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

**CONTENTS**

## SECTION A. General description of project activity

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

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Shunchang Yangkou Hydro Power Project, Fujian, China
Version 5.0
Date: 12 Jan. 2009

History of Document

| Version | Date | Reason for Revision |
|---|---|---|
| 05 | 12-01-2009 | Revised following review request |
| 04 | 15-12-2007 | Revised following with validation protocol |
| 03 | 14-05-2007 | Revised for Public consultation |
| 02 | 30-04-2007 | Interior Revised |
| 01 | 18-04-2007 | Interior Revised |

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

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The objective of Fujian Shunchang Yangkou Hydro Power Co., Ltd. (hereafter as "the project owner") developing Shunchang Yangkou Hydro Power Project, Fujian, China (hereafter as "the proposed project") is to produce electricity from renewable hydro resource to meet increasing energy demand following the economic development. The proposed project is located on the Futunxi River, Shunchang county, Fujian Province, China, and is a run-of-river hydro power project with an installed capacity of 48MW (3×16MW). The proposed project is estimated to produce electricity 204,700MWh per year and a net supply of 183,632MWh per year to Eastern China Power Grid (ECPG) in long-term average term. The surface area of the proposed project at full reservoir level of 115 meter is 6.17 millions square meter, and the power density is 7.78W/$m^2$.

The proposed project will reduce 1,033,963 tons of $CO_2$ equivalent of anthropogenic emissions of greenhouse gases (GHGs) over the first 7 crediting years by avoiding operation of existing thermal power plant and future capacity expansion of fossil fuel-based generation by the regional grid (ECPG).

As a renewable energy power project, the proposed project is in line with the target of Chinese energy industry and contributes to the sustainable development of local communities as following ways:

- To resolve the electricity shortage in Shunchang and Nanping, balancing the electricity supply from the national grid;
- To avoid the electricity generated from fossil fuel and thus reducing air pollution; and
- To increase job opportunities for local people and promote social stability. It is estimated that about 1,300 and 79 people will be employed during the construction and operation of the power station respectively.

**Table A.1 the Implementation Timeline of the proposed CDM project**

| Stage | Date | Source |
|---|---|---|
| Feasibility Study Report Finalization | 05-2003 | |
| EIA | 07-2003 | |
| EIA approve | 04-08-2003 | MHBJ【2003】No.56 |
| FSR Approve | 21-04-2004 | MJJC【2004】No.460 |
| Consideration of CDM | 20-11-2004 | |

| | | |
|---|---|---|
| Procurement Agreement（Turbine Hydroelectric Generator） | 16-12-2004 | |
| Construction start date | 01-01-2005 | |
| Commission for CDM Development | 06-11-2006 | |
| Open for Global Stakeholder Consultation | 12-07-2007 | |
| LoA (China) | 30-09-2007 | FGQH【2007】No.2580 |
| First generator start date | 28-07-2007 | |
| Second generator start date | 08-08-2007 | |
| Third generator start date | 28-08-2007 | |

FSR indicates that if the IRR of the proposed project need to reach the benchmark (8%), then the tariff must to be set at 0.364CNY/KWh. In 2002, the Chinese State Council issued the Notification on the Power System Reform (GF【2002】No.5 which initiated tariff competition to encourage lower electricity cost. Following the reform policy, on 1st July of 2003, Fujian Provincial Pricing Administration re-adjusted and re-identified electricity tariff for all of power plants in Fujian1. It was found that the average on-grid tariff only 0.274CNY/KWh, so the project owner considered that the tariff of 0.364CNY/KWh would not have advantage in tariff competition then the proposed project was therefore being delayed. It was only at the end of 2004, CDM conception was introduced in the 2nd board meeting. The project owner learned that potential CDM revenue could help the proposed project to improve competitiveness on tariff. This encouraged the proposed project to resume their investment in the proposed project. The project owner signed generators procurement agreement and started project construction at the beginning of 2005.

The project owner started to work on CDM development at that time. However, the inquiry to Shunchang County Development & Reform Committee couldn't get much help. At the beginning of 2005, the CDM in China just sprouted up, so it was really hard to precede CDM development. The process went very slowly due to the lack of CDM knowledge, language skills and relevant instruments in Fujian. It is only in the middle of 2006, after attending a capacity building meeting hold by the NDRC in Haerbin, project owner had clearer idea on how to develop CDM and realized that it was better to commit a professional consultation company to do such work.

Up to present the PDD work has started, the PDD was submitted to DOE for GSC on 7th of July 2007 and Chinese LOA was obtained in 30th of September 2007. The details of the implementation of the proposed project are showed on the table A.1.

Fujian Provincial Pricing Administration(2003), Notification Regarding Re-adjust and Identify On-grid Tariff, MJ【2003】No.310, 01-07-2003

1

**A.3. Project participants:**

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| 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) |
|---|---|---|
| The People's Republic of China (host) | Fujian Shunchang Yangkou Hydro Power Co., Ltd. | No |
| Germany | KfW Carbon Fund | No |

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

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

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

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The People's Republic of China (PRC)

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

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Fujian Province

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

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Yangkou (Town), Shunchang (County), Nanping (City)

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

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The proposed hydropower plant is located on Futunxi River, around 200 meters upstream from the Yangkou Bridge and approximately 18 km away from downtown of Shunchang County. The dam of proposed project coordinates are east longitude 117°53′36″and north latitude 26°47′30″. The total catchments area, length and slope of Futunxi River are 13,733 $km^2$, 285 km & 1.2% respectively. The designed total catchments area above the dam is about 12,627 $km^2$, capturing 91.9% of total surface area of Futunxi River. Please refer to Figure A.1 for the location of the proposed project.

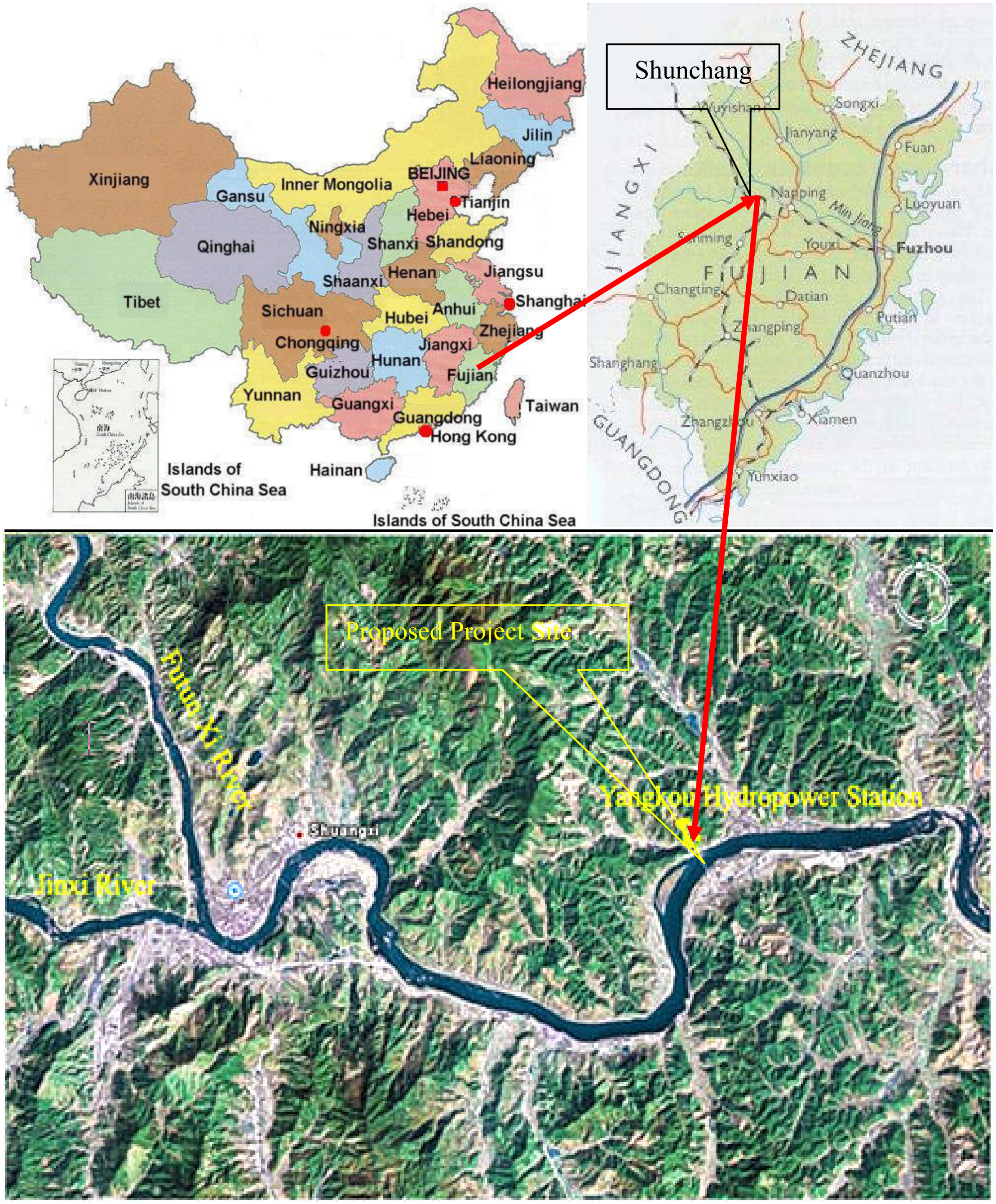


**Figure A.1 Location of the Proposed Project**

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

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Category 1: Energy industries (renewable / non-renewable sources)

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

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The project consists of:

1. a 48 MW run-of-river hydropower plant;
2. a 11 km extension of a 110 kV transmission lines up to a 220 kV Shunchang substation;

The proposed project is a low-head hydro power generation plant and use concrete gravity dam. The catchments level is 115 m and its capacity is 35.895million $m^3$.

The superstructures include (listed in left to right order) left side gravity dam section, shipping lock-gate, navigation lock, floodgate, generator room and right side gravity dam section.

In accordance with Standard of Flood Prevention (GB50201-94) and Hydraulic and Hydroelectric Engineering Classification and Flooding Standard (SL252-2000), this project should be classified as a third class project. Therefore all of the main superstructures are also classified as third class superstructure. The main factory building is a riverbed type factory building. The key technical data for the key equipment within the project are summarised in the table A.1.

