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**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006**

## CONTENTS

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**Revision history of this document**

| Version Number | Date | Description and reason of revision |
|---|---|---|
| 01 | 21 January 2003 | Initial adoption |
| 02 | 8 July 2005 | • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.<br>• As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>. |
| 03 | 22 December 2006 | • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM. |

**SECTION A.   General description of small-scale project activity**

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| A.1 | Title of the small-scale project activity: |
|---|---|

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**The title of the project:** China Tuojiang Small Hydropower Project
**Document version:**1
**Date:** 15/05/2007

| A.2. | Description of the <u>small-scale project activity</u>: |
|---|---|

>>
**Description of the projects activity:**

Tuojiang Small Hydropower Project (hereafter referred to as "the project"), a run-of-river small hydropower plant over the Xiao River, is located in Tuojiang Town, Jianghua Yao Minority County, Yongzhou city, Hunan Province, People's Republic of China. The total installed capacity of the proposed project will be 12.8MW(4×3.2) with a predicted average power generation of 49,367MWh/yr. The electricity will be transmitted to Dongtian substation by 110kV lines, access to the Central China Power Grid[1] (CCPG for short).
The project will not only meet the increasing electricity demand but also displace power generation by fossil fuel based plants, contributing to the local sustainable development. It is estimated the annual emission reduction will be 46,731tCO$_2$e/y in the first credit period.

**Purpose of the project activity:**

The project's main purpose is utilising the water to generate electricity with irrigating the farmlands, supplying the water to the people and improving the sea-route at a specified future date.
1. Reduce the GHG emission reduction to mitigate the trend of global warming by providing clean electric power.
2. The project located in Minority area, it can improve the basic facilities, add the taxes income, enhance nation solidarity, promote harmonious society by promoting regional economic development.
3. After being finished, the project will: 1) reduce import and increase export of electricity from or to CCPG, and subsequently displace power generation by coal-fired thermal power plants; 2) supply jobs to the local people; 3) accelerate the development of the construction-materials business and contribute to the local sustainable development;

| A.3. | <u>Project participants</u>: |
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**Table 1  Name of Parties involved**

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

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[1] Tuojiang Hydropower Project Feasibility Research Report.

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| ((host) indicates a host Party) | entity(ies) project participants(*) (as applicable) | involved wishes to be considered as project participant(Yes/No) |
|---|---|---|
| P.R. China (host) | Jianghua Jianqiao Hydropower Plant Co., Ltd | No |
| Sweden | Carbon Asset Management Sweden AB | No |

### A.4.1.  Location of the small-scale project activity:

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

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People's Republic of China

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

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Hunan Province

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

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Tuojiang Town, Jianghua County, Yongzhou city

#### A.4.1.4.        Details of physical location, including information allowing the unique identification of this small-scale  project activity :

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The project lies in Jianghua Yao Minority County, which is located in south of Yongzhou, Hunan Province. The project will make use of the water of Xiao River, which is the largest first-step branch of Xiang River. The geographical coordinates of project are east longitude 110° 25'～112° 10', north latitude 24° 38'～25° 15'. Chart 1 shows the location of the proje

**Chart 1   the geographical position of the project**

| **A.4.2.  Type and category(ies) and technology/measure of the <u>small-scale  project activity</u>:** |
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1.   **Type and category(ies) of the small-scale project activity**

The capacity of the proposed project is 12.8 MW, under the threshold qualifying capacity of 15 MW; the project activity can be regarded as a small scale CDM project activity and fit the simplified model and programmers of UNFCCC. The project activity utilizes the hydro potential for power generation. Thus the project type is renewable energy. According to the small-scale CDM modalities, the project type and category are defined as follows:

**Project Type: I.** Renewable energy project

**Project Category: I D** Renewable electricity generation for a grid

2.   **Technologies applied on the small-scale project activity**

The project is a run-of-the-river hydropower project, including diversion tunnel, pressure tube, strobe and factory.  The designed installed capacity is 12.8 MW. The annual output to grid is 49,367MWh.The electricity will be transmitted by 35KV lines to Dongtian substation and promoted by 110kV lines, access to the CCPG.

