**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:

>>

Qingshui River Dahuashui Hydropower Station
Version 02
Date: 05 July 2012

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

>>

The proposed Qingshui River Dahuashui Hydropower Station (hereafter referred to as "the Project") is a 200MW hydropower project developed by Guizhou Wujiang Qingshuihe Hydropower Development Co., Ltd (hereafter referred to as "the Project Owner") and is located in the middle stream of Qingshui River in between Kaiyang County and Fuquan City, Guizhou Province of P.R.China.

The Project is the third level cascade hydropower station of the five planned hydropower stations on the Qingshui River. The purpose of the project is mainly for power generation. Construction of the Project will result in a new reservoir with a surface area of 7.633 $km^2$ at full water level and the power density is calculated as 26.20 $W/m^2$, which is higher than 4$W/m^2$. Two 100MW turbine generator units will be installed at the project site and it is expected to deliver an annual of 770,279.5 MWh net electricity to the Guizhou power grid, part of the South China Power Grid (SCPG).

In the absence of the Project, the electricity delivered by the Project would have been provided by the SCPG, which is predominantly supplied by fossil fuel intensive power plants.

The baseline scenario of the Project is the same as the scenario existing prior to the start of implementation of the project activity.

By displacing electricity from the grid which would otherwise have been generated by the combustion of fossil fuel intensive fuels, the Project is expected to result in annual emissions reductions of 549,517 t $CO_2$e.

The project contributes to the sustainable development of the locality in the following aspects：

a. The project will provide clean electricity to the local community and reduce the consumption of fossil fuel resulting in greenhouse gas (GHG) emission reductions as well as alleviating local power shortages.

b. The project activity will provide temporary employment opportunities during the construction period and permanent jobs during the operational period, which will increase the income of local residents.

c. The project will contribute towards the development of local infrastructure, thus improving the livelihoods of local residents through the payment of taxation to local Government bureaus during the operational phase of the project as well as the construction of new roads which will benefit local residents.

### A.3. Project participants:

>>

| Name of Party involved(*) | Private and/or public | Kindly indicate if |
|---|---|---|

| ((host) indicates a host Party) | entity(ies) project participants (*) (as applicable) | The Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| People's Republic of China (host) | Guizhou Wujiang Qingshuihe Hydropower Development Co., Ltd | No |
| Switzerland | Vitol S.A. | No |
| (*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required. | | |

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

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

>>

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

>>

People's Republic of China

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

>>

Guizhou Province

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

>>

Border of Kaiyang County and Fuquan City

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

>>

The Project is located in the middle stream of Qingshui River in between Kaiyang County and Fuquan City, Guizhou Province of P.R.China. The construction site is approximately 62km to Guiyang City and 45km to Kaiyang County. The geographic coordinates of the central point of the power house are latitude: +26.8618°; longitude: +107.2737°; the geographic coordinates of the dam are latitude: +26.8157, longitude: +107.2631°

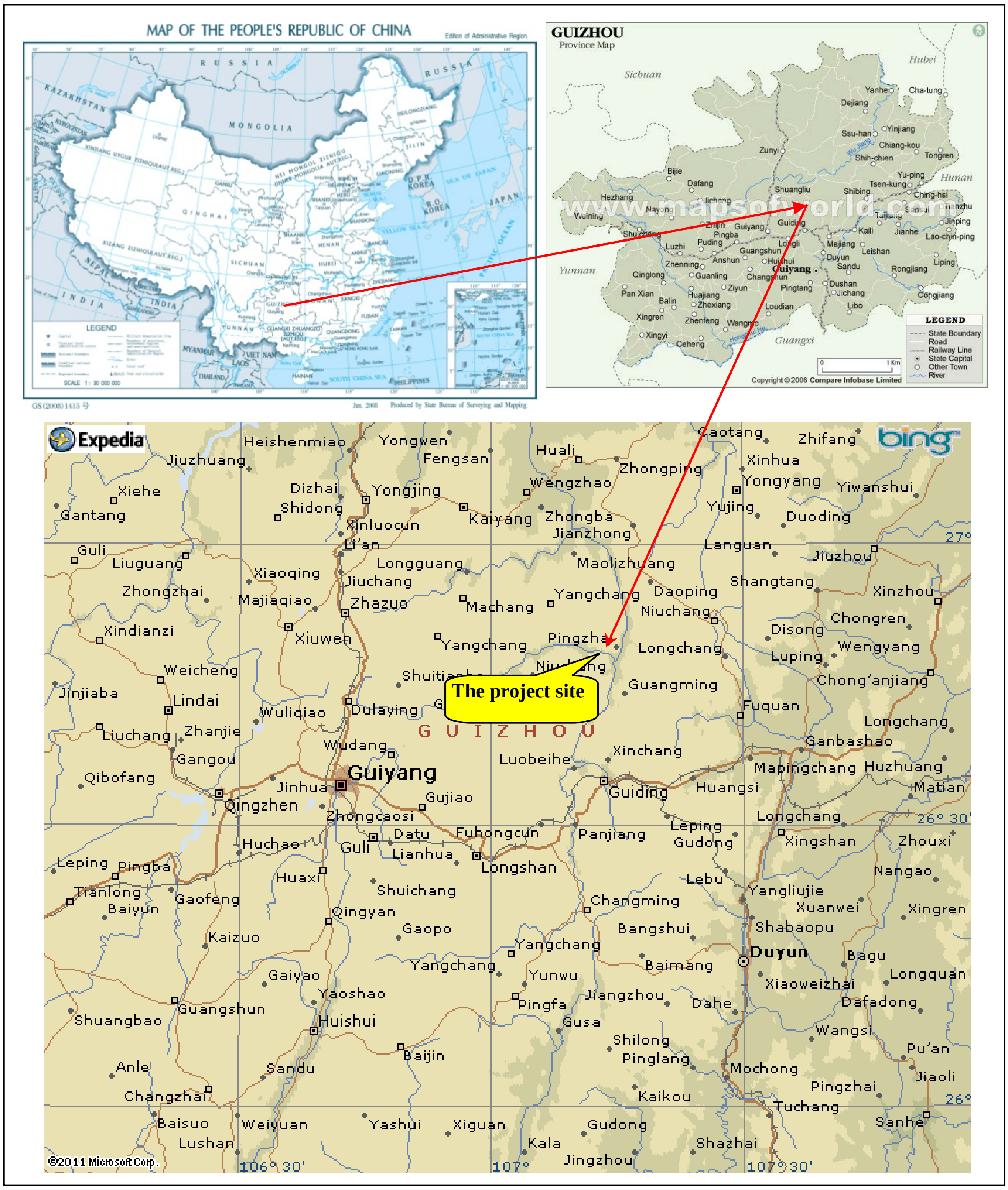


**Fig. A-1** Location of the Qingshui River Dahuashui Hydropower Station Project

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

>>
The project falls into:
Sectoral Scope 1: Energy industries (renewable sources).

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

>>
The scenario prior to the implementation of the project activity is that electricity delivered to the grid is generated by the operation of grid-connected power plants and by the addition of new generation sources. Coal fired power generation is currently the dominant power supply option within the South China Power Grid. Generation data within the Grid are published by Chinese authorities through the Electric Power Yearbook and the Energy Statistic Yearbook yearly.

The Project is newly built hydropower project, which includes the construction of a dam with 134.50m height and 306.12m length, a water inlet tunnel with 5405m length and 7m diameter, a main power plant with a size of 55m*23m*58.3m, etc. The construction results in a new reservoir with a surface area of 7.633 $km^2$ at full water level. The power density of the Project is calculated as 26.20 $W/m^2$. Water from the reservoir would pass through the inlet tunnel and come down to the powerhouse by force of gravity, (due to the height differential of the intake of the diversion tunnel and the exit point of the diversion tunnel) where it will then be utilized to revolve the two sets of hydroelectric turbines located in the Powerhouse. The revolutions of the hydroelectric turbines will in turn drive the generators that are connected to the turbines in the powerhouse thus generating electricity. The annual utilization hours are 3875h and the plant load factor is 44.2%.An annual amount of 770,279.5 MWh net electricity is expected to be delivered via 220kV transmission lines to the 500kV Fuquan Substation, which finally connected into SCPG.

The detailed features of the project are shown in Table A-1 as below:

**TableA-1 Technical parameters of main building and facilities of the project**

| Parameter | | Unit | Value |
|---|---|---|---|
| Turbine | Model | ---- | HL166-LJ-290 |
| | Quantity | unit | 2 |
| | Rated water head | m | 136.2 |
| | Manufacturer | Sichuan Oriental Energy Technology Co., Ltd | |
| Generator | Model | ---- | SF100-22/6000 |
| | Quantity | unit | 2 |
| | Rated Power | MW | 100 |
| | Manufacturer | Sichuan Oriental Energy Technology Co., Ltd | |

*Data Source: Purchase Contract for Turbines and Generators-resigned between Project owner and Sichuan Dongfang Energy Technology Co., Ltd and Tianjin Tianfa Heavy Machinery & Hydro Power Equipment Manufacture Co., Ltd*

It is clearly indicated that both the turbines and the generators are manufactured domestically. Thus, no international technology transfer is involved in the Project. The technology is a state of art technology and their operation would have no negative environmental impacts.

The baseline scenario is the same as the scenario existing prior to the start of the project activity mentioned above, as the project is the construction of a new power plant. In accordance with the applied methodology, the greenhouse gases accounted for are $CO_2$ emissions from electricity generation in fossil fuel fired power plants that is displaced due to the proposed project activity.

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

>>

The Project applies the renewable crediting period and it is expected that 549,517 $tCO_2e$ emission reduction will be generated per year during the first 7-year crediting period from July 2012 to June 2019.

| Year | Annual Estimated Emissions Reductions (tonnes $CO_2$e) |
|---|---|
| 01/09/2012-31/08/2013 | 549,517 |
| 01/09/2013-31/08/2014 | 549,517 |
| 01/09/2014-31/08/2015 | 549,517 |
| 01/09/2015-31/08/2016 | 549,517 |
| 01/09/2016-31/08/2017 | 549,517 |
| 01/09/2017-31/08/2018 | 549,517 |
| 01/09/2018-31/08/2019 | 549,517 |
| Total estimated reductions (t $CO_2$e) | **3,846,619** |
| Total Number of Crediting Years | 7 |
| Annual average of emissions reductions over the crediting period (t $CO_2$e) | 549,517 |

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

>>

No Public funding has been made available for the Project from Annex I parties

## 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:

>>
Approved baseline and monitoring methodology:
*ACM0002: Consolidated methodology for grid-connected electricity generation from renewable resources*
Version 12.3.0
Refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

Tools referenced in this methodology:
*Tool to calculate the emission factor for an electricity system*
Version 2.2.1 (EB 63 Annex 19)
Refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf

*Tool to calculate project or leakage $CO_2$ emission from fossil fuel combustion"*
Version 02 (EB 41 Annex 11)
Refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

*Tool for the demonstration and assessment of additionality*
Version 6.0.0 (EB65 Annex 21) (Valid from 25 November 2011 onwards)
Refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

*Guidelines on Common Practice*
Version 01.1 (EB63 Annex 12)
Refer to:
http://cdm.unfccc.int/Reference/Guidclarif/meth/index_guid.html

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

>>
The Project is a South China Power Grid-connected renewable power generation project activity that meets all the applicable criteria stated in the methodology ACM0002 (Version 12.3.0) as following:

- It is a newly constructed hydro power plant with an accumulation reservoir;
- The project activity results in a new reservoir and the power density of the power plant is 26.20 $W/m^2$, greater than 4 $W/m^2$;
- The project activity doesn't involve switching from fossil fuels to renewable energy at the site of the project activity.
- The project activity is not the biomass fired power plant.

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

>>

The spatial extent of the Project boundary includes the Project power plant and all power plants connected physically to the electricity system that the Project power plant is connected to.

The boundary of the Project includes the dam, power houses, tunnel, reservoir, turbine, generators and auxiliary facilities.

The Project shall be connected to the SCPG via the Guizhou Provincial Power Grid. According to the *Notification on Determining Baseline Emission Factor of China's Grid*[1], Guizhou Provincial Power Grid is an integral part of the South China Power Grid. Therefore, the South China Power Grid is defined as the electricity system boundary of the Project which is composed of Guangdong Power Grid, Guangxi Power Yunnan Power Grid and Guizhou Power Grid.