**Table A.1 Summary of key equipment of the proposed project**

| 1 | Turbine Hydroelectric Generator | Unit | numerical value | |
|---|---|---|---|---|
| | dais | dais | 3 | |
| | type | | GZ 4BN28A-WP-580 | |
| | Rated output | MW | 16.5 | |
| | Rated Speed | r/min | 78.95 | |
| | Rated Pressure | m | 6.91 | |
| | Rated flow | $m^3/s$ | 263.83 | |
| | Manufacturers | Tianjing TianFa Heavy hydropower Equipment Limited Company | | |
| 2 | Generator | | | |
| | dais | dais | 3 | |
| | type | | SFWG16-76/6450 | |
| | Single capacity | MW | 16 | |
| | Voltage | kV | 6.3 | |
| | Manufacturers | Tianjing TianFa Heavy hydropower Equipment Limited Company | | |

The proposed project also equipped with a diesel generator HAW330 with a capacity of 300KW and an oil tank with a capacity of one cubic meter. The diesel generator is for emergency use only, hence the emission from diesel generator is not counted into project emission.

The operation of the proposed project is committed to the work team of Mowu Hydro Power Plant, which have more than 10 years hydro power plant operation experience. So there is no training need.

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

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A crediting period of a fixed 21 years is selected for this proposed project (with two intermediate crediting periods, 7×3=21). An estimation of emissions reductions expected for the first crediting period is provided in the Table A.2.

**Table A.2 Annual estimation of emission reduction in $tCO_2e$**

| Years | Annual estimation of emission reduction |
|---|---|
| 13/10/2008—12/10/2009 | 140,235 |
| 13/10/2009—12/10/2010 | 140,235 |
| 13/10/2010—12/10/2011 | 140,235 |
| 13/10/2011—12/10/2012 | 140,235 |
| 13/10/2012—12/10/2013 | 140,235 |
| 13/10/2013—12/10/2014 | 140,235 |
| 13/10/2014—12/10/2015 | 140,235 |
| Total estimated reductions | 981,645 |
| Total number of crediting years | 7 |
| Annual average over the crediting period of estimated reductions | 140,235 |

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

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There is no public funding from Annex I Parties involved in the proposed project activity.

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

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

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Approved consolidated baseline methodology ACM0002, version 6: Consolidated baseline methodology for grid-connected electricity generation from renewable sources (“the Methodology”).The Methodology will be used in conjunction with the approved monitoring methodology ACM0002 (“The Monitoring Methodology”).

In addition, additionality analysis was based on “Tool for the demonstration and assessment of Additionality for the Methodology, Version 03”.

The methodology and methodology tool can be found from the website below: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

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The methodology of ACM0002 (v.06) is applicable to grid-connected renewable power generation project activities under the following conditions:

- Applies to electricity capacity additions from:
  - Run-of-river hydro power plants; hydro power projects with existing reservoirs where

the volume of the reservoir is not increased;
- New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m$^2$;
- Wind sources;
- Geothermal sources;
- Solar sources;
- Wave and tidal sources.

- This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and
- Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001).

Applying ACM0002 to the proposed project is justified because:
1) The proposed project is a run-of-river hydro project;
2) The proposed project is a new hydro power project with reservoir having power density of 7.78W/m$^2$ which is greater than 4W/m$^2$;
3) The proposed project does not involve switching from fossil fuels to renewable energy at the site; and
4) The geographic and system boundaries for ECPG can be clearly identified and information on the characteristics of the gird is available.

Therefore, the approved consolidated baseline methodology, ACM0002 (v.06): "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" is applicable to the proposed project.

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

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The proposed project will supply electricity to ECPG, according to the delineation of grid boundaries of DNA of China[2], the proposed project boundary is considered as the ECPG (including Shanghai, Jiangsu, Zheiiang, Anhui and Fujian) and all power plants connected physically to the electricity system that the proposed project is connected to, also the physical site of the proposed project as well as the reservoir area. On the other hand, ECPG import electricity from Yangcheng Shangxi Province (Northern China Power Grid (NCPG) and Middle China Power Grid (MCPG).The sources and types of greenhouse gases included in the project boundary are described in Table B.1.

[2] DNA, (2007). The baseline emission factor of electricity grid in China, 9th, August.

**Table B.1 Description of the sources and gases included in the project boundary**

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | Emission from the electricity generation from ECPG which will be replaced by the proposed project | $CO_2$ | Yes | Main emission source. |
| | | $CH_4$ | No | Excluded from simplification. This is conservative. |
| | | $N_2O$ | No | Excluded from simplification. This is conservative. |
| **Project Activity** | Emission from the proposed project activity | $CO_2$ | No | Zero-emissions from renewable energy. |
| | | $CH_4$ | Yes | The power density of the proposed project is 7.78W/m$^2$, which is less than 10 W/m$^2$, the emissions from reservoir should be take account for. |
| | | $N_2O$ | No | Zero-emissions from renewable energy. |

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

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## Background of the China Power Grid and ECPG

Nowadays, the electricity of generation in China Power Grid is dominated by fuel-fired power plant since it has proven, domestically available technology and fuel source, shorter construction period, and lower upfront unit capital investment, and is close to load center. Table B.2 showed that in 1999, 2000 and 2004, the installed capacity of fuel-fired power plant in China were 247898.2MW, 268764.8MW and 329454.5MW, account for 73.98%, 74% and 75.87% of total installed capacity in respectively. And more fuel-fired power plant than other power plants had been build year by year, between 1999-2004, the installed capacity of fuel-fired power plant had increased from 247898.92MW to 329454.5 MW, it accounts of 82.38% of total incremental capacity.

The Eastern China Power Grid has same situation as China Power Grid. Table B.3 showed that in 2002-2005, the installed capacity of fuel-fired in ECPG were 61120.2 MW, 65036.5MW, 79424.1 MW and 104076.6MW, accounted for 80.39%, 80.20%, 81.90% and 84.20% of total installed capacity respectively. And this situation will maintain no change for long time in the future as the incremental capacity of fuel-fired accounts for 90.27% of total during 2002-2005.

**Table B.2 The Installed Capacity of China Power Grid (in MW)**

| **China Power Grid** | **Installed Capacity** | | | **Incremental Capacity (1999-2004)** | **Share in Total Incremental Capacity** |
|---|---|---|---|---|---|
| | 1999 | 2000 | 2004 | | |
| | A | B | C | D=C-A | |
| **Fuel-fired** | 247898.2 | 268764.8 | 329454.5 | 81556.3 | 82.28% |
| **Hrdro** | 82460.2 | 87885.5 | 97137.9 | 14677.7 | 14.81% |
| **Nuclear** | 4468 | 6186 | 6836 | 2368 | 2.39% |
| **Wind and others** | 283.4 | 356.1 | 795.9 | 512.5 | 0.52% |
| **Total** | **335109.8** | **363192.4** | **434224.3** | **99114.5** | **100.00%** |
| | **73.98%** | **74%** | **75.87%** | | |

Noted: data for 2001－2003 are not presented due to unavailable

Source： *China Electric Power Yearbook 2000, 2001,2005*

**Table B.3 The Installed Capacity of ECPG (2002-2005) (in MW)**

| ECPG | Installed Capacity | | | | Incremental Capacity (2002-2005) | Share in Total Incremental Capacity |
|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | | |
| | A | B | C | D | E=D-A | |
| **Fuel-fired** | 61120.2 | 65036.5 | 79424.1 | 104076.6 | 42956.4 | 90.27% |
| **Hrdro** | 13165.1 | 13602.5 | 14417.8 | 16069.4 | 2904.3 | 6.10% |
| **Nuclear** | 1678 | 2406 | 3056 | 3066 | 1388 | 2.92% |
| **Wind and others** | 62.2 | 51.7 | 72.7 | 401.3 | 339.1 | 0.71% |
| **Total** | **76025.5** | **81096.7** | **96970.6** | **123613.3** | **47587.8** | **100.00%** |
| **The ratio of fuel-fired** | **80.39%** | **80.20%** | **81.90%** | **84.20%** | | |

Source：*China Electric Power Yearbook 2003, 2004, 2005, 2006*

## Identification of Baseline scenario

According to the status of China Power Grid, four alternative scenarios were considered for the proposed project:

Alternative Scenario (a), The proposed project activity undertaken without being registered as a CDM project activity;

Alternative Scenario (b), Construction of a fuel-fired power plant with equivalent amount of annual electricity generation;

Alternative Scenario (c), Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation; and

Alternative Scenario (d), Continuation of the current situation. Electricity will continue to be generated by the existing generation mix operating in the grid.

Of the four alternative scenarios:

Alternative Scenario (a) has been excluded since it is not commercially viable as analyzed in Section B.5. Without CERs sales revenues, the project IRR is lower than benchmark.

Alternative Scenario (b) has been excluded since it conflicts with China's current regulation as analysed in sub-step of section B.5.

Alternative Scenario (c), power plant using other sources of renewable energy with equivalent amount of annual electricity generation could be wind farm or biomass power plant in current technology conditions. Wind farm is not commercially viable due to costly capital investment. And it is not known there is a biomass power plant in same area. Further details analysed refer to section B.5.

Alternative Scenario (d) is consistent with Chinese regulations and is commercially viable since there is no investment required.

In conclude, the practical and feasible baseline scenario is scenario (d), continuation of the current situation. Electricity will continue to be generated by the existing generation mix operating in the grid.

**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):**

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This section will demonstrate the additionality of the project in accordance with the “Tool for the demonstration and assessment of Additionality, Version 03”.

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

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

According to the status of China Power Grid, four alternative scenarios were considered for the proposed project:

Alternative Scenario (a), The proposed project activity undertaken without being registered as a CDM project activity;

Alternative Scenario (b), Construction of a fuel-fired power plant with equivalent amount of annual electricity generation;

Alternative Scenario (c), Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation; and

Alternative Scenario (d), Continuation of the current situation. Electricity will continue to be generated by the existing generation mix operating in the grid.

Alternative scenario (c), power plant using other sources of renewable energy with equivalent amount of annual electricity generation could be a wind farm or a biomass power plant in current technology conditions. A wind farm is not commercially viable due to costly capital investment. There are some wind farms in the same area, however, some wind farms had been registered as CDM projects[3] and some wind farms are in the processes of registering as CDM project[4]. And it is not know there is a biomass power plant in the same area. So the alternative scenario (c) is not considered as a feasible alternative scenario to the proposed project.

**Outcome of sub-step 1a**: The realistic and credible alternative scenarios are scenario (a), (b) and (d).

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

In the context of the Chinese power sector’s transformation to a market-oriented system, whether to invest in a power generation project is an individual power project developer’s decision based on the project return and risk profile[5]. There are no laws compelling the project developer to develop hydroelectric plants, thus alternative scenario (a) and (d) are in line with all applicable laws and regulations.

The main sectoral policy relevant to this project activity is the promotion of renewable energy in China, the Renewable Energy Law of the People’s Republic of China, which came into effect on 1st January 2006. This law demonstrates the Chinese Government’s commitment to the development of renewable energy as part of the overall energy development strategy, and encourages grid-connected power generation from renewable sources. However, there are no direct incentives such as financial grants higher tariffs or subsidised loans available for these types of project. In addition to that, moves to increase

[3] Source: http://cdm.unfccc.int/Projects/index.html
[4] Source: http://cdm.unfccc.int/Projects/index.html
[5] The State Council, (2004). the State Council’s Decision on Reforming Investment Approval Process, July 16. No.20.

energy efficiency and renewable energy are set in China's 11$^{th}$ Five-year Plan, but these are a target, not a law[6].

