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

## CONTENTS



**Annexes**

## SECTION A. General description of project activity

### A.1. Title of the project activity:

>>

**Yunnan Maguan Xiaobaihe 25MW Hydropower Project**
Version number of the document: 6.0
Date: 12/12/2010

Version history of the PDD

| Version number | Date | Nature of revision(s) |
|---|---|---|
| 1.0 | 10/03/2009 | Completed version of the PDD, prepared for GSP process. |
| 2.0 | 26/11/2009 | Revised according to the draft validation report. |
| 3.0 | 09/02/2010 | Revised the description in section B according to the "Tool for the Demonstration and Assessment of Additionality" (version 05.2). |
| 4.0 | 30/03/2010 | Revised the description of power generation in sensitivity analysis. |
| 5.0 | 28/06/2010 | Revised the description of the highest tariff in sensitivity analysis. |
| 5.1 | 01/07/2010 | Updated the reference web site to the latest version. |
| 5.2 | 12/10/2010 | Revised the involved party from France to Unite Kingdom. |
| 6.0 | 12/12/2010 | Further substantiate the common practice analysis |

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

>>

The purpose of Yunnan Maguan Xiaobaihe 25MW Hydropower Project (hereinafter referred to as the proposed project) is to build and operate a 25 MW grid connected hydropower station in Maguan County, Wenshan Prefecture, Yunnan Province, P. R. China. Upon completion, the electricity generated from the proposed project will be supplied to Yunnan Power Grid, an integral part of the South China Power Grid (SCPG).

The proposed project is planned to install and operate two sets hydro turbines with capacity of 12.5 MW each, which amount to a total capacity of 25 MW. The project will construct a daily regulating storage reservoir and the power density is 585.02 W/m[1]. The proposed project will achieve greenhouse gas (GHG)

[1] The power density is calculated by dividing the submerged area by the installed capacity. The installed capacity of the proposed project is 25 MW and the submerged area is 42,733 $m^2$. Therefore, the power density = 25,000,000/42,733 = 585.02 W/$m^2$.

emission reductions through the displacement of mainly fossil-fuel dominated grid connected power generation. The estimated annual net electricity generation supplied to the grid is 109,700 MWh[2]. The estimated emission reduction is 86,437 $tCO_2e$ annually.

The proposed project makes contribution to the sustainable development as follows:

1. GHG emission reduction
The project will help reduce the greenhouse gas GHG emissions versus the high-growth, coal-dominated business-as-usual scenario in the SCPG by reducing the electricity generation from the fossil-fuel fired power plants, particularly the emission of SOx、NOx and dust.

2. Employment opportunities
The proposed project will create employment opportunities during the construction phase and operational period.

3. Economic Improvement
The construction of the proposed project will promote local economy by contributing to local government with more tax revenues through selling power generation.

**A.3. Project participants:**

>>

| **Name of Party involved (*) （(host) indicates a host Party）** | **Private and/or public entity(ies) project participants(*) (as applicable)** | **Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)** |
|---|---|---|
| People's Republic of China (host) | Maguan County Changjiang Hydropower Devlopment Co., Ltd. | No |
| United Kingdom | Orbeo | No |
| (*) In accordance with the CDM modalities and procedures, at the time of making the CDM PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. | | |

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

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

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

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

>>

[2] The annual operating hours are 4900 h. So the annual power generation is 25×4,900=122,500 MWh. Considering effective power production factor as 0.9 and self consumption on site of total power production as 0.5%, the annual net electricity supplied to the grid is 122,500×0.9×(1-0.5%)=109,700 MWh.

People's Republic of China

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

>>
Yunnan Province

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

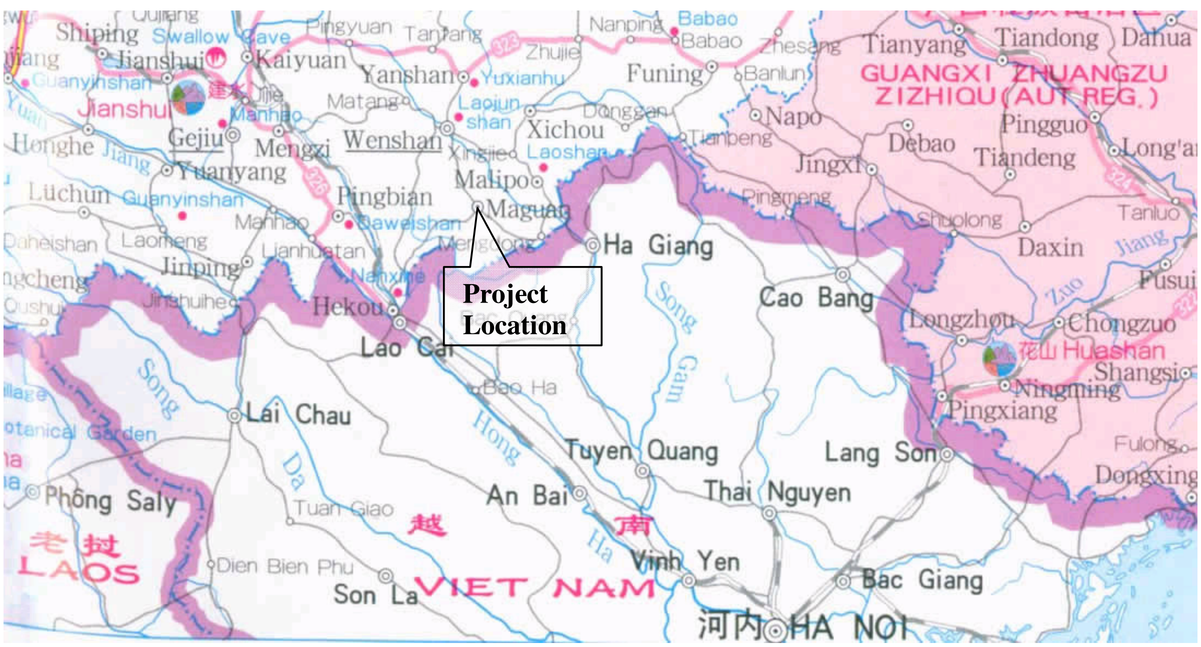
>>
Maguan County, Wenshan Prefecture

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

>>
The proposed project is 22 km away from Maguan County, Wenshan Prefecture, Yunnan Province, P. R. China. The project has central geographical coordinates with east longitude of 104°22'55" and north latitude of 22°45'25". The figure A1 and A2 shows the geographical location of the proposed project.

**Figure A1. The proposed project on the map of P. R. China**


**Figure A2. The proposed project on the map of Yunnan Province, P. R. China**




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

>>

Category: Renewable electricity in grid connected applications

Sectoral Scope: 1 Energy industries

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

>>
The proposed project involves the installation of 2 sets of hydro turbines, each with 12.5 MW capacity. The estimated net annual power supplied to the grid is 109,700 MWh. The annual operation hour is 4900 h and the plant load factor is 0.559[3].

The main technical specifications of the turbines and generators are listed in the following table.

| Parameter | Data |
|---|---|
| Hydro Turbine | |
| Model | HL715-LJ-135 |
| Quantity | 2 |
| Rated water head | 300 m |
| Rated capacity | 12.887 MW |
| Rated flow | 4.71 $m^3/s$ |
| Rated revolutions | 750 r/min |
| Lifetime | ≥50 years |
| Generator | |
| Model | SF12.5-8/2860 |
| Quantity | 2 |
| Rated capacity | 12.5 MW |
| Rated voltage | 10.5 kV |
| Rated current | 809A |
| Rated power factor | 0.85 |
| Rated revolutions | 750 r/min |
| Lifetime | ≥40 years |

The proposed project will build a new substation to connect the 110 kV Dulong substation via a 110 kV transmission line, and then transmitted to the South China Power Grid finally.

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

>>
A crediting period of 7 years (01/11/2010 – 31/10/2017) is selected for the project activity. An estimation of emissions reductions expected over the crediting period is provided in the table below.

| **Years** | **Annual estimation of emission reductions in tonnes of $CO_2e$** |
|---|---|
| 1/11/2010-31/10/2011 | 86,437 |
| 1/11/2011-31/10/2012 | 86,437 |
| 1/11/2012-31/10/2013 | 86,437 |
| 1/11/2013-31/10/2014 | 86,437 |
| 1/11/2014-31/10/2015 | 86,437 |

[3] The plant load factor of the proposed project is calculated as: 4900 h / 8760 h = 0.559

| | |
|---|---|
| 1/11/2015-31/10/2016 | 86,437 |
| 1/11/2016-31/10/2017 | 86,437 |
| **Total estimated reductions** (tonnes of $CO_2$e) | 605,059 |
| **Total number of the first crediting years** | **7** |
| **Annual average over the crediting period of estimated reductions** (tonnes of $CO_2$e) | 86,437 |

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

>>

There is no public funding from Parties included in Annex I is involved in this project.

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

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

>>
The approved methodology applied in the proposed project activity is ACM0002 (version 10) – "Consolidated methodology for grid-connected electricity generation from renewable sources".

Reference:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

"Tool for the Demonstration and Assessment of Additionality (version 05.2)"

Reference:
http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

"Tool to calculate the emission factor for an electricity system (version 02)"

Reference:
http://cdm.unfccc.int/EB/050/eb50_repan14.pdf

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

>>
The proposed project installs a new power plant at a site where no renewable power was operated prior to the implementation of the project activity. It meets all applicability conditions of methodology ACM0002 (version 10) which is listed as follows:

1) The proposed project is a grid-connected renewable new hydropower project; and it does not involve capacity addition, retrofit or replacement;
2) The proposed project does not involve switching from fossil fuels to renewable energy at the site.
3) According to the reservoir at full water level, the proposed project has a power density of 585.02 W/m$^2$, which is higher than 4 W/m$^2$.

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

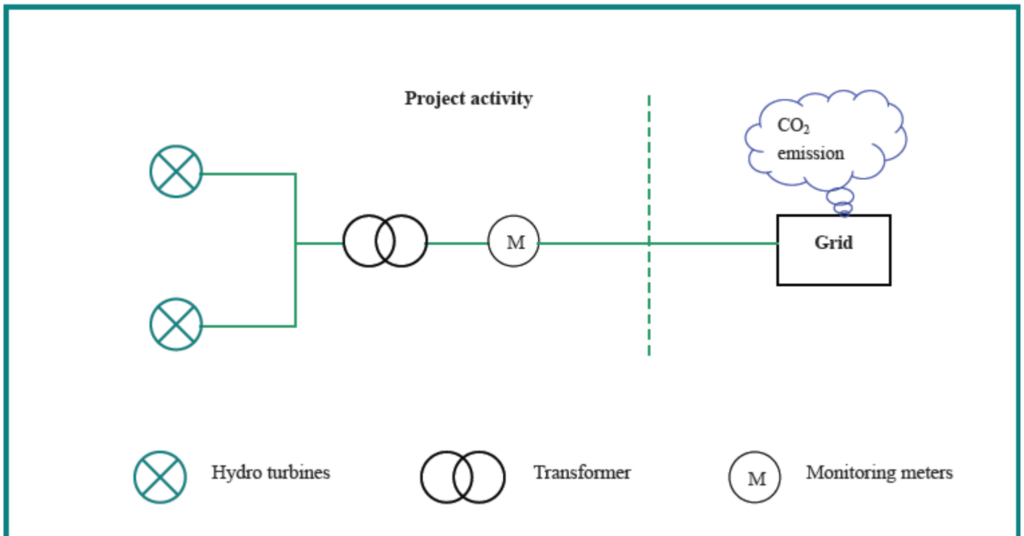
### B.3. Description of the sources and gases included in the project boundary:

>>

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel-fired power plants that is displaced due to the project activity. | $CO_2$ | Yes | Main emission sources |
| | | $CH_4$ | No | Minor emission source. |
| | | $N_2O$ | No | Minor emission source. |

| | | | | |
|---|---|---|---|---|
| **Project Activity** | The hydro power plants, emissions of $CH_4$ form the reservoir. | $CO_2$ | No | Minor emission source. |
| | | $CH_4$ | No | As the power density of the proposed project is 585.02 W/m$^2$, which is greater than 10 W/m$^2$, the project emission is not needed to be calculated. |
| | | $N_2O$ | No | Minor emission source. |

The flow diagram of the project boundary is illustrated as follow:



**The flow diagram of the project boundary**

The spatial extent of the proposed project boundary includes the proposed project site and all power plants connected physically to the SCPG.