Major technological parameters of the project are as follows:

**Table 2 the main technical parameter of the project[2]**

| Main structures | Water retaining structures | | Crest elevation 222m ,maximal dam height 2.5m, |
|---|---|---|---|
| | Release works | | Design  flux 152.2m$^{3/}$s, including channel etc |
| Mechanical& Electrical equipments | Hydro Turbines | Type | GD006-WZ-40(f=+20˚) |
| | | Number | 4 |
| | | Max water head (m) | 12 |
| | | Rated water head (m) | 10.75 |

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[2] Tuojiang Hydropower Project Feasibility Research Report

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| | | | |
|---|---|---|---|
| | | Rated flow (m$^3$/s) | 37.25 |
| | | Rated rotation speed (r/min) | 222.16 |
| | Generators | Type | SFW3200-8/1730 |
| | | Number | 4 |
| | | Rated voltage (KV) | 6.3 |
| | | Rated current (A) | 366.25 |
| | | Rated frequency (HZ) | 50 |
| | | Installed Capacity （kW） | 3200 |
| | Lines | | 35KV×6Km |

**3. Environmental safe technology:**
The technologies applied in the proposed project are environmental friendly, and shall not be harmful to the ecosystem, which has been applied world widely.

**4. Technology transfer:**
The main equipments, such as the turbines and electricity generators, are made in the host country. No technology is transferred from other countries to this project activity.

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**A.4.3    Estimated amount of emission reductions over the chosen <u>crediting period</u>:**

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The project chooses the renewable crediting period. The first crediting period is from March, 2008 to 2014. The amount of annual and total emission reductions are explained in the following table 3

**Table3  the estimated amount of emission reductions in the first crediting period**

| Year | Annual estimation of emission reductions in (tCO$_2$e) |
|---|---|
| 2008 | 46,731 |
| 2009 | 46,731 |
| 2010 | 46,731 |
| 2011 | 46,731 |
| 2012 | 46,731 |
| 2013 | 46,731 |
| 2014 | 48,547 |
| Total estimated reductions (tones of CO$_2$e) | 327,117 |
| Total number of crediting years | 7 |
| Annual average over the crediting period of estimated reductions (tones of CO$_2$ e) | 46,731 |

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### A.4.4. Public funding of the <u>small-scale project activity</u>:

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

### A.4.5. Confirmation that the <u>small-scale project activity</u> is not a <u>debundled</u> component of a large scale project activity:

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According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities, a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

1. With the same project participants;
2. In the same project category and technology;
3. Registered within the previous two years; and
4. Whose project boundary is within 1 km of the project boundary of the proposed small scale activity.

The small-scale project is not a debundled component of a large scale project activity.The project proponents further confirm that they have not registered any small scale CDM project activity or applied to register another small scale CDM project activity within the same project boundary, in the same project category and technology/measure.

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

**B.1.    Title and reference of the <u>approved baseline and monitoring methodology</u> applied to the <u>small-scale project activity</u>:**

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**Title of the approved baseline and monitoring methodology:** AMS-I.D.-Grid connected renewable electricity generation (Version 11, EB 31)

**Reference:** Appendix B of the simplified modalities and procedures for small scale CDM project activities

Please click following link for more information about the methodology and reference:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

**B.2    Justification of the choice of the project category:**

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The applicable criteria stated in the methodology ACM0002 for new-planed project are:
1.  The installed capacity is below 15MW;
2.  The project activity comprises renewable energy generation units, and supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

The total installed capacity of Tuojiang Hydropower Station is 12.8MW which is less than 15 MW, therefore it is appropriate to adopt the methodology AMS-I.D. Version 10. This methodology applies renewable electricity generation for a grid. Thus this methodology can be applied to the project.