In addition, coal-fired power plants with installed capacity of 135MW or less are prohibited from building in large grid, and fossil fuel-fired power plant with installed capacity of 100MW or less is strictly regulated for installation in China[7]. Since the capacity of the proposed project is only 48MW, so alternative (b), Fuel-fired power plant with equivalent amount of annual electricity output should have less than 48MW of installed capacity. Thus alternative scenario (b) is not in line with applicable laws and regulations, and will not be considered in the assessment of the alternative scenarios.

**Outcome of sub-step 1b**: The realistic and credible alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations are scenarios (a) and (d).

***Step 2. Investment analysis***

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

According to the "Tool for the demonstration and assessment of additionality (version 03)", three options can be applied to conduct the investment analysis. They are: the simple cost analysis (Option Ⅰ), the investment comparison analysis (Option Ⅱ) and the benchmark analysis (Option Ⅲ).

The simple cost analysis (Option Ⅰ) is not applicable, as the proposed project will generate electricity revenue as the economic benefit other than CDM related income.

On the other hand, as the alternative scenario (d) to the proposed project is the electricity continue to be generated by the existing generation mix operating in the grid, which is not a new project, the investment comparison analysis (Option Ⅱ) will not be suitable for the investment analysis.

As a result, the benchmark analysis method will be adopted for investment analysis of alternative (a) and (d). If alternative (a) is found financially unattractive, then alternative (d) will be the only alternative for the proposed project.

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

With reference to *Interim Rules on Economic Assessment of Power Engineering Retrofit Projects*[8], the financial benchmark (rate of return post-tax) of Chinese Power Industries is to be 8% of the total investment IRR, which is widely used as sectoral benchmark rate on total investment for hydro projects.

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

According to the feasibility study and information from the project owner, the key parameters used for financial indicators' calculation are showed in the table B.4 as below.

[6] Point Carbon, (2007).Chinese Official Defends Additionality of Renewables in CDM. CDM & JI Monitor, 21 March.
[7] The State Council, (2002). Notice from the State Council regarding the prohibition of thermal power installation of under 135 MW capacity, No.6.
[8] State Power Corporation of China, (2003). *Interim Rules on Economic Assessment of Power Engineering Retrofit Projects*.Page 2. Beijing: China Electric Power Press

**Table B.4 The key parameters for calculation of financial indicators**

| Key Parameters | Value | Unit |
|---|---|---|
| Gross capacity | 48 | MW |
| Total Investment cost | 459.979 | Million CNY |
| Average annual electricity supplied to the Grid | 204,700 | MWh |
| Effective annual electricity supplied to the Grid | 183,632 | MWh |
| Build period | 3.5 | Years |
| Project lifetime | 30 | Years |
| Annual depreciation (straight-line) | 18.36 | Million CNY / Year |
| Expected Tariff | 0.31 | CNY/kwh |
| Annual revenue | 6427 | CNY |
| O&M cost | First 10 years: 11.23<br>After 10 years: 10.31 | Million CNY / Year |
| Value added tax | 17% | |
| Education tax | 4% | |
| Urban planning tax | 5% | |
| Income tax | 33% | |
| Expected CERs Price | USD/CER 10.00 | |

In accordance with benchmark analysis, if the financial indicators of the proposed project are lower than the benchmark, the proposed project is not to be considered as financially attractive.

During the preliminary research stage, it was found that the tariff rate have to be 0.364 CNY/kWh, which higher than common market price, then the project could reach the benchmark of 8%. So the project owner delayed the project process again and again. The project owner then discovered that potential CERs revenue could help the project to be more financial attractive after CDM was introduced to them. So, project owner started to project construction.

Table B.5 shows the project IRR with and without the revenue of CERs. Without the revenue of CERs, the project IRR is 6.54% which is lower than the financial benchmark 8%. Thus the proposed project is not considered to be financially attractive.

**Table B.5 Project IRR with and without CERs**

| | Project FIRR (post-tax) |
|---|---|
| Without CERs (tariff at 0.31 CNY/kWh) | 6.54 % |
| With CERs  (unit price usd10) | 8.51% |

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

A sensitivity analysis was conducted to test whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. Three parameters of tariff, total investment cost and O&M cost is selected for the critical assumptions. Assuming the three parameters vary from –10% to +10%, the project IRR of each variance were calculated and tabulated in Table B.6 and Figure B.2. The results show that even under very favourable circumstances the project IRR is still lower than the benchmark IRR. Therefore it is concluded that the proposed project without CERs is not financially attractive.

**Table B.6 Varied Project IRR to the Parameters Alteration**

| Parameters | -10% | -5% | 0% | 5% | 10% |
|---|---|---|---|---|---|
| Tariff | 5.55% | 6.05% | 6.54% | 6.98% | 7.41% |
| On-grid Electricity | 5.55% | 6.05% | 6.54% | 6.98% | 7.41% |
| O&M cost | 6.74% | 6.63% | 6.54% | 6.43% | 6.32% |
| Total investment cost | 7.29% | 6.90% | 6.54% | 6.18% | 5.85% |

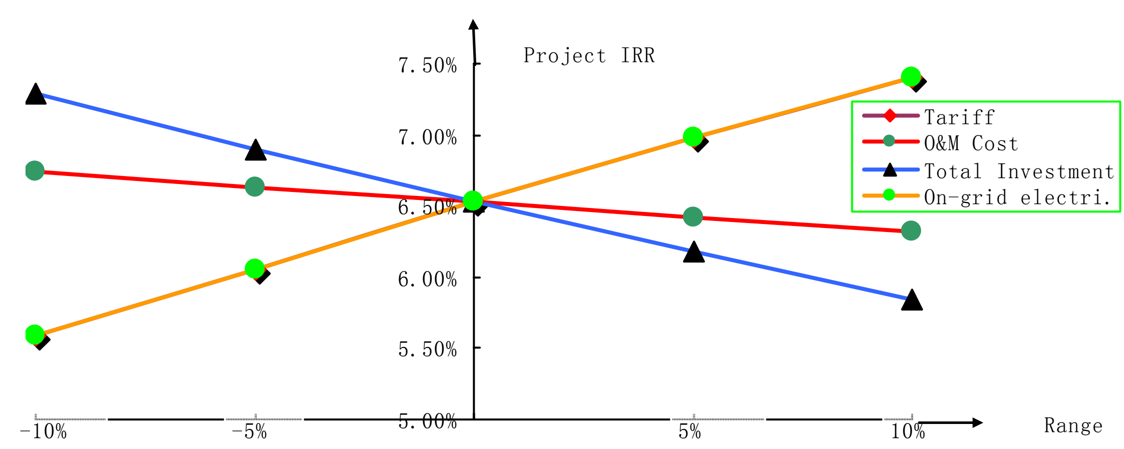


**Figure B.2 Sensitivity Analysis**

**Table B.7 Variation of parameters needed to reach the 8% benchmark**

| Parameters(benchmark) | 8% |
|---|---|
| **Total investment** | -14.30% |
| **O&M cost** | -100% (7.4%) |
| **Tariff** | +19% |
| **On-grid electricity** | +19% |

**For total investment**: the table B.7 shows that the IRR will reach the benchmark if the total investment is decreased by 14.3%. In reality, the total investment has reached 48,963.14×104CNY by the end of 2008 which exceed the input value for IRR calculation. So the IRR wouldn't cross the benchmark.

**For O&M cost**: the table B.7 shows that even if the O&M cost is reduced to zero, the IRR still won't reach the benchmark.

**For Tariff**: The tariff for IRR calculation is based on the expectation tariff of project owner which resulted from an investigation conducted in September of 2003. This price is a little higher than the average tariff 0.278CNY/KWh of 2001-2003 in Fujian9. In reality, the current tariff is 0.28CNY/KWh which is 9.7% lower than the input value for IRR calculation. And such tariff is not likely to increase

[9] Wang, Xianglian 2006. The Analysis of on-grid electricity tariff of small hydropower plants in Fujian. *China Rural Hydropower & Electrification* (3)21-23.

since the tariff tendency in Fujian is going down year by year[10] due to the fierce competition resulted from tariff reform. Thereby, it is highly unlikely that the average tariff will increase by 19% and thus the IRR also unlikely to reach the benchmark.

**For on-grid electricity**: The input value of the on-grid electricity is equal to the expected annual power generation multiply by the Effective Electricity Factor (EEF). And the expected annual power generation is calculated by design institute based on 60 years official hydrological statistics, the EEF is identified by design institute based on multi-year operation data from similar hydropower plants in Fujian. Actual data under normal circumstances may vary slightly. The reality data of on-grid electricity of 2008 (181,544.56MWh) remains almost the same with expectation (183,632MWh, -1.14% difference). Therefore, the average on-grid electricity is unlikely to increase by 19% and the IRR also very unlikely to reach the benchmark.

To sub-conclusion, the IRR of the proposed project is very unlikely to cross the benchmark. Hence, the conclusion regarding the financial additionality is robust and supported by sensitivity analysis.

**Outcome of step 2**: The alternative scenario (a), the proposed project activity undertaken without being registered as a CDM project activity, is unlikely to be financially attractive.

***Step 3. Barrier Analysis***

Since sensitivity analysis concluded that the proposed CDM project activity is unlikely to be most financially attractive or is unlikely to be financially attractive, no barrier analysis was conducted for the proposed project.

***Step 4. Common Practice Analysis***

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

According to the authority documents, similar scale projects between ±50% of the proposed project are appropriate for common practice analysis. Moreover, in 2002, "Notification Regarding the Regulatory and Institutional Reformation Plan in China's Power Sector" (GF【2002】No.5) was released by the State Council of PRC. It initiated the power sector regulatory and institutional reformation in China (including tariff reform). Since then electricity tariff is identified by market force gradually instead of being set up by government as before. So only the hydropower plants started operation after 2002 are deemed as same circumstance as the proposed project. Hydropower plants with installed capacity range between 25MW-75MW and started operation after 2002 or those under construction in Fujian province are listed in table B.8 below. It should note that hydropower plants with installed capacity range between 25MW-75MW in Fujian province that have been opened for GSC are excluded from table B.8

**Table B.8** List of Similar Installed Capacity Hydropower Plants in Fujian Province

| Name | Capacity (MW) | Commissioning | Total Investment ($10^8$CNY) | Unit Capacity Investment (CNY/W) |
|---|---|---|---|---|
| Dayang[11] | 32 | 2004 | 2.1699 | 6.750 |
| Wangkeng[12] | 40 | 2004 | 2.4388 | 6.095 |

[10] Wang, Xianglian 2006. The Analysis of on-grid electricity tariff of small hydropower plants in Fujian. *China Rural Hydropower & Electrification* (3)21-23.

