**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:

Project Title: Sichuan Yanyuan Yongning River Hydropower Station
PDD Version: 0.4
Date: 08/08/2008

**Revision history of the PDD**:

| Version | Date | Comments |
|---|---|---|
| Version 0.1 | October 15, 2006 | Complete version of the PDD, prepared for the host country approval process |
| Version 0.2 | April 12, 2007 | Revised draft PDD for validation |
| Version 0.3 | May 14, 2008 | Revised the PDD according to the draft validation report from DOE |
| Version 0.4 | August 8, 2008 | Revised the PDD according to the second response from DOE |

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

**Summary:**

The specific project activity is located in the lower reaches of the Yongning River close to Changbai Town, within Yanyuan County. The project is a diversion type run-of-river hydropower station, with an installed capacity of 50MW. The project activity is expected to operate during 4,633hours per year, which corresponds to an average annual power generation of 231,670MWh and a net electricity supply to the grid of 201,390MWh. The power generated by the specific project will be transmitted to the Xichang Grid, releasing pressure for power supply in the Xichang district and displacing electricity generation from fossil fuel-fired thermal power plants connected to the Central China Power Grid, thereby reducing greenhouse gas emissions.

**Contribution to sustainable development:**

The project activity contributes significantly to the region's sustainable development in the following ways:

- In recent years, China has witnessed a huge increase in power consumption. Both public and private parties are struggling to meet the demand for electricity.
  The specific hydropower project will contribute in a sustainable manner to bridging the gap between supply and demand of power on a regional and national level.

- In China, more than 80% of total electricity production is derived from coal based power plants. Being so heavily dependant on coal for its energy requirements, the project will carry environmental benefits for the country's air, soil and water sources. The project activity will displace the power generation of fossil fuel power plants, reducing $CO_2$, $SO_x$ and $NO_x$ emissions significantly, thus mitigating the air pollution and its adverse impacts on human health.
  The project activity will promote the growth of sustainable and renewable capacity in China and make it less dependent on exhaustible and polluting fossil fuels.

- The project will definitely contribute to the province's economic development by improving the local energy generation infra-structure and generating employment during both the construction and the operation of the power plant.

**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） |
|---|---|---|
| China (host） | Yanyuan Yongning River Hydro-electric Development Co., Ltd. (as the project owner) | No |
| The Netherlands | ENEL Trade SpA (as the CERs buyer) | No |

**Yanyuan Yongning River Hydro-electric Development Co., Ltd.** is an approved mid-small private company with three Shareholders. The company was established on August 7, 2005 with registered capital of 5,000 ten thousand Yuan RMB. The major business of the company is power development.

**ENEL** is the third largest power producer in the world and also the largest state-owned utility company in Italy. Its' revenues in 2005 exceeded €340,000,000,000. As the largest power manufacturer in Italy, it has power generation plants with the installed capacity of over 45.9GW and approximately 30 million customers throughout the country. It is also the second largest natural gas supplier in Italy serving 2 million clients. ENEL is actively promoting renewable energy worldwide.

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

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

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

People's Republic of China

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

Sichuan Province

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

Changbai Town, Yanyuan County, Liangshan Yi Minority Autonomous Prefecture

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

The specific project activity is located in the lower reaches of Yongning River, which is in the Changbai Village Yanyuan County in the southwest of Liangshan Yi Minority Autonomous Prefecture. The project is located 100km from the Yanyuan County Seat and 251km from Xichang City. The water intake of the

station is located on the reach, which adjacent to Changbai Village of Qiaoman Country, and the exact location of the water intake is at the longitude 100°58′20″ E and latitude 27°39′28″ N. The power plant is located at the right bank of Yongning River which is adjacent to Changbai Village of Heidi Country, and the exact location of the power plant is at the longitude 100°59′45″ E and latitude of 27°36′50″ N. A map indicating the location of the specific project is provided in Fig.A.1.

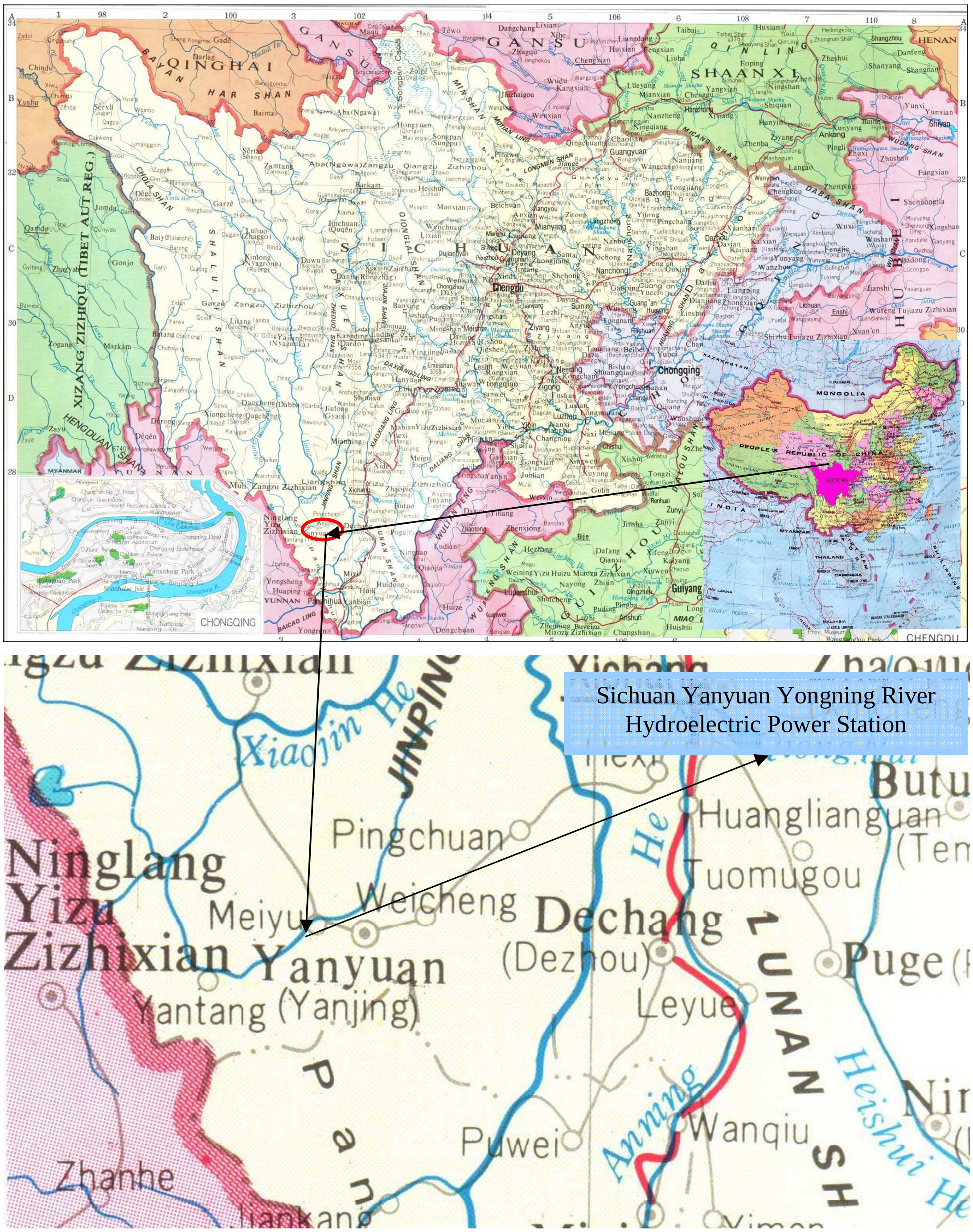

Fig A.1 the Location of Sichuan Yanyuan Yongning River Hydroelectric Power Station

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

The project activity falls under the category described under CDM as "Sectoral Scope Number 1: Energy Industries – Renewable Sources".

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

The specific project is a low dam diversion type run-of-river hydropower station with high water-head, and an installed capacity of 50MW. The main infra-structure consists of the water retaining dam, auxiliary dam, diversion tunnel, pressure-regulating well, pressure pipe, main and auxiliary workshop, booster station and tailrace. The length of the diversion tunnel is about 4.86km; the length of the pressure pipe is 1.1km; the barrage is 47.1m in length, and the maximum dam height is 10.8m.

The project is a run-of-river hydropower station with a small reservoir, the normal water level of reservoir is 2,307.30m above sea level, the corresponding reservoir size is 82,000m$^3$ with daily regulation capacity, and the surface area at full level is only 26,000m$^2$ with a power density of 1,923W/m$^2$.

The station employs two HLA542-LJ-240 turbines and two SF25-18/4250 generator units. The detailed technical specifications of equipment employed at the power station are provided in the table below.

Table A.1 Basic parameters of turbines and generators

| **Turbine** | | |
|---|---|---|
| Type | HLA542-LJ-240 | |
| Units | 2 | |
| Manufacture | Sichuan Dongfeng Generator Co., Ltd. | |
| Rated output | 25.907MW | |
| Rated rotate speed | 333.3r/min | |
| Design water head | 162. 874m | |
| Design flow | 17.7m$^3$/s | |
| Rated Out Power | 25.907MW | |
| **Generator** | | |
| Type | SF25-18/4250 | |
| Manufacture | Sichuan Dongfeng Generator Co., Ltd. | |
| Units | 2 | |
| Rated power | 25MW | |
| Rated rotate speed | 333.3r/min | |
| Rated voltage | 10.5kV | |
| Rated current | 1,676.4A | |
| Efficiency factor | 0.82 (lagging) | |
| **Main Transformer** | | |
| Manufacture | Yunnan Transformer Electric Co., Ltd. | |
| Type | SFSZ9-40000/10 | SF9-31500/220GV |
| Units | 1 | 1 |

Electricity generated by the project activity will be transferred to the Yanyuan 220kV switch station, which is connected to the Xichang Grid, then to the Sichuan Grid, and finally to the Central China Power Grid.
The project owner attended the electrical automation system training. Furthermore, the project owner has introduced a series of internal regulations and procedures, such as, management standards for employees, hydropower station operation rules, safety management and production management standards in order to guarantee an optimum power plant operation in a safe and environmentally sound manner,.

In matters of CDM monitoring process, a monitoring officer will receive training on monitoring methodologies, procedures and information archiving from Beijing Tianqing Power International CDM Consulting Co. Ltd. Thereafter, the monitoring officer will train the project staff in charge for CDM monitoring.

There is no direct technology transfer related to the project activity since all the technology employed is from domestic producers.

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

The project activity will employ the renewable crediting period, and the estimation of the emission reductions during the first seven year crediting period (form November 2008 to October 2015) is presented in Table A.2. Estimated emission reductions throughout the first crediting period are 1,233,568t$CO_2$e.

Table A.2 the Estimation of the Emission Reductions in the Crediting Period

| Years | Annual estimation of emission reductions in tons of $CO_2$e |
|---|---|
| November 1, 2008 to October 31, 2009 | 176,224 |
| November 1, 2009 to October 31, 2010 | 176,224 |
| November 1, 2010 to October 31, 2011 | 176,224 |
| November 1, 2011 to October 31, 2012 | 176,224 |
| November 1, 2012 to October 31, 2013 | 176,224 |
| November 1, 2013 to October 31, 2014 | 176,224 |
| November 1, 2014 to October 31, 2015 | 176,224 |
| Total estimated $CO_2$ reductions(t$CO_2$e) | 1,233,568 |
| Total number of crediting years | 7 |
| Annual Average Reductions over Crediting Period(t$CO_2$e) | 176,224 |

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

There is no public funding from Annex Ⅰ parties available to the 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:

**Baseline and Monitoring Methodology:**

Approved consolidated baseline methodology ACM0002 "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*", *Version 6, dated 19 May 2006.*

Approved consolidated monitoring methodology ACM0002 "*Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", Version 6, dated 19 May 2006*.

The methodology ACM0002*/Version 6* is available at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

**Additionality Tool**

The "*Tool for the Demonstration and Assessment of Additionality", Version 04, dated 26 to 30 November 2007（*the EB 36 meeting） is used to demonstrate the additionality of the project activity. The tool can be found from:
http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf.

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

The project activity meets all applicability conditions of approved consolidated methodology ACM0002 as follows:

1. The project is a grid-connected electricity generation project and capacity addition from a run-of-river hydropower station with a newly small reservoir, the surface area of reservoir is only 0.026km$^2$ having power density of 1,923W/m$^2$, far greater than 4W/m$^2$. The project is a grid-connected electricity generation project;
2. The project does not involve switching from fossil fuel to renewable energy at the site of the project activity;
3. The geographic and system boundaries for the relevant electricity grid, the specific project connected to the Central China Power Grid, and the Grid can be clearly identified and information on the characteristics of the grid is available.

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

According to the ACM0002 definition of project boundary, the project boundary includes the project site and the electricity system that the hydropower station is connected to. The system boundary of the electricity system that the specific project is connected to is defined as the Central China Power Grid due to following reasons:

1. In a country like China, with a layered dispatch system, grid boundary definitions shall be based on regional grids
2. The project power plant is connected to the Sichuan grid and, finally, to the Central China Power Grid. The Central China Power Grid is a large regional grid, which consists of six sub-grids: Hunan, Hubei, Jiangxi, Henan, Sichuan and Chongqing. There is substantial inter-grid power exchange among the above mentioned sub-grids of the Central China Power Grid.

3. The Central China Power Grid can be clearly identified as regional grid and information on the characteristics of this grid is publicly available.

4. There is a guidance from the China DNA (National Climate Change Coordination Office) on project boundaries identifying the applicable grid as the project boundary

According to the applied methodology, emissions related to the construction of power plants are neither considered in the baseline scenario nor in the project scenario. The emissions related to production, transportation and distribution of fuels used in the baseline scenario power plants are excluded from leakage emission calculations.