The project boundary can be demonstrated below:

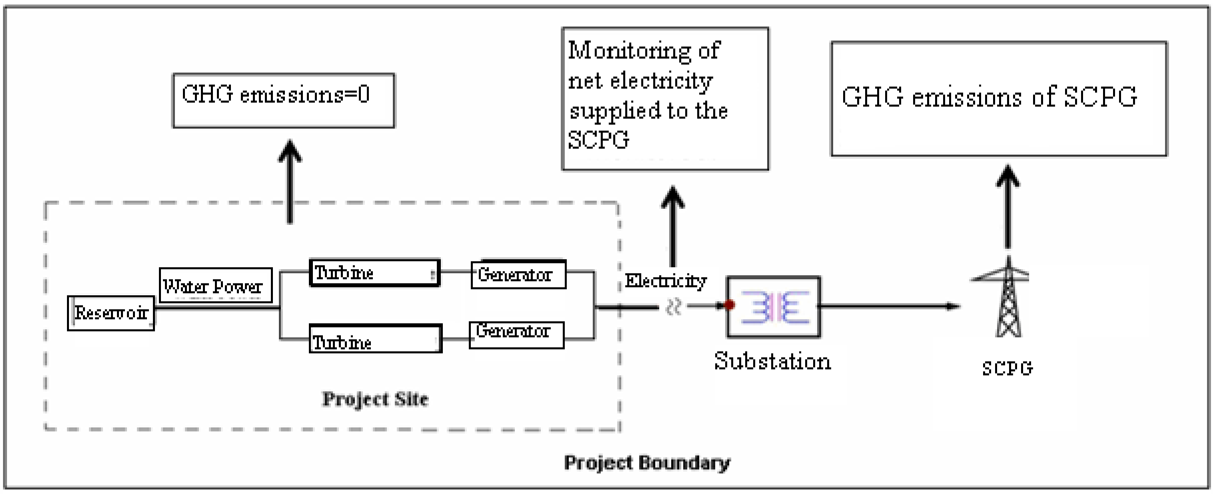


**Fig. B-1 Project Boundary Diagram and Sources of emissions relevant to the Project**

Gases and sources included in the project boundary is list in the Table B-1.

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

| | Source | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Electricity supplied by SCPG | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| Project | Emission from | $CO_2$ | No | Minor emission source |

[1] the *Notification on Determining Baseline Emission Factor of China's Grid* made publicly available on the website of China's DNA (http://cdm.ccchina.gov.cn/) on 20 December., 2010

| | | | | |
|---|---|---|---|---|
| Activity | the reservoir of the project | $CH_4$ | No | The project power density is greater than 10W/m$^2$, $CH_4$ emissions is not considered. |
| | | $N_2O$ | No | Minor emission source |

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

>>

According to the methodology ACM0002 (version 12.3.0), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

The Project is the installation of a new grid-connected renewable power plant that connects to and delivers electricity to South China Power Grid. Therefore, the baseline scenario of the Project can be identified as the following:

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

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

Parameters used to determine the baseline emission are listed in the followed table:

| Variable | Value / Unit | Original Data Source |
|---|---|---|
| Operating Margin Emission Factor | 0.9762t$CO_2$/MWh | Calculated from the China Energy Statistic Yearbooks 2007-2009 and the China Electric Power Yearbooks 2007-2009 |
| Build Margin Emission Factor | 0.4506 t$CO_2$/MWh | Calculated from the China Energy Statistic Yearbook 2008 and the China Electric Power Yearbooks 2007-2009 |
| Combined Margin Emission Factor | 0.7134t$CO_2$/MWh | Calculated from the China Energy Statistic Yearbooks 2006-2008and the China Electric Power Yearbooks 2007-2009 |
| Electricity supplied by the project to the grid in year y | 770,279.5 MWh | Feasible Study Report |

**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):**

>>

According to the “Tool for the demonstration and assessment of additionality” (Version 6.0.0) approved by EB, the additionality of the project is demonstrated and assessed through the following steps.

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

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

The alternatives available to the project activity are as follows:

**Alternative 1**—The project activity undertaken without being registered as CDM project activity;
This scenario complies with China’s laws and regulations at present and does not belongs to project types to be implemented with mandatory requirements.

**Alternative 2**—Construct a fossil fuel-fired power plant with equivalent annual net electricity generation supplied to the grid;

In China, the average annual utilization time of fossil fuel-fired power plants is 4,911h[2] which is larger than that of hydropower plants, so the installed capacity of the fossil fuel-fired plants with equivalent annual electricity supplied to the grid to this project will be smaller than 240MW. However, according to the current laws and regulations in China, the thermal power plant with an installed capacity equal to or less than 300MW is strictly forbidden. Therefore, the Scenario 2 doesn’t comply with current mandatory applicable legislation and regulations in China, and is not feasible.

**Alternative 3**—Construct another renewable sources power plant with equivalent annual net electricity generation supplied to the grid;

This scenario is to construct renewable power plants, which can supply equivalent electricity annually as the project. Other renewable sources energy includes biomass, wind, solar, geothermal and ocean energy. However, those kinds of energy are strongly depended on climate and natural resources, and are still in the investigation phase and can bring only poor economic benefits[3], which can not be operated without support from the national policies[4]. Moreover, the utilization of geothermal and ocean energy are just in the very beginning in China[5], therefore it’s not feasible for the project owner to invest another renewable sources power plant with equivalent annual net electricity generation supplied to the grid. Thus Scenario 3 is not feasible.

**Alternative 4**—Equivalent annual electricity supplied by CSPG.

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[2] China Electricity Council, National Statistics Bulletin of Power Industry in 2009

[3] http://www.in-en.com/power/html/power-1145114599271031.html

[4] http://www.sei.gov.cn/ShowArticle.asp?ArticleID=105482&ArticlePage=3

[5] http://env.people.com.cn/GB/6285168.html

This Scenario complies with national laws and regulations, and doesn't face any barrier, it is feasible.

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

As described in Sub-step 1a, the alternatives 1, 3, 4 are in compliance with all current applicable law and regulations in China. The alternative 2 is not consistent with mandatory laws and regulations.

According to the analysis above, Alternative 1 and Alternative 4 are analyzed in Step 2.

**Step 2. Investment analysis**

The purpose of this step is to determine whether Alternative 1 (the project activity without CDM revenues) is financially less attractive than Alternative 4. The investment analysis is conducted in following steps.

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

According to "Tool for the demonstration and assessment of additionality" (Version 6.0.0), there are three analysis methods for investment analysis, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

Because the project activity will generate economic benefits from the sale of electricity generation other than CDM related income, simple cost analysis method is not applicable; Alternative 4 (equivalent electricity supply by SCPG) isn't a concrete investment project, so investment comparison analysis method isn't applicable, too. Therefore, benchmark analysis method is chosen for the investment analysis.

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

The benchmark Internal Rate of Return (IRR) for total investment for a electric power sector is 8%[6] (not including tax) which is quoted from the statement of Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project. This benchmark IRR is used extensively in China for investment analysis of hydropower projects. According to the *Notice on effective water conservancy technical standard*[7] which is published by Ministry of Water Resources in January 2009, the Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project is still effective now.

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

All the input values come from the approved FSR Adjustment Report completed by an independent organization, obtained grade "A" in water conservancy and electricity industry and engineering investigation, issued by Ministry of Construction of People's Republic of China. Based on the Economic Assessment Method and Parameters for Construction Projects, the fixed parameters should be used in the financial assessment. Therefore, the fixed parameters have been employed. Based on Feasibility Study Report, the main assumptions for the investment analysis are shown in Table B-2.

**Table B-2 Main parameters for investment analysis and evaluation**

[6] State Electrical Power Corp., Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project (China Electrical Power Press, 2003)

[7] http://www.chinawater.net.cn/xiazai/w20090219.pdf

| No. | Main Parameter | Unit | Value | Reference |
|---|---|---|---|---|
| 1 | Installed capacity | MW | 200 | FSR Adjustment Report |
| 2 | Static investment | Million RMB | 1,426.13 | FSR Adjustment Report |
| 3 | Total electricity generation | MWh | 775,000 | FSR Adjustment Report |
| 4 | Net electricity generation | MWh | 770,279.5 | FSR Adjustment Report |
| 5 | Residual rate of fixed assets value | % | 5 | FSR Adjustment Report |
| 6 | Electricity tariff (with VAT) | RMB /KWh | 0.228 | FSR Adjustment Report |
| 7 | Value-added Tax | % | 17 | FSR Adjustment Report |
| 8 | urban maintenance and construction tax | % of VAT | 5 | FSR Adjustment Report |
| 9 | Surtax for education | % of VAT | 3 | FSR Adjustment Report |
| 10 | Income tax | % | 33 | FSR Adjustment Report |
| 11 | Project lifetime | year | 30 | FSR Adjustment Report |
| 12 | O & M costs | Million RMB /Year | 27.6287 | FSR Adjustment Report |

The IRR of the project is shown as Table B-3.

**Table B-3 The project financial indicator without CERs revenue**

| Item | Unit | Without CERs revenue | Benchmark | With CERs revenue |
|---|---|---|---|---|
| IRR | % | 6.22 | 8 | 9.34 |

Without CERs revenue, the project IRR of the project is only 6.22%, which is lower than benchmark IRR. With CERs revenue, the project IRR is 9.34%, which is obviously higher than benchmark IRR. Thus, Alternative 1 is not financially attractive.

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

Four parameters including total investment, electricity tariff, net electricity and annual operation & maintenance costs are selected as sensitive factors to check the financial attractiveness. The result of the sensitivity analysis is shown as follows:

**Table B-4 Sensitivity Analysis (IRR)**

| item | -10% | 0 | 10% |
|---|---|---|---|
| fixed assets investment | 7.02% | 6.22% | 5.57% |
| annual O&M cost | 6.37% | 6.22% | 6.08% |
| electricity output | 5.47% | 6.22% | 6.98% |
| bus-bar tariff | 5.46% | 6.22% | 6.99% |

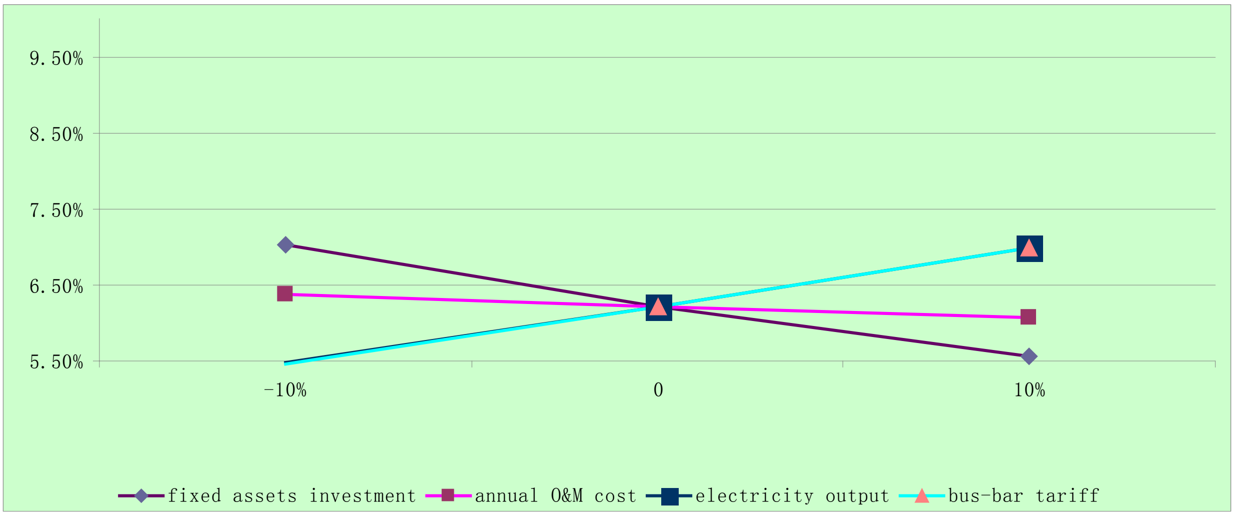


**Fig. B-2 Sensitivity Analysis (IRR)**

The table B-4 shows that IRRs of the project are always lower than the benchmark (8%) within the reasonable variation scope of the total investment, electricity tariff, net electricity and operation & maintenance costs, thus the project activity is unlikely to be financially attractive.

**Table B-5 Critical Value Analysis**

| Sensitivity analysis Factor | Critical point of variation to reach benchmark | Practical assessment |
|---|---|---|
| **Fixed assets investment** | -19.8% | When fixed assets investment of project decrease, the IRR of the project goes up.<br><br>The fixed assets investment of project is mainly subject to the industrial products' price. According to the data in "8-14 Producer Price Indices for Manufactured Goods by Category" in *China Statistical Yearbook 2009* published by the National Bureau of Statistics of China in Sep. 2009, the products price increased 24.64% from 2000 to 2008. Thus the products price has an increasing trend and will not decrease.<br><br>Thus, as the recent published statistics, it is unlikely that the fixed assets investment of the project decreases 19.8%. |
| **Annual O&M cost** | / | Even the O&M costs are 0, the project IRR is still lower than the benchmark of 8%. Thus, the O&M costs have little impact on project IRR. |
| **Electricity output** | +23.5% | When the electricity generation increases, the IRR of project goes up.<br><br>The variation of net electricity generation is mainly subject to the water resources of project site, and also is the outcome of the year's rainfall. It is impossible for the electricity generation of the |

| | | |
|---|---|---|
| | | project to increase 23.5%, because the FSR of the project calculated the power output on the basis of the hydrological data for 49 years, it will not change much.<br><br>And thus, the 23.5% increase of project's electricity generation is unlikely to occur. |
| **Electricity Tariff** | +23.3% | When the tariff increases, the IRR of project goes up.<br><br>When the electricity tariff increases 23.3%, the IRR of the project would reaches the benchmark of 8%. But it is impossible.<br><br>According to the power purchasing agreements signed between the project owner and the grid company, the electricity tariff is hardly increased from year 2008 to year 2012. What's more, the tariff of the project is strictly regulated by the government, dramatic increasing is impossible. Thus, the 23.3% increase of electricity tariff is unlikely to happen. |

***Step 3. Barrier analysis***

This step is not selected by the PP.