[11] http://www.86ne.com/Ocean/200601/Ocean_33118.html

| | | | | |
|---|---|---|---|---|
| Shuangkoudu[13] | 35 | 2005 | 2.100 | 6.000 |
| Shangpei[14] | 51 | 2005 | 2.4569 | 4.817 |
| Zhaokou[15] | 60 | 2006 | 4.9960 | 8.326 |
| Baisha[16] | 70 | 2006 | 5.4600 | 7.800 |
| The proposed project | 48 | 2007 | 4.59979 | 9.583 |

Note: Longxiang(74MW) and Xindian(34MW) are still on preliminary stage[17]

Source: Consulting with experts from Shunchang County Water Resource Bureau Fujian Province Water Resource Bureau and broad literature review.

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

It is noted that the unit capacity investment of the proposed project is the highest amongst Table B.8. Even for Zhaokou which unit installed capacity investment is the closest to the proposed project, it is still 13.11% lower than the proposed project. So under the circumstance of competitive on-grid tariff, the proposed project can't compete with other hydropower plants listed on Table B.8. Hence, the proposed project is distinct differ from other similar capacity hydropower projects in the Fujian Province and not a common practice.

**In conclude**, the proposed project should be deemed to be additional and not a baseline scenario according to ACM0002.

## B.6. Emission reductions

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

>>

***Step 0. Boundary of the power grid***

Based on the approved ACM0002, Version 06, for new hydroelectric projects with reservoirs, the project boundary includes the physical site of the plant as well as the reservoir area, and the spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The power plant and reservoir of the proposed project can be easily delineated. Besides, in accordance with the guidelines published by the DNA of China on 15 Dec. 2006[18], Yangkou power grid is defined as connecting to the ECPG.

For project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following: Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources,

[12] http://www.ndsl.gov.cn/upload/200592605056%E5%B1%8F%E5%8D%97%E5%8E%BF.mht

[13] http://www.ningde.gov.cn/jrnd/xsdt/23345.html

[14] http://www.ndsl.gov.cn/upload/200592605056%E5%B1%8F%E5%8D%97%E5%8E%BF.mht

[15] http://www.ningde.gov.cn/jrnd/xsdt/23345.html

[16] http://www.ningde.gov.cn/jrnd/xsdt/23345.html

[17] http://www.yongtai.gov.cn/typenews.asp?id=5757

[18] DNA, (2006). The announce of identification Baseline Emission Factors of Chinese Electricity Grid, 15, Dec.

as reflected in the combined margin (CM) calculations described below. As the proposed project is a new hydropower plant, and baseline scenario has already been identified as the GHG emission from the ECPG. The next step will be the calculation of operating margin emission and build margin from the ECPG.

**Step 1a. Calculate the operating margin emission factor(s) ($EF_{OM,y}$)**

The GHG emission reductions generated by the proposed project were calculated in accordance with the approved methodology version 6 of ACM0002. Four alternatives calculation method could be used to calculate the OM:

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

Dispatch data analysis should be the first methodological choice. Where this option is not selected project participants shall justify why and may use the simple OM, the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter.

The Simple OM method (a) can only be used where low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term the norms for hydroelectricity production.

The average emission rate method (d) can only be used where low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and where detailed data to apply option (c) above is unavailable.

The Simple OM, simple-adjusted OM, and average OM emission factors can be calculated using either of the two following data vintages for years(s) y:

- (ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,
- the year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex-post monitoring.

The choice between ex-ante and ex-post vintage should be specified in the PDD, and cannot be changed during the crediting period.

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

For this Project, the simple OM was selected to calculate OM based on the following two reasons:

1) Detailed dispatch data is not available. In China, the State Grid Corporation run the interregional dispatch system, and each regional grid corporation run the intra-regional dispatch system. The dispatch information is not available to the public.
2) The ratio of electricity generated by hydro power plants against the total electricity generated in the grid for the Year 2000-2004 are 16.9%, 17.5%, 17.3%, 16.8% and 14.9%[19] respectively. It is show that the low-cost/must run resources constitutes less than 50% of total in recent 5 years.

The Simple OM emission factor is calculated as the generation-weighted average emissions per electricity unit ($tCO_2/MWh$) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

Yearbook, (2001 to 2005). *China Electric Power Yearbook.*Beijing: CEPP.

(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 $i$ ($tCO_2$ / 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 in year(s) $y$;
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source $j$.

The CO2 emission coefficient *COEFi* is obtained as
$COEF_i = NCV_i \bullet EF_{CO2,i} \bullet OXID_i$

where:
$NCV_i$ is the net calorific value (energy content) per mass or volume unit of a fuel i;
$OXID_i$ is the oxidation factor of the fuel (IPCC default value);
$EF_{CO2,i}$ is the $CO_2$ emission factor per unit of energy of the fuel i (IPCC default value);
The details data and cacluation are provided in Annex 3.

The result of calculation $\boldsymbol{EF_{OM,\,simple,\,y}}$ = 0.9411 t $CO_2$e/MWh.

**Step 1b. Calculate the Build Margin emission factor ($EF_{BM,y}$)**

The BM is calculated as the generation-weighted average emission factor of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (2)$$

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants *m*.

Project participants shall choose between one of the following two options. The choice among the two options should be specified in the PDD, and cannot be changed during the crediting period.

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. Project participants should use from these two options that sample group that comprises the larger annual generation.

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. 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. Project participants should use from these two options that sample group that comprises the larger annual generation.

**The option 1 is selected to calculate the BM in this PDD.**

However, because of the limited availability of data, at present it is impossible to know how much generation of Eastern China Power Grid was from the newly built power plant and it is also impossible to find the exact newly built plants which comprise the 20% of the system generation. According to the EB's guidance on DNV's "Request for clarification on use of approved methodology AM0005 for several projects in China", the EB accepted the following deviation and allowed it to be applied for methodology ACM0002 and AMS-I.D. for projects in China[20]:

- Use of capacity additions during last 1-3 years for estimating the build margin emission factor for grid electricity;

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

Therefore, this proposed project uses the alternative method to calculate $EF_{BM,y}$, and the formula is

$$EF_{BM,y} = \frac{EF_{BTCA\_fire,y} \bullet CAP_{fire,y-n,y}}{\sum CAP_{j,y-n,y}} \tag{3}$$

Where :

$CAP_{fire,y-n,y}$ is the incremental installed capacity of fuel-fired power (MW) in *y* year compared to that of *y-n* year;

$\sum CAP_{j,y-n,y}$ is the total incremental installed capacity of various power sources in the grid during the years from y to y-n year;

$\frac{CAP_{fire,y-n,y}}{\sum CAP_{j,y-n,y}}$ represents the share of incremental installed capacity of fuel-fired power in the whole incremental installed capacity.

Where, *n* is fixed by:

Starting from *y* year, the differences of installed capacity between *y* year and *y-1* year, y year and *y-2* year…*y* year and *y-n* year, *y* year and *y-n-1* year, …are calculated respectively, and then divided by the installed capacity of *y* year. The year that can make the left side of the following formula greater than 20% will be regarded as *n*. The formula is as follows:

$$\frac{\sum_j CAP_{j,y-n}}{\sum_j CAP_{j,y}} \geq 20\%$$

$EF_{BTCA\_fire,}$ is the emission factor of fuel-fired power with best technology commercially available (BTCA). It represents the trend of decreased coal consumption in the fuel-fired power generation brought by technology advancement in the coming years. Compared with the method for $EF_{BM,y}$ provided by ACM0002 Methodology, the value of $EF_{BTCA\_fire,y}$ is lower than that of other types of fuel-

[20] Source: http://cdm.unfccc.int/projects/deviations

fired power plants to be built in the grid, because the emission factor of the alternative method reflects the fuel efficiency of the fuel-fired power plants which use the best technology commercially available. Therefore, the building margin factor through this method is conservative.

In addition, there is an assumption in the alternative method:

The average annual operational hours of non fuel-fired power plants are the same as those of fuel-fired power plants. But the fact in China is, except nuclear power, the former is much less than the latter. Therefore, the alternative method is conservative.

$$EF_{BATA,\ fire,\ y} = \lambda_{coal} \bullet EF_{coal,\ adv} + \lambda_{oil} \bullet EF_{oil,\ adv} + \lambda_{Gas} \bullet EF_{Gas,\ adv} \quad (4)$$

$$\lambda_{coal} = \frac{\sum_{i=coal,j} F_{i,\ j,\ y} \bullet COEF_{i,\ j}}{\sum_{i,j} F_{i,\ j,\ y} \bullet COEF_{i,\ j}} \quad (5)$$

$$\lambda_{oil} = \frac{\sum_{i=oil,j} F_{i,\ j,\ y} \bullet COEF_{i,\ j}}{\sum_{i,j} F_{i,\ j,\ y} \bullet COEF_{i,\ j}} \quad (6)$$

$$\lambda_{gas} = \frac{\sum_{i=gas,j} F_{i,\ j,\ y} \bullet COEF_{i,\ j}}{\sum_{i,j} F_{i,\ j,\ y} \bullet COEF_{i,\ j}} \quad （7）$$

The details data and calculation are provided in Annex 3.

The result of calculation $EF_{BM,y}$ = 0.7869 t $CO_2$e/MWh

**Step 1c. Calculate the baseline emission factor $EF_y$**

The baseline emission factor is calculated as the weight average of the OM ($EF_{OM,y}$) and the BM ($EF_{BM,y}$)

$$EF_y = \omega_{OM} \times EF_{OM,y} + \omega_{BM} \times EF_{BM,y} \quad (8)$$

where the weight $\omega_{OM}$ and $\omega_{BM}$ by default, are 50% (i.e., $\omega_{OM}$ and $\omega_{BM}$ = 0.5).

$EF_y$=0.5 × 0.9411+0.5 × 0.7869=0.8640 t$CO_2$e/MWh.

## Step 1d. Calculate the baseline emission of $BE_y$

Based on ACM0002, the baseline emission is the baseline emission factor $EF_y$ times the net electricity supply to the grid $EG_{\text{net,y}}$ during period y, as follows:

$$BE_y = EG_{net,y} \bullet EF_y \quad (9)$$

## Step 2. Calculate the project emission of $PE_y$

If the power density of the project is greater than 4W/$m^2$ and less than or equal to 10W/$m^2$:

$$PE_y = \frac{EF_{\mathrm{Res}} \cdot EG_y}{1000}$$

Where:
$PE_y$ is emission from reservoir expressed as $tCO_2e$/year;
$EF_{Res}$ is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90kg, $tCO_2e$/MWh;
$EG_y$ is electricity produced by the hydro power project in year y, in MWh.

