824 | 1910 | 2001 | 2097 | 2179 | 2287 | 2301 | 2301 | 2301 | 2301 | 2301 | 2301 | 2301 | 2301 | 3096 | 3096 | 3096 | 3096 | 3096 | 3096 | 3096 | 3096 | 3096 |
| 2.1 | Fixed assets | 66899 | 11279 | 25288 | 23028 | 7304 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Circulating fund | 66 | | | | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | O&M costs | 38863 | | | | 0 | 1313 | 1313 | 1313 | 1313 | 1313 | 1313 | 1313 | 1313 | 1313 | 1313 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 | 1287 |
| 2.4 | VAT and other tax | 3342 | | | | 0 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 |
| 2.5 | Payable income tax | 28379 | | | | 0 | 0 | 0 | 49 | 83 | 120 | 319 | 400 | 486 | 577 | 673 | 781 | 889 | 903 | 903 | 903 | 903 | 903 | 903 | 903 | 903 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 |
| 3 | Net cash flow (1-2) | 111420 | -11279 | -25288 | -23028 | -7370 | 6768 | 6768 | 6719 | 6684 | 6647 | 6448 | 6367 | 6282 | 6191 | 6095 | 6013 | 5905 | 5891 | 5891 | 5891 | 5891 | 5891 | 5891 | 5891 | 5891 | 5096 | 5096 | 5096 | 5096 | 5096 | 5096 | 5096 | 5096 | 8507 |
| 4 | Accumulated net cash flow | 679513 | -11279 | -36567 | -59595 | -66965 | -60197 | -53430 | -46711 | -40027 | -33380 | -26931 | -20564 | -14282 | -8091 | -1996 | 4017 | 9922 | 15813 | 21703 | 27594 | 33484 | 39375 | 45266 | 51156 | 57047 | 62143 | 67239 | 72336 | 77432 | 82528 | 87624 | 92721 | 97817 | 102913 | 111420 |
| | IRR | 7.23% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 24. Electricity Tariff +10%

| No. | Items \ Year | Total | Construction period | | | | Operation period | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | Cash inflow | 249170 | 0 | 0 | 0 | 0 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 11603 |
| 1.1 | Electricity revenue | 245739 | | | | 0 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 | 8192 |
| 1.2 | CER revenue | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.3 | Recovered fixed assets | 3345 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3345 |
| 1.4 | Recovered circulation fund | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 66 |
| 2 | Cash outflow | 137699 | 11279 | 25288 | 23028 | 7370 | 1422 | 1422 | 1471 | 1506 | 1543 | 1742 | 1823 | 1909 | 2000 | 2096 | 2178 | 2286 | 2300 | 2300 | 2300 | 2300 | 2300 | 2300 | 2300 | 2300 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 | 3094 |
| 2.1 | Fixed assets | 66899 | 11279 | 25288 | 23028 | 7304 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Circulating fund | 66 | | | | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | O&M costs | 38794 | | | | 0 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1311 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 | 1284 |
| 2.4 | VAT and other tax | 3342 | | | | 0 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 |
| 2.5 | Payable income tax | 28397 | | | | 0 | 0 | 0 | 49 | 84 | 121 | 320 | 401 | 487 | 578 | 674 | 782 | 890 | 904 | 904 | 904 | 904 | 904 | 904 | 904 | 904 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 | 1698 |
| 3 | Net cash flow (1-2) | 111472 | -11279 | -25288 | -23028 | -7370 | 6770 | 6770 | 6721 | 6686 | 6649 | 6450 | 6369 | 6283 | 6192 | 6096 | 6014 | 5906 | 5892 | 5892 | 5892 | 5892 | 5892 | 5892 | 5892 | 5892 | 5098 | 5098 | 5098 | 5098 | 5098 | 5098 | 5098 | 5098 | 8509 |
| 4 | Accumulated net cash flow | 680339 | -11279 | -36567 | -59595 | -66965 | -60195 | -53425 | -46705 | -40019 | -33369 | -26919 | -20550 | -14267 | -8075 | -1978 | 4036 | 9942 | 15834 | 21727 | 27619 | 33511 | 39404 | 45296 | 51189 | 57081 | 62179 | 67277 | 72375 | 77473 | 82571 | 87669 | 92767 | 97865 | 102963 | 111472 |
| | IRR | 7.24% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## Annex 4

## MONITORING INFORMATION

Please refer to B.7 for the monitoring information of the project.

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