**B.3.    Description of the <u>project boundary</u>:**

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According to methodology AMS I.D, the project boundaries contain the physical and geographical places that the renewable energy project is related to. The generated electricity of the project will be delivered to CCPG, which includes Henan Province, Hubei Province, Hunan Province, Jiangxi Province, Sichuan Province and Chongqing Municipality Power Grid[3] . The main emission sources and types of GHG in the project boundaries are listed in table 4 below:

**Table 4** Emission sources and gases are included in the project boundary

|  | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | Power generation of CCPG | $CO_2$ | Yes | Included by the methodology. |
|  |  | $CH_4$ | No | Excluded by the methodology |
|  |  | $N_2O$ | No | Excluded by the methodology |
| **Project Activity** | The project | $CO_2$ | No | Excluded by the methodology |
|  |  | $CH_4$ | No | The project emission need not be considered because it is a run-of river hydropower station |
|  |  | $N_2O$ | No | Excluded by the methodology |

**B.4**.    **Description of <u>baseline and its development</u>:**

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In this part, the project developer identified all the potential substituted scenarios as follows:

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[3] Chinese DNA's Guideline of emission factors of Chinese grids, published in Dec. 15th, 2006
http://cdm.ccchina.gov.cn/web/index.asp

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**Alternative 1**: Project activity not undertaken as CDM project activity.

This option is one of feasible alternatives. However, the IRR of the power station is 7.58% without CERs, less than benchmark IRR 10%, thus the project can not be implemented due to various barriers like investment barrier etc. (see B.5 for details).
Thus, the Project Option 1 is unfeasible and is excluded.

**Alternative 2**: Construction of fossil fuel based power plant with equivalent annual electricity generation, supplying power to the present grid mix.

The average annual operating time of thermal power plants of China is 5,633 h[4]in the year of 2006. Consequently, fossil fuel-based power plant with equivalent annual electricity generation has less installed capacity than the Project (13MW). However, building such small capacity (less than 135MW) coal-based power plants in the areas covered by large grids is forbidden by Chinese government[5]. And fossil fuel-fired power plants with the capacity lower than 100 MW are strictly limited for installation[6]. Thus, the Project Option 2 is not available with the Project and is excluded.

**Alternative 3**: Construction of other renewable energy based power plant with equivalent annual electricity generation, supplying power to the present grid mix.

The other renewable energy includes wind, biomass, tidal, solar and geothermal energy. However, these renewable energy sources and the associated technology are unavailable for the project site.
Thus, the Project Option 3 is not available with the Project and is excluded.

**Alternative 4**: Equivalent electricity service provided by the CCPG.
This option is one of feasible alternatives and consistent with all the mandatory laws and regulations. So the Project Option 4 is considered as one of baseline scenarios.

From the above assessment it is concluded that the Project has the only alternative available and hence the baseline scenario is: **Alternative 4–Get equivalent electricity supply from the CCPG annually**

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**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 small-scale CDM project activity:**

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**Assessment and demonstration of additionality**
According to Appendix B of the simplified modalities and procedures for small scale CDM project activities, the simplified model is given. The project must face at least one discriminating barrier that it self can't overcome.See it as follows.
- Investment barrier;
- Technical barrier;
- Practical barrier ;
- Other barrier.

**1. Investment barrier**

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[4] Association of Chinese Power Industry, Statistics for Electricity Generation of China in 2006.

[5] Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135 MW or Below issued by the General Office of the State Council, decree no. 2002-6.

[6] Interim Rules on the Installation and Management of Small-scale Fuel-fired Generators (issued in Aug., 1997).

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The Stations is a run-of river, which situated in Jianghua County, national grade poverty County with no convenient traffic and poor economic conditions. Therefore, the obstacle to the implementation of project activities is the investment barriers.

The insurmountable barrier for the implementation of the project is investment barrier. There are three analysis methods recommended to conduct investment analysis, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

**Option I:** Simple cost analysis. This analysis method can be used if the project activity produces no economic benefits other than CDM related income. However, this option is not applicable to the project because the project activity generates the revenue from the sale of generated electricity.

**Option II:** Investment comparison analysis. This analysis method can be only used if the alternatives to the project are similar investment projects. However, this option is not applicable to the project because the alternative to the proposed project is expansion of existing power plants or construction of new fuel-fired power plants in CCPG, and investing in a new fuel-fired power plant is irrelevant for the project to make business decision of the project owner.

**Option III:** Benchmark analysis. According to *Economic Assessment Rules of Small Hydropower Project SL16-95*, the financial benchmark rate of return (after tax) for Chinese small hydropower projects is 10% of the total investment, therefore the benchmark analysis is applicable to the project.