Following sources and greenhouse gases have been considered for calculation of baseline and project activity emissions:

Table B.1 Description of How the Sources and Gases Included in the Project Boundary

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | Thermal power plants in the Central China Power Grid | $CO_2$ | Included | According to methodology ACM0002, only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity are considered. |
| | | $CH_4$ | Excluded | According to methodology ACM0002, only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity are considered. |
| | | $N_2O$ | Excluded | According to methodology ACM0002, only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity are considered. |
| **Project Activity** | Sichuan Yanyuan Yongning River Hydroelectric Power Station | $CO_2$ | Excluded | According to methodology ACM0002, no $CO_2$ emissions are considered for run-of-river hydro projects. |
| | | $CH_4$ | Excluded | Since the specific project is a run-of-river hydropower station with a small reservoir, which power density is 1,923W/m$^2$, much larger than 10 W/m$^2$, according to methodology ACM0002, $CH_4$ emissions are not considered. |
| | | $N_2O$ | Excluded | The project consists of grid-connected electricity generation from hydropower, without $N_2O$ emissions. |

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

As per ACM0002/Version 06, the baseline scenario should be selected based on an evaluation of plausible alternatives to the project activity. Following baseline scenarios to the project activity have been identified and considered:

1. The specific project activity undertaken without being registered as a CDM project activity;
2. The equivalent annual power generation is delivered by a new fossil fuel-fired thermal power plant;
3. The equivalent annual power generation is delivered by other renewable energy plants;
4. The equivalent amount of electricity is delivered by the Central China Power Grid.

The baseline scenario options described above are discussed individually considering relevant laws and regulations, as well as investment analysis:

**Scenario 1: The specific project activity undertaken without being registered as a CDM project activity**

The first scenario is in compliance with Chinese relevant laws and regulations, but not a mandatory project. According to section B.5, the project's internal rate of return (IRR, after tax) of the project is 7.59% without CDM revenue which is lower than the benchmark rate of 10% [1]. Thus, the project faces obvious financial barriers without CDM revenues. The first scenario is therefore not feasible and thus cannot be considered as the baseline scenario for the project activity (please refer to Section B.5 for the detailed investment analysis).

**Scenario 2: The equivalent power generation is delivered by a new fossil fuel-fired thermal power plant**

There is a large difference between thermal power and hydropower in their annual operating hours and the stability of their operation. However, an alternative fossil fuel power plant that can provide the equivalent power generation would have an annual utilization rate of 5,876 hours[ 2], which was the average utilization hours of the thermal units in China in 2005, would be one with installed capacity of less than 50MW. However, according to Chinese regulations, coal-fired power plants of less than 135MW are prohibited for construction in the areas covered by the large grids such as provincial grids[3]. At the same time, the construction of such thermal units is strictly controlled by the authority [4]. Therefore, the second baseline scenario does not comply with Chinese relevant laws and regulations; thus it cannot be considered as a feasible alternative.

**Scenario 3: The equivalent power generation is delivered by other renewable energy power plants**

- There is neither potential for wave or tidal energy nor for geothermal energy in the project's area, because the project located in land-locked province of China.
- No biomass based power plant with a similar scale to the project has previously been built in the region. In addition biomass power plants face some barriers, such as high investment [5], lacking of operating experience and low benefit [6], are necessary to apply for CDM for retaining normal operation.
- The region where the project is located is poor in terms of wind resources with very low wind energy potential [7].
- Other renewable energy alternatives, such as solar PV, which is considered to be too cost intensive {the same as [5]} for generating the equivalent annual output.

Thus there are no favorable conditions for the construction of power plants based on other renewable sources. Therefore, this scenario is not a feasible scenario.

**Scenario 4: The equivalent amount of electricity is delivered by the Central China Power Grid.**

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[1] Document [1995] No. 186, Economic Evaluation Code for Small Hydropower Projects (SL16-95), published by the Ministry of Water Resources of the People's Republic of China, where a small hydropower project is defined as a power station with installed capacity lower than 25MW. The regulation applies also to hydropower stations up to 50MW located in rural areas.
[2] *China Electric Power Yearbook 2006, p.37*
[3] Notice on Strictly Prohibiting the Installation of Fuel fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Decree No. [2002]6.
[4] The Management Provisional Regulation on the Construction of Small Fuel fired Generators ( in Aug. 1997)
[5]http://ac.agri.gov.cn/ac/ViewContent.do?id=4affaa20110219f101116d279548047d&year=2007&month=3&right=!ENCODEtkc1vlOItllg1Oe
[6] http://www.86ne.com/Biomass/200712/Biomass_103227.html
[7] http://www.newenergy.org.cn/html/0062/2006217_7650.html

The scenario is in compliance with Chinese relevant laws and regulations, and does not face any financial barriers.

**Conclusion:**

From the above analysis it can be concluded that the fourth baseline scenario is the only plausible alternative to the project activity. Hence, the baseline scenario of the project is described as follows:

In absence of the specific project activity, the electricity amount exported to the grid by the project activity would have otherwise been supplied by grid-connected power plants within the Central China Power Grid (currently installed power plants and power plants to be installed throughout the crediting period).

**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):**

Since the project activity started prior to the date of CDM validation, evidence needs to be provided by the project participants that CDM was seriously considered in the decision to implement the project. This evidence is provided as follows:

CDM has played a decisive role in the successful implementation of the project. In August 2004, project construction had been interrupted due to lack of capital. Only after getting approval by local government to apply for CDM in July 2005, the construction work could be resumed. Therefore it is clear that the project owner has fully considered the revenues from CDM when making the decision to proceed with the project activity. The main events related to the consideration of CDM in the decision to proceed with the project activity are illustrated in the table below. The respective documentation has been provided to the DOE during the validation process as evidence of CDM consideration.

TableB.2 Overview of key events in the development of the project

| Date | Key Event |
|---|---|
| February 2004 | The project construction preparation started |
| July 2004 | Feasibility Study Report |
| August 2004 | The project construction had to be stopped because the economic indicators of the project were not sufficient and the project owner could not get enough capital |
| February 2005 | The project owner received some information about CDM |
| May 2005 | The project owner made a board decision to explore cooperation with companies active under CDM in order to have access to additional revenues, which would improve the economic indicators of the project |
| July 6, 2005 | The project owner made a board decision to apply for CDM in order to improve the economic indicators of the project |
| July 12, 2005 | The project owner received the approval from the local government to proceed with the application of the project under CDM |
| July 18, 2005 | Project construction restarted |
| August 2005 | Project owner signed development contract with CDM advisors and started preparation of CDM application |
| October 2006 | Negotiation of Emission Reductions Purchase Agreement (ERPA) with ENEL Trade SpA |
| November 2006 | Approval by China DNA and receipt of Letter of Approval (LOA) in December 2006. |
| April 2007 | Operation of the project activity |

The additionality of the project activity is demonstrated by using the steps described in *the Tool for the Demonstration and Assessment of Additionality (version 4)* as specific on the 29$^{th}$ EB meeting.

**Step 1: Identification of Alternatives to the Project Activity Consistent with Current Laws and Regulations**

**Sub-Step1a. Define alternatives to the project activity**

This methodological step requires a number of sub-steps, the first of which is the identification of realistic and credible alternatives to the project activity. There are only a few alternatives that are prima facie realistic and credible in the context of the Central China Power Grid:

1. The specific project activity undertaken without being registered as a CDM project activity;
2. The equivalent annual power generation is delivered by a new fossil fuel-fired thermal power plant;
3. The equivalent annual power generation is delivered by other renewable energy plants;
4. The equivalent amount of electricity is delivered by the Central China Power Grid.

As explained under Section B.4, the third alternative is not feasible since there are no realistic and plausible alternatives to the project based on other renewable energy sources, such as wind, biomass, solar, wave and tidal or geothermal energy, to provide the equivalent amount of electricity in the project's area.

**Sub-Step1b. Consistency with mandatory Laws and Regulations**

The second alternative is not in compliance with Chinese relevant laws and regulations, so it is not a feasible alternative. However, as discussed in section B.4, the first and fourth alternatives are in compliance with Chinese relevant laws and regulations.

Therefore, the project activity is not the only alternative consistent with Chinese current laws and regulations, and at the same time, the project is not enforced by relevant mandatory laws and regulations. Thus, the project complies with the additionality concept under Sub-Step 1b.

**Step 2 Investment Analysis**

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

The Tool for the Demonstration and Assessment of Additionality suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since

- The Project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis (Option I) method is not appropriate.
- The investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. Since the alternative scenarios 2 (new thermal power plant) and 3 (other renewable energy plants) have been rejected due to non-compliance with Chinese laws and regulations and non-feasibility of other renewable energy projects in the project's area, and since alternative scenario 4 (electricity supplied by the Central China Power Grid) can not be considered a similar investment project, Option II is not appropriate.
- Thus, the Project will use the benchmark analysis method (Option III) considering the fact that a benchmark IRR for the power sector in China is available.

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

The specific project is located in rural areas, which installed capacity is 50MW.

With reference to the Economic Evaluation Code for Small Hydropower Projects issued by the Ministry of Water Resources in 1995 (Document No. SL16-95), the financial benchmark internal rate of return (IRR; after tax) to be applied to the Project (being a 50 MW hydropower station located in a rural area) is 10%. On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

**Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):**

The project has been started to prepare construction on February 26, 2004, but because the economic indicators of the project were low and the project owner could not get enough capital, the project construction had been stopped in August 2004. At that time, the project owner decided to give up the project, but fortunately, in May 2005, the project owner received some information about CDM and made a board decision to explore cooperation with companies active under CDM in order to have access to additional revenues, which would improve the economic indicators of the project. And then the project owner made a board decision to apply for CDM in order to improve the economic indicators of the project on July 6, 2005 and getting the CDM support approval from the government on July 12, 2005. All dates are earlier than the earliest starting date of the CDM project, i.e. July 18, 2005. It can be concluded that: the project owner was in an early stage aware about the potential of CDM to support its activities. CDM has played a decisive role in the successful implementation of the project.

In Table B.2, we summarize an implementation schedule of the project, illustrating the main events leading up to the start of operations. The events in the Table B.2 clearly demonstrate that the project owner was aware about the potential of CDM revenues before the starting activities of the project activity, and that it played a crucial role in overcoming the barriers towards the implementation of the proposed project activity.

The key financial parameters for calculation of the project's IRR are provided in Table B.3:

Table B.3 the Key Financial Parameters of the Project

| Parameters | Value | Source |
|---|---|---|
| Installed capacity (MW) | 50 | Feasibility Study Report |
| Annual Power supplied to Grid (MWh) | 201,390 | Feasibility Study Report |
| Static Total Investment (Ten Thousand Yuan RMB) | 23,416.9 | Feasibility Study Report |
| Estimated Grid Price (Yuan RMB/ kWh, with VAT) | 0.167 | Feasibility Study Report |
| Operation Period (Years) | 20 | Feasibility Study Report |
| VAT | 6% | Feasibility Study Report |
| Income Tax | 33% | Feasibility Study Report |
| Annual Operating Cost (Ten Thousand Yuan RMB) | 446.41 | IRR analysis[8] |

According to the *Detailed Rule on the Implementation of Economic Assessment Method for Electric Power Construction Project* published by Electric Power Design Institute, *Economic Assessment Software for Electric Power Industry* compiled by China Power Engineering Consulting Co., Ltd., and *Economic Assessment Method and Parameters for Construction Project*, the IRR has been calculated based on the benchmark revenue rate in financial evaluation of Chinese *Economic evaluation code for small hydropower projects*, the IRR of electric power project total investment should not be lower than the threshold of 10%. The IRR of the project is 7.59% without CDM revenues, which is far lower than the benchmark rate of 10%. So the project faces obvious financial barriers without CDM revenues.

**Sub-step 2d. Sensitivity analysis (only applicable to options II and III):**

The sensitivity analysis is conducted to check whether, under reasonable variations in the critical assumptions, the results of the analysis remain unaltered. Following parameters are assumed to be critical assumptions:

[8] All data to calculate the annual operating cost are from Feasibility Study Report

1. Total investment
2. Annual operation & maintenance cost
3. Estimated grid price
4. Electricity supplied to the grid

Variations of ±10% (according to Feasibility Study Report) have been considered for these parameters. Table B.4 and Figure B.1 summarize the results of the sensitivity analysis, while Figure B.1 provides a graphic depiction.

Table B.4 Impact of Variations in Critical Assumptions on IRR

| | -10% | -5% | 0% | 5% | 10% |
|---|---|---|---|---|---|
| Grid price | 6.45% | 7.06% | 7.59% | 8.10% | 8.67% |
| Static total investment | 8.83% | 8.18% | 7.59% | 7.03% | 6.52% |
| Annual operation & maintenance cost | 7.82% | 7.70% | 7.59% | 7.47% | 7.35% |
| Electricity supplied to the grid | 6.47% | 7.03% | 7.59% | 8.12% | 8.65% |

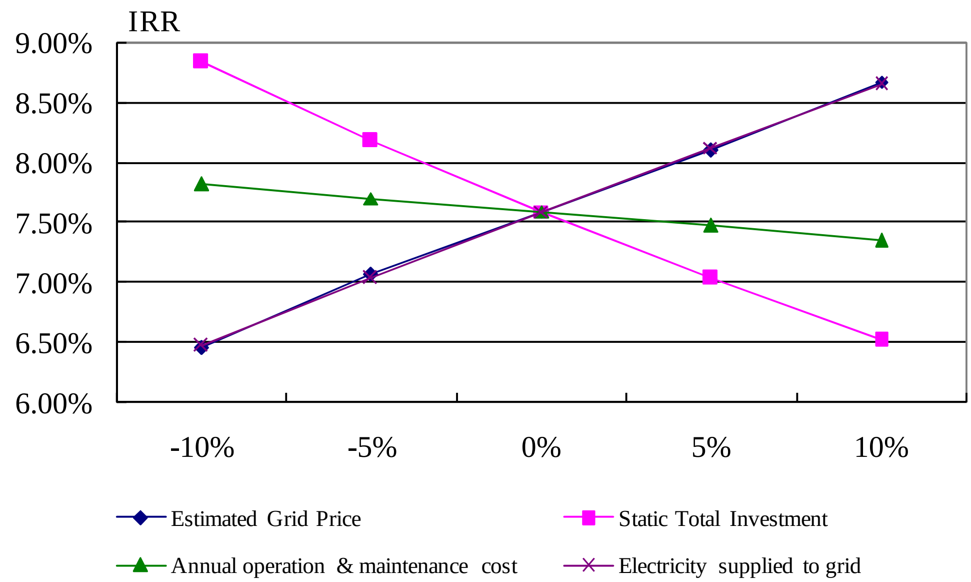



Figure B.1 the IRR Sensitivity Analysis when Static Total Investment, Annual Operation & maintenance Cost, Grid Price, or Electricity supplied to the grid changed

Figure B.1 shows that none of variations can raise the IRR of the specific project higher than the threshold of 10% and the sensitivity of the annual operational cost is very low.