If power density of the project is greater than $10W/m^2$, then $PE_y$=0.

### Step 3. Calculate the project leakage of $L_y$

According to ACM0002 (06), the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling, and land inundation. It is not need to count these emission sources as leakage.

### Step 4. Calculate the emission reduction of $ER_y$

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction $ER_y$ 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 ($L_y$), as follows:

$$ER_y = BE_y - PE_y - L_y \qquad (10)$$

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

>>

| | |
|---|---|
| Data / Parameter: | $EF_{OM}$ |
| Data unit: | $t\ CO_2e$/MWh |
| Description: | The operating margin emission factor |
| Source of data used: | *Caculation* |
| Value applied: | 0.9411 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Caculation method follow with approved methodology, and the base data from official statistical data, the calculation result is reliable. |
| Any comment: | The value will not be revised during first credit period |

| | |
|---|---|
| Data / Parameter: | $EF_{BM}$ |
| Data unit: | $t\ CO_2e$/MWh |
| Description: | The build margin emission factor |
| Source of data used: | *Caculation* |
| Value applied: | 0.7869 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Caculation method follow with approved methodology, and the base data from official statistical data, the calculation result is reliable. |
| Any comment: | The value will not be revised during first credit period |

| | |
|---|---|
| Data / Parameter: | *$EF_y$* |
| Data unit: | t $CO_2$e/MWh |
| Description: | The baseline emission factor |
| Source of data used: | *Caculation* |
| Value applied: | 0.8640 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Caculation method follow with approved methodology, and the base data from official statistical data, the calculation result is reliable. |
| Any comment: | The value will not be revised during first credit period |

| | |
|---|---|
| Data / Parameter: | *$F_{i,j,y}$* |
| Data unit: | Mtons, $Mm^3$ |
| Description: | The amount of fuels i ( in a mass or volume unit) consumed by relevant power sources j in years y |
| Source of data used: | *China Energy Statistical Yearbook(2000-2002,2004,2005)* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data, data sources is Reliable |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | The rate of electricity consumption |
| Data unit: | % |
| Description: | The rate of electricity consumption of power sources j from ECPG in years y |
| Source of data used: | *China Electric Power Yearbook (2003-2005)* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data, data sources is Reliable |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | *NCVi* |
| Data unit: | Mj/t, km3 |
| Description: | The net calorific value(energy content) per mass or volume unit of a fuel i |
| Source of data used: | *China Energy Statistical Yearbook(2005)* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data, data sources is Reliable |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | *$OXID_i$* |
| Data unit: | % |
| Description: | the oxidation rate of fuel i |
| Source of data used: | *2006 IPCC Guidelines for National Greenhouse Gas Inventories* |
| Value applied: | See annex 3 for details |

| | |
|---|---|
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data from the IPCC default value since local and national values can not be Accessed |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,i}$ |
| Data unit: | $tCO_2$ /TJ |
| Description: | The Carbon emission factor per unit of energy of the fuel i |
| Source of data used: | *2006 IPCC Guidelines for National Greenhouse Gas Inventories* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data from the IPCC default value since local and national values can not be Accessed |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $CAP_{m,y,j}$ |
| Data unit: | MW |
| Description: | The installed capacity of power sources j in province m in ECPG in years y |
| Source of data used: | *China Electric Power Yearbook (2003-2005)* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data, data sources is Reliable |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $GEN_{i,j,y}$ |
| Data unit: | MWh |
| Description: | The Generating capacity of power sources j from power sources i in ECPG in years y |
| Source of data used: | *China Electric Power Yearbook (2003-2005)* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data, data sources is Reliable |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | $GEN_{j,y,imports}$ |
| Data unit: | MWh |
| Description: | Electricity import to ECPG |
| Source of data used: | *China Electric Power Yearbook (2003-2005)* |
| Value applied: | See annex 3 for details |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Official statistical data, data sources is Reliable |

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

| | |
|---|---|
| Data / Parameter: | Surface Area |
| Data unit: | Million $m^2$ |
| Description: | The surface area of reservoir at full reservoir level |
| Source of data used: | *Data from The feasibility study institution* |
| Value applied: | 6.17 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | The value will not be revised for the first credit period |

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

>>

According to the above equations of (9), (10) and (11), the ex-ante calculation of emission reductions as follows:

(a) The calculation of baseline emission, according to the equation of (9):

$BE_y = EG_{net,y} \bullet EF_y$ = 183,632×0.8640=158,658 $tCO_2e$.

(b) The calculation of project emission, because the power density of proposed project equal to 7.78W/$m^2$, which is greater than 4W/$m^2$ and less than 10W/$m^2$, according to the equation of (10), and according to feasibility study, the value of $EG_y$ is 204,700MWh, then:

$PE_y = \frac{EF_{Res} \cdot EG_y}{1000}$=(90×204,700)/1000=18,423 $tCO_2e$.

(c) The calculation of emission reduction, according to equation of (11):

$ER_y = BE_y - PE_y - L_y$ = 158,658– 18,423 – 0=140,235 $tCO_2e$

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

>>

The proposed project is estimated to reduce 140,235$tCO_2e$ annually, generating an expected total of approximately over 981,645 $tCO_2e$ for the duration of the first 7-years crediting period.

| Year | Estimation of Project activity Emission ($tCO_2e$) | Estimation of Baseline Emission ($tCO_2e$) | Estimation of leakage ($tCO_2e$) | Estimation of Emission reductions ($tCO_2e$) |
|---|---|---|---|---|
| 13/10/2008—12/10/2009 | 18,423 | 158,658 | 0 | 140,235 |
| 13/10/2009—12/10/2010 | 18,423 | 158,658 | 0 | 140,235 |
| 13/10/2010—12/10/2011 | 18,423 | 158,658 | 0 | 140,235 |
| 13/10/2011—12/10/2012 | 18,423 | 158,658 | 0 | 140,235 |
| 13/10/2012—12/10/2013 | 18,423 | 158,658 | 0 | 140,235 |
| 13/10/2013—12/10/2014 | 18,423 | 158,658 | 0 | 140,235 |
| 13/10/2014—12/10/2015 | 18,423 | 158,658 | 0 | 140,235 |
| TOTAL($tCO_2e$) | 128,961 | 1,110,606 | 0 | 981,645 |

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

>>

Applying the ACM0002 methodology to the proposed project because:

- This monitoring methodology shall be used in conjunction with the approved baseline methodology ACM0002, and the proposed project has adopted the baseline methodology ACM0002.
- The proposed project involves an electricity capacity addition of a renewable source providing power to the grid.
- The proposed project does not involve switching from fossil fuels to renewable energy at the site of the project activity.

The geographic and system boundaries for the ECPG can be clearly identified and information on the characteristics of the grid is available.

### B.7.1 Data and parameters monitored:

>>

| **Data / Parameter:** | $EG_{net,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Net electricity delivered to the grid in year y by the proposed project (M10) |
| Source of data to be used: | The Primary electricity meter in Huayang Transformer Station |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 183,632 |
| Description of measurement methods and procedures to be applied: | Net Electricity delivered to the grid by the proposed project will be continuously measured by meters and will be recorded on a monthly basis. For a detailed description of the measurement methods please refer to B.7.2. |
| QA/QC procedures to be applied: | According to technology standards of DL/T448-2000, meters will be calibrated periodically. Data measured by meters will be cross checked against the data from supplementary electricity meters. For a detailed description of the QA/QC procedures please refer to B.7.2. |
| Any comment: | |

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity produced by the proposed project in year y |
| Source of data to be used: | $EG_y$ =M1+M2+M3 |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 204,700 |
| Description of measurement methods and procedures to be applied: | Electricity produced by the proposed project will be continuously measured by three meters directly connected to three generators and data will be recorded on a monthly basis. For a detailed description of the measurement methods please refer to B.7.2. |
| QA/QC procedures to be applied: | According to technology standards of DL/T448-2000, meters will be calibrated periodically. The measure results (M1+M2+M3) will be cross checked against the results from other meters((M1+M2+M3)-(M4+M5+M6+M7) =(M+M9)). For a detailed description of the QA/QC procedures please refer to B.7.2. |
| Any comment: | |

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

>>

The monitoring plan of the proposed project is developed following with the approved monitoring methodology, ACM0002 (v.06). "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources" to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data. The monitoring plan includes monitoring organisation, monitoring method and procedures, monitoring equipment and installation, monitoring data management and corresponding QA/QC procedures.

**1. Monitoring Organisation**

The monitoring organisation of the proposed project will be integrated with the management organisation of Yangkou hydropower plant. A CDM manager should be nominated to co-ordinate Yangkou Hydro Power Plant, HSE (CDM consulting company), NEB (Nanping Electricity Bureau) and DOE on the matters of CDM and monitoring. The CDM manager also responsible for data collection, storage, archiving and relative documentation archiving. NEB is responsible for operation, maintenance, calibration and data recording for the primary meter. HSE will give technology support for CDM manager.

**2. Monitoring Method and Procedures**

The key monitoring parameters are the net electricity delivered to the grid, which measured by primary meter M11 and cross checked against supplementary meter M10, and the electricity produced by the proposed project, which measured by M1, M2 and M3 ($EG_y$=M1+M2+M3) and cross checked against the results from other meters((M1+M2+M3)-(M4+M5+M6+M7) =(M+M9)). M11 is located at Shunchang Huayang Substation under the management of the NEB, where is about 11km from the proposed project. M10 is located at Yangkou Hydro Power Plant to which the grid is connected. The net electricity delivered by Yangkou power plant is measured via M10 and M11, then is sent to Nanping Grid, next to Fujian Grid, finally to ECPG. M1, M2 and M3 are located at the proposed project power plant, connected to three generators. There are also other meters monitoring the operation status for each generator/dam/plant substation.

Every 28$^{th}$, a data recorder from NEB will read the meter for electricity quantity and time then report to the statistician in production department of Yangkou Hydro Power Plant. The supplementary meter monitor continuously and data record daily. All monitor record of meters in Yangkou Hydro Power Plant will be sent to the statistician. The statistician then compiles all of data and makes analyse. If the difference between two meters exceeds the allowable range, then he/she will report to the manager to calibrate the meters.

Both M10 and M11 are bi-directional electricity meters, which can measure the electricity in and out from the grid and resulted as net electricity delivered to the grid.

The statistician should make a copy of the monthly data of M1, M2, M3, M10 and M11 to the CDM manager.