According to the *Jianghua Tuojiang Hydropower Project Feasibility Research Report*, the IRR was only 7.58% far lower than benchmark IRR 10%, but the IRR would increase by 4%-5% if the project took into account of the CERs income.

The key assumptions are summarized in the following Table 5

**Table 5 Basic parameters for calculation of financial indicators of the project**

| Project | Unite | Number | Data resources |
|---|---|---|---|
| Installed Capacity | MW | 12.8 | Feasibility report |
| Total Investment | ten thousand RMB¥ | 9732.5 | Feasibility report |
| Annual Output | MWh/yr | 49,367 | Feasibility report |
| Electricity Tariff | RMB¥/kWh | 0.30 | Hunan Price Bureau |
| Annual Operation Cost | Ten thousand RMB¥ | 235.96[①] | Feasibility report |
| | | 161.91[②] | |
| Life Period of Project | Year | 30 | Feasibility report |
| Value added tax | % | 17 | Feasibility report |
| Urban Construct &Maintenance tax | % | 5 | Feasibility report |
| Additional Education Fees | % | 3 | Feasibility report |
| Income Tax Rate | % | 33 | Feasibility report |

[①] the Annual Operation Investment take into consideration of Anaphase Support Fund of Reservoir in the first ten years of the project operation period;

[②] the Annual Operation Investment without Anaphase Support Fund of Reservoir since the beginning of eleventh year of the project operation period.

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The IRR with and without CERs refer to as follow:

**Table 6 IRR without CERs income**

| Project | Unite | without CERs income | Benchmark IRR | With CERs Incomes |
|---|---|---|---|---|
| IRR | % | 7.58 | 10 | 11.58 |

According to the benchmark analysis, IRR is only 7.58%, which were obviously below the benchmark of 10%. The project is not financially attractive. It is found that the financial situation is obviously improved under the situations with CERs income.

**2. Sensitivity analysis**

The critical assumptions for investment analysis of the project are the total investment cost, electricity-sales income, and annual operation & management cost. A sensitivity analysis in the contexts of preliminary design phase was conducted to test whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions.

**Table 7** Sensitivity Analysis of the power station(IRR)

| Variation rate / FIRR factor | -10% | -5% | +5% | +10% |
|---|---|---|---|---|
| Total investment | 8.50 | 8.02 | 7.17 | 6.79 |
| Electricity-sales income | 6.62 | 7.17 | 8.04 | 8.49 |
| Management costs | 7.81 | 7.70 | 7.46 | 7.34 |
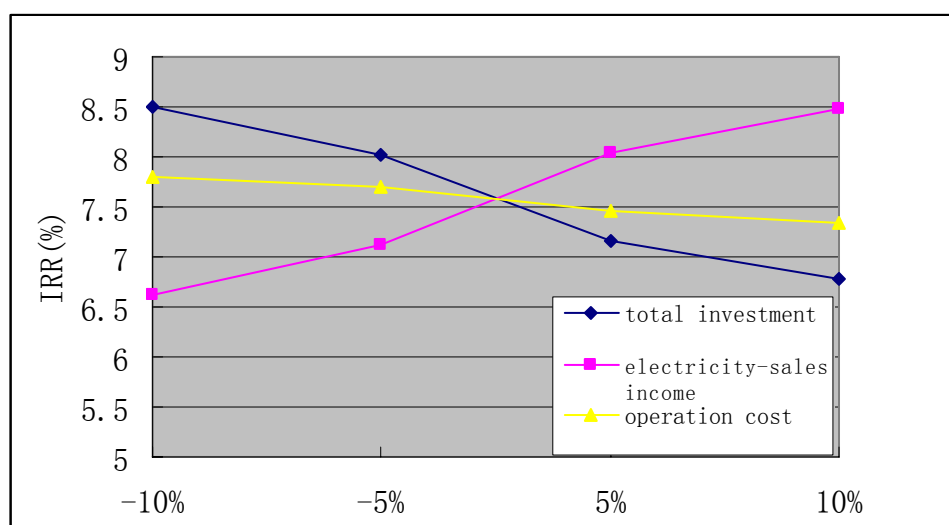
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**Chart 2  Sensitivity Analysis**

Within the reasonable variation scope of the total investment, sale income and management costs, all IRRs are below the benchmark, so the project isn't financially attractive. Therefore the project hasn't enough ability against the risk, needs the CDM support to decrease the risk and improve the feasibility of the project implementation.