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

According to the Guidance on the common practice (Version 01.1), the common practice analysis is described as following steps:

**Step 4a-1**: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The project activity is a 200MW hydro power project. The applicable output range is selected as +/-50% of the design capacity of the proposed project activity, which is 100~300MW;

**Step 4a-2**: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number $N_{all}$. Registered CDM project activities shall not be included in this step.

Step 4a-2.1 Identify the applicable geographical area
Applicable geographical area should be covered the entire host country. But in China, the investment environment for each region is different. Specifically in terms of available resources, labor costs and electricity tariffs, these can vary significantly in different parts of China, even different province of China. Please see the table below including some typical indicators in different province of China, which shows that there is significant difference among different regions in China. Therefore, it is not appropriate to consider activities in the whole of China and Guizhou Province is selected as the appropriate geographical area for the common practice analysis.

**Table B-6 The typical indicators in different provinces of China**

| Province | Annual Average Salary(RMB)[8] | The tariff for the desulfurization power generation units(RMB/kWh)[9] | Average GDP/person (RMB)[10] |
|---|---|---|---|
| Beijing | 65,683 | 0.3807 | 70,234 |
| Tianjin | 52,963 | 0.3820 | 63,395 |
| Hebei | 32,306 | 0.3864 / 0.3868 [11] | 24,583 |
| Shanxi | 33,544 | 0.3253 | 20,779 |
| Inner Mongolia | 35,507 | 0.2849 / 0.3539 [12] | 37,287 |
| Shandong | 33,729 | 0.3974 | 35,893 |
| Shanghai | 71,874 | 0.4568 | 77,205 |
| Jiangsu | 40,505 | 0.4300 | 43,907 |
| Zhejiang | 41,505 | 0.4570 | 44,895 |
| Anhui | 34,341 | 0.3980 | 16,656 |
| Fujian | 28,666 | 0.4143 | 33,106 |
| Liaoning | 35,057 | 0.3900 | 34,193 |
| Jilin | 29,399 | 0.3757 | 25,906 |
| Heilongjiang | 29,603 | 0.3800 | 21,593 |
| Henan | 30,303 | 0.3912 | 21,073 |
| Hubei | 32,588 | 0.4250 | 22,050 |
| Hunan | 30,483 | 0.4405 | 19,355 |
| Jiangxi | 29,092 | 0.4220 | 15,921 |
| Sichuan | 33,112 | 0.3937 | 17,289 |
| Chongqing | 35,326 | 0.3833 | 20,219 |
| Shaanxi | 34,299 | 0.3420 | 20,497 |
| Gansu | 29,588 | 0.2815 | 12,882 |
| Qinghai | 37,182 | 0.2940 | 18,346 |
| Ningxia | 39,144 | 0.2683 | 19,642 |
| Xinjiang | 32,361 | 0.2500 | 19,119 |
| Guangdong | 40,358 | 0.4962 | 39,978 |
| Guangxi | 31,842 | 0.4357 | 16,576 |
| Yunnan | 30,177 | 0.3223 | 13,687 |

[8] The annual average salary of provinces and whole China in 2010 Available at: 110 law consultant net issued on May 26, 2011. http://www.110.com/ziliao/article-219727.html
[9] The tariff for the desulfurization power generation units in provinces of China available at http://wenku.baidu.com/view/645ec0d4195f312b3169a541.html
[10] The ranking of the provincial GDP in China Available at : http://zhidao.baidu.com/question/225894808.html
[11] 0.3864 in northern parts and .6868 in southern parts
[12] 0.2849 in western parts and 0.3539 in eastern parts

| | | | |
|---|---|---|---|
| Guizhou | 31,458 | 0.3244 | 9,214 |

Step 4a-2.2 Identify the applicable projects
Since the starting date of the project activity is identified as 08/10/2005, the projects started before 08/10/2005 shall be identified. On the basis of the statistic on China Electric Power Yearbook 2006,which included all the power plants started commercial operation before the end of 2005, the electricity generation in Guizhou province are all from fuel fired power plants and hydropower plants.

Thus, $N_{all} = N_{\text{all fuel fired power plants from 100MW to 300MW}} + N_{\text{all hydro plants in Guizhou Pronvice}}$

As per the "*China Water Resource Yearbook 2005-2006*", there is only one hydropower projects from 100MW to 300MW which started commercial operation in Guizhou Province till year 2006.

**Table B-7 Hydropower projects of 100~300MW in Guizhou Province listed in the China Water Resources**

| No. | Project name | Installed capacity (MW) |
|---|---|---|
| 1. | Yuguixiangshui Hydropower Station | 100 |

Thus, $N_{all}=N_{\text{all fuel fired power plants from 100MW to 300MW}}+N_{\text{all hydro plants in Guizhou Pronvice}}=N\ N_{\text{all fuel fired power plants from 100MW to 300MW}}+1$.

**Step 4a-3**, within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number $N_{diff}$.

Step 4a-3.1 Identify $N_{diff}$ via Energy source/fuel
$N_{\text{all fuel fired power plants from 100MW to 300MW}}$ identified above utilized fossil fuel as fuel and has the different energy source with the project which utilizes hydro power. Therefore, $N_{diff}$ is identified as fuel fired power plants with capacity of 100MW to 300MW in Guizhou Province.

Step 4a-3.2 Identify $N_{diff}$ via Energy source/fuel
$N_{all}$ identified above is not using feed stock, but hydro power. No $N_{diff}$ is identified in this step.

Step 4a-3.3 Identify $N_{diff}$ via size of installation
As per Article 4 (iii) of the Guidelines on Common Practice, the project activity falls into the range of large size and the projects with a capacity higher than 15MW are in the categories of large. No $N_{diff}$ is identified in this step.

Step 4a-3.4 Identify $N_{diff}$ via Investment climate in the date of the investment decision
1. On February 10, 2002, the State Council of Peoples' Republic of China issued the *Notice on Issuing Electric Power Sector Reform Programme* (Guofa [2002] No 5)[13]. According to the notice, China began undertaking significant reform in electric power sector, including breaking up monopoly, introducing competition, increasing efficiency and decreasing costs in power system. In order to realize these objectives, the China State Power Corporation, which monopolized in electric power industry, was divided into two business section of electricity generation and power grid. The electricity generation was

[13] http://www.energylaw.org.cn/html/news/2008/6/21/2008621151204878.html

reorganized into five independent electricity generation companies (Huaneng, Guodian, Datang, Huadian, and China Power Investment). And the power grid was reorganized into State Grid Company and South China Grid Company. Before the reform, all the hydropower projects were constructed and operated by the national or provincial electric power companies, and the government provided loan guarantee for those companies. Therefore, the projects which started its operation before February 2002 had the essential difference and were excluded from the similar projects. Yuguixiangshui Hydropower Station[14][15] which started construction in year 1993 have different investment climate from the proposed project at the time of investment decision.

Furthermore, information in the websites shows that the unit cost of Yuguixiangshui Hydropower Station is 4539RMB/kW. It is calculated that the unit cost of the project activity (i.e.7131 RMB/kW) is more than 57% higher than the Yuguixiangshui Hydropower Station. It shows that the unit cost of the project has more than 20% difference with the identified projects.

Thus $N_{diff}=1+N_{\text{all fuel fired power plants from 100MW to 300MW}}$.

**Step 4a-4**: Calculate factor $F=1-Nd_{iff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

$F= 1-N_{diff}/N_{all} =1-(1+N_{\text{all fuel fired power plants from 100MW to 300MW}})/(1+N_{\text{all fuel fired power plants from 100MW to 300MW}})=0$ & $N_{all}-N_{diff}=0$

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

Since the factor F is less than 0.2 and $N_{all}-N_{diff}$ is less than 3, it is concluded that the proposed project activity is a not common practice within the electricity generation sector in the applicable geographical area.

**C DM Consideration**

The implementation timeline of the proposed CDM project activity is shown as follow:

**Table B-8 Awareness of the CDM prior to the project activity start date**

| Events | Project Implementation Timeline | CDM Status Timeline |
|---|---|---|
| The Feasibility Study Report (FSR) was finished, of which the installed capacity was determined as 180MW (2*90MW) and the IRR is calculated as 8.01%. | 03/2004 | |
| Positive expert evaluation opinion was made | 04/2004 | |
| The Environmental Impact Assessment Report was finished. | 10/2004 | |
| The dam construction contract was signed in September | 09/2004 | |

[14] http://news.hexun.com/2007-12-28/102541114.html

[15] http://www.sei.gov.cn/ShowArticle2008.asp?ArticleID=114050

| | | |
|---|---|---|
| 2004 as a result of the positive expert evaluation opinion. | | |
| The purchasing contract for the 180MW (2*90MW) turbine generators has been signed. | 09/2004 | |
| The 180MW EIA was approved. | 25/10/2004 | |
| The 180MW FSR was approved. | 08/11/2004 | |
| The 180MW project was approved | 19/11/2004 | |
| The 180MW project was paused, due to the geographical conditions found under the left site of the gravity abutmento and the sections of the water inlet tunnel in succession. Supervision Report on the geographical situation was issued and the construction was paused at the site. | 12/2004 | |
| As a uncertainty of the analysis result, the project owner signed agreement on the "Agreement on Pause of The purchasing contract for the 180MW (2*90MW) turbine generators" | 22/12/2004 | |
| As a uncertainty of the analysis result, the project owner signed agreement on the "Agreement on Pause Contract of The dam construction contract" | 24/12/2004 | |
| Adjusted FSR has to be compiled as a result of the analysis from 12/2004 to 03/2005. As for the reason, the project owner signed cancellation contract of the dam construction contract | 17/02/2005 | |
| Adjusted FSR has to be compiled as a result of the analysis from 12/2004 to 03/2005. As for the reason, the project owner signed cancellation contract of the 180MW (2*90MW) turbine generators. | 21/02/2005 | |
| The preliminary stage adjusted FSR was finished. The preliminary stage adjusted FSR indicated that large amount of stones have to be backfilled and high pressure consolidation grouting has to be taken for the dam site. The preliminary stage adjusted FSR also indicates that extra material and works will be added, such as grouting bolt, the clearer of collapse, cement backfilling, advanced support and argil concrete backfilling, for the tunnel sections. As a result, the investment increased significantly. To increase the economic return, it is necessary to optimize the installed capacity. 200MW is considered and selected. However, even with the upgraded installed capacity, the higher investment leads to an IRR decreasing from 8.01% to 6.04%[16]. | 06/2005 | |
| Meeting was held to discuss the lower IRR in the FSR, during which the project owner agreed with the installation change and request the design institute to further optimize the design, so as to increase the IRR. The board also | 08/06/2005 | |

[16] The IRR in PDD has revised to 6.22% after GSP by assuming the coefficient of the project as 100%, which is meant to present the conservativeness and the change can be found in CL 7 of DOE's report.

| | | |
|---|---|---|
| requests the management team of the company to widen the financing channels to decrease the financing cost. | | |
| Meeting on CDM introduction and decisions on CDM information collection | | 28/08/2005 |
| Project owner's decision on the develop of CDM and the restart of the adjusted 200MW(2*100) project | | 27/09/2005 |
| The Confirmation Letter issued by Environmental Protection Bureau of Guizhou Province on the Notification of Installation Adjustment from 180MW to 200MW of Qingshui River Dahuashui Hydropower Station | 06/10/2005 | |
| Contract of "Restarting the Construction Contract of the Dam" was signed, which is deemed as the starting date of the project activity | 08/10/2005 | |