According to the "Tool to calculate the emission factor for an electricity system" (version 02), the delineation of grid boundaries as provided by the DNA[4] of China is used. The South China Power Grid composed by Guangdong, Guangxi, Yunnan and Guizhou Power Grids is the project electricity system.

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

>>

According to ACM0002 (version 10), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline 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*

[4] Source: 2009 Baseline Emission Factors for Regional Power Grids in China

http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2413.pdf *the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (version 2).*

Therefore, supply of equivalent annual power output by the South China Power Grid is the baseline scenario for the proposed project activity.

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

| Parameter | Value | Unit | Source |
|---|---|---|---|
| $EF_{grid,OMsimple,y}$ | 0.9987 | tCO2e/MWh | Calculated in Annex 3 |
| $EF_{grid,BM,y}$ | 0.5772 | tCO2e/MWh | Calculated in Annex 3 |
| $EF_{grid,CM,y}$ | 0.7879 | tCO2e/MWh | Calculated in Annex 3 |

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

>>

The additionality of the proposed project is demonstrated and assessed by the approved "Tool for the Demonstration and Assessment of Additionality" (Version 05.2). Following steps include:

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

Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

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

Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity.
These alternatives are to include:

1) The proposed project not undertaken as CDM project;
2) Construction of a fossil fuel power plant with equivalent amount of annual electricity output;
3) Construction of a power plant using other source of renewable energy with equivalent amount of annual electricity output; and
4) Supply of equivalent annual power output by the Grid to which the proposed project is connected.

The alternative 3) is to construct renewable power plants whose annual power supply is equivalent to the projects. However, due to the technology development status and high investment costs for power generation, solar PV[5], geothermal resources[6] and biomass[7] are far from being economically attractive. The project locates at areas where lacks of wind resource[8] on-site or around that can provide same

[5] Source: Page 54, *China Solar PV Report 2007*, China Environment Science Press. The cost of solar PV is USD 0.5/kWh, which is around RMB 3.7/kWh.

[6] Source: http://www.crein.org.cn/view/viewnews.aspx?id=20080131103909265

[7] Source: http://news.xinhuanet.com/energy/2009-01/12/content_10644595.htm

[8] According to the Table 2-1 in FSR, the local average wind speed is lower than 2.5 m/s. Therefore, the project location lacks of wind resource.

electricity generation output of the proposed project activity. Hence, Alternative 3) is not a realistic and credible alternative.

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

The average annual utilization hours (5,612 hours Reference: P626 *China Electric Power Yearbook 2007*) of the fossil fuel plants are larger than the average annual utilization of the project. Thus, the comparable installed capacity of the fossil fuel-fired plants with equivalent annual power supply as the project will be lower than 22 MW, while coal-fired plants with a capacity of 135 MW or less are prohibited from development in large grid such as provincial girds according to current regulations in China. Consequently, Alternative 2) is not a realistic and credible alternative.

The alternative 1) and 4) are in line with the existing Chinese laws and regulations.

**Step 2. Investment analysis**

The purpose of this step is to determine whether the proposed project activity is economically or financially less attractive than other alternatives without an additional funding that may be derived from the CDM project activities. The investment analysis was conducted in the following steps:

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

The three analysis methods suggested by *Tool for the demonstration and assessment of additionality* (version 05.2) are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the proposed project will earn revenues from not only the CDM but also the electricity output, the simple cost analysis method is not applicable. Investment comparative analysis method is only applicable to the case that alternative baseline scenario is similar to the proposed projects, so that comparative analysis can be conducted. The alternative baseline scenario of the proposed project is to supply electricity from the South China Power Grid rather than a new investment project. Therefore, Option II is not an appropriate method either. The proposed project will use benchmark analysis method based on Project IRR.

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

According to *Economic Evaluation Code for Small Hydropower Projects* (SL16-95) issued by Water Resources Ministry of P. R. China, the projects whose installed capacity are below or equal to 25 MW fall into this code. Moreover, the projects whose installed capacity are below or equal to 50 MW in rural area also fall into this code. The financial benchmark of project IRR for Chinese small hydropower projects is 10%. The proposed project is located in countryside with the installed capacity of 25 MW, it is suitable for *Economic Evaluation Code for Small Hydropower Projects* (SL16-95), which is widely used in small hydropower projects in China.

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

Based on the above-mentioned benchmark analysis, the calculation and comparative analysis of financial indicators for the proposed project are carried out in sub-step 2c.

**(1) Basic parameters for calculation of financial indicators**

Basic parameters for calculation of financial indicators are as follows:

| ***Parameter*** | ***Data*** | ***Data Source*** |
|---|---|---|

| | | |
|---|---|---|
| Installed capacity | *25* MW | Feasibility Study Report |
| Annual operating hours | *4900 h* | Feasibility Study Report |
| Effective power production factor | *0.9* | Feasibility Study Report |
| Electricity consumed on site (% of total power production) | *0.5%* | Feasibility Study Report |
| Annual output | *109,700* MWh[9] | Feasibility Study Report |
| Project lifetime | *26* years | Feasibility Study Report |
| Total investment | *148.0588* million RMB | Feasibility Study Report |
| Annual O&M cost | *3.3857* million RMB | Feasibility Study Report |
| Tariff | *0.193* RMB/kWh (including VAT) | Feasibility Study Report |
| Depreciation period | *25* years | Feasibility Study Report |
| Depreciation Rate | *4%* | Feasibility Study Report |
| Tax rate | *6%* (Value added tax) | Caishui [1994] No.4 |
| | *33%* (Income tax) | State Council Order [1993] No. 137 |
| | 3% (Educational surtax) | State Council Order [2005] No. 448 |
| | 2% (City maintenance and construction tax) | P.R. China City Construction and Maintenance Regulation Guofa[1985]19 |
| Expected CERs price | *8* Euro/t$CO_2$e | Project developer |

**(2) Comparison of IRR for the proposed project and the financial benchmark**
In accordance with the benchmark analysis (Option III), the proposed project will not be considered as financially attractive if its financial indicators (such as IRR) are lower than the benchmark.

Table 1 shows the Project IRRs of the proposed project, with and without CDM-related income. Without CDM-related income, the Project IRR is lower than the benchmark and the proposed project is not financially acceptable. With it, the Project IRR is better than the benchmark and therefore, the proposed project is financially acceptable.

**Table 1. Financial indicators of the Proposed Project**

| | Project IRR (benchmark = 10%) |
|---|---|
| Without CDM-related income | 8.1% |
| With CDM-related income | 11.73% |

[9] The annual net power supply is calculated as: 25 MW * 4900 h * 0.9 * (1-0.5%) = 109,700 MWh

***Sub-step 2d. Sensitivity analysis (only applicable to options II and III):***
The purpose of the sensitivity analysis is to assess the impact of uncertainties in the input values of the financial model on the calculated IRR. Based on the analysis in the FSR, for a hydro project without CDM funding, the critical factors that influences the Project IRR are mainly as follows:

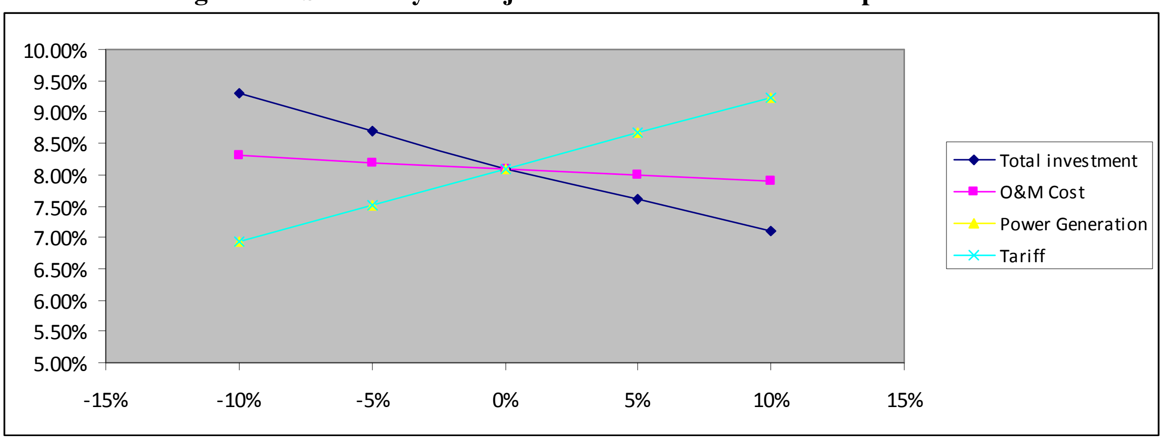
1) Total investment;
2) Annual O&M cost;
3) Power generation;
4) Tariff

They are fluctuated within the range from -10% to +10% in the FSR and the selection is also in accordance with the Guidance from "Tool for the demonstration and assessment of additionality" (Version 05.2). Their impacts on Project IRR of the proposed project were presented in Table 2 and Figure 2.

**Table 2. Sensitivity of Project IRR to different financial parameters**

| Parameter | Range | | | | |
|---|---|---|---|---|---|
| | **-10%** | **-5%** | **0** | **5%** | **10%** |
| Total investment | 9.30% | 8.70% | 8.10% | 7.60% | 7.10% |
| O&M cost | 8.30% | 8.20% | 8.10% | 8.00% | 7.90% |
| Power generation | 6.93% | 7.52% | 8.10% | 8.67% | 9.22% |
| Tariff | 6.93% | 7.52% | 8.10% | 8.67% | 9.23% |

**Figure 2. Sensitivity of Project IRR to different financial parameters**




As shown in Table 2 and Figure 2, the Project IRR of the proposed project varies to different extents, when the above four financial indicators fluctuated within the reasonable range from -10% to +10% and the Project IRR does not exceed the benchmark of 10%.

**Table 3: Parameter variation when project IRR equals to the benchmark**

| **Parameter** | **Project IRR = Benchmark** |
|---|---|

| | |
|---|---|
| Total investment | -14.8% |
| Annual O&M cost | -98.6% |
| Annual power generation | 17.1% |
| Tariff | 17% |

The total investment needs to decrease by 14.8% when the Project IRR meets the benchmark of 10%. Due to increasing CPI during 2005-2007[10], the total investment of the proposed project is not likely to be decreased by over 14.8% to exceed benchmark.

The annual O&M cost needs to decrease by 98.6% when the Project IRR meets the benchmark of 10%, which is impossible considering operation and maintenance needs.

The power generation needs to increase by 17.1% when the Project IRR meets the benchmark of 10%. For the proposed project, the power generation is calculated based on the monitored data of the local hydro resources of 45 years (1959-2003). The annual generation represents a long-term average power supply throughout the lifetime of the proposed project, where the yearly-variations have already been taken into account. Furthermore, a 100% coefficient of effective electricity is applied in IRR spreadsheet, which makes power generation increased by 11.1%[11] and a corresponding IRR is 9.35%, still lower than 10%[12]. Therefore, the power generation of the proposed project is not likely to increase by 17.1% to exceed benchmark.

The project activity is connected to the SCPG Grid through the Wenshan Autonomous Prefecture Power Grid which, according to China regulations, belongs to a category of uncentralized regulating power. Thus, the tariff of the project activity is governed under the tariff policies for uncentralized regulating power supplied from Wenshan Autonomous Prefecture and the tariff notice of the Yunnan Province DRC. At the moment of the investment decision (end of 2007) the notice contemplated a tariff of 0.13 RMB/kWh (incl. VAT) for high flow periods and 0.23 RMB/kWh (incl. VAT) for the drought period[13]. Yunnan Qujin Water Conservancy and Hydroelectric Power Design Institute has calculated the project activity tariff according to these parameters resulting in a tariff equal to 0.193 RMB/kWh (incl. VAT) which falls in the middle of the interval (0.14 to 0.215 RMB/KWh) of the projects analysed in the comparison.