**3.  Financing barrier**

The project was prepared to construct early in Match,1985, and preliminary design report was finished by former reconnaissance and design office of water and electricity in Lingling region in November, 1985. Then, the *Tuojiang Hydropower Project Feasibility Research Report* was finished by September,2003. However, the complex geographical condition and long aqueduct lead to the increase of investment which lower IRR, and the project was delayed out of the plan.

The project owner knew about CDM when looking for financing helps in February, 2005, and decided to develop the CDM project, hoping that the CERs income could increase the stockholders' confidence and decrease the investment risk. After embedded reconnaissance and research of the project, the Institute of Water Conservancy and Hydroelectric Power Research of Shaoyang City finished the preliminary design report[7].The IRR is only 7.58% for the stations, which was below the benchmark of 10%. Considering the CERs income, the IRR was increased obviously. The project stockholders decided to start the project[8]after  considering the CERs income during the stockholder convention. Then the bank agree to provide a loan to the project also considering the CERs income[9].

From the above analyses, it is very clear that the project is not financially attractive without CERs revenue from CDM activities. Only when considering the CERs income, the project can start to work and gain a loan from bank. Thus, the project is additional.

| **B.6.**  **Emission reductions:** |
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| **B.6.1.   Explanation of methodological choices:** |
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**Project Emissions**

According to baseline methodology ACM0002, if the power density of project is greater than 4 W/m$^2$ and less than or equal to 10 W/m$^2$, the project emissions calculation formula is as follow:

$$PE_y = \frac{EF_{\text{Res}} * EG_y}{1000} \quad (1)$$

Where:

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[7] the Preliminary Project Design Report on Tuojiang hydropower project

[8] Directorate summary of Jianghua Jianqiao  Hydropower Plant Co., Ltd

[9] Requisition of credit operation examine and approve of subbranch of agriculture bank of China in Jianghua, Hunan province

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$PE_y$ is emission from reservoir expressed as $tCO_2e/yr$;
$ES_{Res}$ is the default emission factor for emissions from reservoirs, and the default value as per EB 23 is 90 kg $CO_2e/MWh$;
$EG_y$ is electricity produced by the hydro electric power project in year $y$, in MWh

**Baseline Emissions**

According to baseline methodology ACM0002, the baseline emissions are the $CO_2$ emissions from the equivalent electricity generation in CCPG that are displaced by the project activity. So the baseline emissions by the project activity during a given year $y$ is obtained as follow:

According to ACM0002, the project emission should be calculated as:

$$BE_y = EG_y \cdot EF_y \quad (2)$$

Where:

$EG_y$ is electricity supplied by the project activity to the grid in year $y$, in MWh;
$EF_y$ is baseline emission factor in year y, in $tCO_2e/MWh$.

According to baseline methodology ACM0002, the baseline emission factor ($EF_y$) is calculated as a Combined Margin (CM), which is consisting of the weighted average of Operating Margin (OM) emission factor and Build Margin (BM) factor by utilizing an ex-ante 3 years data vintage for the CCPG.

the baseline emission factor ($EF_y$) is calculated as a Combined Margin (CM), which is consisting of the weighted average of Operating Margin (OM) emission factor and Build Margin (BM) factor by utilizing an ex-ante 3 years data vintage for the CCPG. The data used for calculation are from an official source (where available) and publicly available. The calculation processes are as follows:

Step 1. Calculating the Operating Margin emission factor （$EF_{OM,y}$）；
Step 2. Calculating the Build Margin emission factor （$EF_{BM,y}$）；
Step 3. Calculating the baseline emission factor （$EF_y$）.

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

According to baseline methodology ACM0002, there are four methods for calculating the $EF_{OM, y}$:

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

Method (c) should be the first methodological choice. However, this method requires the detailed dispatch data of the CCPG, which is confidential information and is not available to be obtained by public. Thus, method (c) is not applicable. Due to the same reasons, the method (b) is not applicable.