**Table B-9 Continuing and real actions**

| Events | Project Implementation Timeline | CDM Status Timeline |
|---|---|---|
| The Agreement Letter issued by Development and Reform Commission of Guizhou Provincial on the restart construction of Qingshui River Dahuashui Hydropower Station as 200MW | 09/10/2005 | |
| Contract of "Restarting the purchasing contract of Turbine generators with the installed capacity increases to 2*100MW was signed. | 21/10/2005 | |
| Due to the low progress on CDM and lack of faith in CDM, the first letter from a shareholder informing the Developer that they could not make additional equity contributions | 28/02/2006 | |
| The second letter from a shareholder informing the Developer that they could not make additional equity contributions | 21/04/2006 | |
| The third letter from a shareholder informing the Developer that they could not make additional equity contributions | 30/04/2006 | |
| CDM. LoI was signed with Sindicatum Carbon Capital. | | 06/2006 |
| ERPA signed with Sindicatum Carbon Capital | | 02/11/2006 |
| PDD posted for international stakeholder consultation with TUV SUD as DOE | | 01/02/2007 to 02/03/2007 |
| Host country Letter of Approval issued. | | 01/2008 |
| Commissioning date of the 1st generator of the project | 30/11/2007 | |
| Commissioning date of the 2nd generator of the project | 25/04/2008 | |
| The approval on the change of the installed capacity | 28/10/2008 | |
| The Capacity Adjustment of the project is approved by the EPB. | 28/12/2008 | |
| Sindicatum Carbon Capital republished the revised PDD and posted for international stakeholder consultation | | 03/04/2009 to 02/05/2009 |
| The project owner signed termination letter with Sindicatum Carbon Capital | | 08/11/2010 |
| Considering the very low IRR, the project owner has been seeking for the support of CDM. As an action, the project | | 13/04/2011 |

| | | |
|---|---|---|
| owner signed the CDM development agreement with Libra CDM I&M Co., Ltd | | |
| The project owner signed the ERPA with the new CERs buyer Vitol.S.A. | | 08/06/2011 |
| Since the withdraw letter with Sindicatum Carbon Capital, automatically terminated with TUV SUD. The PDD of the project has to be republished with the newly signed DOE TUV Rheinland for international stakeholder consultation. | | 24/06/2011 to 23/07/2011 |
| DOE site visit | | 27/07/2011 to 28/07/2011 |
| Approval Note on Change of Project name and Project Participants from DNA of China | | 08/12/2011 |

As listed in the above two tables, the project activity started construction initially with 180MW as per FSR without CDM as it complied with an 8.01% IRR, which met the benchmark of 8%. However, due to geographical conditions that happened during the construction stage, the project was stopped within 3 months. The new adjusted FSR was developed to overcome the geographical conditions and 200MW was considered to feasible the project output.

With the adjusted FSR, the additional resource to stabilize the geographical condition reduced the IRR to 6.04%, which is lower than the benchmark. Even by assuming the co-efficiency of the project as 100%, the IRR of the project is 6.22%, far less than the 8% benchmark. The project owner further collected information about CDM that can elevate the risk of project financials. The project was restarted considering CDM revenue. However, the long CDM consultancy process, lowered the confidence of three stakeholders, who issued withdraw letters on financial support. The withdrawn made the project owner fastened CDM development pace and signed the CDM development contract with Sindicatum Carbon Capital. The timeline shows that CDM development was not smooth as assumed. The project owner had to terminate the contract and resigned a consultancy company (Libra CDM I&M Co., Ltd) Even considering the capital costs incurred prior to the restart of the project activity as the recoverable value of the assets as per as per paragraph 7 of the guidelines on the Assessment of Investment Analysis, the IRR is still lower than the benchmark of 8%.

The timeline also shows that the project owner has never given up the seeking of CDM support. Even the project has started operation; financial problem is faced since the CDM decision. The path of CDM registration took a long gap due to improper support from consultants and the initially associated DOE.

From the timeline and corresponding description above, it can be concluded that the continuing and real actions have been taken to secure CDM status for the project in parallel with its implementation. In conclusion, the project activity is additional and would not have been developed or invested by the PP without CDM revenue consideration that only showed the hope of project IRR meeting the benchmark.

## B.6. Emission reductions:

>>

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

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Emission reductions from the proposed project are calculated using the consolidated baseline methodology ACM0002 (version 12.3.0). In conjunction with ACM0002, the Methodological Tool “*Tool to calculate the emission factor for an electricity system*” *Version 2.2.1* shall be followed in order to determine the emission factor of the relevant electricity system in order to determine the baseline emissions of the Project.

**Project Emissions**

According to the methodology, the project emissions shall be accounted for as project emissions by using the following equation:

$PE = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$ (1)

Where:

$PE_y$ =the project emissions in year *y* ($tCO_2e$/yr)

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

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

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

*Fossil Fuel Combustion ($PE_{FF,y}$)*

Diesel generator will be used to produce power only in the case of emergency and only when the grid line and power plant trip/shut down together. Hence the project emission from diesel consumption should be calculated. As per ACM0002 (version 12.3.0), $PE_{FF,y}$ shall be calculated as per the latest version of the "Tool to calculate project or leakage $CO_2$ emission from fossil fuel combustion". As per the latest version (version 2.2.1) of the Tool mentioned above, $CO_2$ emission from fossil fuel combustion are calculated based on the quantity of fuels combusted and $CO_2$ emission coefficient of those fuels, as follows:

$$PE_{FF,y} = FC_{i.,j,y} * COEF_{i.y} \quad (2)$$

Where:

$PE_{FF,y}$ = are the $CO_2$ emission from fossil fuel combustion in process j during the year y ($tCO_2$/yr)

$FC_{i.j,y}$ = the quantity of fuel type I combusted in process j during the year y (mass or volume unit/yr)

$COEF_{i,y}$ = the $CO_2$ emission coefficient of fuel type i in year y

$i$ = the fuel types combusted in process j during the year y

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i.y} \quad (3)$$

$NCV_{i.,y}$ = the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)

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

$i$ = the fuel types combusted in process j during the year y

The diesel motor employed in the project will only consume diesel oil and it has a capacity of 200kw. It is estimated to consume 0.04t diesel oil per hour [17] and run about 60 hours annually. To be very conservative, assuming it will run 24hours in 365days. The weighted average net calorific value of diesel

[17] According to http://www.docin.com/p-60902910.html, the diesel consumption for 250 kW diesel generator is about 52.5kg.

oil is 42.652GJ/ton, and the weighted average CO2 emission factor of diesel oil is 0.0748 tCO2/GJ[18]. Even assuming that the disel motor runs 365 days and 24 hours, the annual $CO_2$ emission from diesel oil combustion can be calculated as follows:

$PE_{FF,y}$ =0.04t/hour* 365*24hours*42.652 GJ/ton *0.0748tCO2/GJ=1,118t$CO_2$.

Considering that the estimated annual project emissions from diesel oil combustion 1,118t$CO_2$ is far less than 1% of the expected average annual emission reduction[19], based on the 77th paragraph of VVM(version 01.2), the annual $CO_2$ emissions from diesel oil combustion is negligible, that is, $PE_{FF,y}$=0.

*Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)*

As the Project is hydropower project activities, no emissions of non-condensable gases from the operation of geothermal power plant should be considered, i.e., the $PE_{GP,y}$ is zero.

*Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)*

According to the baseline methodology ACM0002 (Version 12.3.0), the power density of the project is calculated as follows:

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

Where:

| | | |
|---|---|---|
| $PD$ | = | Power density of the project activity ($W/m^2$) |
| $Cap_{PJ}$ | = | Installed capacity of the hydro power plant after the implementation of the project activity (W) |
| $Cap_{BL}$ | = | Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero |
| $A_{PJ}$ | = | Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full ($m^2$) |
| $A_{BL}$ | = | Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full ($m^2$). For new reservoirs, this value is zero |

As the project will build a new reservoir, $Cap_{BL}$ and $A_{BL}$ are zero.

PD = (200,000,000 W-0) / (7,633,000 $m^2$-0) = 26.20 $W/m^2$

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

**Baseline emissions**

[18] According to page 286 of China Energy Statistical Yearbook 2010, the NCV of diesel oil is 42.652 GJ/ton. According to IPCC 2006 table 2.2, volume 2, chapter 2, the upper value of CO2 emission factor for diesel is 0.0748 t$CO_2$/GJ.

[19] The expected average annual emission reduction is 549,517 t$CO_2$, so the maximum emission from diesel generator is only 0.21% of the baseline emissions.

According to the methodology ACM0002 (Version 12.3.0), baseline emissions are the $CO_2$ emissions from the electricity generation of the existed SCPG. The baseline emissions of the project activity are to be calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \qquad (1)$$

Where:
$BE_y$ is baseline emissions in year y ($tCO_2$/yr).
$EG_{PJ,y}$ is quantity of net electricity generation that is produced and fed into the grid as the result of the implementation of the CDM project activity in year *y* (MWh/yr).
$EF_{grid,CM,y,}$ is combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using "Tool to calculate the emission factor for an electricity system (version 2.2.1)"($tCO_2$/MWh).

According to baseline methodology ACM0002 (Version 12.3.0), for Greenfield renewable energy power plants:

$$EG_{PJ,y} = EG_{facility,y} \qquad (2)$$

Where:
$EG_{PJ,y}$ is 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).
$EG_{facility,y}$ is quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/yr).

$$EG_{facility,y} = EG_{delivery,y} – EG_{import,y} \qquad (3)$$

Where:
$EG_{delivery,y}$ is electricity delivered by the Project to SCPG in year y (MWh/yr).
$EG_{import,y}$ is electricity imported by the Project from SCPG in year y (MWh/yr).
The emission coefficient (measured in kg $CO_2$e/kWh) should be calculated in a transparent and conservative manner as: a combined margin (CM), consisting of the combination of operating margin(OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system (Version 2.2.1)".The data used for calculation are from an official source (where available) and publicly available. The calculation processes are as follows:

STEP 1: Identify the relevant electricity system.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3: Select a method to determine the operating margin (OM).
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Calculate the build margin emission factor.
STEP 6: Calculate the combined margin (CM) emissions factor.

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

The power to be generated from the proposed Project will be delivered to the SCPG. The SCPG as defined by the NDRC has clearly identifiable geographic and system boundaries namely that it covers four provincial grids (Guangdong, Guangxi, Yunnan and Guizhou).

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

According to ‘Tool to calculate the emission factor for an electricity system’ (Version 2.2.1), project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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.

For the proposed project, Option I is chosen due to the unavailability of information of off-grid power plants.

***Step 3: Select a method to determine the Operating Margin (OM)***

According to “Tool to calculate the emission factor for an electricity system (Version 2.2.1)”, there are four methods for calculating the $EF_{grid,OM,y}$:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM

Method (a) can be used if low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages data for hydroelectricity production. It can be found from Table 7 that the low-cost/must run resources including hydro, geothermal, wind, low-cost biomass constitute less than 50% of SCPG during year 2004 to 2008. Thus, method (a) is applicable to calculate $EF_{grid,OM,y}$.

**Table B-2 Percentage of low-cost/must run resources in CSPG during year 2004～2008**[20]

| Year | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Percentage (%) | 31.58 | 30.69 | 29.75 | 29.95 | 40.84 |

For the project, $EF_{grid,OMsimple,y}$ is calculated using ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

***Step 4: Calculate the Operating Margin emission factor according to the selected method***

According to “Tool to calculate the emission factor for an electricity system (Version 2.2.1)”, there are two options based on different data for calculating $EF_{grid,OMsimple,y}$:

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.
For the project, the necessary data for Option A is not available, so Option A can’t be used, Option B can be used if only nuclear and renewable power generation are considered as low-cost/must-run power

[20] China Electric Power Yearbook 2005～2009

sources and the quantity of electricity supplied to the grid by these sources is known and off-grid power plants are not included in the calculation. There isn't any nuclear power in SCPG at present and renewable power generation are considered as low-cost / must-run power sources in SCPG, and the quantity of electricity supplied to SCPG by these sources is known and off-grid power plants are not included in the calculation, so Option B is used for calculating $EF_{grid,OMsimple,y}$, the formula is as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO_{2},i,y})}{EG_y} \quad (4)$$

Where:

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

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

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

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

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

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

y= The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).

The calculation method of $EF_{grid,OMsimple,y}$ issued by National Development and Reform Commission is referred to for the project[21], to see Annex 3 for details.

***<u>Step 5 Calculate the build margin emission factor</u>***

According to 'Tool to calculate the emission factor for an electricity system' (Version 2.2.1), In terms of vintage of data, project participants can choose between one of the following two options: Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

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

Option 1 is chosen to calculate the build margin emission factor.

[21] National Development and Reform Commission, China's Regional Grid Baseline Emission Factors 2010, 20 December 2010.

Build Margin emission factor ($EF_{grid, BM, y}$) is calculated by utilizing an *ex-ante* 3 years data vintage for SCPG, the formulae as follow:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad (5)$$

Where：

| | | |
|---|---|---|
| $EF_{grid,BM,y}$ | = | Build margin $CO_2$ emission factor in year *y* ($tCO_2$/MWh) |
| $EG_{m,y}$ | = | Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh) |
| $EF_{EL,m,y}$ | = | $CO_2$ emission factor of power unit *m* in year *y* ($tCO_2$/MWh) |
| *m* | = | Power units included in the build margin |
| *y* | = | Most recent historical year for which power generation data is available |

The $CO_2$ emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using options A1, A2 or A3, using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

Because of the data unavailability at the power plant level in China, the 22nd CDM EB meeting agreed the following deviation[22] approaches for $EF_{grid,BM,y}$ calculation:

1) Use the efficiency level of the most advanced commercialized technologies of provincial/regional or national grid of China, as a conservative proxy, for fuel *i* consumption estimation to estimate the $EF_{grid,BM,y}$;

2) Use of capacity additions during last several years for estimating the $EF_{grid,BM,y}$ i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity;

3) Use of installed capacity to replace annual power generation to estimate weights.