- With a decrease in the static total investment by 10%, the IRR is 8.83%, far lower than 10%. When a decrease in static investment has reached 18%, the IRR of the project can reach benchmark. However, the price of equipment, material etc has been raised and investment increased has been considered in Financial Supplementary Report. It is therefore impossible to improve the economic attraction due to the increase in static total investment.
- With an increase in the estimated grid price and electricity supplied to the grid by 10%, the IRR of the project both are 8.67% or 8.65% respectively, far lower than 10%. When an increase in grid price has reached 23%, the IRR of the project can reach benchmark. But the actual grid price is 0.167 Yuan

RMB/ kWh[9]. Therefore, it is unlikely that the grid price will be increased and as a result, it is not possible to improve the economic revenue through an increase in the grid price. When an increase in electricity supplied to the grid reaches 23%, the IRR of the project also can reach benchmark, however this is improbable due to the instability and uncertainty of hydropower and the Grid Company is reluctant to purchase electricity from hydropower generation [10]. In addition, in FSR, based on the water resource of the river in past 46 years, the annual utilization hours of the project has been calculated, and will not impose significant changes in normal situations too. Therefore, it is also impossible to increase electricity supplied to the grid to improve IRR. Therefore, it is very unlikely for the project to become commercially attractive through an adjustment of the grid price and electricity supplied to the grid.

- With a decrease in the annual operation & maintenance cost by 10%, the IRR only rises by 0.23% which is very little; moreover, the payroll, welfare, the operation and maintenance expense and etc. is unable to decrease for the price rising every year, therefore, obviously, it is difficult to adjust the annual operational cost to raise the IRR.

Hence, the results of the sensitivity analysis confirm that the project faces significant economic and financial barriers without CDM revenue, so the first alternative lacks economic attractiveness and cannot be considered as a feasible alternative.

However, if the impact of CDM is considered, the IRR of the project increases significantly when the project has access to CER income; it will rise to 13.80% ( Considering a CER price of €8/t$CO_2$e, Exchange rate: 1€=10Yuan RMB), thus passing the critical barrier of 10%, leading to a positive decision to invest in the project. It is obvious that the benefit from CDM will help to eliminate the financing barriers which would have prevented the final project construction.

Please refer to Annex 5 for more details on the IRR calculation.

**Step 3 Barrier analysis**

**Sub-step 3a. Identify barriers that would prevent the implementation of the specific CDM project activity**

There are some additional barriers to the implementation of the project without CDM revenue. These barriers include:

**Uncertainty of electricity sale**

Hydropower plants are affected by hydrological conditions to a large extent, so the generation of electricity is unstable. Because of the uncertainty of hydroelectric power, the Grid Company is reluctant to purchase hydropower. At the same time, during the flood period, the supply will exceed demand of electricity, and the Grid Company will not purchase the whole power generated, which will make it difficult to achieve a full-load operation. For example, the Ertan Hydropower Project in Sichuan Province failed to sell almost half of its generation capability after the first year. This uncertainty further increases the financial risk of the project.

On the contrary, the income from CERs will improve the project's ability to overcome risks, and reduce the financial barriers. It will also diminish the investment risk related to the uncertainty of electricity sales and grid prices, improving the financial viability of the project. All this enables the project to be implemented and operated.

**Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the specific project activity):**

[9] Power supplied invoices.
[10] Power generation dispatch agreement

Scenarios 1, 2 and 3 have been mutually excluded under Steps 1 and 2 of the Additionality Tool. However, Steps 1 and 2 as well as the above described barriers under Step 3a do not have an impact on scenario 4, represented by operating and recently build power plants connected to the Central China Power Grid. Thus, scenario 4 is considered the most plausible and only feasible alternative to the project activity.

**Step 4 Common Practice Analysis**

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

Sichuan Province with an area of 48.5 ten thousand $km^2$, is comparatively and considerably larger than many countries. According to the requirements of common practice, the projects with similar conditions, such as investment conditions and natural conditions (including geographical conditions, climate conditions, development conditions and so on), are necessary to be analyzed. Projects located in different provinces of the Central China Power Grid do not have the similar investment conditions [11] and natural conditions [12] [13] [14]. Therefore, the PDD selects Sichuan Province as the geographical area for the common practice.

Therefore, for the common practice analysis, for the common practice analysis, we have analyzed all hydropower projects located in Sichuan Province between 15MW and 50MW from Yearbook of China *Water Resources 2006* and registered PDD. We have selected projects with an installed capacity between 15MW and 50MW because UNFCCC considers hydropower projects above 15MW as normal scale projects, and the Chinese government classifies hydropower stations below 50MW as small scale projects[15].

In our range, a number of hydropower stations exist that have obtained CDM project status or are in the process of applying for CDM project status[16] and are therefore not included in the table. There are 25 stations in total in the *Yearbook of China Water Resources 2006*, and 1 station in registered PDD, all together 26 projects during our range. Of which, 4 projects, such as Tongkou Hydropower Station, Zhongzui Hydropower Station, Waner Hydropower Station and Huilongqiao Hydropower Station are applying CDM.

Of these remaining 22 projects projects, 10 projects[17], such as Wenfeng Power Plant, Huaneng Mingzhi Power Plant, Luosichi Power Station, Damo Power Station, Huangdan Hydropower Station, Sijiutan Hydropower Station, Caopo Hydropower Station, Shapai Hydropower Station, Lixian Hydropower Station, Ganbao Hydropower Station, were operated in the last century, they were developed by the state under a market environment that is substantially different from the current market environment, which is, for

[11] Yearbook of China Water Resources 2006
[12] http://www.checc.cn/zgsd/zgsd_zy.jsp
[13]http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=19
[14] http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=20
[15] Almanac of China's Water Power (2005), page 141
[16] http://cdm.ccchina.gov.cn/web/index.asp
[17] *Yearbook of China Water Resources 2000, published by Almanac of China Water Resources,P534*

independent power producers at least, considerably less attractive.[18] So they are not similar with the proposed project. The remaining 12 projects are listed in Table B.5.

[18] Economist Intelligence Unit (2003), "China Hand", page 37-40

Table B.5 Existing or Constructing Hydropower Stations similar to the specific activity

| Name of hydropower plant | Capacity (MW) | Location | Operation year | Investor | Company type | Remark |
|---|---|---|---|---|---|---|
| Laifu Hydropower Station | 30 | Gao County | 2000 | Gaoxian Electric Power Co., Ltd. | State owned[19] | IRR 17.9%[20] |
| Huatan Hydropower Station | 25 | Yingjing County | 2000 | Sichuan Yingjing Power Co., Ltd, | - | Annual utilization hours 5,328h[21], Grid Price 0.28 Yuan/kWh[22] |
| Jinhua Hydropower Station | 42 | Hong County | 2001 | Sichuan Mingzhu Electric Power Co., Ltd. | State owned[23] | Annual utilization hours 5,934h[24] |
| Sanxing Hydropower Station | 48 | Suining City | 2001 | Sichuang Mingxing Power Co., Ltd. | Stock company | Annual utilization hours 5,097h[the same with [24]] |
| Dingcunba HydropowerStation | 30 | Tianquan County | 2001 | Ya'an Electric Power Co., Ltd. | State owned | IRR 13.5%[25] |
| Yuechi Fuliutan Hydropower Station | 39 | Yuechi County | 2002 | Yuechi Fuliutan Electric Power Co., Ltd. | State holding company[26] | Grid Price 0.288 Yuan/kWh[27], annual utilization hours 6,633h[the same with [24]] |
| Longdonggou Hydropower Station | 26.25 | Longshi Town | 2002 | Chongqing Yuyuan Hydropower Development Co., Ltd. | State holding company[28] | - |
| Niujiaowan Third Level Hydropower Sttation | 25 | Butuo County | 2003 | Sichuan Xichang Electric Power Co., Ltd. | State holding company[29] | Annual utilization hours 6,127h[the same with [24]] |
| Yongle Hydropower Station | 50 | Leshan City | 2003 | Sichuan Provincial Electric | State owned | Grid Price 0.288 Yuan/kWh[the same with |

[19] http://www.567info.cn/sichuan/405833.htm
[20] http://www.lonwin.com.cn/display.asp?ID=4615
[21] http://www.cnpre.com/so/Proejct/index.php?modules=show&id=5098
[22] http://www.xxpi.com/Article/UploadFiles/200606/20060603013719739.doc
[23] http://www.cs.com.cn/jrbznew/images/2006-10/13/G33a13C.pdf
[24] Yearbook of China Water Resources
[25] http://www.topper.cn/westdatadetail.asp?id=12344
[26] http://www.chinarein.com/qkhc/detail.asp?id=781
[27] http://www.qy12358.gov.cn/edit/UploadFile/2007418132228465.doc
[28] http://www.zgsdzx.cn/MemberCompany/ViewCompanyDetail.aspx?userid=12
[29] Sichuan Xichang Electric Power Co., Ltd. Report in 2003

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Power Co., Ltd. | | [27]] |
| Bolo Hydropower Station | 48 | Leshan City | 2003 | Water Resource System | State owned | annual utilization hours 5,309h[the same with [24]] |
| Baishuihe Hydropower Station | 26 | Boundary of Ya'an City and Ganzi Prefecture | 2004 | Shimian Kaiyuan Electricity Co., Ltd | Private owned | Grid Price 0.288 Yuan/kWh[the same with [27]], annual utilization hours 6,633h[the same with [24]] |
| Shazui Hydropower Station | 38 | Luding CountyGao | 2004 | Hongchang Electric Power Co., Ltd. | Private owned | Grid Price 0.288 Yuan/kWh[the same with [27]]Unit investment 4,289 Yuan RMB/kW[30] |

[30] http://www.gzz.gov.cn/hongchang/

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

The 12 projects listed in the table above, of which:

- Nine projects (i.e. Laifu, Jinhua, Sanxin, Dingcunba, Yuechi Fuliutan, Longdonggou, Niujiaowan Third Level, Bolo and Yongle hydropower stations) are developed by state owned company or state holding company or stock company with strong ability and therefore enjoy certain benefits in the areas of financing and policy support. Furthermore
  - The Yuechi Fuliutan and Yongle hydropower stations sell electricity at a grid price of 0.288Yuan RMB/kWh, which is higher than the grid price of 0.167Yuan RMB/kW paid to the Yongning River project.
  - The Jinhua, Sanxin, Yuechi Fuliutan, Niujiaowan Third Level and Bolo hydropower stations have higher annual utilization hours than the Yongning River project, and are therefore able to generate more electricity and be more profitable than the Yongning River project.
  - The Dingcunba and Laifu have higher IRR of 13.5% and 17.9% respectively than the Yongning River project's IRR of 7.59%, and are therefore has economic attraction.

- The other three projects (i.e. Huatan, Yongle and Baishuihe Hydropower Station) sell electricity at a grid price of 0.28 Yuan RMB/kWh or 0.288Yuan RMB/kWh, which is higher than the grid price of 0.167Yuan RMB/kW paid to the Yongning River project. Furthermore, Baishuihe Hydropower Station has significantly higher annual utilization hours. Furthermore:
  - The Huatan and Baishuihe hydropower stations have higher annual utilization hours than the Yongning River project, and are therefore able to generate more electricity and be more profitable than the Yongning River project.
  - The Shazui Hydropower Station requires significantly lower unit investment of 4,289 Yuan RMB/ kW compared to the Yongning River project of 4,890Yuan RMB/ kW.

It is clear from the investment and the barrier analysis that the proposed project, like other similar projects benefiting from or applying for CDM support, does not benefit from the same economic advantages as the projects listed in Table B.5. Therefore, the project is additional.

**Conclusion**

The project faces several barriers which would prevent the implementation of the specific project activity without CDM. CDM helps to overcome these barriers. If the project could not be implemented, the equivalent electric power would be supplied by the Central China Power Grid, which is highly dependent on fossil fired power plants, leading to higher GHG emissions. Hence, the specific project activity is not the baseline scenario and additionality is given.

## B.6. Emission reductions:

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

As described under Section B.3, the $CO_2$ emissions from power plants connected to the Central China Power Grid represent the baseline emissions to the project activity. The baseline emissions are calculated as follows:

**Baseline emissions**

According to methodology ACM0002, baseline emissions are equal to the power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor $EF_y$. The baseline emission factor is defined as the Combined Margin (CM): the equally weighted average of the Operating Margin (OM) Emission Factor ( $EF_{OM,y}$ ) and the Build Margin (BM) Emission Factor ( $EF_{BM,y}$ ).

The data used to calculate the grid emissions factor comes from reliable and publicly accessible statistics e.g. China Energy Statistic Yearbook and China Electric Power Yearbook, as well as China DNA, using the latest available publications.

According to the calculation process of *the Bulletin on Baseline Emission Factors of China's Regional Grid* renewed by the Director Office of National Climate Change Coordination of NDRC (China DNA) on Dec. 15, 2006[31], but the latest data (2005) will be employed. The Operating Margin Emission Factor ( $EF_{OM,y}$ ) for the Central China Power Grid is calculated as follows:

**STEP 1 Calculate the Operating Margin emission factor (** $EF_{OM,y}$ **)**

ACM0002 (version 06) outlines four options for the calculation of the Operating Margin emission factor(s) ( $EF_{OM,y}$ ):

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

As the methodology ACM0002 "Dispatch Data Analysis" should be the first methodological choice. However, the method is not selected for OM emission factor calculation, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, the simple adjusted OM methodology cannot be used.

The Simple OM method has been chosen, this is because low cost/ must run resources account for less than 50% of the power generation in the grid in most recent years. Specifically, from 2001 to 2005, in the composition of gross annual generation power for Central China Power Grid, the ratio of power generated by hydro-power and other low cost// must run resources is as following: 36.76% in 2001 (provided in Table B.6), 35.95% in 2002 (provided in Table B.7), 34.43% in 2003 (provided in Table B.8), 38.54% in 2004 (provided in Table B.9), and 38.18% in 2005 (provided in Table B.10), obviously lower than 50%.