Method (a) can 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 normals for hydroelectricity production. The only low-cost/must run resource in CCPG is hydropower plants. It can be found from table 8 that installed capacity of hydropower plants constitute less than 50% of CCPG

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during year 2000 to 2004. Thus, method (a) is applicable to calculate $EF_{OM, y}$. And method (d) can only be used where low-cost/must run resources constitute more than 50% of total grid generation, therefore, method (d) is not applicable to calculate $EF_{OM, y}$.

**Table 8   Electricity generation of hydropower plants in CCPG during year 2000~2004[10]**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| Electricity generation of hydros (%) | 38.00 | 36.76 | 35.95 | 34.43 | 38.37 |

According to baseline methodology ACM0002, the method (a) Simple OM is chosen for calculating the $EF_{OM, y}$. The $EF_{OM, y}$ is calculated by utilizing an *ex-ante* 3 years data vintage for CCPG, the formula as follow:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad (3)$$

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 $i$ (t$CO_2$ / 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) $y$; and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source $j$.
The $CO_2$ emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \quad (4)$$

Where:

$NCV_i$ is the net calorific value (energy content) per mass or volume unit of a fuel $i$;
$OXID_i$ is the the oxidation factor of the fuel;
$EF_{CO2, i}$ is the $CO_2$ emission factor per unit of energy of the fuel $i$.

There are net exports from the CCPG to other power grids, thus the imports are not taken into account.

$EF_{OM,y}$ is calculated according to the statistics information of recent 3 years (from 2002 to 2004), the data are the newest and available at the time of this PDD submission, the detailed calculation is shown in Annex 3.

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

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[10] China Electric Power Yearbook 2001~2005

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According to baseline methodology ACM0002, the Build Margin emission factor ($EF_{BM,\,y}$) is calculated by utilizing an *ex-ante* 3 years data vintage for CCPG, the formulae as follow:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \quad (5)$$

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.*

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total fuel-fired installed capacity, according to the approved deviation[11] by CDM EB, the $EF_{BM,\,y}$ will be calculated as:

1) Based on the most recent years energy balance of the CCPG, calculating the proportions of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired $CO_2$ emissions;

2) Based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the fuel-fired emission factor of the CCPG;

3) Calculating the $EF_{BM,\,y}$ through fuel-fired emission factor times the weighted-average of fuel-fired installed capacity which is more close to 20% in the new capacity additions.

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

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad \lambda_{Oil} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad \lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (6)$$

Where:

$\lambda_{Gas}$, $\lambda_{Oil}$ and $\lambda_{Coal}$ are respectively the percentages of $CO_2$ emissions from the gas-fired, oil-fired, coal-fired power plants in total fuel-fired $CO_2$ emissions;
$F_{i,j,y}$ is the amount of fuel $i$ (tce) consumed by the power grid in year $y$;
$COEF_{i,j}$ is the $CO_2$ emission coefficient (t$CO_2$/tce) of fuel $i$, taking into account the carbon content of the fuels used by the grid and the percent oxidation of the fuel in year $y$.

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

$$EF_{Thermal} = \lambda_{coal} \times EF_{coal,adv} + \lambda_{oil} \times EF_{oil,adv} + \lambda_{gasl} \times EF_{gas,adv} \quad (7)$$

Where:

$EF_{Thermal}$ is the fuel-fired emission factor;

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[11] EB approved deviation for Methodologies AM0005 and AMS-I.D on 7 October 2005.

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$EF_{Coal, Adv}$, $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$ are corresponding to the emission factors of coal, oil and gas, which are applied by the most advanced commercialized technologies.

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

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

Where:

$EF_{BM,y}$ is the Build Margin (BM) emission factor with advanced commercialized technologies for year $y$;
$CAP_{Total}$ is the new capacity additions;
$CAP_{Thermal}$ is the new fuel-fired capacity additions;
$EF_{Thermal}$ is fuel-fired emission factor.

**Step 3: Calculating the baseline emission factor ($EF_y$)**

According to baseline methodology ACM0002, baseline emission factor $EF_y$ is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (9)$$

Where:

The weighs $w_{OM}$ and $w_{BM}$, by default, are 50% ( i.e., $w_{OM}= w_{BM}= 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO$_2$e/MWh.