According to “Information note on the highest tariffs applied by the executive board in its decisions on registration of projects in the People’s Republic of China”[14] published by the EB, for the project activity category, run-of-river hydro plants with installed capacity below 50 MW, the highest tariff in the Yunnan Province equals to 0.215 RMB/kWh (VAT included) and corresponds to Yunnan Jinping Dapo

[10] http://www.stats.gov.cn/tjsj/ndsj/2006/indexch.htm; http://www.stats.gov.cn/tjsj/ndsj/2007/indexch.htm; http://www.stats.gov.cn/tjsj/ndsj/2008/indexch.htm

[11] The annual operating hours are 4900 h. So the annual power generation is 25×4,900=122,500 MWh. Considering effective power production factor as 0.9 and self consumption on site of total power production as 0.5%, the annual net electricity supplied to the grid is 122,500×100%×(1-0.5%)=121,887.5 MWh

[12] A 100% coefficient effective electricity of IRR spreadsheet has been provided to DOE.

[13] Yunfagaijiage[2005]792. http://xxgk.yn.gov.cn/canton_model44/newsview.aspx?id=42596

[14] http://cdm.unfccc.int/Reference/Notes/reg_note07.pdf

Hydropower Station. Applying this tariff to the proposed project activity, the resulting IRR is 9.37% which is lower than benchmark of 10%.

In conclusion of the sensitive analysis, as the financial indicators vary within reasonable range, the proposed project remains financially unattractive without CDM support and the proposed project is additional. Hence, the Scenario 1) is not a realistic alternative.

**Step 3. Barrier analysis**

According to "Tool for the Demonstration and Assessment of Additionality" (version 05.2), the sensitivity analysis is concluded that the proposed project is unlikely to be financially attractive. Thus the barrier analysis is not employed for the project, and then proceeds to Step 4 (Common practice analysis).

**Step 4. Common practice analysis**

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

Choose similar construction year
In April 2002, China implemented the policy "Separate power plants from network and compete in price to enter network[15]. The objective of this power sector reform is to establish a more commercialized power market in China. Power project investment has to be under a more commercialized condition and considers project investment return more seriously. Since market condition for power project development changes much since April 2002, this common practice analysis starts from April 2002.

Choose similar scale
According to the methodology ACM0002, projects with installed capacity of or below 15 MW belongs to small scale projects, hence, this common practice analysis compares projects larger than 15 MW.

According to Classification & Design Safety Standard of Hydropower Projects issued by State Economic and Trade Commission of People's Republic of China in 2003[16], hydropower plants, with capacity less than 50 MW, are defined as small scale hydropower projects. The proposed project is a small scale hydropower station with a total installed capacity of 25MW.

So the common practice analysis chooses similar hydropower stations with capacity of 15-50 MW.

Choose similar area
As China is so large and the development policy and investment environment for each province for hydropower projects are so different, for example, the tariff in each province has some difference, so each province in China is set as the area for common practice. Therefore, Yunnan Province is chosen as the similar area.

Therefore, 'Similar projects' to the project activity are identified by the criteria of: (1) hydropower stations with capacity of 15-50MW; (2) construction year from 2002-2009; and (3) located in Yunnan Province.

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[15] China implemented the policy "S*eparate power plants from network and compete in price to enter network*"

[16] Classification & Design Safety Standard of Hydropower Projects, page 12 table 5.0.1

Crosschecking with Yearbook of China Water Resources 2005, 2006 and 2007, there are 49 projects being identified as falling into the criteria. Among these 49 projects, 37 projects are already registered or in the process of developing as CDM projects (**Table 2**) and thus excluded. Thus 12 projects are identified as similar with the proposed project in the PDD. For the remaining 12 projects, 2 projects are excluded: because the first one is not a new hydropower project[17] and the other project has applied for Voluntary Emission Reductions[18].

Thus, based on the analysis above, the identified 10 'similar projects' will be further analyzed. Key areas used for distinguish and comparing the 'similar projects' and the project activity are listed in **Table 1**.

**Table 1: Existing hydropower projects similar to the project activity (without CDM)**

| N | Project Name | Installed Capacity (MW) | Construction year | Start Operation | Project Developer Attribute | Grid Connected | Receive Special Advantages | Annual Operation Hours | Total Investment (million RMB) | Unit Investment Cost (RMB/kW) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Xima Xingyun Aluminium Factory Hydropower Station[19] | 26 | 2002 | 2004 | Private[20] | No | No | Not Available | Not Available | Not Available |
| 2 | Nanting River Hydropower Station[21] | 34 | 2003 | 2004 | State owned & Listed[22] | Yes | Yes (support under the Planning of 10th five-year development in Wenshan Prefecture[23]) | 5,735[24] | 154[21] | 4,529 |
| 3 | Mengdianhe II Hydropower Station (in FSR)[25] | 30 | 2004 | 2004 | State owned & Listed[26&27] | Yes | Yes (a sum of subsidy funds provided by government of Dehong Dai-Jingpo Autonomous Prefecture[28]) | 6,000[25] | 126[25] | 4,200 |
| | Mengdianhe II Hydropower Station (in actual)[29] | | | | | | | | 124.54[29] | 4,151 |
| 4 | Houqiao Hydropower Station[30] | 48 | 2003 | 2005 | State owned | Yes | Yes (support under the"West-East Electricity Transmission Project"[31]) | Not Available | 297[30] | 6,188 |

[17] Chongjianghe (Expansion) Hydro Project is an expansion project based on existing hydropower plant (http://www.yn.xinhuanet.com/newscenter/2006-05/09/content_6932319.htm).

[18] Wunihe Hydropower Project which has applied for Voluntary Emission Reductions (http://www.ynsph.com.cn/information/1571.whtml)

[19] http://www.dhtjb.com/Html/20057492156-1.html

[20] http://www.yjxy.cn/newEbiz1/EbizPortalFG/portal/html/GeneralContentShow.html

[21] http://www.ynepb.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=9179

[22] http://www.wsdl.com.cn/introduce/

[23] http://www.ydxw.com/showinfo.asp?id=6684

[24] http://news.sina.com.cn/c/2004-12-30/09444669685s.shtml The operation hours is calculated by dividing the annual power generation with the installed capacity, i.e. 195,000MWh / 34MW = 5,735h.

[25] http://news.sina.com.cn/c/2005-01-06/09204735289s.shtml

[26] http://www.ctn.net.cn/webpage/cxdw/dlxx050111.htm

[27] http://www.yndaily.com/html/20081111/news_100_181938.html

[28] http://www.dhtjb.com/Html/20041230111017-1.Html

[29] http://www.7c.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=9172

[30] http://www.7c.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=9212

[31] http://www.baoshan.cn/4034/2005/10/25/707@277291.htm

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Yanziya Hydropower Station[32] | 25 | 2004 | 2005 | State owned | Yes | Yes (support under the China's Western Development Strategy[33]) | 6,000[32] | 120[32] | 4,800 |
| 6 | Maomaotiao Hydropower Station[34] | 40 | 2002 | 2005 | State owned & Listed[35] | Yes | Yes (The biggest transnational power station and got higher bus-bar tariff 0.28RMB.kWh of the power transferred to Vietnam[35]) | 6,000[34] | 120[36] | 3,000 |
| 7 | Xiashilong Hydropower Station[36] | 25 | 2003 | 2005 | State owned & Listed[37] | Yes | Yes (support from the China's Western Development Strategy[38]) | 5,520[39] | 108[36] | 4,320 |
| 8 | Laodukou Hydropower Station[40] | 37.5 | 2003 | 2005 | State owned & Listed[41] | Yes | Yes (support under "Village Power Connection Project" which support by local government[42]) | 5,250[43] | 199.6[43] | 5,323 |
| 9 | Lamenga I Hydropower Project[44] | 32 | 2003 | 2005 | Private | Yes | No | Not Available | 144[44] | 4,500 |
| 10 | Mengga River IV Hydropower Project[45] | 40 | 2005 | 2006 | Private | Yes | No | 5,245[45] | 142.3[45] | 3,558 |

The essential distinctions between the identified 10 similar projects and the proposed project activity are analyzed as follows:

(a) Based on the **Table 1**, Project 1 is excluded as it is not connected to the grid.

(b) Projects 2 to 8 are all developed and owned by state-owned companies and many of these state-owned companies are also public listed companies. They cannot be considered similar to privately owned small medium entities (SMEs) such as the proposed project activity. The main reason is that state-owned enterprises do not make investment decisions solely based on economic considerations but also take into account other considerations (stability of power supply, government objective to increase renewable energy components, etc). Also, in China, these projects have easier access to capital and higher capacity of resisting risks since they are backed up by the government. Although the development of renewable energy is encouraged by the Chinese government, it is still

[32] http://www.cnaec.com.cn/Info/Show.asp?ID=78270&SortID=. The operation hours is calculated by dividing the annual power generation with the installed capacity, i.e. 150,000MWh / 25MW = 6,000h.

[33] http://www.chinalawedu.com/news/1200/22016/22017/22045/2006/4/xu99401350361814600212985-0.htm and http://www.sp.com.cn/zgsd/zjgcdt/200410/t20041022_8909.htm

[34] http://www.wszs.ynws.gov.cn/docdetail_new.asp?id1=20050329153147

[35] http://money.finance.sina.com.cn/corp/view/vCB_AllBulletinDetail.php?stockid=600995&id=399715

[36] http://km.xxgk.yn.gov.cn/canton_model24/newsview.aspx?id=230735

[37] http://www.yngn.gov.cn/jichujianshe/ShowArticle.asp?ArticleID=61

[38] http://www.yngn.gov.cn/Article/ShowArticle.asp?ArticleID=4268

[39] http://www.cnki.com.cn/Article/CJFDTotal-YNSD201004039.htm

[40] http://www.qjetc.gov.cn/lpxjjj/UploadFiles/20061128164018389.doc

[41] http://www.p5w.net/today/200804/t1589770.htm

[42] http://www.yn.xinhuanet.com/topic/2007-11/04/content_11577599.htm

[43] http://www.7c.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=21605. The operation hours is calculated by dividing the annual power generation with the installed capacity, i.e. 189,000MWh / 36MW = 5,250h.

[44] http://www.yn.xinhuanet.com/newscenter/2005-12/13/content_5805948.htm

[45] http://www.ynepb.gov.cn/color/DisplayPages/AdSearchView.aspx?contentid=9213. The operation hours is calculated by dividing the annual power generation with the installed capacity, i.e. 209,800MWh / 40MW = 5,245h.

restricted by regional policies. Priority of such development is still given to large and ultra-large hydropower plants[46]. Though the private SMEs contribute over a half of China's economy, they still face severe financing difficulties[47]. In China, less than 10% of total bank loans have been granted to SMEs due to their weaker fund and collateral strength[48].

From **Table 1**, it has been demonstrated that Projects 2 to 8 have **very good financing options, strong backup by government and/or higher annual operation hours which suggest better financial return.** Therefore, Projects 2 to 8 are excluded.

(c) The remaining Projects 9 and 10 were developed by private entities, similar to the proposed project activity. However, both projects were excluded for the following reasons:

**Project 9:** Lamenga I Hydropower Project was located on the Nu River in Lushui County, Nujiang Autonomous County, Yunnan Province with total installed capacity 32 MW. Lushui County has an enriched water reserves. Its water reserves calculated per km is equal to 5.8 times of total China water reserves per km[49]. This project is developed at 2003 which is 5-year early than the proposed project (start to construction from 2008). Therefore, Lamenga I Hydropower Project enjoyed a lower total investment, which is 144 million RMB with a unit investment cost of 4,500 RMB/kW[50]. Also, this project has a higher water head, and a shorter tunnel, which has greatly reduced the unit investment cost as compared to the proposed project activity:

| Items | Lamenga I Hydropower Project[51] | Proposed Project Activity |
|---|---|---|
| Rated water head | 777.1m | 314.8m[52] |
| Tunnel | 3,000m | 8,089.48m[53] |

As a result, its unit investment cost is 31.61% lower than the proposed project activity. Thus, the two projects are not similar. Lamenga I Hydropower Project is excluded.