TableB.6 Power Generation of the Central China Power Grid in 2001

| Power generation | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | GWh | 16,191 | 76,022 | 32,045 | 19,403 | 13,687 | 20,808 | 178,156.00 |
| Hydro Power | GWh | 5,425 | 3,572 | 27,026 | 21,339 | 3,354 | 42,838 | 103,554.00 |
| Nuclear Power | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Others | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | GWh | 21,616 | 79,594 | 59,071 | 40,742 | 17,041 | 63,646 | 281,710.00 |
| Percent of low cost/ must run resources to the power generation in the Central China Power Grid | | | | | | | | 36.76% |

*Data Source: 2002 China Electric Power Yearbook, P617.*

TableB.7 Power Generation of the Central China Power Grid in 2002

| Power generation | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | GWh | 18,648 | 84,734 | 34,301 | 20,058 | 14,727 | 27,879 | 200,347.00 |
| Hydro Power | GWh | 6,151 | 4,859 | 27,854 | 25,329 | 3,748 | 44,499 | 112,440.00 |
| Nuclear Power | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Others | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | GWh | 24,799 | 89,593 | 62,155 | 45,387 | 18,475 | 72,378 | 312,787.00 |
| Percent of low cost/ must run resources to the power generation in the Central China Power Grid | | | | | | | | 35.95% |

*Data Source: 2003 China Electric Power Yearbook, P585.*

[31] Bulletin on confirming of the baseline emission factors for China's Regional Grid was renewed by the Director's Office of the National Climate Change Coordination of NDRC(China DNA) on Dec. 15, 2006.

TableB.8 Power Generation of the Central China Power Grid in 2003

| Power generation | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | GWh | 27,165 | 95,518 | 39,532 | 29,501 | 16,341 | 32,782 | 240,839.00 |
| Hydro Power | GWh | 3,864 | 5,457 | 38,775 | 24,401 | 3,951 | 50,000 | 126,448.00 |
| Nuclear Power | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Others | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | GWh | 31,029 | 100,975 | 78,307 | 53,902 | 20,292 | 82,782 | 367,287.00 |
| Percent of low cost/ must run resources to the power generation in the Central China Power Grid | | | | | | | | 34.43% |

*Data Source: 2004 China Electric Power Yearbook, P709.*

TableB.9 Power Generation of the Central China Power Grid in 2004

| Power generation | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | GWh | 30,127 | 109,352 | 43,034 | 37,186 | 16,520 | 34,627 | 270,846.00 |
| Hydro Power | GWh | 3,890 | 6,884 | 69,512 | 24,236 | 5,670 | 58,902 | 169,094.00 |
| Nuclear Power | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Others | GWh | 0.0 | 0.0 | 0.0 | 0.0 | 725 | 0.0 | 725 |
| Total | GWh | 34,017 | 116,236 | 112,546 | 61,422 | 22,915 | 93,529 | 440,665.00 |
| Percent of low cost/ must run resources to the power generation in the Central China Power Grid | | | | | | | | 38.54% |

*Data Source: 2005 China Electric Power Yearbook, P474.*

TableB.10 Power Generation of the Central China Power Grid in 2005

| Power generation | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | GWh | 30,000 | 131,590 | 47,700 | 39,900 | 17,584 | 37,202 | 303,976 |
| Hydro Power | GWh | 5,000 | 6,700 | 81,400 | 24,100 | 6,036 | 64,498 | 187,734 |
| Nuclear Power | GWh | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | GWh | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| Total | GWh | 35,000 | 138,300 | 129,100 | 64,000 | 23,620 | 101,700 | 491,720 |
| Percent of low cost/ must run resources to the power generation in the Central China Power Grid | | | | | | | | 38.18% |

*Data Source: 2006 China Electric Power Yearbook, P568.*

The simple Operating Margin (OM) emission factor ( $EF_{OM,simple,y}$ ) is calculated as the generation-weighted average emissions per electricity unit ($tCO_2e/MWh$) of all generating sources serving the system, not including low-operating cost and must-run power plants. A three-year average, based on the most recent fuel consumption statistics available at the time of PDD submission, is used ("ex-ante" approach).

According to ACM0002 (version 06), the Simple OM has been employed to calculate the OM. The calculation equation is as follows:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{j} GEN_{j,y}} \quad \text{(Equation B.1)}$$

Where

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

$COEF_{i,j,y}$ is the $CO_2$ emission coefficient of fuel $i$ ($tCO_2e$/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel(coal, oil and gas) in year(s) y; and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by relevant power sources j.

The $CO_2$ emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i \quad \text{(Equation B.2)}$$

Where:
$NCV_i$ is the net calorific value (energy content) per mass or volume unit of a fuel $i$, National fixed values;
$OXID_i$ is the oxidation factor of the fuel $i$, according to default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories;
$EF_{CO_2,i}$ is the $CO_2$ emission factor per unit of energy of the fuel $i$, according to default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

In addition, there is no net imported power in the Central China Power Grid according to Chinese Electricity Statistics.

The Operating Margin emission factors for 2003, 2004 and 2005 are calculated separately and then the three-year average is calculated as a full-generation-weighted average of the emission factors. For details please refer to Annex 3. The operating margin emission factor of the baseline is calculated as a fixed ex-ante value and will not be renewed within the first crediting period of the project activity.

The Build Margin Emission Factor ( $EF_{BM}$ ) calculation of the Central China Power Grid is followed:

**STEP 2 Calculate the Build Margin emission factor ( $EF_{BM,y}$ )**

According to ACM0002, the Build Margin Emission Factor is calculated as the generation weighted average emission factor (measured in $tCO_2e$/MWh) of a sample of *m* power plants. The calculation equation is as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \quad \text{(Equation B.3)}$$

Where
$F_{i,m,y}$, is the amount of fuel $i$ (in a mass or volume unit) consumed by relevant power plants m in year(s) y,
$COEF_{i,j,m}$ is the $CO_2$ emission coefficient of fuel $i$ ($tCO_2e$/mass or volume unit of the fuel), taking into account the carbon content of the fuels (coal, oil and gas) used by relevant power plants m and the oxidation percentage of the fuel in year(s) y; and
$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by relevant power plants m.

The methodology provides the following two options for calculation of $EF_{BM,y}$:

*Option 1:* Calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group *m*

consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. It is suggested that the sample group that comprises the larger annual generation should be used.

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

Project participants have chosen Option 1, which requires the project participant to calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available already built for sample group m at the time of PDD submission.

However, in China it is it is impossible to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts [32] the following deviation in methodology application:

*1)* Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1 - 4 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.

TableB.11 Capacity Additions in the Central China Power Grid (MW)

| | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|
| Thermal Power installed capacity（MW） | 43,303.20 | 46,893.50 | 53,744.70 | 55,419.72 |
| Hydropower installed capacity（MW） | 31,034.70 | 36,557.00 | 34,642.00 | 43,384.33 |
| Nuclear power(MW) | 0.00 | 0.00 | 0.00 | 0.00 |
| Other power and wind power (MW) | 0.00 | 0.00 | 0.00 | 5.00 |
| Total (MW) | 74,337.90 | 83,450.50 | 88,386.70 | 98,809.06 |
| Total percent of installed capacity as share of 2005 Capacity | 75.23% | 84.46% | 89.45% | 100.00% |

*Data Source: 2003-2006 China Electricity Power Yearbooks.*

2) Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

According to China DNA, the optimum commercial, coal-fired power supply efficiency is 336.66gce/kWh, which corresponds to an efficiency of 36.53% for electricity generation. [33]

There are no data available of installed capacity additions for oil and gas power in the Central China Power Grid. However, the fuels consumption ratio of coal-fired generators of the Central China Power

[32] This is in accordance with the “Request for guidance: Application of AM0005 and AMS-I.D in China”, a letter from DNV to the Executive Board, dated 07/10/2005, available online at: http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM. This approach has been applied by several registered CDM projects using methodology ACM0002 so far.

[33] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1051.pdf

Grid is 99.63%, 99.49% and 99.76% in 2003-2005 years respectively[34]. Therefore the ratio of coal-fired generators occupies dominance absolutely. However, the ratio of oil/gas-fired generator occupies much less. Therefore taking coal emission factor as thermal emission factor for simplification is reasonable.

The ratio of coal-fired generators' $CO_2$ emissions is 99.48%, therefore, 0.9948 is considered as reduction coefficient, this is conservative.

**The datum of 99.48% calculation**

The datum of 99.48% calculation the detail is provided in annex 3:

According to the statistical data of the most recent one year, determine the ratio of $CO_2$ emissions produced by coal, oil and gas fuels consumption for power generation.

Calculate the proportion of $CO_2$ emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total $CO_2$ emissions from the total fossil fuelled electricity generation (sum of $CO_2$ emissions from coal, oil and gas).

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad \text{Equation (B.4)}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad \text{Equation (B.5)}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad \text{Equation (B.6)}$$

Where,

$F_{i,m,y}$, is the amount of fuel $i$ (in a mass or volume unit) consumed by power sources j in year(s) y,

$COEF_{i,j,m}$ is the $CO_2$ emission coefficient of fuel $i$ ($tCO_2e$/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power plants m and the oxidation percentage of the fuel(coal, oil and gas) in year(s) y,

*Coal*, *Oil* and *Gas* is solid, liquid and gas fuels respectively.

**Calculate the Building Margin emission factor**

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times I \times 336.66\text{kg/MWh} \times 99.48\% / 1000 \qquad \text{Equation (B.7)}$$

Where,

$CAP_{Total}$ is the total capacity addition(MWh);

$CAP_{Thermal}$ is the total thermal power capacity addition(MWh);

$I$ is the $CO_2$ Emission Factor of Standard Coal ($tCO_2e$/tSCE)

[34] China Energy Statistical Yearbook 2005 p.202-221,258-261; China Energy Statistical Yearbook 2004 p.146-165, 202-205; China Energy Statistical Yearbook 2000-2002 p.164-167, 176-179, 188-191, 200-203, 212-215, 332-335.

The building margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period of the project activity.

The data resources for calculating OM and BM are:

- Installed capacity, power generation and the rate of internal electricity consumption of thermal power plants
  Source: *China Electric Power Yearbook* (2001-2006)
- Fuel consumption and the net caloric value of thermal power plants
  Source: *China Energy Statistical Yearbook* (figures are for 2000-2006),
- Carbon emission factor and carbon oxidation factor of each fuel
  Source: *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table1.3 of Page 1.21-Page 1.22 and Table 1.4 of Page 1.23- Page 1.24 in Volume 2, Chapter 1.*

**STEP 3 Calculate the Electricity Baseline Emission Factor ( $EF_y$ )**

The Baseline Emission Factor is calculated as a Combined Margin, using a weighted average of the Operating Margin and Build Margin.

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y} \quad \text{(Equation B.8)}$$

According to the calculation process of the *Bulletin on the Baseline Emission Factors of the China's Regional Grid* renewed by Director Office of National Climate Change Coordination of NDRC (China DNA) on Dec. 15, 2006, but the latest data (2005) will be employed. The Operating Margin Emission Factor ( $EF_{OM,y}$ ) of the Central China Power Grid is 1.29092t$CO_2$e/MWh, and, according to the calculation in Annex 3, the Build Margin Emission Factor ( $EF_{BM}$ ) is 0.45916t$CO_2$e/MWh. The defaults weights for hydropower projects are used as specified in the ACM0002 (version 06).

$$w_{OM} = 0.5\,;\, w_{BM} = 0.5$$

Using above mentioned values the Combined Margin Baseline Emission Factor of the Central China Power Grid **c**orresponds to 0.87504t$CO_2$e/MWh. Please refer to Annex 3 for detailed information on the baseline emission factor calculation.

**Emission Reductions** $ER_y$

The project activity reduces carbon dioxide emissions through displacement of grid electricity generation based on fossil fuel fired power plants by renewable electricity. The emission reduction $ER_y$ achieved by the project activity during a given year y is the difference between baseline emissions ( $BE_y$ ), project emissions ( $PE_y$ ) and emissions due to leakage ( $L_y$ ):

$$ER_y = BE_y - PE_y - L_y \quad \text{(Equation B.9)}$$

Of which:

$BE_y$ is baseline emissions during a given year y, the baseline emissions is calculated by:

$$BE_y = (EG_y - EG_{baseline}) \times EF_y \quad \text{(Equation B.10)}$$

Where,

$EG_y$ is the electricity supplied by the project activity to the grid, in MWh. it is calculated by:

$$EG_y = EG_{s,y} - PR_{g,y} \quad \text{(EquationB.11)}$$

Of which: $EG_{s,y}$ is the power supplied to the grid.

$PR_{g,y}$ is the electricity use of power plant supplied by the grid.

$EF_y$ is baseline emissions factor, in $tCO_2e/MWh$.

$EG_{baseline}$ is the baseline electricity supplied to the grid in the case of modified or retrofit facilities. There are no modified or retrofit facilities for the specific project, therefore $EG_{baseline} = 0$.

$PE_y$ is project emissions during a given year y. The specific project is a run-of-river hydropower station, according to ACM0002, the project greenhouse gas emissions from the project activity are zero. Hence $PE_y = 0$.

$L_y$ is leakage, according to ACM0002, there is no leakage calculation is required. Hence $L_y = 0$.