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total thermal installed capacity, the $EF_{grid,BM,y}$ will be calculated as:

1) Based on the most recent years energy balance of the CSPG, calculating the proportions of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total $CO_2$ emissions of thermal power plants and taking them as weights of each type of plants in the following calculations;

2) Based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the emission factor of thermal power plants in CSPG. This approach is more conservative as it assumes all recently built plants have the fuel efficiency as that of the most advanced commercialized technologies;

3) Calculating the $EF_{grid,BM,y}$ through multiplying the emission factor of thermal power plants by the percentage share of thermal power plants installed capacity addition within all recently built installed

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

capacity. The proper year is selected so that it is the closest time when the last 20% of installed capacity was built.

The BM in this PDD is calculated as the following sub-steps.

**SUB-STEP 5a: Calculating the percentages of $CO_2$ emissions from the coal-fired, gas-fired and oil-fired power plants in $CO_2$ emissions from total thermal power plants**

$$\lambda_{Coal,y} = \frac{\sum_{i \in Coal,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \qquad (6)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in Oil,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \qquad (7)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in Gas,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \qquad (8)$$

Where:

| | | |
|---|---|---|
| $\lambda_{Gas,y}$ | = | Percentage of $CO_2$ emissions from the gas-fired power plants in $CO_2$ emissions from total thermal power plants in year *y*; |
| $\lambda_{Oil,y}$ | = | Percentage of $CO_2$ emissions from the oil-fired power plants in $CO_2$ emissions from total thermal power plants in year *y*; |
| $\lambda_{Coal,y}$ | = | Percentage of $CO_2$ emissions from the coal-fired power plants in $CO_2$ emissions from total thermal power plants in year *y*; |
| $F_{i,j,y}$ | = | Amount of fuel i (mass or volume unit, t for solid and liquid fuel, $m^3$ for gas fuel) consumed by the power sources of province j in year y; |
| $NCV_{i,y}$ | = | Net calorific value (energy content) of fossil fuel type i in year y (GJ/t for solid and liquid fuel, GJ/ $m^3$ for gas fuel); |
| $EF_{CO_2,i,j,y}$ | = | $CO_2$ emission factor of fossil fuel type i in year *y* ($tCO_2$/MWh). |

**SUB-STEP 5b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)**

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \qquad (9)$$

Where:

| | | |
|---|---|---|
| $EF_{Thermal,y}$ | = | Emission factor of thermal power plants; |
| $EF_{Coal,Adv,y}$ | = | Emission factor of coal-fired power plants applying the most advanced commercialized technologies; |
| $EF_{Oil,Adv,y}$ | = | Emission factor of oil-fired power plants applying the most advanced commercialized technologies; |

$EF_{Gas,Adv,y}$ = Emission factor of gas-fired power plants applying the most advanced commercialized technologies.

**SUB-STEP 5c: Calculating the Build Margin (BM) emission factor ($EF_{grid,BM,y}$)**

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (10)$$

Where:

$EF_{grid,BM,y}$ = Build Margin (BM) emission factor with advanced commercialized technologies for year y of SCPG;

$CAP_{Total,y}$ = Incremental installed capacity of recently built power plants, which constitutes near and greater than 20% of the total installed capacity;

$CAP_{Thermal,y}$ = Newly installed capacity of recently built thermal power plants;

$EF_{Thermal,y}$ = Emission factor of thermal power plants.

$EF_{grid,BM,y}$ is calculated according to the latest available data at the submission time of this PDD, the detailed data for the calculations is shown in Table A8-Table A10 of Annex 3.

***Step 6: Calculate the combined margin emissions factor ($EF_{grid,CM,y}$)***

According to 'Tool to calculate the emission factor for an electricity system' (Version 2.2.1), baseline emission factor $EF_y$ is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$):

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (11)$$

Where:

$w_{OM}$ = Weighting of operating margin emission factor (%);

$w_{BM}$ = Weighting of build margin emission factor (%).

The weighs $w_{OM}$ and $w_{BM}$, by default, are 50% ( i.e., $w_{OM}$= $w_{BM}$= 0.5) in the first crediting period , and $w_{OM}$= 0.25,$w_{BM}$= 0.75 in the second and third crediting period.

**Leakage**

According to baseline methodology ACM0002 (Version 12.3.0), no leakage emissions are considered.

**Emission Reductions**

The annual emission reduction ($ER_y$) of the project is the difference between baseline emission, project emissions and emissions due to leakage:

$ER_y$ ($tCO_2e/yr$) = $BE_y - PE_y$ (12)

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

| | |
|---|---|
| **Data / Parameter:** | $NCV_{i,y}$ |
| Data unit: | kJ/kg or kJ/$m^3$ |
| Description: | The net calorific value (energy content) per mass or volume unit of fuel i in year y |
| Source of data used: | *China Energy Statistical Yearbook 2009*. |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $EG_{Thermal,j,y}$ |
| Data unit: | MWh |
| Description: | The electricity generated by fuel-fired power plants in province *j* in CSPG in year *y* |
| Source of data used: | *China Electric Power Yearbook 2007-2009* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $IPCR_{j,y}$ |
| Data unit: | % |
| Description: | The internal power consumption rate of power plants in province *j* in CSPG in year *y*. |
| Source of data used: | *China Electric Power Yearbook 2007-2009* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $EF_{CO2,\ i,y}$ |
| Data unit: | $tCO_2$/TJ |
| Description: | The $CO_2$ emission factor per unit of fuel i in year y |
| Source of data used: | *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories* |

| | |
|---|---|
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | No specific Chinese value available, to adopt the IPCC default value. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $FC_{i,y}$ |
| Data unit: | $10^4$ t, $10^8$ $m^3$ |
| Description: | The quantity of fuel *i* (in a mass or volume unit) consumed by CSPG in year *y* |
| Source of data used: | *China Energy Statistical Yearbook 2007-2009* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $CAP_{j,y}$ |
| Data unit: | MW |
| Description: | Installed capacities of province *j* in CSPG in years *y*. |
| Source of data used: | *China Electric Power Yearbook 2004-2009* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $F_{i,j,y}$ |
| Data unit: | $10^4$ t, $10^7 m^3$ |
| Description: | The quantity of fuel *i* (in a mass or volume unit) consumed by the relevant provinces *j* in year(s) *y* |
| Source of data used: | China Energy Statistical Yearbook 2009 |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |

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

| | |
|---|---|
| **Data / Parameter:** | $CAP_{BL}$ |
| Data unit: | W |
| Description: | Installed capacity of the hydro power plant before the implementation of the project activity |
| Source of data used: | |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to ACM0002 (version 12.3.0), for new hydro power plants, this value is zero. |
| Any comment: | |

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

| | |
|---|---|
| **Data / Parameter:** | $GENE_{Coal,Adv}$ |
| Data unit: | / |
| Description: | The power supply efficiency of coal-fired power plants with best technology commercially available |
| Source of data used: | China's Regional Grid Baseline Emission Factors 2010 |
| Value applied: | 39.08% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $GENE_{Oil,Adv,y}$ |
| Data unit: | / |
| Description: | The power supply efficiency of oil/gas-fired power plants with best technologies commercially available |

| | |
|---|---|
| Source of data used: | China's Regional Grid Baseline Emission Factors 2010 |
| Value applied: | 51.46% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

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

>>

**Project emission**

According to section B.6.1, $PE_y$ = 0

**Baseline emission**

According to the formula (3)-(10) in section B.6.1, the results of $EF_{grid,OM,y}$ , $EF_{grid,BM,y}$ and $EF_{grid,CM,y}$ are listed in following Table B-3 , the detailed calculation is shown in Annex 3.

**Table B-10 Calculating result of baseline emission factor of CSPG**

| $EF_{grid,OM,y}$ **($tCO_2e$/MWh)** | $EF_{grid,BM,y}$ **($tCO_2e$/MWh)** | $EF_{grid,CM,y}$ **($tCO_2e$/MWh)** |
|---|---|---|
| 0.9762 | 0.4506 | 0.7134 |

According to the formula (1) in Section B.6.1, the baseline emissions ($BE_y$) of the project in a typical year are calculated as follows:

$BE_y = EG_y \cdot EF_{grid,CM,y}$=770,279.5 MWh×0.7134 $tCO_2e$ /MWh = 549,517$tCO_2e$ /yr

**Leakage**

According to Section B.6.1, no leakage emissions are considered.

**Emission Reductions**

According to the formula (12) in Section B.6.1, the emission reductions ($ER_y$) of the project in a typical year are calculated as follows:

$ER_y$ ($tCO_2e$/yr) = $BE_y - PE_y$ = 549,517 $tCO_2e$ − 0 $tCO_2e$ = 549,517 $tCO_2e$

In this PDD, the *Total electricity generation* for the calculation of emission reductions is estimated based on hydrological conditions, actually, as the impact of rainfall, runoff of the Qingshui River and so on, the actual net electricity generation may be slightly different, so does the actual emission reductions.

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

>>

The estimated project emission reductions in the first crediting period are listed in Table 10:

**Table B-11 The ex-ante estimation of emission reductions**

| Year | Estimation of project activity emissions (tonnes of $CO_2$e) | Estimation of baseline emissions (tones of $CO_2$e) | Estimation of leakage (tonnes of $CO_2$e) | Estimation of overall emission reductions (tonnes of $CO_2$e) |
|---|---|---|---|---|
| 01/09/2012-31/08/2013 | 0 | 549,517 | 0 | 549,517 |
| 01/09/2013-31/08/2014 | 0 | 549,517 | 0 | 549,517 |
| 01/09/2014-31/08/2015 | 0 | 549,517 | 0 | 549,517 |
| 01/09/2015-31/08/2016 | 0 | 549,517 | 0 | 549,517 |
| 01/09/2016-31/08/2017 | 0 | 549,517 | 0 | 549,517 |
| 01/09/2017-31/08/2018 | 0 | 549,517 | 0 | 549,517 |
| 01/09/2018-31/08/2019 | 0 | 549,517 | 0 | 549,517 |
| Total ($tCO_2e$) | 0 | 3,846,619 | 0 | 3,846,619 |

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

### B.7.1 Data and parameters monitored:

| **Data Parameter:** | $EG_{delivery,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity delivered by the Project to CSPG in year y. |
| Source of data to be used: | Measurement in the project activity site |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 770,279.5 |
| Description of measurement methods and procedures to be applied: | The data will be continuously measured and at least monthly recorded by The main meter and back-up meter installed at the connection point to the grid. The accuracy of the meters will be higher than 0.5S meeting the national standard, and should be calibrated at least once a year. |

| | |
|---|---|
| QA/QC procedures to be applied: | The main meter and back-up meter will be calibrated once a year. The meters are bidirectional and sealed. |
| Any comment: | The data will be cross checked with the sales receipts and conservative value will be taken for emission reduction calculation. |

| **Data Parameter:** | $EG_{import,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity imported by the Project from CSPG in year y |
| Source of data to be used: | Measurement in the project activity site |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0 |
| Description of measurement methods and procedures to be applied: | The data will be continuously measured and at least monthly recorded by The main meter and back-up meter installed at the connection point to the grid. The accuracy of the meters will be higher than 0.5S meeting the national standard, and should be calibrated at least once a year. |
| QA/QC procedures to be applied: | The main meter and back-up meter will be calibrated once a year. The meters are bidirectional and sealed. |
| Any comment: | The data will be cross checked with the sales receipts and conservative value will be taken for emission reduction calculation. |

| **Data Parameter:** | $EG_{facility,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* |
| Source of data to be used: | Calculation through the formula $EG_{facility,y=}$ $EG_{delivery,y}$ - $EG_{import,y}$ |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 770,279.5 |
| Description of measurement methods and procedures to be applied: | Calculation through the formula $EG_{facility,y=}$ $EG_{delivery,y}$ - $EG_{import,y}$ |
| QA/QC procedures to be applied: | The values will be cross checked with the sales receipts and conservative value will be taken for emission reduction calculation. |
| 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 | 200,000,000 |
| Description of measurement methods and procedures to be applied: | Monitored annually through reading the Nameplate Capacity which states the maximum output of the hydro turbines. |
| 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 | 7,633,000 |
| Description of measurement methods and procedures to be applied: | Yearly measured from topographical surveys and maps. |
| QA/QC procedures to be applied: | / |
| Any comment: | / |

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

>>

Baseline emission factor of the Project is determined ex ante. Therefore, the electricity delivered by the Project to the South China Power Grid ($EG_{facility,y}$), the installed capacity of the hydro power plant after the implementation of the Project ($Cap_{PJ}$) and surface area of the reservoir after the implementation of the Project activity when the reservoir is full ($A_{PJ}$) are defined as the key data to be monitored. Meanwhile the electricity delivered to the grid by the Project in year y ($EG_{facility,y}$) is calculated as subtract the electricity import from the grid in year y ($EG_{import,y}$) from the electricity exported to the grid in year y ($EG_{deliver,,y}$), therefore the electricity import from the grid in year y ($EG_{import,y}$) and the electricity exported to the grid in year y ($EG_{deliver,,y}$) are also the key parameters to be monitored. The monitoring plan is drafted to focus on monitoring the parameters mentioned above.