**3. Monitoring equipment and installation**

The key monitoring equipment is M1, M2, M3, M10 and M11. There are other meters measuring electricity generation and consumption to monitoring operational status of plant. M8 and M9 are installed in #1 and #2 main substation, which are used to measure the electricity supplied to the grid by the proposed project (M10=M8+M9). M4, M5, M6 and M7 are installed for measuring self-use electricity consumption of #1 dam, #2 dam, #1 plant, #2 plant respectively. The details of meters showed on table B.9. For the location of all meters and generators please refer to figure B.3.

**Table B.9 The details of meters**

| Meter No. | Model | Accuracy | Error |
|---|---|---|---|
| M11 | DTSD132 | 0.5S | ±0.5% |

| | | | |
|---|---|---|---|
| M10 | DST718 | 0.2S | ±0.2% |
| M9 | DST718 | 0.2S | ±0.2% |
| M8 | DST718 | 0.2S | ±0.2% |
| M7 | DST719 | 0.5S | ±0.5% |
| M6 | DST719 | 0.5S | ±0.5% |
| M5 | DST719 | 0.5S | ±0.5% |
| M4 | DST719 | 0.5S | ±0.5% |
| M3 | DST719 | 0.5S | ±0.5% |
| M2 | DST719 | 0.5S | ±0.5% |
| M1 | DST719 | 0.5S | ±0.5% |

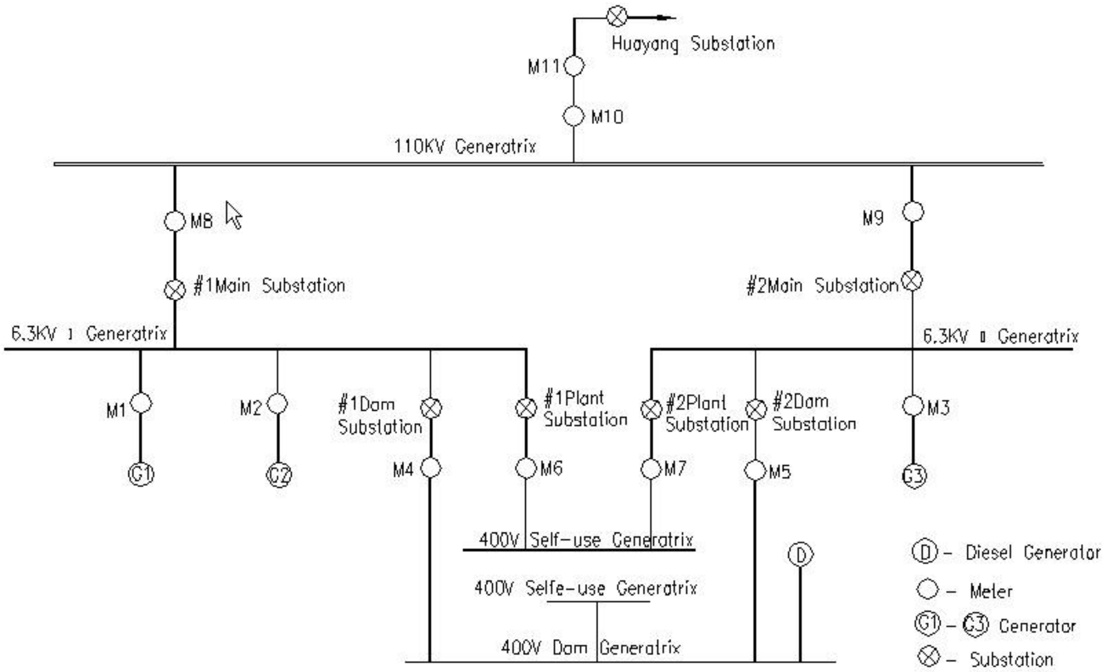


**Figure B.3 Location and Connection of Meters**

**4. Monitoring Data management**

The CDM manager will establish electronic database for measure data of M1, M2, M3, M10 and M11. A copy of monthly data record of M1, M2, M3, M10 and M11, invoices of net electricity delivered to the grid (collected from financial department of Yangkou Hydro Power Plant), calibration record and other written documentation such as maps, diagram of meter location, EIA report, preliminary design report should be archived. All data (electronic and paper form) should be kept until two years after the end of the crediting period.

**5. QA/QC Procedures**

Prior to the installation, all meters should be sent to NEB for calibration. Periodically calibration will be conducted during operation (around once per 6 years). The Meters will be calibrated in compliance with the "National Guidelines for accuracy and reliability, and regulations of the State Electricity Regulatory Commission, DL/T448-2000". If it is found that the error over the range, then the meter should be replaced.

Every calibration or adjustment to the meters should be documented and copied to the CDM manager.

**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 baseline and monitoring methodology was completed at 18-11-2006
HSE Environmental Engineering Consulting y.huang@hse-china.com
Unit 1601, 106 Changqing North Ave, Xiamen, 361012

The above entity is not a 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:

>>
16-12-2004, the earliest date either the implementation or construction or real action of a project activity begins.

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

>>
30 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:

>>
13-10-2008 or the day after registration

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

>>
7 years

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

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

>>
N/A

##### C.2.2.2. Length:

>>
N/A

## SECTION D. Environmental impacts

>>

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

>>

The proposed project of the Environmental Impact Assessment (EIA) is prepared by Fujian Hydrological and Hydraulic Investigation and Design Institute. The EIA was approved by Fujian Environmental Protection Bureau. The following section provided a summary of the EIA. A copy of the full report is available on request.

During construction period

(1) Ecological Impact

The proposed project will not involve destruction of woodland and will not cause impact on the forestry resources in both the project area and surrounding area. Therefore it will not affect the biodiversity of the subject area. Basically the wildlife of the surrounding area will not be affected.

(2) Air Emission

Main source of air impact is the fugitive particulates generated during construction work. The impact will be temporary. Mitigation measures such as water spraying, compressing and prompt disposal of inert materials will be implemented to minimize the impact.

(3) Water Quality

During construction, small amount of sanitary wastewater will be discharged. Septic tanks will be provided and therefore no significant impact posed on water quality in Futun Xi River. For construction wastewater, suspended solid (SS) pluming of different scenarios were modelled. As sedimentation tanks will be provided, SS of wastewater after treatment will comply with Level I of the Comprehensive Effluent Discharge Standard (GB8978-1996).

(4) Solid Waste

Only limited amount of solid waste will be produced during the operational period. Designated waste storage area will be established for regular disposal of waste.

(5) Noise Impact

The proposed project is located near National Road no. 316 and Yingsha Railway. Baseline noise level is currently dominated by traffic noise (Level IV of Urban District Environmental Noise Standard GB3096-93). Therefore, construction noise generated by the proposed project will be insignificant.

During operation period

(1) Water Quality Impact

Septic tank will be provided for sanitary water from the station during the operation period. The wastewater will be treated by oxidation before discharge. Oil interceptor will be used in the hydropower station. All wastewater generated during maintenance pass through the oil interceptor before discharge.

(2) Ecological Impact

Impact on the wildlife of the surrounding area is deemed insignificant. No impact was expected on the natural resources of Futun River.

In conclude, no major environmental impact is expected during both construction and operation phase of the proposed project. Nevertheless, mitigation measures implemented will minimize the impact.

**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:**

>>

There are no significant environmental impacts following the above mitigation measures. In addition, the proposed project will have positive impacts on the local social and economy benefits.

## SECTION E. Stakeholders' comments

>>

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

>>

When Fujian Hydrological and Hydraulic Investigation and Design Institute conducted EIA, a public consultation was taken via questionnaires in 2003. Villagers, whose house or land will be inundated were consulted. 50 questionnaires were sent out and 100% returned. In line with the regulations of CDM, a stakeholder's comment was conducted again in April 2007 to collect lastest comments and concerns via questionnaires and notice board. 100 questionnaires were distributed to migrants (64), officials from local relative governmental agency (8), several other residents (9), employee of the proposed project (6) and others (13). Several Notice boards inviting public participation were placed in three primary migration allocation sites, which are Shadun Village, Jiangjun Village and Baisha Village.

Summary of questionnaire
1, Do you think the proposed project will increase employ opportunity and local economy development?
2, Are there any negative ecology impacts from the proposed project?
3, Are the proposed project impact your house and land? What is your point of view to the migration allocation?
4, Do you know of CDM?
5, Do you support the proposed project applying for CDM?
6, What is your attitude towards the construction of the CDM project?
7, What would be the positive impacts of the proposed project?
8, What would be the negative impacts of the proposed project?

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

>>

The questionnaire received 100% response though there was no reply to the notice board invitation. The comments of the survey summarised as follows:
1, 100% repliers considered that the proposed project will improve the local economy development and increase local employ opportunity.
2, Replier considered that the proposed project may have negative ecology impacts.
3, Most of migrants satisfied with migration allocations and future living development, though few migrants complained the governmental compensation standard. According to the feasibility, the total amount of re-settlement population was 51 houses (222 individuals). As requested by the Government to adopt a more conservative assumption, the affect area due to a potential flooding impact was enlarged and therefore a total of 98 houses (444 individuals) were moved. The migrants were happy on that.
4, There were only 2 officials know of CDM. People got to know of CDM after investigator's explain.
5, 96% of repliers supported the proposed project applying for CDM, the left had no concern on this point.
6, Most of repliers considered the proposed project, as a renewable energy power plant will prevent environmental pollution, and is a kind of green energy.
7, People played more concern on geology landslip and flooding.

Details of the results will be available upon request.

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

>>

Took all of concers into account, the project owner took active as follows:

1, To strictly compliance with the suggestions of EIA to mitigate ecology impact during construction.
2, The geology investigation concluded that the local geology is suitable for the proposed project and the landslip prevent projects had been included in whole project construction. To prevent flooding, an automatic hydrology monitoring system had been set and flooding altitude had been increased 0.5 meters out of requirement of common practice.
3, In some cases, the economy compensation was a little higher than the requirements of government to make sure the migrants not decrease their living.

Except for above statements, no further adjustment is deemed necessary.

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Fujian Shun Chang Yangkou Hydro Power Co., Ltd. |
| Street/P.O.Box: | Shuinan |
| Building: | 5F Mo Dian Building |
| City: | Shunchang County |
| State/Region: | Fujian |
| Postfix/ZIP: | 353200 |
| Country: | China |
| Telephone: | 0086-599-7858766 |
| FAX: | 0086-599-7858955 |
| E-Mail: | |
| URL: | N/A |
| Represented by: | |
| Title: | Assistant manager |
| Salutation: | Mr. |
| Last Name: | Xie |
| Middle Name: | |
| First Name: | Shaotong |
| Department: | |
| Mobile: | |
| Direct FAX: | 0086-599-7858955 |
| Direct tel: | 0086-599-7858766 |
| Personal E-Mail: | x_xike@126.com |

| | |
|---|---|
| Organization: | KfW Carbon Fund |
| Street/P.O.Box: | |
| Building: | Palmengartenstr. 5-9 |
| City: | Frankfurt |
| State/Region: | |
| Postfix/ZIP: | 60325 |
| Country: | Germany |
| Telephone: | 0049-69-7431-4035 |
| FAX: | 0049-69-7431-4775 |
| E-Mail: | |
| URL: | www.kfw.de |
| Represented by: | |
| Title: | Project manager |
| Salutation: | Mr. |
| Last Name: | Theilacker |
| Middle Name: | |
| First Name: | Peter |
| Department: | |
| Mobile: | |
| Direct FAX: | 0049-69-7431-4775 |
| Direct tel: | 0049-69-7431-4035 |
| Personal E-Mail: | peter.theilacker@kfw.de |

## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex Ⅰ Parties of UNFCCC for the proposed project.