Therefore, the emission reductions are equal to the baseline emissions, namely,

$$ER_y = BE_y = EG_y \times EF_y = (EG_{s,y} - PR_{g,y}) \times EF_y \quad \text{(Equation B.12)}$$

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

| **Data / Parameter:** | $GEN_{j,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity delivered to the grid by relevant power sources j in (years) y (2001-2005, including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan) |
| Source of data used: | *China Electric Power Yearbook 2002-2006* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate the OM and BM |

| **Data / Parameter:** | The rate of electricity consumption of thermal power plants |
|---|---|
| Data unit: | % |
| Description: | The rate of electricity consumption of thermal power plants of relevant power sources j in the years y (2003-2005 including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan) |
| Source of data used: | *China Electric Power Yearbook 2004-2006* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate the power delivered to the grid |

| | |
|---|---|
| **Data / Parameter:** | *Electricity Imports to the Central China Power Grid* |
| Data unit: | MWh |
| Description: | The Power Transmitted from other regional grids to the Central China Power Grid in (years) y (2003-2005) |
| Source of data used: | *State Power Information Network (http://www.sp.com.cn)* |
| Value applied: | Electricity imports to Central China Power Grid are assumed to be zero. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate the OM |

| | |
|---|---|
| **Data / Parameter:** | $F_{i,j,y}$ |
| Data unit: | $10^4t/10^8m^3$ |
| Description: | Amount of fuel *i* consumed by relevant power sources *j* in (years) y (2003-2005, including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan) |
| Source of data used: | *China Energy Statistics Yearbook 2004-2006* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate OM and BM |

| | |
|---|---|
| **Data / Parameter:** | $NCV_i$ |
| Data unit: | TJ/fuel in a mass or volume unit |
| Description: | Net calorific value per mass or volume unit of fuel $i$ |
| Source of data used: | *China Energy Statistics Yearbook 2006* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate OM and BM |

| | |
|---|---|
| **Data / Parameter:** | $EF_{CO_2,i}$ |
| Data unit: | t/TJ |
| Description: | $CO_2$ emission factor per energy unit of fuel $i$ |
| Source of data used: | *2006 IPCC Guidelines for National Greenhouse Gas Inventories* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC default value |
| Any comment: | To calculate OM and BM |

| | |
|---|---|
| **Data / Parameter:** | $OXID_i$ |
| Data unit: | % |
| Description: | Oxidation factor of fuel $i$ |

| | |
|---|---|
| Source of data used: | *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC default value |
| Any comment: | To calculate OM and BM |

| **Data / Parameter:** | *Efficiency level of best technology commercially available for coal-fired power generation* |
|---|---|
| Data unit: | % |
| Description: | Efficiency level of best technology commercially available in China for coal-fired power generation |
| Source of data used: | China DNA*: Bulletin on Baseline Emission Factors of the China's Regional Grids-the calculation of baseline Build Margin emission factor for the China's Regional Grids* |
| Value applied: | 36.53% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate BM |

| **Data / Parameter:** | *Efficiency level of best technology commercially available for oil and gas-fired power generation* |
|---|---|
| Data unit: | % |
| Description: | Efficiency level of best technology commercially available in China for oil and gas-fired power generation |
| Source of data used: | China DNA *: Bulletin on Baseline Emission Factors of the China's Regional Grids -the calculation of baseline Build Margin emission factor for the China's Regional Grids* |
| Value applied: | 45.87% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate BM |

| **Data / Parameter:** | $CAP_{y,i}$ |
|---|---|
| Data unit: | MW |
| Description: | The installed capacity of power generation sources j in (years) y (2000-2005, including Chongqing, Sichuan, Henan, Jiangxi, Hubei and Hunan) |
| Source of data used: | *China Electric Power Yearbook 2003-2006* |
| Value applied: | Provided in Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Officially released statistics; publicly accessible and reliable data source |
| Any comment: | To calculate BM |

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

According to Section B.6.1 and further details in Annex3, the Combined Margin baseline emission factor of the project is 0.87504t$CO_2$e/MWh throughout the first crediting period. And the expected annual power to be supplied to the grid by the project is 201,390MWh.

Therefore, $BE_y$ in the first crediting period is to be calculated as follows:

$$BE_y = EG_y \times EF_y = 176{,}224 tCO_2e$$

According to section B6.1, the emission reductions are equal to the baseline emissions; therefore, in the first crediting period, the annual emission reductions are 176,224t$CO_2$e

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

The total expected emission reductions during the first seven years crediting period of the project are 1,233,568t$CO_2$e.

Table B.12 Estimate of Emission Reductions Due to the Project

| years | Project Emissions (t$CO_2$e) | Baseline Emissions (t$CO_2$e) | Leakage (t$CO_2$e) | Emission Reductions (t$CO_2$e) |
|---|---|---|---|---|
| 01/11/2008-31/10/2009 | 0 | 176,224 | 0 | 176,224 |
| 01/11/2009-31/10/2010 | 0 | 176,224 | 0 | 176,224 |
| 01/11/2010-31/10/2011 | 0 | 176,224 | 0 | 176,224 |
| 01/11/2011-31/10/2012 | 0 | 176,224 | 0 | 176,224 |
| 01/11/2012-31/10/2013 | 0 | 176,224 | 0 | 176,224 |
| 01/11/2013-31/10/2014 | 0 | 176,224 | 0 | 176,224 |
| 01/11/2014-31/10/2015 | 0 | 176,224 | 0 | 176,224 |
| **Total(t$CO_2$e)** | 0 | 1,233,568 | 0 | 1,233,568 |

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

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

In order to calculate emission of baseline, it need to be monitored the power supplied to the grid ($EG_{s,y}$) and the electricity use of power plant supplied by the grid $PE_{g,y}$, and according to the two data, the net power supplied to the grid($EG_y$) will be calculated($EG_y = EG_{s,y} - PE_{g,y}$). In addition the surface area at full reservoir level ($S_{reservoir}$) will be monitored.

| **Data / Parameter:** | $EG_{s,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Power supplied to the grid in y year |
| Source of data to be used: | Measured by ammeter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | The annual electricity supplied to the grid by the project is 201,591MWh |
| Description of measurement methods and procedures to be applied: | The meters will be periodically checked according to the relevant national electric industry standards and regulations; Power supplied to the grid and double checked according to electricity sales invoice. |
| QA/QC procedures to be applied: | Power supplied to the grid and double checked according to electricity sales receipt. |

| | |
|---|---|
| Any comment: | Refer to B.7.2. Description of the monitoring plan |

| | |
|---|---|
| Data / Parameter: | $PR_{g,y}$ |
| Data unit: | MWh |
| Description: | Power supplied to the specific project from the grid in the years y |
| Source of data to be used: | Measured and verified against sale data |
| Value of data: | The electricity supplied to the specific project by the grid is 201MWh(estimated according to the 1/‰ of the net electricity supplied to the grid from the specific project, and in the monitoring process, the factual monitoring data will be employed) |
| Description of measurement methods and procedures to be applied: | Measured continuously and recorded on a monthly basis |
| QA/QC procedures to be applied: | The meters will be periodically checked according to the relevant national electric industry standards and regulations; Power supplied to the grid and double checked according to electricity purchase invoice. |
| Any comment: | Refer to B.7.2. Description of the monitoring plan |

| | |
|---|---|
| Data / Parameter: | $S_{reservoir}$ |
| Data unit: | m2 |
| Description: | Surface area at full reservoir level |
| Source of data to be used: | Measured |
| Value of data: | 26,000m$^2$ |
| Description of measurement methods and procedures to be applied: | The surface area will be calculated using the design schematics and area maps. Photographs of the reservoir at several key locations will be taken when the project becomes operational to check whether the actual reservoir does not deviate substantially for the design. |
| QA/QC procedures to be applied: | The power density of the project is 1,923 W/m$^2$, which is far higher than 10 W/m$^2$ and therefore substantial deviations from the calculated design surface area will not affect the calculation of emission reductions by the project. Therefore no further QA/QC procedures will be applied. |
| Any comment: | Refer to B.7.2. Description of the monitoring plan |

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

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of emissions reductions during the whole crediting period of the project activity. The project owner will be responsible for the implementation of the monitoring plan, and the Grid Company will cooperate with the project owner.

**1. Monitoring Objective**

The main monitoring data are electricity supplied to the grid and power supplied to the project from the grid company since the baseline emission factor is fixed by ex-ante calculations.

**2. Monitoring Organization**

A monitoring officer will be appointed by the project owner, who will supervise and verify metering and data recording, data collection (including sales invoice), emission reduction calculations and monitoring report preparation.

The monitoring officer will receive support from Beijing Tianqing Power International CDM Consulting Co., Ltd, including:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving, using among others a detailed Monitoring manual that will be made available to the validator for review.
- Provide the monitoring officer with a calculation template in electronic form for calculation of annual emission reductions.
- Continuous advice to the monitoring officer on a need basis.
- Review of monitoring reports.

**3. Monitoring Equipment and program**

According to the Chinese national standard "*Technical Management Code for Electricity Metering" (DL/T448-2000)*, the electricity metering equipment will be properly configured and the metering equipment will be checked by both the project owner and the grid company before the project is in operation.

The project involves nine meters, but only five out of these nine meters are needed to monitor parameters as per CDM project requirements. The main meter M1 is located at the exit of Yanyuan Yongning River Hydropower Station for measuring power supplied (except the hydropower station use power generated by itself) $M1_A$, and power supplied to the hydropower station from the grid company through main line (except the transmission line loss) $M1_B$; M2 and M3 meters are located at the exit of the two generators respectively for measuring power generation by the specific hydropower station $M2_A$ and $M3_{A,}$ and the two meters can be used as backup meters to verify recordings from meter M1. The meters M4 and M5 are used to measure electricity imports from the grid to the project, of which the M4 meter is installed at low voltage side of the intake main transformer of the 10kV backup power source to measure the self-consumption of the intake of the project supplied by the grid company via a auxiliary line; M5 meter is at the low voltage side of the forebay main transformer of the 10kV backup power source to measure the self-consumption of the forebay of the project supplied by the grid company via a auxiliary line. Therefore, the net power supplied to the grid is $M1_A$-$M1_B$-M4- M5. More details about the location of the electricity meters are provided in Annex 4.

The project owner will monitor the surface area of the reservoir by collecting photographic evidence of the surface level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

**4. Data Collection**

The project owner is responsible for operation monitoring of the backup meters whereas the Grid Company is responsible for operation monitoring of the main meter respectively and guarantee that measuring equipments are in good operation and completely sealed.

The electricity recorded by the main meter alone will suffice for the purpose of sales invoice and emission reduction verification as long as any main meter errors are within the allowable tolerance. The main monitoring process is as follows:

- The project owner and Grid Company read and check the backup meters and the main meter, and record the data at one appointed day of every month.
- The project owner sells the electricity to the Grid Company;
- The project owner provides an electricity sales invoice to the Grid Company. A copy of the invoice is stored by the project owner, together with a record of the payment by the grid company.
- The grid company supplies the electricity supplied to the grid to the project owner through main line and auxiliary line.

- The Grid Company provides electricity sales invoice to the project owner, and the invoices are stored by the project owner.
- The project owner records the net electricity supplied to the grid of $M1_A$-$M1_B$-M4- M5.
- The project owner keeps and safeguards the records of the main meters' data readings for verification by the DOE.

If inaccuracy of the reading data from the main meter exceeds the allowable tolerance, when the meter operates abnormally during a certain period or when any other unexpected problems occur, the net amount of electricity exported to the grid shall be determined by:

- Using readings from the backup meters (taking potential transmission losses into consideration) to get electricity supplied to the grid, and the power supplied to the specific project from the grid company(including $M1_B$, M4 and M5 ) use the max value in the history for the project, unless a test by either party reveals it is inaccurate;
- If the backup system is not with acceptable limits of accuracy or performed improperly the specific project owner and the Grid Company shall based on mutual agreement, determine the amount of supplied electricity during the period of the occurred distortion or mal-function of backup meters by means of referring to voltage and current data in accordance with relevant rules; and
- If the specific project owner and the Grid Company fail to reach an agreement concerning the amount of supplied electricity to the grid during the period of the occurred distortion or mal-function of backup meters, then the matter will be submitted for arbitration according to agreed procedures.

The meter reading will be readily accessible for DOE. Calibration test records will be maintained for verification.

**5. Calibration**

The verification and calibration of electricity meters shall be carried out periodically according to relevant national electric industry standards and regulations. After verification and calibration, meters should be sealed. All meters shall be jointly inspected and sealed on behalf of the project owner and Grid Company and shall not be accessible by either party except in the presence of the other party or its accredited representatives.

All the meters installed shall be tested by the qualified metrical organization co-authorized by the project owner and Grid Company within 10 days after:

i The detection of a difference larger than the allowable error in the reading of main meters and backup meters;

ii Repair the faulty meter caused by improper operation..

**6. Data Management**

Data will be archived at the end of each month using the electronic spreadsheet described. The electronic files will be stored on hard disk and CD-ROM. In addition a hard copy printout will be archived.

Physical documentation will be collected and stored by the project owner in a central place, together with the monitoring plan. In order to facilitate the auditor's reference, monitoring results will be indexed. All data records will be kept for a period of 2 years following the end of the crediting period.

**7. Monitoring Report**

In addition, the project owner will collect sales invoices for the power delivered to the grid as a cross-check. At the end of each crediting year, a monitoring report will be compiled detailing the metering results and evidence (i.e. sales invoices). The monitoring report should include: the monitoring of the

electricity supplied to the grid, emission reductions calculation report, repair records and calibration records of the monitoring equipment.

**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: 08/08/2008
Name of persons determining the baseline:

Alex Yang, General Manager, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68298491/68298496
Fax: +86-10-68173622/68221621
Email: aiminyang820@yahoo.com.cn
(Not Project Participant)

Jane Yang, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68298491/ 68298496
Fax: +86-10-68173622/68221621
Email: jingqiuyang@sina.com
(Not Project Participant)

Tracy (Xiujuan) Yuan, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68298491/68298496
Fax: +86-10-68173622/68221621
Email: abeautytracy@yahoo.com.cn
(Not Project Participant)

Daniel Jiang, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-6829849/68298496
Fax: +86-10-68173622/68221621
Email: jiang_dongkuai@yahoo.com.cn
(Not Project Participant)

**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:**

The starting date of the project construction preparation: 26/02/2004, and in August 2004, project construction had been interrupted due to lack of capital.
Only after getting approval by local government to apply for CDM in July 2005, the construction work could be resumed. The restarting date of the project construction: 18/07/2005, which is the earliest starting date of the CDM project.

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

The expected operational lifetime of the project activity 20 years

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

**C.2.1. Renewable crediting period**

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

01/11/2008 (or the registration date, whichever is later)

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

7 years

**C.2.2. Fixed crediting period:**

Not applicable

**C.2.2.1. Starting date:**

**C.2.2.2. Length:**

## SECTION D. Environmental impacts

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

According to the relevant environmental laws and regulations, an Environmental Impact Assessment (EIA) was carried out, and has been approved by the Environmental Protection Bureau of Liangshan Yi Minority Autonomous Prefecture. There are no transboundary environment impacts foreseen for the project. The main conclusions of the EIA are provided below.

**1. Impact on the soil and water loss and vegetation**

The roadbed excavation leads to the exposition of ground, which leads to soil and water losses and damages to surrounding vegetation. All the slag produced in the construction period will be left in an adjacent slag disposal pit. After the completion of the project, the slag will be cleared up, the ground earthed up and trees and grass planted to restore the vegetation.

**2. Impact on Ambient Air**

The main air pollution sources during the construction period will be dust, automobile and diesel generator exhaust and pollution, but the impacts are considered to be very low and of short-term nature.

**3. Impact on Aquatic Environment**

The main water pollution sources during the construction period are from constructing the dam, tunnel and diversion tunnel and the waste water produced by workers.

The main waste water during operation period is the domestic wastewater produced by the management people of the project. The project will install small treating equipment, and the waste water will be treated to primary standard before discharging.

**4. Noise Impact**

The main noise during construction period is caused by the operation of bulldozers, excavators, crushers and air compressors; all impacts are of short-term nature. The main noise during operating period is brought by the turbine and generator, but noise levels are considered to be low outside of the power house. Power plant operators working inside the power house shall wear noise protection gear.