**Project 10:** Mengga River IV Hydropower Project was located on Yinjiang County, Dehong Dai-Jingpo Autonomous Prefecture, Yunnan Province. Its total installed capacity is 40 MW, annual power generation is 209,800MWh. Its operation hours are 5,245h[54] which is higher than the proposed project activity of 4,900h. Furthermore, according to the *Hydropower Planning Report of Mengga River, Yingjiang County, Yunnan Province*, the project site has an excellent water resource and geological conditions[55], which let the project owner has more financial benefits and lower the construction cost. In addition, this project is developed at 2005 which is early than the proposed project (start to construction from 2008). Because of the reasons above, Mengga River IV Hydropower Project's investment is 142.3 million RMB with a unit investment cost of 3,558

[46] China Power News Network (15/08/2005), Changes of Power Network Plans in Yunnan Province. Source: http://nfj.serc.gov.cn/Html/News/ywdd/67.html

[47] Phonex Finanace Net (9/03/2009), SMEs anticipate to overcome the finance difficulty. Source: http://finance.ifeng.com/roll/20090309/429547.shtml

[48] Key problems of SME finance difficulties by Mr LONG Zhuan-Wei, Committee Member to the National People Congress Annual Meeting 2009 (7/03/2009) Source: http://news.sina.com.cn/c/2009-03-07/030315269731s.shtml

[49] http://www.wcb.yn.gov.cn/gzdt/1634.html

[50] http://www.yn.xinhuanet.com/newscenter/2005-12/13/content_5805948.htm

[51] http://www.yn.xinhuanet.com/newscenter/2005-12/13/content_5805948.htm

[52] Feasibility study report, Table 1.3-2 No. 18

[53] Feasibility study report, Section 1.4.5.1

[54] The operation hours is calculated by dividing the annual power generation with the installed capacity, i.e. 209,800MWh / 40MW = 5,245h.

[55] http://www.yn.xinhuanet.com/newscenter/2007-02/06/content_9245613.htm

RMB/kW[56].Therefore, the two projects are not similar. Mengga River IV Hydropower Project is excluded.

**In comparison, the proposed project Yunnan Maguan Xiaobaihe 25MW Hydropower Project has unfavorable geological conditions which resulted in higher total investment costs.**

According to the Feasibility Study Report[57], which compiled by Yunnan Qujing Design Institute of Water Conservancy and Electric Power, the proposed project locate at the gap between Honghe Fracture Zone and Wenshan-Malipo Fracture Zone. These two fracture zones are regional fracture and with the depth type of crustal fault. These fracture zones have controlled the sedimentary stratigraphic, magmatism and mineralization on the proposed project site[58]. Beside these two fracture zones, the proposed project is also the prone area of debris flow[59]. According to the Feasibility Study Report, there is a large area of sand-mudstone strata, which as the forming region of debris flow, distributed around the proposed project site. Therefore, the proposed project site has an unsatisfactory geological condition. As the result of these unstable and unsafe geological conditions, a higher investment cost is incurred decided by the qualified Design Institute

**Conclusion**

The project owner of the proposed project is a private SME with no advantage for accessing to the power grids, acquiring a better tariff and in granting financing supports for the proposed project. Also, the proposed project activity has a much higher investment cost per kWh due to increasing of material costs and unfavorable geological conditions. Thus, the project owner faces great difficulties in obtaining financial supports from the bank and PPA negotiation with the Grid which would prevent the implementation of the proposed project. This means that without the incentives of CDM, the proposed project is not a feasible project.

In conclusion, the proposed project faces essential distinctions with the 12 hydropower projects and it is not a common practice.

**Table 2: Existing hydropower projects similar to the project activity (with CDM)[60]**

| CDM-Ref. | Project Name | Installed Capacity (MW) | Start Construcation | Start Operation | Annual Operation Hours | PLF (%) | Unit Investment Cost (RMB/kW) |
|---|---|---|---|---|---|---|---|
| 1074 | Yunnan Yingjiang Nandihe Hydro Power Project | 20 | 2005 | 2007 | 4550 | 51.94% | 6,597 |
| 1102 | Yunnan Heier 25MW Hydropower Project | 25 | 2005 | 2007 | 4963 | 56.66% | 4,600 |
| 1388 | Yunnan Dali Yanger 49.8MW Hydropower Project | 49.8 | 2005 | 2008 | 3631 | 41.45% | 7,550 |
| 1862 | Yunnan Lushui County Laowohe 25MW Hydropower Project | 25 | 2006 | 2008 | 4684 | 53.47% | 4,830 |
| 1983 | Yingjiang Songpo Hydropower Station | 20 | 2008 | 2010 | 4571 | 52.18% | 4,922 |
| 2003 | Yunnan Guangnan Duimen River Hydropower Station | 20 | 2006 | 2008 | 4927 | 56.24% | 5,578 |
| 2006 | Yunnan Nujiang Fugong Guquan River Hydropower Station | 22 | 2005 | 2008 | 5351 | 61.08% | 4,517 |

[56] http://www.ynepb.gov.cn/color/DisplayPages/AdSearchView.aspx?contentid=9213

[57] Compiled by Yunnan Qujing Design Institute of Water Conservancy and Electric Power, which is a qualified third party issued by Ministry of Construction P.R.China.

[58] Feasibility study report, pg 3-3

[59] Feasibility study report, pg 3-16

[60] http://cdm.unfccc.int/Projects/projsearch.html

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2010 | Dachunhe 50 MW Hydropower Project | 50 | 2005 | 2008 | 4794 | 54.73% | 4,890 |
| 2015 | Yunnan Dayao County Yupao River 3rd Level Hydropower Station | 20 | 2005 | 2008 | 3880 | 44.29% | 5,739 |
| 2016 | Yunnan Yingjiang Xiangbai River Zhina Hydropower Station | 21 | 2006 | 2008 | 5086 | 58.06% | 4,084 |
| 2045 | Mujiajia Yiji 18.9MW Hydropower Project | 18.9 | 2007 | 209 | 3828 | 43.70% | 4,567 |
| 2048 | Lufeng 36MW Hydropower Project | 36 | 2007 | 2010 | 3773 | 43.07% | 5,501 |
| 2050 | Shangri-La Langdu River 1st Level Hydropower Station | 21.6 | 2006 | 2009 | 4548 | 51.92% | 4,074 |
| 2057 | Shangri-La Langdu River 4th Level Hydropower Station | 24 | 2007 | 2007 | 4714 | 53.81% | 3,984 |
| 2059 | Shangri-La Langtayong Hydropower Station | 18 | 2007 | 2009 | 4648 | 53.06% | 4,696 |
| 2063 | Yunnan Longchuan Nanwanhe 2nd Level Hydropower Station | 20 | 2008 | 2011 | 5320 | 60.73% | 5,610 |
| 2064 | Yunnan Jinping Miao-Yao-Dai Autonomous County Kesikou Hydropower Station | 17 | 2007 | 2009 | 4776 | 54.52% | 6,681 |
| 2075 | Expansion Project of Sanjiangkou Hydro-electric Power Station | 32 | 2005 | 2008 | 5984 | 68.31% | 5,383 |
| 2080 | Binglang River Tucang Hydropower station | 35 | 2005 | 2009 | 5131 | 58.57% | 3,548 |
| 2106 | Yunnan Lianghe Hulukou Hydropower Station | 20 | 2005 | 2008 | 5876 | 67.08% | 4,745 |
| 2114 | Lijiang Wulanghe Secondary Hydropower Project | 32 | 2005 | 2008 | 4557 | 52.02% | 4,852 |
| 2116 | Yunnan Yingjiang Mangya River 1st Hydropower Station | 24.9 | 2005 | 2008 | 5837 | 66.63% | 6,050 |
| 2376 | Yunnan Tengchong Longchuan River Stage I Hydropower Plant | 24 | 2006 | 2006 | 5235 | 59.76% | 6,418 |
| 2625 | Yunnan Maguan Laqi Hydropower Project | 50 | 2006 | 2009 | 4399 | 50.22% | 4,671 |
| 2803 | Yunnan Yingjiang Binglang River Mengnai Hydropower Station Project | 24 | 2006 | 2009 | 4975 | 56.79% | 4,942 |
| 2815 | Yunnan Yingjiang Binglangjiang Shizishan Hydropower Station Project | 24 | 2006 | 2009 | 5043 | 57.57% | 5,280 |
| 2828 | Yunnan Kunming Dongchuan Xiaoqing River 7th Level Hydropower Station | 24 | 2007 | 2009 | 3503 | 39.99% | 3,986 |
| 2859 | Houpayan Hydropower Project in Qiubei County Yunnan Province, China | 24 | 2006 | 2009 | 6238 | 71.21% | 6,238 |
| 2874 | Sidehe 24.8MW Hydropower Project in Yunnan Province | 24.8 | 2006 | 2009 | 3952 | 45.11% | 4,960 |
| 3063 | Zilenghe 24MW Hydropower Project in Yunnan Province | 24 | 2006 | N/A | 5513 | 62.93% | 4,994 |
| 3094 | Yunnan Yizi 19.2MW Hydropower Project | 19.2 | 2007 | 2010 | 4428 | 50.55% | 4,614 |
| 3118 | Yunnan Maguan Mihu River 3rd Level Hydropower Station | 16 | 2006 | 2010 | 4554 | 51.99% | 4,973 |
| 3293 | Zhenkang Fengweihe Hydropower Project in Yunnan Province | 40 | 2008 | 2010 | 4242 | 48.42% | 4,781 |
| 3377 | Yunnan Maguan Tongguo Hydropower Station | 16 | 2006 | 2010 | 3950 | 45.09% | 5,347 |
| 3590 | Zhenkang Quanqiaohe Hydropower Project in Yunnan Province | 16 | 2008 | 2010 | 3856 | 44.02% | 5,215 |
| 3672 | Xiaopengzu 44MW Hydropower Project, Luquan County, Yunnan Province | 44 | 2007 | 2010 | 4028 | 45.98% | 4,805 |
| 3747 | Yunnan Gaohe River 4th level Hydropower Project | 20 | 2008 | 2010 | 4626 | 52.81% | 4,726 |
| Max | - | - | - | - | 6238 | 71.21% | 7,550 |
| Min | - | - | - | - | 3503 | 39.99% | 3,548 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Average | - | - | - | - | 4708 | 53.75% | 5,104 |
| **Proposed project (4051)** | **Yunnan Maguan Xiaobaihe 25 MW Hydropower Project** | **25** | **2008** | **2011** | **4900** | **55.94%** | **5,922** |

**Prior consideration of the CDM**

| Time | Project action | CDM action |
|---|---|---|
| 9/2005 | Feasibility Study Report (FSR) developed | The FSR of the proposed project is with the consideration of CDM |
| 4/2007 | The FSR approved by Yunnan Provincial Development and Reform Committee | |
| 17/10/2007 | | Board meeting to decide to invest the project and apply for CDM |
| 10/2007 | | CDM Consultancy Agreement signed |
| 11/2007 | | Term sheet signed |
| 12/12/2007 | Construction contract signed | (Starting date of the proposed project) |
| 6/2008 | | Host country LoA obtained |
| 10/2008 | | ERPA signed |
| 12/2008 | | CDM consultancy agreement re-signed |

On the date of Oct.17, 2007, the board meeting was held to decide to invest the proposed project and apply for CDM in order to overcome financial weakness and unfavorable conditions. The CDM consulting contract was signed in Oct 2007.

With the expected CDM revenue into consideration, the construction contract was signed on 12 Dec 2007 and can be considered as the starting date of the proposed project. The development procedure shows that CDM was serious considered before the proposed project started.