**1. Monitoring Structure**

The Project owner assigns the person in charge of CDM operation with assistance of the technological departments and financial department. The structure shows as the following Figure B-2.

**Personal in charge of CDM**

In full charge of issues related to CDM projects, in particular:
(1) track the development of CDM;
(2) supervise the project operation status related to data monitoring and the monitoring process as well, ensure a smooth and orderly monitoring process;
(3) in charge of activities related to CER issuance, ensure the completeness and accuracy of related data.

**Technical Department**

In charge of calibrating and maintaining the meter, and checking, archiving and managing data

**Financial Department**

In charge of collecting data required by the checking activity, including meter readings records, electricity sales records and copies of electricity sales invoices.

**Statistician**

In charge of measuring and recording the meter readings;
In charge of measuring the installed capacity of the hydro power plant.

**Figure B-3. Management Structure of Monitoring Plan**

**2. Monitoring apparatus and installation**

The meters will be installed in accordance with "Technology & Management Regulations for Power Metering Devices" (DL/T448-2000). The main meter and back-up meter will be installed at the connection point to the grid to measure net electricity delivered to CSPG. The accuracy of the meters will be higher than 0.5S meeting the national standard, and should be calibrated at least once a year.

The Location of the metering system of the above mentioned two stages are shown in Figure B-3.

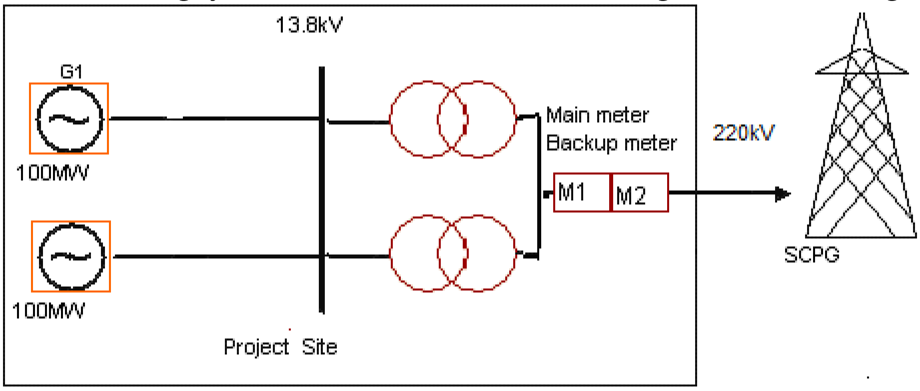


**Figure B-4. The Location of the metering system**

**3. Data monitoring**

**Electricity supplied to the grid and electricity generated by the Project**

To ensure the collection of reliable and accurate data, the project will adopt real-time continuous monitoring as well as manual recording. The electricity generation of each generator, the electricity consumed by the project and the electricity delivered to and from SCPG will be read and recorded monthly.
The readings of the Gateway meter are used for calculating the emission reductions when the Gateway meter is in normal operation state. The monitoring processes are as follows:

(1) The designated persons from the grid company and the project company co-read and record the readings of the Gateway meter for the electricity delivered to and from SCPG on the same day every month;

(2) The power grid company provides the project owner with a settling accounts sheet to confirm the net electricity supplied to SCPG monthly;

(3) The power grid company pays for the power after the project owner provides the power grid company with a sale receipt.

**Surface area of the reservoir**

The Project owner assigned given statistician to monitor the surface area of the reservoir with GPS or maps according with the request of precision when the reservoir is full every year.

**Installed capacity**

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

**Actual diesel consumption**

When the generator operates in normal condition, the auxiliary power will be from the electricity generated by the generators directly. When the generators shut down, the auxiliary power will be imported from the grid, and the electricity will be monitored by the check meter as well as the main meter (bi-directional).If station is shut down and at the same time the electricity of the grid is unavailable, an independent diesel generator will be used to produce electricity at the emergency situation.

The actual diesel consumption will be record by the pointed staff once it is used for power generation at the emergency situation. The value will be accumulated per year. But it will not be monitored as a monitoring parameter due to considering that the estimated annual project emissions from diesel oil combustion is far less than 1% of the expected average annual emission reduction[23], based on the 77th paragraph of VVM(version 01.2) and the applied methodology, the annual $CO_2$ emissions from diesel oil combustion is negligible,

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[23] The expected average annual emission reduction is 549,517 $tCO_2$, so the maximum emission from diesel generator is only 0.21% of the baseline emissions.

**4. Quality control**

1) Calibration of meters

The main meter and back-up meter at the connection point to the grid will be calibrated once per year.. Calibration will be carried out by staff of a qualified measurement and inspection organization.

When the main meter or back-up meter have a breakdown, the party finding the breakdown should tell another party and inform the qualified calibration organization to check, calibrate, test and treat the meter so as to recover the normal monitoring state.

2) Emergency treatment

When the main meter or back-up meter have a breakdown, the electricity generation difference will be treated as follows:

a. When Main Meter has a breakdown, the readings of Backup Meter will be adopted;

b. If both of the Main Meter and Backup Meter have breakdowns, the project owner should notice the power grid company immediately and solve the problem with a conservative calculation method.

After handling of the emergencies, the project owner must prepare a report regarding the emergency to explain to DOE that the handling method is reasonable.

In case of erroneous measurements, it will be reported to the Manager immediately and the Manager will initiate the corrective actions.

**5. Data management**

All monitoring data and records will be archived electronically and be kept at least for 2 years after the end of the last crediting period. Receipts of electricity sales and settling accounts sheet will be used as a final doublecheck to ensure that measurements are correct. The project owner will ensure that all required documentation is made available to the verifier.

**6. Training program**

The project developer and the CDM Consulting company will train all the related staffs before the registration of the project activity. The training contains CDM knowledge, operational regulations, quality control (QC), data monitoring requirements and data management regulations, etc.

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

>>

The application of the baseline study and monitoring methodology of the Project was completed on 05/07/2012 by:

Entity: Libra CDM I&M Co., Ltd

Email: kevinz@libracdm.com

The person/entity is not project participant listed in Annex 1.

## SECTION C. Duration of the project activity / crediting period

### C.1. Duration of the project activity:

#### C.1.1. Starting date of the project activity:

>>

08/10/2005 (Agreement of Dam Construction was signed, which is the earliest starting date of the project activity.)

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

>>

30 years 0 months

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

#### C.2.1. Renewable crediting period:

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

>>

01/09/2012 or the day of registration whichever is later.

##### C.2.1.2. Length of the first crediting period:

>>

7 years

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

>>

Not applicable.

##### C.2.2.2. Length:

>>

Not applicable.

## SECTION D. Environmental impacts

>>

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

>>

The Environmental Impacts Assessment Report (EIA) report of the Project was approved by the Guizhou Environmental Protection Bureau on October 25, 2004 (Approval No.: ([2004]253). According to the EIA report of the Project, environmental impacts possibly caused by the Project and the corresponding measures adopted by the project owner are analyzed as follows:

- **Air pollution and noise**

Exhaust gas, dust and noise generated by the excavation, explosion and transportation during the construction of the Project will have certain impacts on the air environment and acoustical environment of the construction area. Measures to reduce exhaust gas and dust will be taken, including utilizing sprinklers in the construction area to reduce dust in the excavation and blasting areas, equipping the Concrete Mixing System with a dust catcher to limit the dust levels on site. The project owner also took several measures to mitigate noise levels produced during the project construction period, such as strengthening construction management, limiting the construction time at night, banning blasting activities during the night time, and limiting the speed of and banning horning when transport vehicles pass through villages. As for the construction workers, the project owner provided them with noise reduction equipment in line with national regulations.

- **Waste water**

The waste water created during the construction period was properly treated via usage of a sand basin and sedimentation basin. The water that was treated was recycled. The organic sewage produced during the construction and operation periods were treated by utilizing organic sewage treatment equipment. All the sewage that was discharged met the requirements of the “Sewage Discharge Standards” (GB8978-1996).

- **Solid waste**

The project owner established three waste residue fields. In order to avoid water and soil loss caused by residue slipping, the waste residue field was kept flat. Also, water and soil conservation measures were taken to avoid water and soil loss. Vegetation protection and restoration is being carried out following the construction period.

- **Ecological impact**

In order to reduce ecological impacts, measures, such as marking the construction area clearly and banning the activities of smoking, fire, hunting, and fishing, were taken. The manner in which the equipment was operated and the construction seasons were strictly controlled to prevent the water and soil produced during the construction period from entering into the river waters. In the construction area, topsoil was stored and protected properly so that it could be reused to refill the temporarily occupied land. The project involves a small number of migrants, and they have been properly resettled.

**In summary, the Project will not have significant impacts on the 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 Project use clean renewable energy to generate electricity whose environmental impact comply with relevant national laws and regulations. Environmental impacts are considered not significant.

## SECTION E. Stakeholders' comments

>>

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

>>

In order to collect stakeholder's comments, the project owner held a stakeholder consultation meeting in November 2006. Participants include the local villagers and the representatives from the local NDRC, provincial power grid company, Development and Reform Committee of Kaiyang, Municipal Council of Kaiyang, Environmental Protection Bureau of Kaiyang and the Power Company. The project was introduced t to the participants during the meeting.

The project owner further conducted a questionnaire-based survey in December 2006 to collect the opinions of stakeholders. 322 questionnaires were delivered to the stakeholders with a 100% return rate.

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

>>

The results of the questionnaires are summarized below:

| Serial | Questions | Option | Number of participants | Proportion |
|---|---|---|---|---|
| 1 | Did you know the power station? | Yes | 317 | 98.45% |
| | | No | 5 | 1.55% |
| | | Abstain | 0 | 0 |
| 2 | Do you agree with the construction of the project? | Yes | 314 | 97.52% |
| | | No | 0 | 0 |
| | | Don't care | 8 | 2.48% |
| | | Abstain | 1 | 0.31% |
| 3 | Do you believe the construction of the project will create great impact on local environment? | Yes | 170 | 52.80% |
| | | No | 104 | 32.30% |
| | | Don't know | 47 | 14.60% |
| | | Abstain | 1 | 0.31% |
| 4 | Do you believe the project will create outstanding influence to the environment during its operation period? | Yes | 190 | 59.01% |
| | | No | 84 | 26.09% |
| | | Don't know | 46 | 14.29% |
| | | Abstain | 2 | 0.62% |
| 5 | Will the construction of the | I would be glad to do so | 253 | 78.57% |

| | | | | |
|---|---|---|---|---|
| | project influence your house and farmland? Were you forced to move, would you be glad to do so? | I am reluctant to do so | 7 | 2.17% |
| | | Don't care | 58 | 18.01% |
| | | Abstain | 4 | 1.24% |
| 6 | Have you been well compensated for the removal? | Yes | 207 | 64.29% |
| | | Not yet | 33 | 10.25% |
| | | Not involved in this matter | 64 | 19.88% |
| | | abstain | 17 | 5.28% |
| 7 | How the resettlement will change your life and family | It will improve my life | 237 | 73.60% |
| | | Benefit and disadvantage coexist | 62 | 19.25% |
| | | It will bring adverse impact on my life | 17 | 5.28% |
| | | abstain | 6 | 1.86% |
| 8 | Do you willing to participate in the construction of the project? | Yes | 289 | 89.75% |
| | | No | 14 | 4.35% |
| | | Not clear | 18 | 5.59% |
| | | Abstain | 1 | 0.31% |
| 9 | How the project will influence local economy? | It will be beneficial to local economy | 274 | 85.09% |
| | | It will create no influence to local economy | 30 | 9.32% |
| | | It will bring adverse impact to local economy | 13 | 3.73% |
| | | Abstain | 6 | 1.86% |
| 10 | Will the construction of the project improve water supply facilities? | Yes | 273 | 84.78% |
| | | No | 15 | 4.66% |
| | | Don't clear | 24 | 7.45% |
| | | Abstain | 10 | 3.11% |
| 11 | Will the construction of the project improve local traffic system and communication service?(mobile communication or land communication) | Yes | 270 | 83.85% |
| | | No | 18 | 5.59% |
| | | Don't clear | 29 | 9.01% |
| | | Abstain | 5 | 1.55% |

The results of the questionnaire show a broad level of support for the project. Questions 3 and 4 are difficult to interpret because the meaning of the question was ambiguous because it was not clear if “great impact” and “outstanding influence” were to be viewed in a positive or negative light. When considered alongside the other questions, it is clear that the vast majority of the respondents were in favor of the project.