**5. Impact of Solid Waste on Environment**

The waste soil produced due to excavation during the construction period amounts to 590,000 $m^3$, whereas 106.000$m^3$ are reused for construction, and the rest is stored in the slag disposal yard. The domestic waste produced by workers during the construction period and operating period produced by management people will be disposed in solid waste disposal sites.

**6. Impact of Land Utilization and Migration**

Being a run-of-river power station, the project activity has no migration related to the project activity. The flood area of the project is 1.4 hectares. The permanent land requirement is 6.75 hectares, of which 5.98 hectares are dry land, 0.37 hectares are farmland and the rest is unused land. The temporary land requirement is 8.05 hectares, of which 3.37 hectares are forest area and the rest is unused land.

The project will compensate for the permanent and temporary land requirements. And it will clean up the field as soon as construction is finished, and then rehabilitate the tilled land.

There is no object needing special protection and no sensitive area, so the negative environmental impact is small.

In order to guarantee the ecological water requirement of lower reach, there are some branches meeting the water need of downstream, furthermore, ecological flow of $3.54m^3/s$ from the dam has been used as ecological water. Ecological water will be sluiced and will satisfy the ecological water demand of lower reaches.

**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 participants and the host party involved consider negative environmental impacts of the project to be marginal. Comparing the environmental impacts and the mitigation measures mentioned above to the contribution of the project towards sustainable development on a regional a national level, the project will have an overall positive impact on the local and global environment.

## SECTION E. Stakeholders' comments

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

The project owner has distributed questionnaires to local residents who may be impacted by the project in order to collect advice for the project. 20 questionnaires have been filled out and sent back to the project owner. The aim of these questionnaires was to collect opinions concerning the influence the project would have on the local society, environment, economy, daily life etc.

Furthermore, a special stakeholder consultation meeting was organized on May 18, 2006 at Yanyuan Town, Sichuan Province to collect opinions from all the potential stakeholders, such as local residents. Potential stakeholders have been informed about the stakeholder meeting through bulletins on the newspaper of *Liangshan Daily* Paper on 17 May, 2006, and through the website of www.tqcdmchina.com. In the bulletin, the company invited the potential stakeholders to get to know detailed information about the hydropower station. Furthermore, on the meeting, the project owner and the consultant invited the participants to express their comments and concerns about the project and CDM.

The following questions come from the summary of the stakeholder consultation meeting and questionnaires:

1. Will the construction of the power station result in more benefits or losses for the stakeholders?
2. Are there any situations where there is a lack of electricity? What type of energy source is used for daily life? How will the power station have an influence?
3. What type of negative influence will the station bring to the local residents?
4. Will the construction of a hydro power station influence noise and drinking water pollution? How far is it from the nearest local residents?
5. Will the construction of the station influence the living environment for animals, fish and plants? If yes, how much?
6. Will there be migration as a result of this project?
7. What is the land used for before the construction of the power station? And is there some tilled land used for the plant construction? If it is, is the compensation in compliance with the national policy?
8. What is the main source of income of local residents? Will the project have an impact on local residents' income situation? What will be the impact brought to the local natural site?
9. What impact will the project have on the ecosystem?
10. Do you understand CDM? And what is your attitude toward the development of CDM? Do you oppose or support it?
11. Do you agree with the construction of this power station?

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

As previously mentioned 20 questionnaires have been returned to the project owner prior to the stakeholder meeting. The profile of the interviewed persons is as follows:

- 20% were women
- 25% had a junior school graduation or higher
- 95% were elder than twenty years old

The results of the survey are as follows:

- 100% of the investigated residents mentioned lack of electricity in local area
- 65% of the investigated residents think the hydropower station will bring benefit to their lives
- 100% of the investigated residents agree with the construction of the project.

In addition to the survey, 15 stakeholders have attended the stakeholder meeting. All stakeholders think that hydropower is a renewable energy which will cause little negative impacts on the environment.

Further, there will be no migration and the income of the local residents will be increased due to the project. At present firewood is used for heating; this project can supply sufficient electricity for heating purpose to local residents, which is beneficial to the environment and to human health. At the same time, the project will provide electricity to local industries, promoting employment opportunities and stimulating the economic development. All stakeholders were pleased with the development of the project, and considered that the CDM project would actually accelerate the development of local economy and increase incomes of the local residents. The impacts of the project are generally positive, thus all stakeholders support the construction of this project.

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

Given the generally positive (or neutral) nature of the comments received, no action has been taken to address the comments received.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Entity:

| | |
|---|---|
| Organization: | Yanyuan Yongning River Hydro-electric Development Co., Ltd. |
| Street/P.O.Box: | 56# Business Street Xichang City |
| Building: | / |
| City: | Xichang City, Liangshan Yi Minority Autonomous Prefecture |
| State/Region: | Sichuan Province |
| Postfix/ZIP: | 615000 |
| Country: | China |
| Telephone: | +86-834-3222996 |
| FAX: | +86-834-3301996 |
| E-Mail: | dujingwei198235@126.com |
| URL: | / |
| Represented by: | Lin Zhao |
| Title: | Board Chairman |
| Salutation: | Mr. |
| Last Name: | Zhao |
| Middle Name: | / |
| First Name: | Lin |
| Department: | / |
| Mobile: | +86-13608063639 |
| Direct FAX: | +86-28-66016000 |
| Direct tel: | +86-28-66016118 |
| Personal E-Mail: | linshao@shuangnan.com |

The Buyer

| | |
|---|---|
| Organization: | ENEL Trade SpA |
| Street/P.O.Box: | Viale Regina Margherita, 125 |
| Building: | / |
| City: | Rome |
| State/Region: | / |
| Postfix/ZIP: | 00198 |
| Country: | Italy |
| Telephone: | +39-06-83058506 |
| FAX: | +39-06-83054394 |
| E-Mail: | |
| URL: | http://www.enel.it |
| Represented by: | Eliano Russo |
| Title: | / |
| Salutation: | Mr. |
| Last Name: | Russo |
| Middle Name: | / |
| First Name: | Eliano |
| Department: | / |
| Mobile: | / |
| Direct FAX: | +39-06-83054394 |
| Direct tel: | +39-06-83058506 |
| Personal E-Mail: | Eliano.russo@enel.it |

## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I parties used in the project activity.

## Annex 3

### BASELINE INFORMATION

Table 1. Calculation of the Thermal Power supplied to the Central China Power Grid in 2003

| Province | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan |
|---|---|---|---|---|---|---|
| Thermal Power Generation (MWh) | 27,165,000 | 95,518,000 | 39,532,000 | 29,501,000 | 16,341,000 | 32,782,000 |
| Rate of Electricity Consumption of Power Plant (%) | 6.43 | 7.68 | 3.81 | 4.58 | 8.97 | 4.41 |
| Thermal Power Supplied to the Grid (MWh) | 25,418,290.5 | 88,182,217.6 | 38,025,830.8 | 28,149,854.2 | 14,875,212.3 | 31,336,313.8 |
| Total Thermal Power Supplied to the Central China Power Grid (MWh) | 225,987,719.2 | | | | | |

*Data source: 2004 China Electric Power Yearbook, P670, 709.*

Table 2. Calculation of the Thermal Power supplied to the Central China Power Grid in 2004

| Province | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan |
|---|---|---|---|---|---|---|
| Thermal power Generation (MWh) | 30,127,000 | 109,352,000 | 43,034,000 | 37,186,000 | 16,520,000 | 34,627,000 |
| Rate of Electricity Consumption of Power Plant (%) | 7.04 | 8.19 | 6.58 | 7.47 | 11.06 | 9.41 |
| Thermal Power Supplied to the Grid (MWh) | 28,006,059.2 | 100,396,071.2 | 40,202,362.8 | 34,408,205.8 | 14,692,888.0 | 31,368,599.3 |
| Total Thermal Power Supplied to the Central China Power Grid (MWh) | 249,074,186.3 | | | | | |

*Data Source: 2005 China Electric Power Yearbook, P472-474.*

Table 3. Calculation of the Thermal Power supplied to the Central China Power Grid in 2005

| Province | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan |
|---|---|---|---|---|---|---|
| Thermal power Generation (MWh) | 30,000,000 | 131,590,000 | 47,700,000 | 39,900,000 | 17,584,000 | 37,202,000 |
| Rate of Electricity Consumption of Power Plant (%) | 6.48 | 7.32 | 2.51 | 5 | 8.05 | 4.27 |
| Thermal Power Supplied to the Grid (MWh) | 28,056,000.0 | 121,957,612.0 | 46,502,730.0 | 37,905,000.0 | 16,168,488.0 | 35,613,474.6 |
| Total Thermal Power Supplied to the Central China Power Grid (MWh) | 286,203,304.6 | | | | | |

*Data Source: 2006 China Electric Power Yearbook, P559, 560, 568.*

Table 4. Energy Consumption Statistics of Power Generation of the Central China Power Grid in 2003

| Fuel | Unit | Jiangxi<br>A | Henan<br>B | Hubei<br>C | Hunan<br>D | Chongqing<br>E | Sichuan<br>F | The Central China Power Grid<br>G=A+B+C+D+E+F |
|---|---|---|---|---|---|---|---|---|
| Raw coal | Ten thousand Tons | 1,427.41 | 5,504.94 | 2,072.44 | 1,646.47 | 769.47 | 2,430.93 | 13,851.66 |
| Clean coal | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other washed coal | Ten thousand Tons | 2.03 | 39.63 | 0.00 | 0.00 | 106.12 | 0.00 | 147.78 |
| Coke | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 1.22 | 0.00 | 0.00 | 1.22 |
| Coke oven gas | $10^8$ Cubic meter | 0.00 | 0.00 | 0.93 | 0.00 | 0.00 | 0.00 | 0.93 |
| Other gas | $10^8$ Cubic meter | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crude oil | Ten thousand Tons | 0.00 | 0.5 | 0.24 | 0.00 | 0.00 | 1.20 | 1.94 |
| Diesel oil | Ten thousand Tons | 0.52 | 2.54 | 0.69 | 1.21 | 0.77 | 0.00 | 5.73 |
| Fuel oil | Ten thousand Tons | 0.42 | 0.25 | 2.17 | 0.54 | 0.28 | 1.20 | 4.86 |
| LPG | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Refinery gas | Ten thousand Tons | 1.76 | 6.53 | 0.00 | 0.66 | 0.00 | 0.00 | 8.95 |
| Natural gas | $10^8$ Cubic meter | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 2.2 | 2.24 |
| Other petroleum products | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other coking products | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other Energy | Ten thousand Tce | 0.00 | 11.04 | 0.00 | 0.00 | 16.2 | 0.00 | 27.24 |

*Data Source: China Energy Statistical Yearbook 2004: p.198-201, 206-217, 230-237.*

Table 5. Energy Consumption Statistics of Power Generation of the Central China Power Grid in 2004

| Fuel | Unit | Jiangxi A | Henan B | Hubei C | Hunan D | Chongqing E | Sichuan F | The Central China Power Grid G=A+B+C+D+E+F |
|---|---|---|---|---|---|---|---|---|
| Raw coal | Ten thousand Tons | 1,863.80 | 6,948.50 | 2,510.50 | 2,197.90 | 875.50 | 2,747.90 | 17,144.10 |
| Clean coal | Ten thousand Tons | 0.00 | 2.34 | 0.00 | 0.00 | 0.00 | 0.00 | 2.34 |
| Other washed coal | Ten thousand Tons | 48.93 | 104.22 | 0.00 | 0.00 | 89.72 | 0.00 | 242.87 |
| Coke | Ten thousand Tons | 0.00 | 109.61 | 0.00 | 0.00 | 0.00 | 0.00 | 109.61 |
| Coke oven gas | $10^8$ Cubic meter | 0.00 | 0.00 | 1.68 | 0.00 | 0.34 | 0.00 | 2.02 |
| Other gas | $10^8$ Cubic meter | 0.00 | 0.00 | 0.00 | 0.00 | 2.61 | 0.00 | 2.61 |
| Crude oil | Ten thousand Tons | 0.00 | 0.86 | 0.22 | 0.00 | 0.00 | 0.00 | 1.08 |
| Gasoline | Ten thousand Tons | 0.00 | 0.06 | 0.00 | 0.00 | 0.01 | 0.00 | 0.07 |
| Diesel oil | Ten thousand Tons | 0.02 | 3.86 | 1.7 | 1.72 | 1.14 | 0.00 | 8.44 |
| Fuel oil | Ten thousand Tons | 1.09 | 0.19 | 9.55 | 1.38 | 0.48 | 1.68 | 14.37 |
| LPG | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Refinery gas | Ten thousand Tons | 3.52 | 2.27 | 0.00 | 0.00 | 0.00 | 0.00 | 5.79 |
| Natural gas | $10^8$ Cubic meter | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.27 | 2.27 |
| Other petroleum products | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other coking products | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other Energy | Ten thousand Tce | 0.00 | 16.92 | 0.00 | 15.2 | 20.95 | 0.00 | 53.07 |

*Data Source: China Energy Statistical Yearbook 2005: p.254-257, 262-273, 286-293.*

Table 6. Energy Consumption Statistics of Power Generation of the Central China Power Grid in 2005

| Fuel | Unit | Jiangxi<br>A | Henan<br>B | Hubei<br>C | Hunan<br>D | Chongqing<br>E | Sichuan<br>F | The Central China Power Grid<br>G=A+B+C+D+E+F |
|---|---|---|---|---|---|---|---|---|
| Raw coal | Ten thousand Tons | 1,869.29 | 7,638.87 | 2,732.15 | 1,712.27 | 875.40 | 2,999.77 | 17,827.75 |
| Clean coal | Ten thousand Tons | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Other washed coal | Ten thousand Tons | 0.00 | 138.12 | 0.00 | 0.00 | 89.99 | 0.00 | 228.11 |
| Coke | Ten thousand Tons | 0.00 | 25.95 | 0.00 | 105.00 | 0.00 | 0.00 | 130.95 |
| Coke oven gas | $10^8$ Cubic meter | 0.00 | 0.00 | 1.15 | 0.00 | 0.36 | 0.00 | 1.51 |
| Other gas | $10^8$ Cubic meter | 0.00 | 10.20 | 0.00 | 0.00 | 3.12 | 0.00 | 13.32 |
| Crude oil | Ten thousand Tons | 0.00 | 0.82 | 0.36 | 0.00 | 0.00 | 0.00 | 1.18 |
| Gasoline | Ten thousand Tons | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 |
| Diesel oil | Ten thousand Tons | 1.30 | 3.03 | 2.39 | 1.39 | 1.38 | 0.00 | 9.49 |
| Fuel oil | Ten thousand Tons | 0.64 | 0.29 | 3.15 | 1.68 | 0.89 | 2.22 | 8.87 |
| LPG | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Refinery gas | Ten thousand Tons | 0.71 | 3.41 | 1.76 | 0.78 | 0.00 | 0.00 | 6.66 |
| Natural gas | $10^8$ Cubic meter | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 | 3.00 |
| Other petroleum products | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other coking products | Ten thousand Tons | 0.00 | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | 1.50 |
| Other Energy | Ten thousand Tce | 0.00 | 2.88 | 0.00 | 1.74 | 32.80 | 0.00 | 37.42 |