## Annex 3

## BASELINE INFORMATION

| Table F1 OM Emission factor calculation of ECPG in 2002 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel Type | **Unit** | **Shanghai** | **Jiangsu** | **Zhejiang** | **Anhui** | **Fujian** | **Subtotal** | **EF** | **Oxidation factor** | **NCV** | **$CO_2$ emission（$tCO_2e$）** |
| | | | | | | | | **(tc/TJ)** | **(%)** | **(MJ/t, $km^3$）** | **J=G*H*I*F*44/12/10000（mass unit）** |
| | | **A** | **B** | **C** | **D** | **E** | **F=A+B+C+D+E** | **G** | **H** | **I** | **J=G*H*I*F*44/12/1000 (volume unit)** |
| Raw Coal | 10000t | 2386 | 5674.69 | 2923.66 | 2025.05 | 1336.49 | **14345.89** | 25.8 | 98 | 20908 | 278071961.3 |
| Clean Coal | 10000t | | | | | | **0** | 25.8 | 98 | 26344 | 0 |
| Other washed coal | 10000t | | | | | | **0** | 25.8 | 98 | 8363 | 0 |
| Coke | 10000t | | | | | | **0** | 29.5 | 98 | 28435 | 0 |
| Coke Oven Gas | $10^8m^3$ | 2.23 | 0.02 | | | | **2.25** | 13 | 99.5 | 16726 | 178489.4183 |
| Other Coal Gas | $10^8m^3$ | 66.82 | | | | | **66.82** | 13 | 99.5 | 5227 | 1656520.577 |
| Crude oil | 10000t | | | | | | **0** | 20 | 99 | 41816 | 0 |
| Gasoline | 10000t | | 0.07 | | | | **0.07** | 18.9 | 99 | 43070 | 2068.432443 |
| Diesel | 10000t | 1.21 | 13.45 | 30 | | | **44.66** | 20.2 | 99 | 42652 | 1396741.747 |
| Fuel Oil | 10000t | 53.2 | 1.19 | 91.38 | 1.09 | 12.6 | **159.46** | 21.1 | 99 | 41816 | 5107205.431 |
| LPG | 10000t | | | | | | **0** | 17.2 | 99.5 | 50179 | 0 |
| Refinery Gas | 10000t | 0.84 | | | | | **0.84** | 18.2 | 99.5 | 46055 | 25687.50785 |
| Natural Gas | $10^8m^3$ | | | | | | **0** | 15.3 | 99.5 | 38931 | 0 |
| Other petroleum products | 10000t | 10 | 3.47 | | | | **13.47** | 20 | 99 | 38369 | 3752188.922 |
| other coking products | 10000t | | | | | | **0** | 25.8 | 98 | 28435 | 0 |
| Other energy | 10000tce | 3 | | 10.4 | | | **13.4** | 0 | 0 | 0 | 0 |
| *China Energy Statistics Yearbook 2000-2002* | | | | | | | | | | Total | 290190863.3 |

| Table F2 Electricity Generation from the thermal power plants of East China Power Grid (2002) | | | | |
|---|---|---|---|---|
| **Province** | **Electricity generation** | **Electricity generation** | **Used by the power station** | **power output** |
| | **（$10^8$Wh)** | **（MWh)** | **（%）** | **（MWh)** |
| Shanghai | 616.48 | 61,648,000 | 5.44 | 58,294,349 |
| Jiansu | 1167.16 | 11,6716,000 | 6.09 | 109,607,996 |
| Zhejiang | 692.87 | 69,287,000 | 5.95 | 65,164,424 |
| Anhui | 457.03 | 45,703,000 | 6.36 | 42,796,289 |
| Fujian | 308.5 | 30,850,000 | 6.68 | 28,789,220 |
| **Total** | | | | 304,652,277 |
| *China Electric Power Yearbook2003* | | | | |

**Table F3 Electricity Source & Emission (Year 2002)**

| | |
|---|---|
| Electricity Generation From ECPG (MWh) A | 304,652,277 |
| Electricity Import from MCPG (MWh) B | 7,883,000 |
| Total Power Output (MWh) A+B | 312,535,277 |
| Total Emission ($tCO_2$) | 295,924,831.50 |

Source: *China Electric Power Yearbook2003*

| Table F4 OM Emission factor calculation of ECPG in 2003 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel Type | **Unit** | **Shanghai** | **Jiangsu** | **Zhejiang** | **Anhui** | **Fujian** | **Subtotal** | **EF** | **Oxidation factor** | **NCV** | **$CO_2$ emission（$tCO_2e$）** |
| | | | | | | | | **(tc/TJ)** | **（%）** | **(MJ/t, $km^3$)** | **J=G*H*I*F*44/12/10000（mass unit）** |
| | | **A** | **B** | **C** | **D** | **E** | **F=A+B+C+D+E** | **G** | **H** | **I** | **J=G*H*I*F*44/12/1000 (Volume Unit)** |
| Raw Coal | 10000t | 2618 | 6417.74 | 3442.4 | 2669.67 | 1754 | **16901.81** | 25.8 | 98 | 20908 | 327614351.9 |
| Clean Coal | 10000t | | | | | | **0** | 25.8 | 98 | 26344 | 0 |
| Other washed coal | 10000t | | | | | | **0** | 25.8 | 98 | 8363 | 0 |
| Coke | 10000t | | | | | | **0** | 25.8 | 98 | 28435 | 0 |
| Coke Oven Gas | $10^8m^3$ | 1.99 | 0.06 | | | | **2.05** | 12.1 | 99.5 | 16726 | 162623.6922 |
| Other Coal Gas | $10^8m^3$ | 66.34 | | | | | **66.34** | 12.1 | 99.5 | 5227 | 1644620.998 |
| Crude oil | 10000t | | | | | | **0** | 20 | 99 | 41816 | 0 |
| Diesel | 10000t | 1.26 | 14.71 | 13.99 | | | **29.96** | 20.2 | 99 | 42652 | 936999.1654 |
| Fuel Oil | 10000t | 95.49 | 0.76 | 174.48 | | 18.89 | **289.62** | 21.1 | 99 | 41816 | 9275986.686 |
| LPG | 10000t | | | | | | **0** | 17.2 | 99.5 | 50179 | 0 |
| Refinery Gas | 10000t | 0.49 | 0.96 | | | | **1.45** | 18.2 | 99.5 | 46055 | 44341.5314 |
| Natural Gas | $10^8m^3$ | | | | | | **0** | 15.3 | 99.5 | 38931 | 0 |
| Other petroleum products | 10000t | 18.91 | 5.3 | 15.04 | | | **39.25** | 20 | 99 | 38369 | 1093343.84 |
| other coking products | 10000t | | | | | | **0** | 25.8 | 98 | 28435 | 0 |
| Other energy | 10000tce | 5.68 | | 7.08 | | | **12.76** | 0 | 0 | 0 | 0 |
| *China Energy Statistics Yearbook 2004* | | | | | | | | | | Total | 340772267.9 |

| Table F5 Electricity Generation from the thermal power plants of ECPG (2003) | | | | |
|---|---|---|---|---|
| **Province** | **Electricity generation** | **Electricity generation** | **Used by the power station** | **Power output** |
| | **（$10^8$kWh)** | **（MWh)** | **（%）** | **（MWh)** |
| Shanghai | 694.44 | 69444000 | 5.14 | 65,874,578 |
| Jiansu | 1332.77 | 133277000 | 5.9 | 125,413,657 |
| Zhejiang | 830.89 | 83089000 | 5.31 | 78,676,974 |
| Anhui | 541.56 | 54156000 | 6.06 | 50,874,146 |
| Fujian | 421.46 | 42146000 | 5.07 | 40,009,198 |
| **Total** | | | | 360,848,554 |
| *China Electric Power Yearbook2004* | | | | |

**Table F6 Electricity Source & Emission (Year 2003)**

| | |
|---|---|
| Electricity Generation From ECPG (MWh) A | 360,848,554 |
| Electricity Import From Yangcheng Shangxi Province (MWh) B | 10,705,870 |
| Electricity Import from MCPG (MWh) C | 13,756,040 |
| Total Power Output (MWh) A+B+C | 385,310,464 |
| Total Emission ($tCO_2$) | 361,514,179 |

Source: *China Electric Power Yearbook 2004*

| Table F7 OM Emission factor calculation of ECPG in 2004 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel Type | **Unit** | **Shanghai** | **Jiangsu** | **Zhejiang** | **Anhui** | **Fujian** | **Subtotal** | **EF** | **Oxidation factor** | **NCV** | **$CO_2$ emission（$tCO_2e$）** |
| | | | | | | | | **(tc/TJ)** | **(%)** | **(MJ/t, $km^3$)** | **J=G*H*I*F*44/12/10000（Mass unit）** |
| | | **A** | **B** | **C** | **D** | **E** | **F=A+B+C+D+E** | **G** | **H** | **I** | **J=G*H*I*F*44/12/1000 (Volume Unit)** |
| Raw Coal | 10000t | 2779.6 | 7601.9 | 4008.9 | 2906.2 | 2183.7 | **19480.3** | 25.8 | 98 | 20908 | 377594225.7 |
| Clean Coal | 10000t | | | | | | **0** | 25.8 | 98 | 26344 | 0 |
| Other washed coal | 10000t | | 5.46 | | | 4.63 | **10.09** | 25.8 | 98 | 8363 | 78229.4857 |
| Coke | 10000t | | | | | | **0** | 25.8 | 98 | 28435 | 0 |
| Coke Oven Gas | $10^8m^3$ | 2.59 | | | | | **2.59** | 12.1 | 99.5 | 16726 | 205461.1526 |
| Other Coal Gas | $10^8m^3$ | 72.46 | | | | | **72.46** | 12.1 | 99.5 | 5227 | 1796340.631 |
| Crude oil | 10000t | | | | | | **0** | 20 | 99 | 41816 | 0 |
| Diesel | 10000t | 2.69 | 27.17 | 6.23 | | | **36.09** | 20.2 | 99 | 42652 | 1128714.949 |
| Fuel Oil | 10000t | 58.52 | 55.07 | 202.89 | | 23.26 | **339.74** | 21.1 | 99 | 41816 | 10881236.51 |
| LPG | 10000t | | | | | | **0** | 17.2 | 99.5 | 50179 | 0 |
| Refinery Gas | 10000t | 0.77 | 0.55 | | | | **1.32** | 18.2 | 99.5 | 46055 | 40366.08376 |
| Natural Gas | $10^8m^3$ | | 0.14 | | | | **0.14** | 15.3 | 99.5 | 38931 | 30423.52536 |
| Other petroleum products | 10000t | 21.22 | 1.37 | 24.89 | | | **47.48** | 20 | 99 | 38369 | 1322597.847 |
| other coking products | 10000t | | | | | | **0** | 25.8 | 98 | 28435 | 0 |
| Other energy | 10000tce | 6.43 | | 15.48 | | | **21.91** | 0 | 0 | 0 | 0 |
| *China Energy Statistics Yearbook 2005* | | | | | | | | | | Total | 393077595.9 |