## B.6. Emission reductions:

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

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**The key methodological steps are as follows:**

1. Calculating the Baseline Emission (*BEy*)
2. Calculating the Project Emission (*PEy*)
3. Calculating the Leakage Emission (*LEy*)
4. Calculating the Emission Reduction (*ERy*)

**1. Calculating the Baseline emissions**

The baseline emissions (*BEy*) is the product of the baseline emissions factor ($EF_{grid,CM,y}$ in $tCO_2e/MWh$) calculated, times the electricity supplied by the project activity to the grid ($EG_{PJ,y}$ in MWh), as follows:

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

### 1.1 Calculation of the baseline emissions factor

Following ACM0002, the baseline emission factor (*EFy*) is calculated as a combined margin ($EF_{grid,CM}$), consisting of the combination of operating margin ($EF_{grid,OM}$,) and build margin ($EF_{grid,BM}$,) factors according to the following seven steps defined in the "Tool to calculate the emission factor for an electricity system" (version 02). Data for the calculations are based on official national statistics books: China Energy Statistical Yearbook and China Electric Power Yearbook.

The following seven steps are applied to calculate the emission factor for an electricity system:
STEP 1. Identify the relevant electricity systems.
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. Identify the group of power units to be included in the build margin (BM).
STEP 6. Calculate the build margin emission factor.
STEP 7. Calculate the combined margin (CM) emissions factor.

**Step 1. Identify the relevant electricity systems**

The DNA of the host country has published a delineation of the project electricity system and connected electricity systems, this delineation is used. Following the DNA delineation, the project electricity system is the South China Power Grid (SCPG), which consists of Guangdong, Guangxi, Yunnan and Guizhou Power Grids. The proposed project is located in Yunnan Province and covered by the SCPG. Therefore, SCPG is chosen as the relevant electric power system. The connected electricity system is the Central China Power Grid (CCPG), consisting of Henan, Hubei, Hunan, Jiangxi, Sichuan and Chongqing provincial grids.

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

The proposed project will be connected to SCPG and therefore does not include off-grid power plants in the project electricity system.

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

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

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

Detailed information to carry out a dispatch data analysis is not publicly available; therefore, method (b) and method (c) is not suitable for the proposed project.

According to "Tool to calculate the emission factor for an electricity system (version 02)", the Simple OM method is applicable to the project if the low-cost resources constitute less than 50% of total grid generation on average in the five most recent years or based on long-term normals for hydroelectric production.

The share of low-cost/must-run generation in SCPG is 23.712% of its total electricity generation that comes from renewable energy sources in 2007, 21.282% in 2006, 30.938% in 2005, and 29.912% in 2004. The Simple OM method, therefore, is selected to calculate the Operating Margin emission factor of the proposed project.

The Simple OM can be calculated using either of the two following data vintages for years(s) y:

• Ex-ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

• Ex-post option : If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Here ex-ante vintage is chosen, and the $EF_{grid,OM}$ is fixed during the first crediting period.

**Step 4. Calculate the operating margin emission factor according to the selected method**
The Simple OM emission factor is calculated as the generation-weighted average $CO_2$ emissions per unit net electricity generation ($tCO_2e/MWh$) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

The simple OM may be calculated:

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

- 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 proposed project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

For Option B, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad (2)$$

Where:

| | | |
|---|---|---|
| $EF_{grid,OMsimple,y}$ | = | Simple operating margin $CO_2$ emission factor in year $y$ ($tCO_2e/MWh$) |
| $FC_{i,y}$ | = | Amount of fossil fuel type $i$ consumed in the project electricity system in year $y$ (mass or volume unit) |
| $NCV_{i,y}$ | = | 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 $y$ ($tCO_2e/GJ$) |
| $EG_y$ | = | Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year $y$ (MWh) |
| $i$ | = | All fossil fuel types combusted in power sources in the project electricity system in year $y$ |
| $y$ | = | The relevant year as per the data vintage chosen in Step 3 |

For this approach (simple OM) to calculate the operating margin, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and including electricity imports to the grid. Electricity imports should be treated as one power plant source.

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. The Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2008. Emission factors ($EF_{CO2,i,y}$ ) of each type of fossil fuel come from IPCC 2006 default values.

On the basis of the data available, the three-year average operating margin emission factor is calculated by the DNA as a full-generation-weighted average of the emission factors:

*EFgrid,OMsimlpe* = 0.9987 tCO2e/MWh

**Step 5. Identify the group of power units to be included in the build margin**

The sample group of power units *m* used to calculate the build margin consists of either:

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

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

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

In terms of vintage of data, project participants can choose between option 1 ex-ante, and option 2 ex-post data vintages. The project proponents have chosen to use the ex-ante option, and *EFgrid,BM,y* is fixed for the duration of the first crediting period.

*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[61]. This option does not require monitoring the emission factor during the crediting period.

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

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (3)$$

Where:

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

Currently, it is very difficulty to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity generated and delivered to the grid and fuel consumption data in power unit *m* are regarded as commercial secrets or only for internal usage. Then the following deviation[62] approved by the EB was adopted to calculate the Build Margin emission factor.

According to the guidance from the CDM Executive Board for a deviation of the baseline methodology of AM0005, which had combined into the baseline methodology of ACM0002, the following deviation was adopted to calculate the Build Margin emission factor.

1) Use the efficiency level of the best technologies commercially available in the 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 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. For the proposed project, the data from Year 2005 to 2007 is used to calculate $EF_{grid,BM,y}$

[61] Although the data published by NDRC in July 2009 was not available when the project was GSP in May 2009, the China Power Electric Yearbook 2008 and China Energy Statistical Yearbook 2008 (the main data source) have already published in December 2008. And the data in July 2009 is more conservative than that in December 2008. Therefore, the data in July 2009 is used in the emission factor calculation.

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

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

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

Sub-step 1. Calculation of weights of $CO_2$ emissions of solid, liquid and gaseous fossil fuels in total emissions for power generation

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \quad (4)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \quad (5)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \quad (6)$$

Where:

$FC_{i,j,y}$ = Amount of fossil fuel type $i$ consumed in province $j$ in year $y$ (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type $i$ in year $y$ (GJ/t or GJ/m$^3$)

$EF_{CO2,i,y}$ = $CO_2$ emission factor of fossil fuel type $i$ in year $y$ ($tCO_2e$/GJ)

*Coal*, *Oil* and *Gas* refer to the group of solid, liquid, and gaseous fossil fuels, respectively.

Sub-step 2: Calculation of Emission Factor of Relevant Thermal Power

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (7)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ refer to the emission factors representing best technologies commercially available for coal, oil and gas fired power plants, respectively.

Sub-step 3: Calculation of BM of the Grid

Using the share of different type of capacity in total capacity addition as weight, the weighted average of emission factors of different type capacity is calculated as the Build Margin emission factor $EF_{grid,BM,y}$ of SCPG.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (8)$$

Where:

$CAP_{Total}$ = The total newly added electricity generation capacity (MW)

$CAP_{Thermal}$ = The newly added electricity generation capacity of thermal power (MW)

Following the four steps above, the build margin emission factor $EF_{grid,BM,y}$ of the SCPG is calculated to be: 0.5772 tCO2e/MWh (see Annex 3 for more details).

**Step 7. Calculate the combined margin emission factor**

The baseline emissions factor ($EF_{CM}$) is calculated as the weighted average of the Operating Margin emission factor and Build Margin emission factors following ACM0002. For hydro projects, the default weights are as follows: $w_{OM}$ = 0.5 and $w_{BM}$ = 0.5:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (9)$$

Where:

$EF_{grid,BM,y}$ = Build margin $CO_2$ emission factor in year *y* ($tCO_2e/MWh$)

$EF_{grid,OM,y}$ = Operating margin $CO_2$ emission factor in year *y* ($tCO_2e/MWh$)

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

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

On the basis of these weights for the first crediting period, the combined margin emission factor is calculated, and fixed ex-ante:

$EF_{grid,CM,y}$ = 0.7879 tCO2e/MWh

Baseline emissions (*BEy*) now can be calculated as the combined margin $CO_2$ emission factor ($EF_{grid,CM,y}$) multiplied by the annual net generation of the Proposed Project (*EGy*).

**2 Calculating the Project Emission (*PEy*)**

According to ACM0002 (version 10), project emission of the proposed hydropower project is zero.

$PE_y = 0$

**3 Calculating the Leakage Emission (*LEy*)**

According to ACM0002 (version 10), no leakage is considered for the proposed project.

$LE_y = 0$

**4 Calculating the Emission Reduction (*ERy*)**

The annual emission reductions $ER_y$ for the project activity are calculated as the baseline emissions minus the project emissions and minus the leakage emissions. Being the project of a zero-emission activity the final GHG emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (10)$$

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

>>

| Data / Parameter: | $FC_{i,m,y}$ |
|---|---|
| Data unit: | tonnes or $m^3$ |
| Description: | Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y* |
| Source of data used: | China Energy Statistical Yearbook（2002~2008） |
| Value applied: | See Annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data |
| Any comment: | Applied for calculating OM and BM |

| **Data / Parameter:** | $NCV_{i,y}$ |
|---|---|
| Data unit: | kJ/kg or kJ/$m^3$ |
| Description: | Net calorific value (energy content) of fossil fuel type *i* in year *y* |
| Source of data used: | China Energy Statistical Yearbook（2008） |
| Value applied: | See Annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data |
| Any comment: | Applied for calculating OM and BM |

| **Data / Parameter:** | $EF_{CO2,i,y}$ |
|---|---|
| Data unit: | $tCO_2e/GJ$ |
| Description: | $CO_2$ emission factor of fossil fuel type *i* in year *y* |
| Source of data used: | 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 : | IPCC default value |
| Any comment: | Applied for calculating OM and BM |

| **Data / Parameter:** | **Carbon Oxidation Factor** |
|---|---|
| Data unit: | % |
| Description: | Carbon Oxidation Factor of fossil fuel type *I* consumed by the power plants in the grid |

| | |
|---|---|
| Source of data used: | 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 : | IPCC default value |
| Any comment: | Applied for calculating OM and BM |

| **Data / Parameter:** | **Installed Capacity** |
|---|---|
| Data unit: | MW |
| Description: | The Installed Capacity of the power plants in the grid in the year y |
| Source of data used: | China Electric Power Yearbook (2006-2008) |
| Value applied: | See Annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data |
| Any comment: | Applied for calculating BM |

| **Data / Parameter:** | $GEN_y$ |
|---|---|
| Data unit: | MWh |
| Description: | The electricity generation of the power plants in the grid in the year y |
| Source of data used: | China Electric Power Yearbook |
| Value applied: | See Annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data |
| Any comment: | Applied for calculating BM |

| **Data / Parameter:** | **Efficiency of the best technology commercially** |
|---|---|
| Data unit: | % |
| Description: | Best commercial available efficiency of coal, gas, oil fuel power plant |
| Source of data used: | Chinese DNA's Guideline of emission factors of Chinese grids |
| Value applied: | Best efficiency for coal plant is 37.28%<br>Best efficiency for oil plant is 48.81%<br>Best efficiency for gas plant is 48.81% |
| Justification of the choice of data or description of measurement methods | Official statistic value |

| | |
|---|---|
| and procedures actually applied : | |
| Any comment: | Applied for calculating BM |

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

>>
Based on the FSR, the net power generation of this proposed project will be 109,700 MWh annually. The emission reduction *ERy* by the project activity in a given year y is calculated as follows

$BE_y = EG_y \times EF_{grid,CM,y}$ = 109,700 × 0.7879 = 86,437 $tCO_2e$

$ER_y = BE_y - PE_y - LE_y$ = 86,437 - 0 – 0 = 86,437 $tCO_2e$

The proposed project activity is expected to achieve 605,059 $tCO_2e$ of net emission reductions during the first 7-year crediting period.