*Data Source: China Energy Statistical Yearbook 2006: p.178-181, 186-197, 210-217.*

Table 7. The Operation Margin Emission Factor Calculation of the Central China Power Grid in 2003

| Fuel | Unit | Fuel Consumption of The Central China Power Grid in 2003 G | Emission Factor H（tc/TJ） | Oxidation Rate I (%) | Average NCV J (MJ/t,km$^3$) | $CO_2$ Emission($tCO_2e$) K=G*H*I*J*44/12/10000 (for quality unit) K=G*H*I*J*44/12/1000 (for volume unit) |
|---|---|---|---|---|---|---|
| Raw coal | Ten thousand Tons | 13,851.66 | 25.8 | 100.00 | 20,908 | 273,971,539.89 |
| Clean coal | Ten thousand Tons | 0.00 | 25.8 | 100.00 | 263,44 | 0 |
| Other washed coal | Ten thousand Tons | 147.78 | 25.8 | 100.00 | 8,363 | 1,169,146.40 |
| Coke | Ten thousand Tons | 1.22 | 29.2 | 100.00 | 28,435 | 37,142.18 |
| Coke oven gas | $10^8$ Cubic meter | 0.93 | 12.1 | 100.00 | 16,726 | 69,013.15 |
| Other gas | $10^8$ Cubic meter | 0.00 | 12.1 | 100.00 | 5,227 | 0 |
| Crude oil | Ten thousand Tons | 1.94 | 20.0 | 100.00 | 41,816 | 59,490.23 |
| Diesel oil | Ten thousand Tons | 5.73 | 20.2 | 100.00 | 42,652 | 181,015.94 |
| Fuel oil | Ten thousand Tons | 4.86 | 21.1 | 100.00 | 41,816 | 157,229.00 |
| LPG | Ten thousand Tons | 0.00 | 17.2 | 100.00 | 50,179 | 0.00 |
| Refinery gas | Ten thousand Tons | 8.95 | 15.7 | 100.00 | 46,055 | 237,285.34 |
| Natural gas | $10^8$ Cubic meter | 2.24 | 15.3 | 100.00 | 38,931 | 489,222.52 |
| Other petroleum products | Ten thousand Tons | 0.00 | 20 | 100.00 | 38,369 | 0 |
| Other coking products | Ten thousand Tons | 0.00 | 25.8 | 100.00 | 28,435 | 0 |
| Other Energy | Ten thousand Tce | 27.24 | 27.3 | 100.00 | 0 | 0 |
| Total Emission (Q) | | 276,371,084.63$tCO_2e$ | | | | |
| Thermal Power supplied to the Central China Power Grid (P) | | 225,987,719.20MWh | | | | |
| OM Emission Factor in 2003 [ = Q/P] | | 1.22295$tCO_2e$/MWh | | | | |

*Data Source: China Energy Statistical Yearbook 2006: p.287;2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table1.3 of Page 1.21-Page 1.22 and Table 1.4 of Page 1.23- Page 1.24 in Volume 2, Chapter 1.*

Table 8. The Operation Margin Emission Factor Calculation of the Central China Power Grid in 2004

| Fuel | Unit | Fuel Consumption of the Central China Power Grid in 2004 G | Emission Factor H ( tc/TJ ) | Oxidation Rate I (%) | Average NCV J (MJ/t,km$^3$) | $CO_2$ Emission($tCO_2e$) K=G*H*I*J*44/12/10000 (for quality unit) K=G*H*I*J*44/12/1000 (for volume unit) |
|---|---|---|---|---|---|---|
| Raw coal | Ten thousand Tons | 17,144.10 | 25.80 | 100.00 | 20,908 | 339,092,605.29 |
| Clean coal | Ten thousand Tons | 2.34 | 25.80 | 100.00 | 26,344 | 58,316.13 |
| Other washed coal | Ten thousand Tons | 242.87 | 25.80 | 100.00 | 8,363 | 1,921,441.23 |
| Coke | Ten thousand Tons | 109.61 | 29.20 | 100.00 | 28,435 | 3,337,011.41 |
| Coke oven gas | $10^8$ Cubic meter | 2.02 | 12.10 | 100.00 | 16,726 | 149,899.53 |
| Other gas | $10^8$ Cubic meter | 2.61 | 12.10 | 100.00 | 5,227 | 60,527.09 |
| Crude oil | Ten thousand Tons | 1.08 | 20.00 | 100.00 | 41,816 | 33,118.27 |
| Gasoline | Ten thousand Tons | 0.07 | 18.90 | 100.00 | 43,070 | 2,089.33 |
| Diesel oil | Ten thousand Tons | 8.44 | 20.20 | 100.00 | 42,652 | 266,627.32 |
| Fuel oil | Ten thousand Tons | 14.37 | 21.10 | 100.00 | 41,816 | 464,893.14 |
| LPG | Ten thousand Tons | 0.00 | 17.20 | 100.00 | 50,179 | 0 |
| Refinery gas | Ten thousand Tons | 5.79 | 15.70 | 100.00 | 46,055 | 153,506.38 |
| Natural gas | $10^8$ Cubic meter | 2.27 | 15.30 | 100.00 | 38,931 | 495,774.61 |
| Other petroleum products | Ten thousand Tons | 0.00 | 20.00 | 100.00 | 38,369 | 0 |
| Other coking products | Ten thousand Tons | 0.00 | 25.80 | 100.00 | 28,435 | 0 |
| Other Energy | Ten thousand Tce | 53.07 | 27.30 | 100.00 | 0 | 0 |
| Total Emission (Q) | | 346,035,809.73$tCO_2e$ | | | | |
| Thermal Power supplied to the Central China Power Grid (P) | | 249,074,186.30MWh | | | | |
| OM Emission Factor in 2004 [ = Q/P] | | 1.38929$tCO_2e$/MWh | | | | |

*Data Source: China Energy Statistical Yearbook 2006: p.287;2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table1.3 of Page 1.21-Page 1.22 and Table 1.4 of Page 1.23- Page 1.24 in Volume 2, Chapter 1.*

Table 9. The Operation Margin Emission Factor Calculation of the Central China Power Grid in 2005

| Fuel | Unit | Fuel Consumption of the Central China Power Grid in 2005 G | Emission Factor H (tc/TJ) | Oxidation Rate I (%) | Average NCV J (MJ/t,km$^3$) | $CO_2$ Emission($tCO_2e$) K=G*H*I*J*44/12/10000 (for quality unit) K=G*H*I*J*44/12/1000 (for volume unit) |
|---|---|---|---|---|---|---|
| Raw coal | Ten thousand Tons | 17827.75 | 25.80 | 100.00 | 20,908 | 352,614,496.76 |
| Clean coal | Ten thousand Tons | 0.02 | 25.80 | 100.00 | 26,344 | 498.43 |
| Other washed coal | Ten thousand Tons | 228.11 | 25.80 | 100.00 | 8,363 | 1,804,669.00 |
| Coke | Ten thousand Tons | 130.95 | 29.20 | 100.00 | 28,435 | 3,986,695.05 |
| Coke oven gas | $10^8$ Cubic meter | 1.51 | 12.10 | 100.00 | 16,726 | 112,053.61 |
| Other gas | $10^8$ Cubic meter | 13.32 | 12.10 | 100.00 | 5,227 | 308,896.88 |
| Crude oil | Ten thousand Tons | 1.18 | 20.00 | 100.00 | 41,816 | 36,184.78 |
| Gasoline | Ten thousand Tons | 0.04 | 18.90 | 100.00 | 43,070 | 1,193.90 |
| Diesel oil | Ten thousand Tons | 9.49 | 20.20 | 100.00 | 42,652 | 299,797.78 |
| Fuel oil | Ten thousand Tons | 8.87 | 21.10 | 100.00 | 41,816 | 286,959.09 |
| LPG | Ten thousand Tons | 0.00 | 17.20 | 100.00 | 50,179 | 0 |
| Refinery gas | Ten thousand Tons | 6.66 | 15.70 | 100.00 | 46,055 | 176,572.11 |
| Natural gas | $10^8$ Cubic meter | 3.00 | 15.30 | 100.00 | 38,931 | 655,208.73 |
| Other petroleum products | Ten thousand Tons | 0.00 | 20.00 | 100.00 | 38,369 | 0 |
| Other coking products | Ten thousand Tons | 1.50 | 25.80 | 100.00 | 28,435 | 40,349.27 |
| Other Energy | Ten thousand Tce | 37.42 | 27.30 | 100.00 | 0 | 0 |
| Total Emission (Q) | | 360,323,575.39$tCO_2e$ | | | | |
| Thermal Power supplied to the Central China Power Grid (P) | | 286,203,304.60MWh | | | | |
| OM Emission Factor in 2005 [ = Q/P] | | 1.25898$tCO_2e$/MWh | | | | |

*Data Source: China Energy Statistical Yearbook 2006: p.287;2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table1.3 of Page 1.21-Page 1.22 and Table 1.4 of Page 1.23- Page 1.24 in Volume 2, Chapter 1.*

According to electricity supplied to the grid of fire power, the OM of latest three years should be weighted average, so the weighted average OM is:

$$EF_{OM,y} = \frac{(1.22295 \times 225{,}987{,}719.20 + 1.38929 \times 249{,}074{,}186.30 + 1.25898 \times 286{,}203{,}304.60)}{(225{,}987{,}719.20 + 249{,}074{,}186.30 + 286{,}203{,}304.60)} = 1.29092\, tCO_2e / MWh$$

Table10. Calculation of $CO_2$ Emission of Solid, Liquid and Gas Fuel for Power Generation in 2005

| Fuel | Unit | Jiangxi A | Henan B | Hubei C | Hunan D | Chongqing E | Sichuan F | Total G=A+B+C +D+E+F | NCV kJ/kg kJ/$m^3$ H | Emission Factor I | Oxidation Rate J | $CO_2$ emission ($tCO_2e$) | $\lambda_{Coal}$, $\lambda_{Oil}$ $\lambda_{Gas}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw coal | $10^4$ Tons | 1,712.27 | 2,732.15 | 1,869.29 | 2,999.77 | 875.40 | 7,638.87 | 17,827.75 | 20,908 | 25.80 | 1.00 | 352,614,497 | - |
| Clean coal | $10^4$ Tons | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 26,344 | 25.80 | 1.00 | 498 | - |
| Other washed coal | $10^4$ Tons | 0.00 | 0.00 | 0.00 | 0.00 | 89.99 | 138.12 | 228.11 | 8,363 | 25.80 | 1.00 | 1,804,669 | - |
| Coke | $10^4$ Tons | 105.00 | 0.00 | 0.00 | 0.00 | 0.00 | 25.95 | 130.95 | 28,435 | 29.20 | 1.00 | 3,986,695 | |
| Subtotal | - | - | - | - | - | - | - | - | - | - | - | 358,406,359 | 99.48% |
| Crude oil | $10^4$ Tons | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.82 | 1.18 | 41,816 | 20.00 | 1.00 | 32,787 | - |
| Gasoline | $10^4$ Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.04 | 43,070 | 18.90 | 1.00 | 2,068 | - |
| Diesel oil | $10^4$ Tons | 1.39 | 2.39 | 1.30 | 0.00 | 1.38 | 3.03 | 9.49 | 42,652 | 20.20 | 1.00 | 263,961 | - |
| Fuel oil | $10^4$ Tons | 1.68 | 3.15 | 0.64 | 2.22 | 0.89 | 0.29 | 8.87 | 41,816 | 21.10 | 1.00 | 460,244 | - |
| Other petroleum products | $10^4$ Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 38,369 | 20.00 | 1.00 | 0 | - |
| Subtotal | - | - | - | - | - | - | - | - | - | - | - | 624,136 | 0.17% |
| Natural gas | $10^7$ $m^3$ | 0.00 | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 3.00 | 38,931 | 15.30 | 1.00 | 655,209 | - |
| Coke oven gas | $10^7$ $m^3$ | 0.00 | 1.15 | 0.00 | 0.00 | 0.36 | 0.00 | 1.51 | 16,726 | 12.10 | 1.00 | 112,054 | - |
| Other gas | $10^7$ $m^3$ | 0.00 | 0.00 | 0.00 | 0.00 | 3.12 | 10.20 | 13.32 | 5,227 | 12.10 | 1.00 | 308,897 | - |
| PLG | $10^4$ Tons | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 50,179 | 17.20 | 1.00 | - | - |
| Refinery gas | $10^4$ Tons | 0.78 | 1.76 | 0.71 | 0.00 | 0.00 | 3.41 | 6.66 | 46,055 | 15.70 | 1.00 | 176,572 | - |
| Subtotal | - | - | - | - | - | - | - | - | - | - | - | 1,252,732 | 0.35% |
| Total | - | - | - | - | - | - | - | - | - | - | - | 360,283,226 | 100% |

Table 11. The Calculation of $CO_2$ Emission Factor of Standard Coal

| NCV (TJ/tSCE) | The Carbon quantity of unit energy standard coal (tC/TJ) | Oxidation Rate (%) | C-$CO_2$ Factor (=44/12) | $CO_2$Emission Factor of Standard Coal ($tCO_2e/tSCE$) I |
|---|---|---|---|---|
| 0.02927 | 25.80 | 100 | 3.6667 | 2.7689 |

*Data Source：General principles for calculation of total production energy consumption: GB2589-81, China Energy Statistical Yearbook 2006: p.287;2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table1.3 of Page 1.21-Page 1.22 and Table 1.4 of Page 1.23- Page 1.24 in Volume 2, Chapter 1.*

Table12. Installed Capacity of the Central China Power Grid in 2002

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | MW | 5,128.8 | 15,904.5 | 8,147.8 | 4,975.6 | 3,004.5 | 6,142.0 | 43,303.2 |
| Hydro Power | MW | 2,197.4 | 2,438.0 | 7,213.9 | 6,135.3 | 1,195.5 | 11,854.6 | 31,034.7 |
| Nuclear Power | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 |
| Wind Power and others | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 |
| Total | MW | 7,326.2 | 18,342.5 | 15,361.7 | 11,110.9 | 4,200.0 | 17,996.6 | 74,337.9 |