These views reinforce the views of the Government officials and Village Representatives that joined the face-to-face meetings:

All of the Government and regulatory officials were very supportive of the project. The questions received related to the application of CDM to other sectors of the economy, including the mining of phosphorous. There were no specific questions on the Qingshui River Dahuashui Hydropower Station from the Government representatives, Regulatory officials or investors that required a response.

The villagers around the Qingshui River Dahuashui Hydropower Station were very proud to be hosting a hydropower project because they felt that it would be beneficial for their environment, in comparison to a coal-fired power plant, and were aware of many benefits, including: road access; piped drinking water; tourism potential (the road would now allow tourists to visit the villages which have a rich and intact cultural heritage); the construction of a central market; installation of mobile phone systems and fixed-line telephones, brining internet access to the village for the first time. There were no questions that required a specific response.

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

>>

The project owner had fully taken into account of views all parties concerned, and will implement the following activities:

As for the noise problem, the project used construction equipment that meets national standards. The project owner took the following measures to mitigate the noise level: enhancing construction management; construction at night is strictly prohibited; blasting at night is prohibited; and vehicles passing through villages must change into low gear and are not allowed to use the horn.

As for land occupation, the relevant farmers have been compensated for the loss of land that is occupied by the construction of this project. They have been properly resettled.

As for environmental impacts, the relevant measures taken by the project owner have been mentioned in the Environmental Impact Assessment Report and have been approved by the Guizhou Environmental Protection Bureau. The project owner followed the environmental protective measures and further optimized the construction scheme. Vegetation is being restored following the construction period.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

### Project Owner

| | |
|---|---|
| Organization: | Guizhou Wujiang Qingshuihe Hydropower Development Co., Ltd |
| Street/P.O.Box: | No.5 Airport Road, Nanming District |
| Building: | 15th Floor, Qianyuan Plaza, |
| City: | Guiyang City |
| State/Region: | Guizhou Province |
| Postcode/ZIP: | 550003 |
| Country: | P.R.China |
| Telephone: | +86 851-520 8056 |
| FAX: | +86 851-520 8056 |
| E-Mail: | |
| URL: | |
| Represented by: | Mr. Luo Yong |
| Title: | Vice Manager |
| Salutation: | Mr. |
| Last name: | Luo |
| Middle name: | |
| First name: | Yong |
| Department: | |
| Mobile: | |
| Direct FAX: | +86 851-520 8056 |
| Direct tel: | +86 851-520 8056 |
| Personal e-mail: | bangly327@sina.com.cn |

**Project Participant**

| | |
|---|---|
| Organization: | Vitol S.A. |
| Street/P.O.Box: | 28 Boulevard du Pont-d'Arve, |
| Building: | |
| City: | Geneva |
| State/Region: | / |
| Postcode/ZIP: | CH 1205 |
| Country: | Switzerland |
| Telephone: | 0041-22322 1111 |
| FAX: | 0041-22800 2374 |
| E-Mail: | carbonproject@vitol.com |
| URL: | / |
| Represented by: | David Fransen |
| Title: | Manager |
| Salutation: | Mr. |
| Last name: | Fransen |
| Middle name: | / |
| First name: | David |
| Department: | / |
| Mobile: | |
| Direct FAX: | 0041-22800 2374 |
| Direct tel: | 0041-22322 1111 |
| Personal e-mail: | carbonproject@vitol.com |

## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

No public funding from parties included in Annex I is available to the project activity.

## Annex 3

### BASELINE INFORMATION

The installed capacity and the fuel consumption data used for OM and BM calculations are derived from <China Energy Statistical Yearbook>, <China Electric Power Yearbook>.

The low calorific value, $CO_2$ emission factor and oxidation factor of fuels are listed in Table A1 below.

**Table A1 Low calorific values, $CO_2$ emission factors and oxidation factors of fuels**

| Fuel | Low Calorific Value | Emission Factor ($kgCO_2/TJ$) | Oxidation Factor |
|---|---|---|---|
| Raw Coal | 20908 kJ/kg | 87,300 | 1 |
| Cleaned Coal | 26344 kJ/kg | 87,300 | 1 |
| Other Washed Coal | 8363 kJ/kg | 87,300 | 1 |
| Moulded coal | 20908 kJ/kg | 87,300 | 1 |
| Coke | 28435 kJ/kg | 95,700 | 1 |
| | | | |
| Crude Oil | 41816 kJ/kg | 71,100 | 1 |
| Gasoline | 43070 kJ/kg | 67,500 | 1 |
| Diesel Oil | 42652 kJ/kg | 72,600 | 1 |
| Fuel Oil | 41816 kJ/kg | 75,500 | 1 |
| Other oil production | 41816 kJ/kg | 75,500 | 1 |
| | | | |
| Natural Gas | 38931 kJ/$m^3$ | 54,300 | 1 |
| Coke Oven Gas | 16726 kJ/$m^3$ | 37,300 | 1 |
| Other Gas | 5227 kJ/$m^3$ | 37,300 | 1 |
| LPG | 50179 kJ/kg | 61,600 | 1 |
| Refinery Dry Gas | 46055 kJ/kg | 48,200 | 1 |

Data Source: The net calorific values are quoted from <China Energy Statistical Yearbook 2009>, Page 507.

The emission factors are quoted from <2006 IPCC Guidelines for National Greenhouse Gas Inventories >, Table 1.3 and Table 1.4, Page 1.21-1.24, Chapter 1, Volume 2 Energy. 95% of lower limit value of emission factors confidence interval is adopted

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

**Table A2 Simple OM Emission Factors Calculation of CSPG for Year 2006**

| **Energy** | **Unit** | **Guangdong**<br>**A** | **Guangxi**<br>**B** | **Guizhou**<br>**C** | **Yunnan**<br>**D** | **Subtotal**<br>**E=A+B+C+D** | **Carbon Content (tC/TJ)**<br>**F** | **Oxidation rate (%)**<br>**G** | **Emission factor (kg $CO_2$/TJ)**<br>**H** | **Average Low Calorific Value (MJ/t or $km^3$)**<br>**I** | **Emission ($tCO_2e$)**<br>**J** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw coal | $10^4$t | 7303.19 | 1490.01 | 4001.54 | 2735.88 | **15530.62** | 25.8 | 100 | 87,300 | 20,908 | 283,475,499 |
| Cleaned coal | $10^4$t | | | | | **0** | 25.8 | 100 | 87,300 | 26,344 | 0 |
| Other washed coal | $10^4$t | | | 19.53 | 45.8 | **65.33** | 25.8 | 100 | 87,300 | 8,363 | 476,968 |
| Briquette | $10^4$t | 133.75 | | | | **133.75** | 26.6 | 100 | 87,300 | 20,908 | 2,441,296 |
| Coke | $10^4$t | | | | 1.31 | **1.31** | 29.2 | 100 | 95,700 | 28,435 | 35,648 |
| Coke oven gas | $10^8m^3$ | | 0.84 | | 2.06 | **2.9** | 12.1 | 100 | 37,300 | 16,726 | 180,925 |
| Other coal gas | $10^8m^3$ | 0.89 | | | 19.15 | **20.04** | 12.1 | 100 | 37,300 | 5,227 | 390,714 |
| Crude oil | $10^4$t | 0.87 | | | | **0.87** | 20 | 100 | 71,100 | 41,816 | 25,866 |
| Gasoline | $10^4$t | | | | | **0** | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | $10^4$t | 29.92 | 1.26 | | 3 | **34.18** | 20.2 | 100 | 72,600 | 42,652 | 1,058,396 |
| Fuel oil | $10^4$t | 685.85 | 0.09 | | | **685.94** | 21.1 | 100 | 75,500 | 41,816 | 21,655,867 |
| LPG | $10^4$t | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | $10^4$t | | | | | **0** | 15.7 | 100 | 48,200 | 46,055 | 0 |
| Natural gas | $10^8m^3$ | 7.92 | | | | **7.92** | 15.3 | 100 | 54,300 | 38,931 | 1,674,251 |
| Other petroleum products | $10^4$t | 0.67 | | | | **0.67** | 20 | 100 | 75,500 | 41,816 | 21,153 |
| Other coke products | $10^4$t | | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other energy | $10^4$tCe | 93.54 | 189.68 | | 20.29 | **303.51** | 0 | 0 | 0 | 0 | 0 |
| Emission of Centre China Power Grid ($tCO_2e$) | | | | | | 311,436,583 | | | | | |

Data source: China Energy Statistics Yearbook 2007

**Table A3 Fuel-fired Electricity Generation of SCPG for Year 2006**

| | Electricity generation (MWh) | Auxiliary electricity consumption (%) | Electricity delivered to the grid (MWh) |
|---|---|---|---|
| **Guangdong** | 188,429,000 | 5.27 | 178,498,792 |
| **Guangxi** | 27,967,000 | 4.45 | 26,722,469 |
| **Guizhou** | 76,039,000 | 6.06 | 71,431,037 |
| **Yunnan** | 39,791,000 | 4.12 | 38,151,611 |
| **Total** | | | 314,803,908 |

Data source: China Electric Power Yearbook 2007

The electricity import to the CSPG from CCPG was 21,730,840 MWh for year 2006. The Operating Margin emission factor of CCPG was 1.12157. According to Table A4, the total $CO_2$ emission of CSPG is 335,809,186 t $CO_2e$ in year 2006. According to Table A5, the total supplied electricity of CSPG is 336,534,748 MWh. According to formula (2) in section B.6.1, the $EF_{grid,OM,2006}$ is 0.99784 $tCO_2e$/MWh.

**Table A4 Simple OM Emission Factors Calculation of SCPG for Year 2007**

| Energy | Unit | Guangdong A | Guangxi B | Guizhou C | Yunnan D | Subtotal E=A+B+…+D | Carbon Content (tC/TJ) F | Emission factor (tC/TJ) G | Oxidation rate (%) H | NCV (MJ/t or 1000m$^3$) I | Emission ($tCO_2e$) J |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw coal | $10^4$t | 8214.78 | 1750.63 | 4298.8 | 3170.79 | 17435 | 25.8 | 100 | 87,300 | 20,908 | 318,235,546 |
| Cleaned coal | $10^4$t | 3.46 | | | | 3.46 | 25.8 | 100 | 87,300 | 26,344 | 79,574 |
| Other washed coal | $10^4$t | | 0.65 | 21.58 | 14.64 | 36.87 | 25.8 | 100 | 87,300 | 8,363 | 269,184 |
| Briquette | $10^4$t | 271.25 | | | | 271.25 | 26.6 | 100 | 87,300 | 20,908 | 4,951,041 |
| Coke | $10^4$t | 0.04 | 1.69 | | 2.15 | 3.88 | 29.2 | 100 | 95,700 | 28,435 | 105,584 |
| Coke oven gas | $10^8m^3$ | | 0.96 | 3.19 | 1.8 | 5.95 | 12.1 | 100 | 37,300 | 16,726 | 371,208 |
| Other coal gas | $10^8m^3$ | | 30.77 | | 21.63 | 52.4 | 12.1 | 100 | 37,300 | 5,227 | 1,021,628 |
| Crude oil | $10^4$t | | | | | 0 | 20 | 100 | 71,100 | 41,816 | 0 |
| Gasoline | $10^4$t | | | | | 0 | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | $10^4$t | 21.37 | 2.13 | | 2.29 | 25.79 | 20.2 | 100 | 72,600 | 42,652 | 798,596 |
| Fuel oil | $10^4$t | 467.97 | 0.41 | | | 468.38 | 21.1 | 100 | 75,500 | 41,816 | 14,787,262 |
| LPG | $10^4$t | | | | | 0 | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | $10^4$t | 0.37 | | | | 0.37 | 15.7 | 100 | 48,200 | 46,055 | 8,213 |
| Natural gas | $10^8m^3$ | 32.17 | | | | 32.17 | 15.3 | 100 | 54,300 | 38,931 | 6,800,588 |
| Other petroleum products | $10^4$t | 8.47 | | | | 8.47 | 20 | 100 | 75,500 | 41,816 | 267,407 |
| Other coke products | $10^4$t | | | | | 0 | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other energy | $10^4$tCe | 118.04 | 81.89 | 44.1 | 50.3 | 294.33 | 0 | 0 | 0 | 0 | 0 |
| Emission of China Southern Power Grid ($tCO_2e$) | | | | | | | | | | | **347,695,831** |

Data source: China Energy Statistics Yearbook 2008

**Table A5 Fuel-fired Electricity Generation of NWPG for Year 2007**

| | Electricity generation (MWh) | Auxiliary electricity consumption (%) | Electricity delivered to the grid (MWh) |
|---|---|---|---|
| **Guangdong** | 215,700,000 | 6.01 | 202,736,430 |
| **Guangxi** | 36,100,000 | 7.42 | 33,421,380 |
| **Guizhou** | 84,300,000 | 6.62 | 78,719,340 |
| **Yunnan** | 47,400,000 | 7.23 | 43,972,980 |
| **Total** | | | 358,850,130 |

Data source: China Electric Power Yearbook 2008

The electricity import to the CSPG from CCPG was 24,237,240 MWh for year 2007. The Operating Margin emission factor of CCPG was 1.10197 According to Table A6, the total $CO_2$ emission of CSPG is 374,404,628 t $CO_2e$ in year 2007. According to Table A7, the total supplied electricity of CSPG is 383,087,370 MWh. According to formula  in section B.6.1, the $EF_{grid,OM,2007}$ is 0.97733 $tCO_2e/MWh$.