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

>>

| Year | Estimation ofproject activityemissions (tonnes of $CO_2e$) | Estimation of baseline emissions (tonnes of $CO_2e$) | Estimation of leakage (tonnes of $CO_2e$) | Estimation of overall emission reductions (tonnes of $CO_2e$) |
|---|---|---|---|---|
| 1/11/2010-31/10/2011 | 0 | **86,437** | 0 | **86,437** |
| 1/11/2011-31/10/2012 | 0 | **86,437** | 0 | **86,437** |
| 1/11/2012-31/10/2013 | 0 | **86,437** | 0 | **86,437** |
| 1/11/2013-31/10/2014 | 0 | **86,437** | 0 | **86,437** |
| 1/11/2014-31/10/2015 | 0 | **86,437** | 0 | **86,437** |
| 1/11/2015-31/10/2016 | 0 | **86,437** | 0 | **86,437** |
| 1/11/2016-31/10/2017 | 0 | **86,437** | 0 | **86,437** |
| **Total (tonnes of $CO_2e$)** | **0** | **605,059** | 0 | **605,059** |

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

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

>>

| | |
|---|---|
| **Data / Parameter:** | $EG_{facility,y}$ |
| Data unit: | MWh/yr |
| Description: | Quantity of net electricity generation supplied by the project to the Grid in year y. |
| Source of data to be used: | Calculation by $EG_{export,y}$ minus $EG_{import,y}$ |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5. | 109,700 |

| | |
|---|---|
| Description of measurement methods and procedures to be applied: | The net electricity supplied to the Grid by the proposed project will be calculated through electricity supplied by the project to the grid ($EG_{export,y}$) minus electricity purchased from the Grid ($EG_{import,y}$). |
| QA/QC procedures to be applied: | Power supplied to the grid will be checked by internal verification procedure and electricity sales receipts. |
| Any comment: | |

| **Data / Parameter:** | $EG_{export,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied to the grid by the proposed project during year *y* |
| Source of data to be used: | Bidirectional electricity meter reading |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 109,700 |
| Description of measurement methods and procedures to be applied: | The readings of the electricity meter will be hourly measured and monthly recorded. Data will be archived for 2 years following the end of the last crediting period by means of electronic and paper backup. The accuracy of electricity meter will be no lower than 0.5s. The calibration frequency is one time/year. |
| Monitoring frequency: | Hourly measurement and monthly recording |
| QA/QC procedures to be applied: | The electricity supplied by the project activity to the grid will be monitored and recorded at the central control room. The project operator is responsible for recording such data. Double check by receipt of sales. |
| Any comment: | The reading from the main meter is first choice. When the main meter is out of order, the reading from the backup meter will be used. |

| **Data / Parameter:** | $EG_{import,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity purchased from the grid by the proposed project during year *y* |
| Source of data to be used: | Electricity meter reading |
| 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 readings of the electricity meter will be hourly measured and monthly recorded. Data will be archived for 2 years following the end of the crediting period by means of electronic and paper backup. The accuracy of electricity meter will be no lower than 0.5s. The calibration frequency is one time/year. |
| QA/QC procedures to be applied: | The electricity purchased from the grid will be monitored and recorded at the central control room. The project operator is responsible for recording such data. Double check by receipt of sales. |
| Any comment: | The reading from the main meter is first choice. When the main meter is out of |

| | |
|---|---|
| | order, the reading from the backup meter will be used. |

| **Data / Parameter:** | $PE_{EF,y}$ |
|---|---|
| Data unit: | $tCO_2$/yr |
| Description: | CO2 emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr). This parameter shall be calculated as per the latest version of the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" where j stands for the processes required for the operation of the solar/geothermal power plant and/or backup power generation. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0 |
| Source of data to be used: | As per the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" |
| Measurement procedures (if any): | As per the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" |
| Monitoring frequency: | As per the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" |
| QA/QC procedures: | As per the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" |
| Any comment: | As per the "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" |

| **Data / Parameter:** | $CAP_{PJ}$ |
|---|---|
| Data unit: | W |
| Description: | Installed capacity of the hydro power plant after the implementation of the project activity |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | $25\times10^6$ |
| Source of data to be used: | Project site |
| Measurement procedures (if any): | Determine the installed capacity based on recognized standards |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| 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 |
| Value of data applied | 42,733 |

| | |
|---|---|
| for the purpose of calculating expected emission reductions in section B.5 | |
| | |
| Source of data to be used: | Project site |
| Measurement procedures (if any): | Measured from topographical surveys, maps, satellite pictures, etc |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Any comment: | - |

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

>>
The proposed project adopts the approved consolidated monitoring methodology ACM0002 "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources" (version 10) to determine the emission reductions from the net electricity generation from the hydropower plant. The details of the process are discussed as shown below:

**1. Monitoring Object**

The monitoring is to justify the realistic amount of emission reduction from the CDM project. The monitoring plan will provide credible, accurate, transparent and conservative monitoring data and ensure the real, measurable, long-term GHG emission reduction from this project.

**2. Management Structure**

Maguan County Changjiang Hydropower Development Co., Ltd., the owner of the proposed project, will use this document as guideline in monitoring of the project emission reduction performance and will adhere to the guidelines set out in this monitoring plan to ensure that the monitoring is credible, transparent and conservative.

The responsibilities of the project staff are as follow:

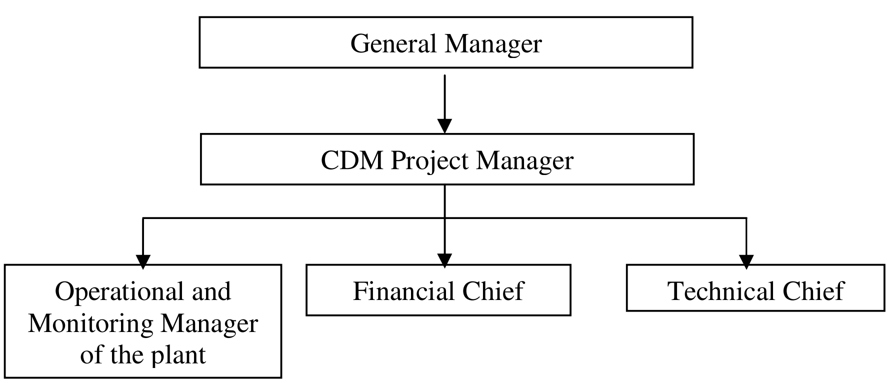
General Manager: To be responsible for supervising the whole monitoring procedure.

CDM Project Manager: To be responsible for data management and compiling monitoring report.

Operational and monitoring manager: To be responsible for collecting data and do internal audit.

Financial chief: To be responsible for collection of sales receipts.

Technical chief: To be responsible for preparing operational reports of the project activity, recording the daily operation of the proposed project, including operating periods, equipment defects, etc.

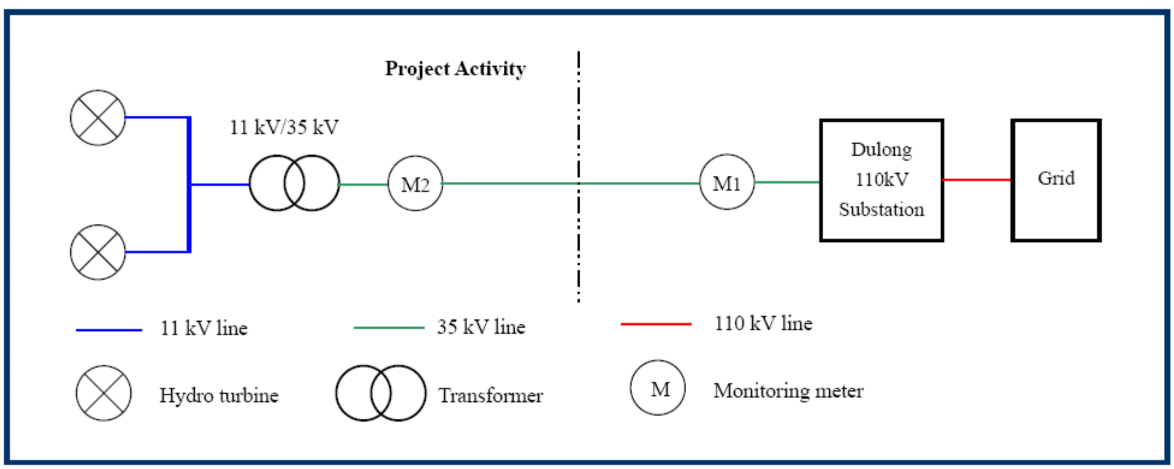


### 3. Monitoring Equipments

Two bi-directional electricity meters (no lower than 0.5s) are installed to measure directly and continuously the electricity delivered to the grid by the project activity and the electricity fed from the grid to the project site. The to-grid and from-grid electricity will be cross-checked with the electricity receipts.

The receipts of the electricity delivered to the power grid by this proposed project and the electricity fed from the power grid will be issued based on the power purchase agreement (PPA) signed between the project entity and the power grid company and the readings from the main meter (M1). The net generation is calculated as exports minus imports.

The main meter (M1) is located near Dulong 110kV substation and back-up meter (M2) is located in the project site as the following chart.




The metering equipment are calibrated and checked for accuracy so that the metering equipment shall have sufficient accuracy within the agreed limits. The metering equipments are calibrated and checked annually by qualified third party for accuracy. The records will be supplied to the operator, and maintained by the operator.

If any error is detected, the party owning the meter shall repair, recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.

### 4. Monitoring procedure

The electricity supplied to the gird and the electricity imported from the grid will base on the main meter (M1) installed in 110kV Dulong substation. The receipts of the electricity delivered to the power grid by this proposed project and the electricity fed from the power grid will be issued based on the power purchase agreement (PPA) signed between the project entity and the power grid company and the readings from M1. The on site backup meter M2 will be used when M1 fails to work.

The net generation is calculated as exports minus imports. Every month, the electricity exchanged between the proposed project and SCPG via the 110kV Dulong substation is cross-checked by the project owner and the grid company, the metered values of electricity exported and imported will confirmed by the two sides.

**5. Quality Assurance and Quality Control**
The workers are trained to be competent and the metering equipments are calibrated and sealed as per the industry practices at regular intervals, with the purpose to provide credible, accurate, transparent and conservative monitoring data and ensure the real, measurable, long-term GHG emission reduction from this project.

Monthly net on-grid electricity supplied data will be approved and signed off by the Manager before it is accepted and stored. This audit will check compliance with monitoring procedures in this monitoring plan. This internal audit will also identify potential improvements to procedures to improve monitoring and reporting in future years. The monitoring officers will also attend a training session organized by the CDM consultant, including data monitoring procedures, quality control & quality assurance (QA/QC) and emergencies. The purpose of training is to assure those staffs are competent to conduct the monitoring plan, thus to make the monitored data accurate. In particular, the CDM manager will manage the process of training new staff, ensuring trained staff performs the monitoring duties and the integrity of the monitoring system is maintained by other backup staff when trained monitoring staff is absent.

**Emergency Procedure:**
In case metering equipment is damaged and no reliable readings can be recorded the project entity will estimate net supply by the proposed project activity according to the following procedure:
1. In case metering equipment operated by project entity is damaged: The metering data logged by the grid company will be used as record of net power supplied to the grid for the days for which no record could be recorded.
2. In case both metering equipment operated by project entity and grid company is damaged: The project entity and the grid company will jointly calculate a conservative estimate of power supplied to the grid. A statement will be prepared indicating
► the background to the damage to metering equipment
► the assumptions used to estimate net supply to the grid for the days for which no record could be recorded
► the estimation of power supplied to the grid. The statement will be signed by both a representative of the project entity as well as a representative of the grid company.

The project entity will furthermore document all efforts taken to restore normal monitoring procedures.

**6. Data Management System**
The CDM manual sets out the procedures for tracking information from the primary source to the end-data calculations in paper document format. Physical documentation such as paper-based maps, diagrams and environmental assessment will be collated in a central place, together with this monitoring

plan. In order to facilitate auditors' reference of relevant literature relating to the proposed project activity, the project material and monitoring results will be made available.

At the end of each month, the monitoring data will be filed in a spreadsheet and stored electronically, and the paper-based printout should be also archived. Furthermore, the project owner collects the sales receipts for the electricity supplied to the grid as a cross-check, and compiled the monitoring report including the monitoring data and relevant evidence at the end of each crediting year.

All the data will be kept for two years following the end of the last crediting period.

**7. Monitoring Report**

The monitoring report is prepared by the CDM project manager alone or with designated third party. The project developer and/or the designated third party have to make sure that the format and content of the monitoring report are consistent with the monitoring methodology in the registered PDD.