*Data Source: 2003 China Electric Power Yearbook, p584-585, P591-592.*

Table13. Installed Capacity of the Central China Power Grid in 2003

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | MW | 5,407.8 | 17,635.5 | 8,173.3 | 6,446.7 | 3,126.2 | 6,104.0 | 46,893.5 |
| Hydro Power | MW | 2,307.4 | 2,438.0 | 11,537.2 | 6,603.1 | 1,329.8 | 12,341.5 | 36,557.0 |
| Nuclear Power | MW | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Wind Power and others | MW | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | MW | 7,715.2 | 20,073.5 | 19,710.5 | 13,049.8 | 4,456.0 | 18,445.5 | 83,450.5 |

*Data Source: 2004 China Electric Power Yearbook, P670, 709.*

Table14. Installed Capacity of the Central China Power Grid in 2004

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | MW | 5,496.0 | 21,788.5 | 9,509.3 | 6,779.5 | 3,271.1 | 6,900.3 | 53,744.7 |
| Hydro Power | MW | 2,549.9 | 2,438.0 | 7,415.1 | 7,448.2 | 1,407.9 | 13,382.9 | 34,642.0 |
| Nuclear Power | MW | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Wind Power and others | MW | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | MW | 8,045.9 | 24,226.5 | 16,924.4 | 14,227.8 | 4,679 | 20,283.2 | 88,386.8 |

*Data Source: 2005 China Electric Power Yearbook, P473. The data of Hubei take no account of power generation by Three Gorge Engineering.*

Table15. Installed Capacity of the Central China Power Grid in 2005

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power | MW | 5,580.4 | 23,228.6 | 9,534.3 | 6,730.8 | 3,231.2 | 7,114.6 | 55,419.7 |
| Hydro Power | MW | 2,193.9 | 2,384.3 | 16,087.0 | 7,554.9 | 1,519.6 | 13,644.6 | 43,384.3 |
| Nuclear Power | MW | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Wind Power and others | MW | 0.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 |
| Total | MW | 7,774.3 | 25,617.9 | 25,621.3 | 14,285.7 | 4,750.8 | 20,759.2 | 98,809.0 |

*Data Source: Other power installed capacity calculation is provided as below.*

Because there are no data for installed capacity of each province in *2006 China Electric Power Yearbook*, *t*he PDD employ some method to resolve the problem: of which, for thermal power and hydropower installed capacity, the calculation formula is provided as:

$$\text{thermal power (hydropower) installed capacity} = \frac{\text{thermal power (hydropower) generation}}{\text{thermal power (hydropower) annual utilization hours}}$$

For other power installed capacity calculation, in the Central China Power Grid, from 2000 to 2004, except Chongqing in 2004(with other power generation of 725,000MWh, but the installed capacity is neglectful in*2005 China Electric Power Yearbook, P473*), power installed capacity of other provinces is zero. In 2005, except Henan province with other power generation of 10,000MWh, this is further smaller than 725,000MWh; therefore, the installed capacity of other power in Henan province can be neglectful, but for conservative purpose, the other power is considered to the wind power (because the wind power utilization hours is fewer than other power ) with utilization hours of 2,000h[35].

[35] Chinese Wind Energy Association, Shi Pengfei, the wind power installed capacity of China in 2006.

Table 16. Installed Capacity Calculation of the Central China Power Grid in 2005

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Thermal Power generation | MWh | 30,000,000 | 131,590,000 | 47,700,000 | 39,900,000 | 17,584,000 | 37,202,000 | 303,976,000 |
| Annual utilization hours | h | 5,376 | 5,665 | 5,003 | 5,928 | 5,442 | 5,229 | - |
| Thermal Power | MW | 5,580.4 | 23,228.6 | 9,534.3 | 6,730.8 | 3,231.2 | 7,114.6 | 55,419.7 |
| Hydro Power generation | MWh | 5,000,000 | 6,700,000 | 81,400,000 | 24,100,000 | 6,036,000 | 64,498,000 | 187,734,000 |
| Annual utilization hours | h | 2,279 | 2,810 | 5,060 | 3,190 | 3,972 | 4,727 | - |
| Hydro Power | MW | 2,193.9 | 2,384.3 | 16,087.0 | 7,554.9 | 1,519.6 | 13,644.6 | 43,384.3 |
| Other Power generation | MWh | 0.0 | 10,000 | 0.0 | 0.0 | 0.0 | 0.0 | 10,000 |
| Annual utilization hours | h | - | 2,000 | - | - | - | - | - |
| Wind Power and others | MW | 0.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 |
| Total installed capacity | MW | 7,774.3 | 25,617.9 | 25,621.3 | 14,285.7 | 4,750.8 | 20,759.2 | 98,809.0 |

*Data Source: Power generation and annual utilization hours data come from 2006 China Electric Power Yearbook，P560, 568; Power installed capacity is calculated.*

Table 17. The BM Calculation of the Central China Power Grid

| | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|
| Thermal Power installed capacity（MW） | 43,303.20 | 46,893.50 | 53,744.70 | 55,419.72 |
| Hydropower installed capacity（MW） | 31,034.70 | 36,557.00 | 34,642.00 | 43,384.33 |
| Nuclear power(MW) | 0.00 | 0.00 | 0.00 | 0.00 |
| Wind power (MW) | 0.00 | 0.00 | 0.00 | 5.00 |
| Total (MW) | 74,337.90 | 83,450.50 | 88,386.70 | 98,809.06 |
| Percent of Installed Capacity to 2005 Capacity | 75.24% | 84.46% | 89.45% | 100% |
| Ratio of Thermal Capacity Additions to Total Capacity Additions (L) | 49.51% | | | |

| | |
|---|---|
| Commercially available coal-fired power plant corresponding to the best practice in terms of efficiency (M) | 336.66kg/MWh[36] |
| Building Margin Emission Factor (=M*I*L*0.9948/1000) | 0.45916t$CO_2$e/MWh |

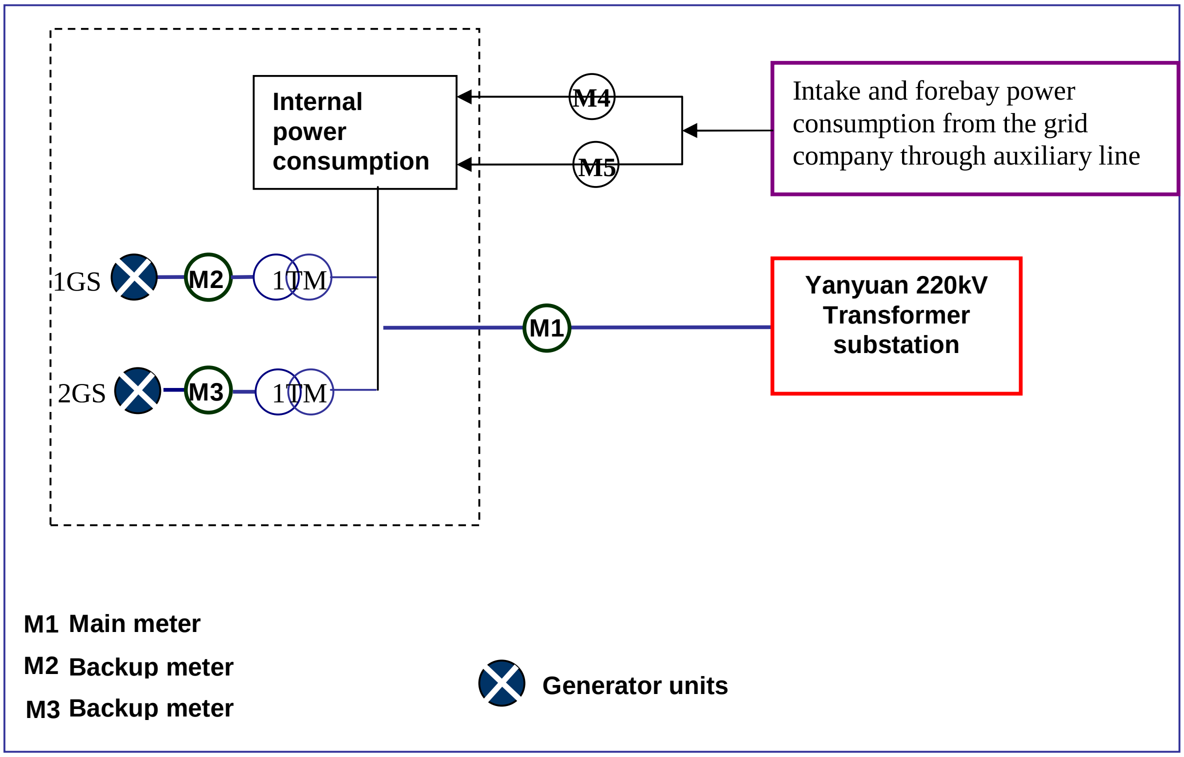
[36] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1051.pdf

The baseline emission factor was calculated as the weighted average of the OM Emission Factor (1.29092t$CO_2$e/MWh) and the BM Emission Factor (0.45916t$CO_2$e/MWh). The defaults weights for hydropower projects are used as 0.5 respectively. We obtain a baseline emission factor of 0.87504t$CO_2$e/MWh.

# Annex 4

## MONITORING INFORMATION

In this monitoring plan, we only monitor the electricity to the Central China Power Grid supplied by this specific project activity and power supplied to the specific project form the grid through main line and auxiliary line, provided the relative information in section B7.2.



# Annex 5

## Finance Assessment

| The specific Project-Summary of Indicators | | | | |
|---|---|---|---|---|
| No | Items | Unit | Calculation indexes | Remarks |
| I | Basic parameters | | | |
| 1 | Installed capacity | kW | 50,000 | |
| 2 | Annual utilization hours | h/year | 4,633 | |
| 3 | Electricity supplied to grid | $10^4$kWh | 20,139 | |
| 4 | The operating period of power station | year | 20 | Construction period is not included in the operating period of power station (year) |
| 5 | Depreciable life of fixed assets | year | 20 | Depreciation will be provided on a straight-line basis from the first year of production period by straight line method |
| | 1. Formation rate of fixed assets | % | 99.8 | Ratio of original value of fixed assets to total investment (dynamic investment) |
| | 2. Depreciation rate of fixed assets | % | 5 | Provide for depreciation based on original value of fixed assets |
| 6 | Rate on long-term loan | % | 6.39 | Calculate based on compound rate |
| 8 | Grid price | RMB Yuan/kWh | | Price of electricity (with tax ) |
| 9 | Emission reduction of $CO_2$ | Ton/year | 176,224 | |
| 10 | Unit income from CERs | RMB Yuan/ton | 80 | (1€=10Yuan RMB) |
| 11 | Period of income from CERs | Year | 20 | |
| 12 | Income from CERs | RMB $10^4$/year | 1,353.40 | Income after tax.21 years' income is: 27,068ten thousand Yuan. |
| II | Investment in construction and Sources of fund | | | |
| 1 | Total dynamic investment: | RMB $10^4$ Yuan | 24,548.98 | |
| | Of which ①Total static investment: | RMB $10^4$ Yuan | 23,416.9 | Including price differences |
| | ②Interest incurred during construction period | RMB $10^4$Yuan | 1,082.08 | |
| | ③Floating capital | RMB $10^4$Yuan | 50.00 | |
| 2 | Original value of fixed assets | RMB $10^4$Yuan | 24,449.98 | Interest incurred during construction period will be included in the original value of fixed assets. |
| 3 | Self-raised capital | RMB $10^4$Yuan | 7025.07 | |

| | | | | | |
|---|---|---|---|---|---|
| | In which: 1. Used as current funds | RMB $10^4$Yuan | 15.00 | | |
| | 2. Used for investment in fixed assets) | RMB $10^4$Yuan | 6,385.00 | Including investment for electricity transforming subproject. | |
| 4 | Investment per kW: | RMB Yuan/kw | 4,890 | | |
| | | | | | |
| III | **Rate of loss/gain** | | | | |
| 1 | Sales tax and surcharges | % | 6.6 | Composite tax rate | |
| | Of which: 1.VAT rate | % | 6.00 | Rate of sales tax | |
| | 2. Additional urban construction tax | % | 7.00 | VAT surcharges | |
| | 3. Education surcharges | % | 3.00 | VAT surcharges | |
| 2 | Income tax rate | % | 33.00 | Income tax | |
| 3 | Reserves | % | 10.00 | Reserves provided on profits after tax | |
| 4 | Welfare funds | % | 5.00 | | |
| 5 | Insurance for fixed assets | % | 0.167 | Insure fixed assets based on original value | |
| IV | **Calculation parameters** | | | | |
| 1 | Accumulated net cash flows after income tax | RMB $10^4$Yuan | 3,456.42 | Total investment，Discount rate is Ic = 10 % | |
| 2 | Internal return rate of full investment (FIRR ) | % | 13.80 | After-tax rate with 21 years' $CER_S$ | |
| 3 | | % | 7.59 | After-tax rate without income from $CER_S$ | |
| 4 | Period (years) for repayment of loan | year | 13.80 | Including construction period 3 years. | |
| 5 | Static investment recovery period (Pt) | year | 11.41 | | |
| Note: | 1～2 and 4～5 indicators in Calculation parameters is indicators with 20 years' $CER_S$. | | | | |
| V | **Cost of production** | | | | |
| 1 | Payroll | RMB $10^4$Yuan | 54.00 | | |
| | 1. Number of employees | Person | 60 | | |
| | 2. Annual average payroll | Yuan/year | 9,000 | | |
| 2 | Employee welfare | RMB $10^4$Yuan | 21.60 | 40.00% | Proportion in total payroll of employees (%) |
| | 1. Employee’s insurance | RMB $10^4$Yuan | 14.04 | 26.00% | |
| | 2. Welfare fund | RMB $10^4$Yuan | 7.56 | 14.00% | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3 | Operation and maintenance expense | RMB $10^4$Yuan | 309.69 | | |
| | 1. Cost of overhaul | RMB $10^4$Yuan | 241.19 | 1% | Proportion in the original value of fixed assets. |
| | 2.Cost of materials | RMB $10^4$Yuan | 15.50 | 3.1 | 3.1 Yuan RMB/kW |
| | 3. Other expenses | RMB $10^4$Yuan | 53.00 | 10.6 | 10.6 Yuan RMB/kW |