**Table A6 Simple OM Emission Factors Calculation of SCPG for Year 2008**

| Energy | Unit | Guangdong<br>A | Guangxi<br>B | Guizhou<br>C | Yunnan<br>D | Subtotal<br>E=A+B+…+D | Carbon Content (tC/TJ)<br>F | Emission factor (tC/TJ)<br>G | Oxidation rate (%)<br>H | NCV (MJ/t or 1000m$^3$)<br>I | Emission ($tCO_2e$)<br>J |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw coal | $10^4$t | 8001.54 | 1513.1 | 4117.45 | 2766.85 | 16398.94 | 25.8 | 100 | 87,300 | 20,908 | 299,324,670 |
| Cleaned coal | $10^4$t | 2.31 | | | | 2.31 | 25.8 | 100 | 87,300 | 26,344 | 53,126 |
| Other washed coal | $10^4$t | | 0.08 | 13.38 | 57.11 | 70.57 | 25.8 | 100 | 87,300 | 8,363 | 515,224 |
| Briquette | $10^4$t | 297.43 | | | | 297.43 | 26.6 | 100 | 87,300 | 20,908 | 5,428,896 |
| Coke | $10^4$t | 3.24 | 1.73 | | 2.74 | 7.71 | 29.2 | 100 | 95,700 | 28,435 | 209,807 |
| Coke oven gas | $10^8m^3$ | | 1.55 | 3.92 | 2.17 | 7.64 | 12.1 | 100 | 37,300 | 16,726 | 476,644 |
| Other coal gas | $10^8m^3$ | 1.09 | 29.6 | | 35.71 | 66.4 | 12.1 | 100 | 37,300 | 5,227 | 1,294,582 |
| Crude oil | $10^4$t | | | | | 0 | 20 | 100 | 71,100 | 41,816 | 0 |
| Gasoline | $10^4$t | 0.01 | | | | 0.01 | 18.9 | 100 | 67,500 | 43,070 | 291 |
| Diesel | $10^4$t | 10.46 | 0.97 | | 2.28 | 13.71 | 20.2 | 100 | 72,600 | 42,652 | 424,535 |
| Fuel oil | $10^4$t | 344.59 | 0.24 | | | 344.83 | 21.1 | 100 | 75,500 | 41,816 | 10,886,656 |
| LPG | $10^4$t | | | | | 0 | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | $10^4$t | 0.76 | | | | 0.76 | 15.7 | 100 | 48,200 | 46,055 | 16,871 |
| Natural gas | $10^8m^3$ | 35.6 | | | | 35.6 | 15.3 | 100 | 54,300 | 38,931 | 7,525,674 |
| Other petroleum products | $10^4$t | 7.3 | | | | 7.3 | 20 | 100 | 75,500 | 41,816 | 220,395 |
| Other coke products | $10^4$t | | | | | 0 | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other energy | $10^4$tCe | 120.17 | 103.26 | 89.44 | 42.63 | 355.5 | 0 | 0 | 0 | 0 | 0 |
| Emission of China Southern Power Grid ($tCO_2e$) | | | | | | | | | | | **326,377,370** |

Data source: China Energy Statistics Yearbook 2009

**Table A7 Fuel-fired Electricity Generation of NWPG for Year 2008**

| | Electricity generation (MWh) | Auxiliary electricity consumption (%) | Electricity delivered to the grid (MWh) |
|---|---|---|---|
| **Guangdong** | 210,700,000 | 6.18 | 197,678,740 |
| **Guangxi** | 34,200,000 | 7.14 | 31,758,120 |
| **Guizhou** | 81,300,000 | 7.04 | 75,576,480 |
| **Yunnan** | 41,800,000 | 7.29 | 38,752,780 |
| **Total** | | | 343,766,120 |

Data source: China Electric Power Yearbook 2008

The electricity import to the CSPG from CCPG was 22,342,090MWh for year 2008. The Operating Margin emission factor of CCPG was 1.04205 According to Table A6, the total $CO_2$ emission of CSPG is 326,377,370t $CO_2e$ in year 2008. According to Table A7, the total supplied electricity of CSPG is 343,766,120MWh. According to formula (2) in section B.6.1, the $EF_{grid,OM,2007}$ is 0.95507t$CO_2$e/MWh.

The Operating Margin (OM) emission factor is the weighted average emission factors of year 2006-2008, and is expressed as follows:

$$EF_{grid,OM,y} = \mathbf{0.9762\ tCO_2e/MWh}.$$

:

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

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

**Table A8 Percentages of CO2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO2 emissions**

| Fuels | Unit | Guangdong A | Guangxi B | Guizhou C | Yunnan D | Total E=A+…+D | Average low calorific rate F | Emission Factor G | Oxidation rate H | Total $CO_2$ Emission I=E×F×G×H/100,000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Raw coal | $10^4$t | 8,001.54 | 1,513.10 | 4,117.45 | 2,766.85 | 16,398.94 | 20,908 | 87,300 | 1 | 299,324,670 |
| Wash coal | $10^4$t | 2.31 | 0 | 0 | 0 | 2.31 | 26,344 | 87,300 | 1 | 53,126 |
| Other wash coal | $10^4$t | 0 | 0.08 | 13.38 | 57.11 | 70.57 | 8,363 | 87,300 | 1 | 515,224 |
| Briquette | $10^4$t | 297.43 | 0 | 0 | 0 | 297.43 | 20,908 | 87,300 | 1 | 5,428,896 |
| Coke | $10^4$t | 3.24 | 1.73 | 0 | 2.74 | 7.71 | 28,435 | 95,700 | 1 | 209,807 |
| Other coke products | $10^4$t | 0 | 0 | 0 | 0 | 0.00 | 28,435 | 95,700 | 1 | 0 |
| **Sub-total** | | | | | | | | | | **305,531,723** |
| Crude oil | $10^4$t | 0 | 0 | 0 | 0 | 0 | 41,816 | 71,100 | 1 | 0 |
| Gasoline | $10^4$t | 0.01 | 0 | 0 | 0 | 0.01 | 43,070 | 67,500 | 1 | 291 |
| Diesel oil | $10^4$t | 10.46 | 0.97 | 0 | 2.28 | 13.71 | 42,652 | 72,600 | 1 | 424,535 |
| Fuel oil | $10^4$t | 344.59 | 0.24 | 0 | 0 | 344.83 | 41,816 | 75,500 | 1 | 10,886,656 |
| Other petroleum products | $10^4$t | 7.3 | 0 | 0 | 0 | 7.3 | 41,816 | 72,200 | 1 | 220,395 |
| **Sub-total** | | | | | | | | | | **11,531,876** |
| Natural gas | $10^8 m^3$ | 356 | 0 | 0 | 0 | 356 | 38,931 | 54,300 | 1 | 7,525,674 |
| Coke oven gas | $10^8 m^3$ | 0 | 15.5 | 39.2 | 21.7 | 76.4 | 16,726 | 37,300 | 1 | 476,644 |
| Other coal gas | $10^8 m^3$ | 10.9 | 296 | 0 | 357.1 | 664 | 5,227 | 37,300 | 1 | 1,294,582 |
| LPG | $10^4$t | 0 | 0 | 0 | 0 | 0 | 50,179 | 61,600 | 1 | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Refinery gas | $10^4$t | 0.76 | 0 | 0 | 0 | 0.76 | 46,055 | 48,200 | 1 | 16,871 |
| **Sub-total** | | | | | | | | | | **9,313,770** |
| **Total** | | | | | | | | | | **326,377,369** |

Data source: China Energy Statistics Yearbook 2009

$\lambda_{Coal,y}$ =92.61%， $\lambda_{Oil,y}$ =3.54%， $\lambda_{Gas,y}$ =2.85%

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

The most advanced commercialized technologies for coal-fired power plants in China are generators of 600 MW and above. The calculation uses the top 30 of the lowest coal consumption generators built in 2008. The estimated average standard coal consumption of them is 314.35 gce/kWh, corresponding to the power supply efficiency of 39.08%. For gas-fired and oil-fired power plants in China, the most advanced commercialized technologies are 200 MW combined cycle generators. The standard coal consumption (equivalent) for power supply of oil-fired and gas-fired power plants is 238.74gce/kWh, corresponding to the power supply efficiency of 51.46%.

Parameters used for calculating fuel-fired emission factor are shown in Table A9 below:

**Table A9 Emission factors of coal/gas/oil-fired power plants applying the most advanced commercialized technologies**

| | Variable | Efficiency of power supply (%) | Emission factor for the fuel ($kgCO_2/TJ$) | Oxidation | Emission factor ($tCO_2/MWh$) |
|---|---|---|---|---|---|
| | | A | B | C | D=3.6/A/1,000,000×B×C |
| Coal-fired plants | $EF_{Coal,Adv,y}$ | 39.08 | 87,300 | 1 | 0.8042 |
| Oil-fired plants | $EF_{Oil,Adv,y}$ | 51.46 | 75,500 | 1 | 0.5282 |
| Gas-fired plants | $EF_{Gas,Adv,y}$ | 51.46 | 54,300 | 1 | 0.3799 |

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$$
$$= 0.7823\ tCO_2/MWh$$

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

**Table A10 Installed capacity of CSPG in 2008**

| Installed capacity | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total |
|---|---|---|---|---|---|---|
| Thermal power | MW | 45,730 | 10,270 | 10,030 | 17,170 | 83,200 |
| Hydropower | MW | 10,280 | 13,970 | 15,740 | 9,470 | 49,460 |
| Nuclear power | MW | 3,780 | 0 | 0 | 0 | 3,780 |
| Wind power | MW | 290 | 0 | 80 | 0 | 370 |
| Total | MW | 60,080 | 24,240 | 25,850 | 26,640 | 136,810 |

Source: China Electric Yearbook 2009

**Table A11 Installed capacity of CSPG in 2007**

| Installed capacity | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total |
|---|---|---|---|---|---|---|
| Thermal power | MW | 44,710 | 9,310 | 10,630 | 15,960 | 80,610 |
| Hydropower | MW | 10,110 | 10,440 | 11,580 | 8,210 | 40,340 |
| Nuclear power | MW | 3,780 | 0 | 0 | 0 | 3,780 |
| Wind power | MW | 250 | 0 | 0 | 0 | 250 |
| Total | MW | 58,850 | 19,750 | 22,210 | 24,170 | 124,980 |

Source: China Electric Yearbook 2008

**Table A12 Installed capacity of CSPG in 2006**

| Installed capacity | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total |
|---|---|---|---|---|---|---|
| Thermal power | MW | 40,615 | 5,434 | 8,564 | 14,350 | 68,963 |
| Hydropower | MW | 9,320 | 7,624 | 9,698 | 7,534 | 34,176 |
| Nuclear power | MW | 3,780 | 0 | 0 | 0 | 3,780 |
| Wind power and others | MW | 183 | 0 | 0 | 0 | 183 |
| Total | MW | 53,898 | 13,058 | 18,262 | 21,884 | 107,102 |

Source: China Electric Yearbook 2007

**A13Newly Added Installed Capacity from Year 2006-2008**

| | Installed Capacity in 2006 | Installed Capacity in 2007 | Installed Capacity in 2008 | New Capacity Additions from 2006 to 2008 | Percentage Relative to New Capacity Additions |
|---|---|---|---|---|---|
| | 68,963 | 80,610 | 83,200 | 21,412 | 6,030 |
| Thermal power | 34,176 | 40,340 | 49,460 | 15,572 | 9,317 |
| Hydro power | 3,780 | 3,780 | 3,780 | 0 | 0 |
| Nuclear power | 183 | 250 | 370 | 187 | 120 |
| Wind power | **107,102** | **124,980** | **136,810** | **37,171** | **15,467** |
| Total | | | | 27.17% | 11.31% |
| Percentage relative to capacity installed in 2007 | 68,963 | 80,610 | 83,200 | 21,412 | 6,030 |

According to Table A10 and formula  in section B.6.1, the $EF_{grid,BM,y}$ is calculated as:
$EF_{grid,BM,y}$ = 0.7823×57.60%=0.4506 $tCO_2$/MWh

**Step 3: Calculating the baseline emission factor ($EF_{grid,CM,y}$)**

According to formula (8) in section B.6.1, the baseline emission factor of SCPG is calculated as:

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} = 0.7134\ tCO_2e/MWh$$

## Annex 4

## MONITORING INFORMATION

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No more information. Refer to B.7 section.