**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):**

>>

Date of completion of Baseline Study: 10/03/2009

Name of person/entity determining the baseline:

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Above persons are not Project Participants.

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

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

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

>>
12/12/2007 (the date of construction contract signed)

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

>>
26 years

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

#### C.2.1. Renewable crediting period

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

>>
01/11/2010 (or the date of registration date 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 impact assessment for this project was carried out by Yunnan University in Dec 2005 and approved by Yunnan Provincial Environmental Protection Bureau on 20 Jan 2006. A summary of conclusion of the report is illustrated as below:

**1. Impact on Ambient Air**
The main air pollutions produced during the construction period will be dust, $SO_2$ and $NO_x$. With proper measures such as watering and covering measures will be taken, the construction of the project will have little impact on the quality of the ambient air.

**2. Impact on Acoustic Environment**
The acoustic environment will be impacted during the construction period. There will be a minimal impact on local resident. Construction workers will use earplugs to minimize the impact of the noise. The impact will be temporary and will disappear once the construction is completed.

**3. Impact on Aquatic Environment**
The industrial wastewater will be treated in a setting pit and discharged after satisfying the proper standards. The domestic wastewater will be utilized by local farmers or will be discharged within the discharging limits. The impact on the water quality will be comparatively small.

**4. Impact of Solid Waste on Environment**
The domestic garbage will be disposed into a low-lying waste disposal site and covered by earth and virescence. The waste slag produced will be shipped to designed slag waste fields, backfilled and finally comprehensively used. So there will be little impact on the environment after due to proper measures taken.

**5. Impact on Soil and Water Loss**
The project entity will employ engineering, vegetation and management measures to control and prevent soil and water loss. Due to practical measures taken with regard to water and soil loss in the project area, the ecological environment will be protected and improved.

**6. Impact on Land Requisition, Land Utilization and Immigration**
The project will expropriate some land. The project entity will compensate for the occupied land and the influence on local citizens will be comparatively small. The project has not involved immigration.

**7. Impact on Ecosystem**
The hydrobios involved in this project includes general species which are commonly found in the surrounding area. So there is no treat of extinction or significant reduction of these species and the impact on the ecosystem is small.

**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 environmental laws and regulations in the host country. The environmental impacts of the proposed project are not considered significant.

## SECTION E. Stakeholders' comments

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

>>
In Nov 2007, staff from the project owner carried out a survey of the local residents around the project location. The staffs put up a notice about the conference of local stakeholders on Yunnan Maguan Xiaobaihe 25MW Hydropower Project and then sent out 50 copies of questionnaire in a random way, 48 pieces of reply was received. Among the interviewees, 39 of them are farmers, 3 are workers, 1 is governmental officials, 2 are students, 2 are teachers and 1 is others.

An invitation notice for stakeholder comments was later issued by the project developer, 25 representatives of local stakeholders, including governmental officials of local county, local residents, and representatives of the project owner. Etc attended the meeting on 20th Nov. 2007 to discuss the questionnaires collected and further introduce the project. No negative opinion on construction of the project is heard and environmental considerations expressed by stakeholders are discussed on the meeting.

The questions regarding the proposed project were mainly as follows:

| |
|---|
| Do you know about the proposed project? |
| Do you think the proposed project will stimulate the local economic development? |
| Do you think the proposed project will bring effect to the local environment? |
| Do you think the proposed project will bring effect to the ecological environment and the social environment? |
| Which environmental problem concerns you most during the construction and operation of the proposed project? |
| Do you support the proposed project? |

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

>>
The summary of questionnaire survey is listed as the following:

- 18 (37.5%)of them know very well about the proposed project; 28 (58.33%) know a little of it; 2 (4.16%) do not know about it;
- 47 (97.92%) of them think the proposed project will stimulate the local economic development and 1 (2.08%) of them is unsure;
- 38 (79.17%) of them think the proposed project will bring effect to the local environment;,4 (8.33%) think it will not bring effect to the local environment, 6 (12.5%) are unsure;
- 35 (72.92%) of them think the proposed project will bring effect to the ecological environment and social environment ; 8 (16.67%) think it will not bring effect to the ecological environment and social environment; and 5 (10.42%) are unsure;
- 2 (4.17%) of them think impacts on arable land and resident s' living and production is what they concern most during the construction and operation of the proposed project; 31 (64.58%) of them

think, impacts on water loss and soil erosion is what they concern most; and 15 (31.25%) of them think the impacts on ecological environment and aquatic organism is what they concern most;; ;

- 48 (100%) of them support the proposed project.

The summary of local stakeholders meeting:
This stakeholder meeting was very successful. The local community possesses basically positive comments on the effects of the proposed project. The interviewees considered that local social, economic and environmental development would be beneficial from the proposed project. The response was overall supportive to the project implementation.

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

>>
During the survey some people express their concerns about the environmental impacts of the project; local residents were most concerned about water loss and soil erosion, ecological environment and aquatic organism, and arable land and resident s' living and production as showed in the questionnaires. For the benefit of local stakeholders, the requirements in the EIA report to mitigate influence on water loss and soil erosion, ecological environment and aquatic organism, and arable land and resident s' living and production will be strictly conducted by the project owner and be supervised by the municipal environmental protection bureau. Therefore, the proposed project can be carried out as planned.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Maguan County Changjiang Hydropower Devlopment Co., Ltd. |
| Street/P.O. Box: | Juncheng Road Mabai Town Maguan County |
| Building: | Guangdian Building 6F |
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| State/Region: | Yunnan |
| Postfix/ZIP: | 663700 |
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## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for Yunnan Maguan Xiaobaihe 25MW Hydropower Project.

## Annex 3

## BASELINE INFORMATION

*All the tables related to the calculation of baseline emission reduction are presented below:*

**Calculation of Operating Margin (OM)**

**Table A1. Simple OM Emission Factor of Southern China Power Grid in 2005**

| Fuel types | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Subtotal | Carbon Content (tc/TJ) | Oxidation rate (%) | Emission Coefficient of Fuel ($kgCO_2/TJ$) | Average low Caloric value (MJ/t,km3) | $CO_2$ emission ($tCO_2e$) J=E×H×I/100000 (unit of mass) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | I | J=E×H×I/10000 (unit of volume) |
| Raw coal | 10000ton | 6,696.47 | 1,435 | 3,212.31 | 1,975.55 | **13,319.33** | 25.8 | 100 | 87,300 | 20,908 | 243,113,522 |
| Cleaned coal | 10000 ton | | | | 0.15 | **0.15** | 25.8 | 100 | 87,300 | 26,344 | 3,450 |
| Other washed coal | 10000 ton | | | 10.39 | 33.88 | **44.27** | 25.8 | 100 | 87,300 | 8,363 | 323,211 |
| Coke | 10000 ton | 4.79 | | | 8.05 | **12.84** | 29.2 | 100 | 95,700 | 28,435 | 349,406 |
| Coke oven gas | 108m3 | | | | 0.79 | **0.79** | 12.1 | 100 | 37,300 | 16,726 | 49,287 |
| Other coal gas | 108m3 | 1.87 | | | 15.96 | **17.83** | 12.1 | 100 | 37,300 | 5,227 | 347,626 |
| Crude oil | 10000 ton | 10.91 | | | | **10.91** | 20 | 100 | 71,100 | 41,816 | 324,367 |
| Gasoline | 10000 | 0.68 | | | | **0.68** | 18.9 | 100 | 67,500 | 43,070 | 19,769 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ton | | | | | | | | | | |
| Diesel | 10000 ton | 31.96 | 2.02 | | 1.81 | **35.79** | 20.2 | 100 | 72,600 | 42,652 | 1,108,250 |
| Fuel oil | 10000 ton | 887.21 | | | | **887.21** | 21.1 | 100 | 75,500 | 41,816 | 28,010,178 |
| LPG | 10000 ton | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | 10000 ton | 4.92 | | | | **4.92** | 15.7 | 100 | 48,200 | 46,055 | 109,217 |
| Natural gas | $10^8$m3 | 0.93 | | | | **0.93** | 15.3 | 100 | 54,300 | 38,931 | 196,598 |
| Other oil product | 10000 ton | 1.7 | | | | **1.7** | 20 | 100 | 75,500 | 41,816 | 53,671 |
| Other coking product | 10000 ton | | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other fuel | 10000 tce | 104.66 | 133.15 | | 59.72 | **297.53** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | **Subtotal** | 274,008,550 |

Source: China Energy Statistical Yearbook 2006

**TableA2. Thermal Power Generation of Southern China Power Grid in 2005**

| **Province** | **Power Generation (MWh)** | **Ratio of Self Power Consumption of Plant (%)** | **Power Supply(MWh)** |
|---|---|---|---|
| Guangdong | 176,453,000 | 5.58 | 166,606,923 |
| Guangxi | 25,023,000 | 7.95 | 23,033,672 |
| Guizhou | 58,430,000 | 7.34 | 54,141,238 |
| Yunnan | 27,281,000 | 6.94 | 25,387,699 |
| **Total** | | | 269,169,531 |

Source: China Electric Yearbook 2006

**Table A3. Emission Factor of Southern China Power Grid in 2005**

| | Parameter | Unit | Value | Source |
|---|---|---|---|---|
| A | Net Import from Central China Power Grid to Southern China Power Grid (MWh) | MWh | 20,264,000 | |
| B | Average Emission Factor of Central China Power Grid | tCO2e /MWh | 1.16148 | Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook |
| C | Total Power Supply of Southern China Power Grid | MWh | 289,433,531 | C= Total Power Generation of Southern China Power Grid＋A |
| D | Total Emissions of Southern China Power Grid | tCO2e | 297,544,857 | |
| E | Emission Factor of Southern China Power Grid | tCO2e /MWh | 1.02802 | E=D/C |

**Table A4. Simple OM Emission Factor of Southern China Power Grid in 2006**

| **Fuel types** | **Unit** | **Guangdong** | **Guangxi** | **Guizhou** | **Yunnan** | **Subtotal** | **Carbon Content （tc/TJ）** | **Oxidation rate （%）** | **Emission Coefficient of Fuel (kg$CO_2$/TJ)** | **Average low Caloric value （MJ/t,km$^3$）** | **$CO_2$ emission （t$CO_2$e） J=E×H×I/100000 （unit of mass）** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** | **E=A+B+C+D** | **F** | **G** | **H** | **I** | **J=E×H×I/10000 (unit of volume)** |
| Raw coal | 10000 ton | 7303.19 | 1490.01 | 4001.54 | 2735.88 | **15530.62** | 25.8 | 100 | 87,300 | 20,908 | 283,475,499 |
| Cleaned coal | 10000 | | | | | **0** | 25.8 | 100 | 87,300 | 26,344 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ton | | | | | | | | | | |
| Other washed coal | 10000 ton | | | 19.53 | 45.8 | **65.33** | 25.8 | 100 | 87,300 | 8,363 | 476,968 |
| Coal Briquette | 10000 ton | 133.75 | | | | **133.75** | 26.6 | 100 | 87,300 | 20,908 | 2,441,296 |
| Coke | 10000 ton | | | | 1.31 | **1.31** | 29.2 | 100 | 95,700 | 28,435 | 35,648 |
| Coke oven gas | $108m^3$ | | 0.84 | | 2.06 | **2.9** | 12.1 | 100 | 37,300 | 16,726 | 180,925 |
| Other coal gas | $108m^3$ | 0.89 | | | 19.15 | **20.04** | 12.1 | 100 | 37,300 | 5,227 | 390,714 |
| Crude oil | 10000 ton | 0.87 | | | | **0.87** | 20 | 100 | 71,100 | 41,816 | 25,866 |
| Gasoline | 10000 ton | | | | | **0** | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | 10000 ton | 29.92 | 1.26 | | 3 | **34.18** | 20.2 | 100 | 72,600 | 42,652 | 1,058,396 |
| Fuel oil | 10000 ton | 685.85 | 0.09 | | | **685.94** | 21.1 | 100 | 75,500 | 41,816 | 21,655,867 |
| LPG | 10000 ton | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |
| Refinery gas | 10000 ton | | | | | **0** | 15.7 | 100 | 48,200 | 46,055 | 0 |
| Natural gas | $108m^3$ | 7.92 | | | | **7.92** | 15.3 | 100 | 54,300 | 38,931 | 1,674,251 |
| Other oil product | 10000 ton | 0.67 | | | | **0.67** | 20 | 100 | 75,500 | 41,816 | 21,153 |
| Other coking product | 10000 ton | | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other fuel | 10000 tce | 93.54 | 189.68 | | 20.29 | **303.51** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | Subtotal | 311,436,583 |