| Table F8 Electricity Generation from the thermal power plants of East China Power Grid (2004) | | | | |
|---|---|---|---|---|
| **Province** | **Electricity generation** | **Electricity generation** | **Used by the power station** | **Power output** |
| | **（$10^8$ kWh)** | **（MWh)** | **（%）** | **（MWh)** |
| Shanghai | 711.27 | 71127000 | 5.22 | 67,414,171 |
| Jiansu | 1635.45 | 163545000 | 5.93 | 153,846,782 |
| Zhejiang | 952.55 | 95255000 | 5.68 | 89,844,516 |
| Anhui | 598.75 | 59875000 | 6.03 | 56,264,538 |
| Fujian | 504.9 | 50490000 | 6.07 | 47,425,257 |
| Total | | | | 414,795,263 |
| *China Electric Power Yearbook2005* | | | | |

**Table F9 Total Electricity & Emission (Year 2004)**

| | |
|---|---|
| Electricity Generation From ECPG (MWh) A | 414,795,263 |
| Electricity Import From Yangcheng Shangxi Province (MWh) B | 11,649,610 |
| Electricity Import from MCPG (MWh) C | 26,933,850 |
| Total Power Output (MWh) A+B+C | 453,378,723 |
| Total Emission ($tCO_2$) | 425,920,925 |

Source: *China Electric Power Yearbook 2005*

**Table F10 Total Power Output & Emission (Year 2002-2004)**

| Year | Power Output (MWh) | Emission ($tCO_2$) |
|---|---|---|
| 2002 | **312535277** | **295,924,831** |
| 2003 | **385,310,464** | **361,514,179** |
| 2004 | **453,378,723** | **425,920,925** |
| Total | **1,151,224,463** | **1,083,359,935** |

The result from formula (1): $EF_{OM,y}$=0.9411 $tCO_2$/MWh

**Table F11 The Emission of variable fuels of Solid, liquid, gas(Data source:** *China Energy Statistical Yearbook 2005***)**

| | | Shanghai | Zhejiang | Jiangsu | Anhui | Fujian | Subtotal | NCV | EF | Oxidation | Carbon Emission |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel Variety | Unit | A | B | C | D | E | F=A+…+E | G | H | I | J=F*G*H*I*44/12/100 |
| Raw Coal | 10000t | 2779.60 | 7601.90 | 4008.90 | 2906.2 0 | 2183.70 | 19480.3 | 20908 kJ/kg | 25.80 | 0.98 | 377,594,226 |
| Clean Coal | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 26344 kJ/kg | 25.80 | 0.98 | 0 |
| Other washed Coal | 10000t | 0 | 5.46 | 0 | 0 | 4.63 | 10.09 | 8363 kJ/kg | 25.80 | 0.98 | 78,229 |
| Coke | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 28435 kJ/kg | 25.8 | 0.98 | 0 |
| Sum | | | | | | | | | | | **377,672,455** |
| Cruel Oil | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 41816 kJ/kg | 20.00 | 0.99 | 0 |
| Gasoline | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 43070 kJ/kg | 18.90 | 0.99 | 0 |
| Kerosene | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 43070 kJ/kg | 19.60 | 0.99 | 0 |
| Diesel | 10000t | 2.69 | 27.17 | 6.23 | 0 | 0 | 36.09 | 42652 kJ/kg | 20.20 | 0.99 | 1,128,715 |
| Fuel Oil | 10000t | 58.52 | 55.07 | 202.89 | 0 | 23.26 | 339.74 | 41816 kJ/kg | 21.10 | 0.99 | 10,881,237 |
| Other Oil products | 10000t | 21.22 | 1.37 | 24.89 | 0 | 0 | 47.48 | 38369 kJ/kg | 20.00 | 0.99 | 1,322,598 |
| Sum | | | | | | | | | | | **13,332,550** |
| Natural Gas | 100M $m^3$ | 0 | 1.4 | 0 | 0 | 0 | 1.4 | 38931 kJ/m3 | 15.30 | 0.995 | 30,424 |
| Oven Gas | 100M $m^3$ | 25.9 | 0 | 0 | 0 | 0 | 25.9 | 16726 kJ/m3 | 12.1 | 0.995 | 205,461 |
| Other Coal Gas | 100M $m^3$ | 724.6 | 0 | 0 | 0 | 0 | 724.6 | 5227 kJ/m3 | 12.1 | 0.995 | 1,796,341 |
| LPG | 10000t | 0 | 0 | 0 | 0 | 0 | 0 | 50179 kJ/kg | 17.20 | 0.995 | 0 |
| Dry Gas | 10000t | 0.77 | 0.55 | 0 | 0 | 0 | 1.32 | 46055 kJ/kg | 18.20 | 0.995 | 40,366 |
| Sum | | | | | | | | | | | **393,077,596** |
| Total | | | | | | | | | | | **464,840,691** |

| Table F12 Emission Factor of Coal, Gas & Oil Associated with the Best Available Advanced Technology of Electricity Generation | | | | | |
|---|---|---|---|---|---|
| | Variable | Efficiency | Emission Factor | Oxidation Factor | Emission Factor |
| | | A | B | C | **D=3.6/A/1000*B*C*44/12** |
| Coal-Fire plants | $EF_{Coal,Adv}$ | 36.53% | 25.8 | 0.98 | **0.9136** |
| Gas-Fire Plants | $EF_{Gas,Adv}$ | 45.87% | 15.3 | 0.995 | **0.4381** |
| Oil-Fire Plants | $EF_{OilI,AdV}$ | 45.87% | 21.1 | 0.99 | **0.6011** |

$\lambda_{Coal}$ =96.08%，$\lambda_{Oil}$ =3.39%， $\lambda_{Gas}$ =0.53%

Calculate from formula（4）, $EF_{BATA,fire,y}$ =0.9004 $tCO_2$/MWh

**Table F13 Installed Capacity and Generation of ECPG in 2002**

| | Shanghai | Jiangsu | Zhejiang | Anhui | Fujian | Total |
|---|---|---|---|---|---|---|
| Coal-fired Capacity (MW) | 11382.6 | 20599 | 13082.4 | 9056.3 | 6999.9 | 61120.2 |
| Hydro Capacity (MW) | 0 | 137.2 | 5866.8 | 649.1 | 6512 | 13165.1 |
| Nuclear Capacity (MW) | 0 | 0 | 1678 | 0 | 0 | 1678 |
| Other Capacity (MW) | 0 | 0 | 50.2 | 0 | 12 | 62.2 |
| Total (MW) | 11382.6 | 20736.2 | 20677.4 | 9705.4 | 13523.9 | 76025.5 |

Data source: *China Electric Power Yearbook 2003*

**Table F14 Installed Capacity and Generation of ECPG in 2003**

| | Shanghai | Jiangsu | Zhejiang | Anhui | Fujian | Total |
|---|---|---|---|---|---|---|
| Coal-fired Capacity (MW) | 11092.6 | 22245 | 15321.2 | 9284.9 | 7092.8 | 65036.5 |
| Hydro Capacity (MW) | 0 | 137.8 | 6054.5 | 649.1 | 6761.1 | 13602.5 |
| Nuclear Capacity (MW) | 0 | 0 | 2406 | 0 | 0 | 2406 |
| Other Capacity (MW) | 0 | 0 | 39.7 | 0 | 12 | 51.7 |
| Total (MW) | 11092.6 | 22382.7 | 23821.4 | 9934 | 13865.8 | 81096.5 |

Data source: *China Electric Power Yearbook 2004*

**Table F15 Installed Capacity and Generation of ECPG in 2004**

| | Shanghai | Jiangsu | Zhejiang | Anhui | Fujian | Total |
|---|---|---|---|---|---|---|
| Coal-fired Capacity (MW) | 12014.9 | 28289.5 | 21439.8 | 9364.5 | 8315.4 | 79424.1 |
| Hydro Capacity (MW) | 0 | 126.5 | 6418.4 | 692.8 | 7180.1 | 14417.8 |
| Nuclear Capacity (MW) | 0 | 0 | 3056 | 0 | 0 | 3056 |
| Other Capacity (MW) | 3.4 | 17.6 | 39.7 | 0 | 12 | 72.7 |
| Total (MW) | 12018.3 | 28433.6 | 30953.9 | 10057.3 | 15507.5 | 96970.6 |

Data source: *China Electric Power Yearbook 2005*

**Table F16 Calculation of BM from ECPG**

| | Capacity of 2002 | Capacity of 2002 | Capacity of 2004 | Increasing Capacity of 2002-2004 | Ratio in Increasing Capacity |
|---|---|---|---|---|---|
| | A | A | B | D=C-A | |
| Coal-fired Capacity (MW) | 61120.2 | 65036.5 | 79424.1 | 18303.9 | 87.39% |
| Hydro Capacity (MW) | 13165.1 | 13602.5 | 14417.8 | 1252.7 | 5.98% |
| Nuclear Capacity (MW) | 1678 | 2406 | 3056 | 1378 | 6.58% |
| Other Capacity (MW) | 62.2 | 51.7 | 72.6 | 10.5 | 0.05% |
| **Total （MW）** | **76025.5** | **81096.5** | **96970.5** | **20945.1** | **100.00%** |
| Percent in Capacity of 2004 | 78.4% | 83.63% | 100% | | |

Calculate from formula (3), $EF_{BM,y}$ ＝0. 7869 $tCO_2/MWh$
Calculate from formula(8), $EF_y$ ＝0. 8640 $tCO_2/MWh$

**Table F.17  OM and BM value**

| | |
|---|---|
| $EF_{OM}$ | 0.9411 $tCO_2/MWh$ |
| $EF_{BM}$ | 0.7869 $tCO_2/MWh$ |
| $EF_{CM}$ | 0.864 $tCO_2/MWh$ |

**Annex 4**
**MONITORING INFORMATION**

No additional information