Source: China Energy Statistical Yearbook 2007

**Table A5. Thermal Power Generation of Southern China Power Grid in 2006**

| Province | Power Generation (MWh) | Ratio of Self Power Consumption of Plant (%) | Power Supply(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 |

Source: China Electric Yearbook 2007

**Table A6. Emission Factor of Southern China Power Grid in 2006**

| | Parameter | Unit | Value | Source |
|---|---|---|---|---|
| A | Net Import from Central China Power Grid to Southern China Power Grid (MWh) | MWh | 21,730,840 | |
| B | Average Emission Factor of Central China Power Grid | tCO2e /MWh | 1.12157 | Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook |
| C | Total Power Supply of Southern China Power Grid | MWh | 336,534,748 | C= Total Power Generation of Southern China Power Grid＋A |
| D | Total Emissions of Southern China Power Grid | tCO2e | 335,809,186 | |
| E | Emission Factor of Southern China Power Grid | tCO2e /MWh | 0.99784 | E=D/C |

**Table A7. Simple OM Emission Factor of Southern China Power Grid in 2007**

| Fuel types | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Subtotal | Carbon Content (tc/TJ) | Oxidation rate (%) | Emission Coefficient of Fuel ($kgCO_2/TJ$) | Average low Caloric value ($MJ/t,km^3$) | $CO_2$ emission ($tCO_2e$) J=E×H×I/100000 (unit of mass) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | I | J=E×H×I/10000 (unit of volume) |
| Raw coal | 10000 ton | 8214.78 | 1750.63 | 4298.8 | 3170.79 | **17435** | 25.8 | 100 | 87,300 | 20,908 | 318,235,546 |
| Cleaned coal | 10000 ton | 3.46 | | | | **3.46** | 25.8 | 100 | 87,300 | 26,344 | 79,574 |
| Other washed coal | 10000 ton | | 0.65 | 21.58 | 14.64 | **36.87** | 25.8 | 100 | 87,300 | 8,363 | 269,184 |
| Coal Briquette | 10000 ton | 271.25 | | | | **271.25** | 26.6 | 100 | 87,300 | 20,908 | 4,951,041 |
| Coke | | 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 | 10000 ton | | | | | **0** | 20 | 100 | 71,100 | 41,816 | 0 |
| Gasoline | 10000 ton | | | | | **0** | 18.9 | 100 | 67,500 | 43,070 | 0 |
| Diesel | 10000 ton | 21.37 | 2.13 | | 2.29 | **25.79** | 20.2 | 100 | 72,600 | 42,652 | 798,596 |
| Fuel oil | 10000 ton | 467.97 | 0.41 | | | **468.38** | 21.1 | 100 | 75,500 | 41,816 | 14,787,262 |
| LPG | 10000 | | | | | **0** | 17.2 | 100 | 61,600 | 50,179 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ton | | | | | | | | | | |
| Refinery gas | 10000 ton | 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 oil product | 10000 ton | 8.47 | | | | **8.47** | 20 | 100 | 75,500 | 41,816 | 267,407 |
| Other coking product | 10000 ton | | | | | **0** | 25.8 | 100 | 95,700 | 28,435 | 0 |
| Other fuel | 10000 tce | 118.04 | 81.89 | 44.1 | 50.3 | **294.33** | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | Subtotal | 347,695,831 |

Source: China Energy Statistical Yearbook 2008

**Table A8. Thermal Power Generation of Southern China Power Grid in 2007**

| **Province** | **Power Generation (MWh)** | **Ratio of Self Power Consumption of Plant (%)** | **Power Supply(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 |

Source: China Electric Yearbook 2008

**Table A9. Emission Factor of Southern China Power Grid in 2007**

| | **Parameter** | **Unit** | **Value** | **Source** |
|---|---|---|---|---|
| A | Net Import from Central China Power Grid to Southern China Power Grid | MWh | 24,237,240 | |

| | | | | |
|---|---|---|---|---|
| | (MWh) | | | |
| B | Average Emission Factor of Central China Power Grid | tCO2e /MWh | 1.10197 | Calculation based on data from China Electric Power Yearbook and China Energy Statistical Yearbook |
| C | Total Power Supply of Southern China Power Grid | MWh | 383,087,370 | C= Total Power Generation of Southern China Power Grid＋A |
| D | Total Emissions of Southern China Power Grid | tCO2e | 374,404,628 | |
| E | Emission Factor of Southern China Power Grid | tCO2e /MWh | 0.97733 | E=D/C |

**Table A10. Operating Margin Emission Factor of Southern China Power Grid**

| | | Year 2005 | Year 2006 | Year 2007 | Total |
|---|---|---|---|---|---|
| A | Emissions (tCO2e /year) | 297,544,857 | 335,809,186 | 374,404,628 | 1,007,758,671 |
| B | Power Supply (MWh) | 289,433,531 | 336,534,748 | 383,087,370 | 1,009,055,649 |
| C | CO2 Emission Factor (tCO2e/MWh) | C = A/B | | | 0.9987 |

**Calculation of Build Margin (BM):**

**Step 1. Calculation of weights of CO2 emissions of solid, liquid and gas fuel in total emissions for power generation**

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

Where:
$FC_{i,j,y}$ : Amount of fossil fuel type *i* consumed in province *j* in year *y* (mass or volume unit, for solid and wet fuel, the unit is ton, for gas fuel, the unit is $m^3$);
$NCV_{ij}$ : Net thermal value of fuel type *i* in year *y* (for solid and wet fuel, the unit is GJ/t, for gas fuel, the unit is $GJ/m^3$);
$EF_{CO2,i,y}$ : $CO_2$ emission factor of fossil fuel type *i* in year *y* ($tCO_2$ /GJ);
*COAL, OIL and GAS* respectively refers to the group of solid, liquid, and gas fuels.

Based on China Energy Statistical Yearbook 2008, the calculation of the weights of solid, liquid, and gas fuels in Southern China Power Grid are:
$\lambda_{Coal}$=93.08%， $\lambda_{Oil}$=4.56%， $\lambda_{Gas}$=2.36%

**Step 2: Calculation of Emission Factor of Relevant Thermal Power**

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

Where: $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ respectively refers to the emission factor representing best technology commercially available for fuel of coal, oil or gas fired power plants. For specific workings, see the following:

**Table A11. Emission factor representing best technology commercially available for fuel of coal, oil or gas fired power plants**

| | Variable | Efficiency of Power Supply | Emission Coefficient of Fuel **($kgCO_2$/TJ)** | Oxidation Rate | Emission Factor ($tCO_2e$/MWh) |
|---|---|---|---|---|---|

| | | A | B | C | D=3.6/A/1,000,000×B×C |
|---|---|---|---|---|---|
| Coal-fired Power Plant | $EF_{Coal,Adv}$ | 38.10% | 87,300 | 1 | 0.8249 |
| Gas-fired Power Plant | $EF_{Gas,Adv}$ | 49.99% | 75,500 | 1 | 0.5437 |
| Oil-fired Power Plant | $EF_{Oil,Adv}$ | 49.99% | 54,300 | 1 | 0.3910 |

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =0.8018 ($tCO_2$/MWh)

**Step 3: Calculation of BM of the Grid**

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

Where: $CAP_{Total}$ is the total of new capacity additions, and $CAP_{Thermal}$ is the new capacity addition of thermal power.

**Table A12. Installed Capacity of Southern China Power Grid in 2007**

| Installed Capacity | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total |
|---|---|---|---|---|---|---|
| Thermal Power | MW | 44,710 | 9,310 | 15,960 | 10,630 | 80,610 |
| Hydropower | MW | 10,110 | 10,440 | 8,210 | 11,580 | 40,340 |
| Nuclear Power | MW | 3,780.0 | 0.0 | 0.0 | 0.0 | 3,780.0 |
| Wind Power and Others | MW | 250 | 0.0 | 0.0 | 0.0 | 250 |
| Total | MW | 58,850 | 19,750 | 24,170 | 22,210 | 124,980 |

Source: China Power Yearbook 2008

**Table A13. Installed Capacity of Southern China Power Grid in 2006**

| Installed Capacity | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total |
|---|---|---|---|---|---|---|
| Thermal Power | MW | 40,615 | 5,434 | 14,350 | 8,564 | 68,963 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Hydropower | MW | 9,320 | 7,624 | 7,534 | 9,698 | 34,176 |
| Nuclear Power | MW | 3,780 | 0 | 0 | 0 | 3,780 |
| Wind Power and Others | MW | 183 | 0 | 0 | 0 | 183 |
| Total | | 53,898 | 13,058 | 21,884 | 18,262 | 107,102 |

Source: China Power Yearbook 2007

**Table A14. Installed Capacity of Southern China Power Grid in 2005**

| Installed Capacity | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total |
|---|---|---|---|---|---|---|
| Thermal Power | MW | 35,182.6 | 4,931.2 | 9,634.8 | 4,758.4 | 54,507.0 |
| Hydropower | MW | 9,035.7 | 6,085.3 | 7,233.0 | 7,993.1 | 30,347.1 |
| Nuclear Power | MW | 3,780.0 | 0.0 | 0.0 | 0.0 | 3,780.0 |
| Wind Power and Others | MW | 83.4 | 0.0 | 0.0 | 0.0 | 83.4 |
| Total | MW | 48,081.7 | 11,016.5 | 16,867.8 | 12,751.5 | 88,717.5 |

Source: China Power Yearbook 2006

**Table A15. Calculation of BM of Southern China Power Grid (MW)**

| | Installation in year 2005 | Installation in year 2006 | Installation in year 2007 | New Additions from 2005 to 2007 | Ratio in New Additions |
|---|---|---|---|---|---|
| | A | B | C | D=C-A | |
| Thermal Power（MW） | 54,507.0 | 68,963.0 | 80,610 | 26,103 | 71.98% |
| Hydro Power（MW） | 30,347.1 | 34,176.0 | 40,340 | 9,992.9 | 27.56% |
| Nuclear Power（MW） | 3,780.0 | 3,780.0 | 3,780 | 0.0 | 0.00% |
| Wind Power and Others（MW） | 83.4 | 183.0 | 250 | 166.6 | 0.46% |
| Total（MW） | 88,717.5 | 107,102.0 | 124,980 | 36,262.5 | 100.00% |
| Percentage compared with installation of 2006 | 70.99% | 85.70% | 100.00% | | |

$EF_{grid,BM,y}$ =0.8862×76.91%=0.5772 $tCO_2/MWh$

**Table A16. Baseline Emission Factor of Southern China Power Grid**

| | Parameter | Unit | Amount |
|---|---|---|---|
| A | Operating Margin Emission Factor | $tCO_2$/MWh | 0.9987 |
| B | Build Margin Emission Factor | $tCO_2$/MWh | 0.5772 |
| C | Combined Emission Factor (C=0.5*A+0.5*B) | $tCO_2$/MWh | **0.7879** |

**Table A17. Electricity Generation Baseline Emissions**

| | Parameter | Unit | Amount | Source or Equation |
|---|---|---|---|---|
| A | Project installed capacity | MW | 25 | FSR |
| B | Annual electricity supplied | MWh | 109,700 | FSR |
| C | Baseline Emissions Factor | $tCO_2$/MWh | 0.7879 | Table A16 |
| D | Electricity generation baseline emissions | $tCO_2$/year | **86,437** | D = B * C |

**Annex 4**

**MONITORING PLAN**

**Please refer to B 7.2. in the PDD.**

**- - - - -**