**Leakage**

According to baseline methodology ACM0002, there is no need for the project to consider leakage ($L_y$).

**Emission Reductions**

The annual emission reduction ($ER_y$) of the project is the difference between baseline emission and project activity emission. The final GHG emission reduction is calculated as follows:

$$ER_y \text{ (tCO}_2\text{e/yr)} = BE_y － PE_y － L_y \quad (10)$$

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

>>

| Data / Parameter: | $NCV_i$ |
|---|---|
| Data unit: | GJ/t or GJ/m$^3$ |
| Description: | The net calorific value (energy content) per mass or volume unit of fuel $i$ |
| Source of data used: | *The China Energy Statistical Yearbook 2005*, Page 365, *General Code Comprehensive Energy Consumption Calculation* (GB2589-81) |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or | Data used are from Chinese authorities. |

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| description of measurement methods and procedures actually applied : | |
|---|---|
| Any comment: | |

| Data / Parameter: | $OXID_i$ |
|---|---|
| Data unit: | % |
| Description: | Oxidation rate of the fuel $i$ |
| Source of data used: | *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | No specific local value available, adopt the IPCC default value. |
| Any comment: | |

| Data / Parameter: | $F_{i, j, y}$ |
|---|---|
| Data unit: | $10^4\,t$, $10^7\,m^3$ |
| Description: | The quantity of fuel $i$ (in a mass or volume unit) consumed by the relevant power sources j in year(s) $y$ |
| Source of data used: | *the China Energy Statistical 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 : | Data are collected from the published official statistics. |
| Any comment: | |

| Data / Parameter: | $EGP_{j, y}$ |
|---|---|
| Data unit: | MWh |
| Description: | The electricity quantity generated by the relevant power sources $j$ in year(s) $y$ |
| Source of data used: | *The China Electric Power Yearbook 2001-2005* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually | Data used are from Chinese authorities. |

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| | |
|---|---|
| **applied :** | |
| **Any comment:** | |

| | |
|---|---|
| | $PR_y$ |
| **Data unit:** | % |
| **Description:** | The internal power consumption of power plants in year(s) $y$ |
| **Source of data used:** | *The China Electric Power Yearbook 2001-2005* |
| **Value applied:** | See Annex 3 for details. |
| **Justification of the choice of data or description of measurement methods and procedures actually applied :** | Data used are from Chinese authorities. |
| **Any comment:** | |

| | |
|---|---|
| **Data / Parameter:** | $CC_{pg}$ |
| **Data unit:** | t/MWh |
| **Description:** | The standard coal consumption of power generation of Chinese mainly sub-critical and super critical power plants. |
| **Source of data used:** | Chinese DNA's Guideline of emission factors of Chinese grids |
| **Value applied:** | 0.32 |
| **Justification of the choice of data or description of measurement methods and procedures actually applied :** | The best available technologies in China are mainly sub-critical and super critical power plants, with the standard coal consumption of power generation of 0.327t/MWh and 0.323t/MWh respectively. It is conservative for standard coal to adopt the value 0.32t/MWh. It can be found from <China Electric Power Yearbook 2005> that the standard coal consumption of power generation is 0.371t/MWh in Central China Power Grid. Thus, the value 0.32t/MWh is very conservative to calculation BM. |
| **Any comment:** | |

| | |
|---|---|
| **Data / Parameter:** | $EF_{CO2, i}$ |
| **Data unit:** | tC/TJ |
| **Description:** | The $CO_2$ emission factor per unit of fuel i |
| **Source of data used:** | *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories* |
| **Value applied:** | See Annex 3 for details. |
| **Justification of the choice of data or description of measurement methods and procedures actually applied :** | No specific local value available, adopt the IPCC default value. |
| **Any comment:** | |

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| Data / Parameter: | $CAP_{j,\,y}$ |
|---|---|
| Data unit: | MW |
| Description: | Installed capacities of hydropower and fuel-fired power of the CCPG during 2000-2004 |
| Source of data used: | *the China Electric Power Yearbook 2001-2005* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

| Data / Parameter: | Installed Capacity |
|---|---|
| Data unit: | MW |
| Description: | Installed capacities of hydropower and fuel-fired power of the CCPG during 2000-2004 |
| Source of data used: | *the China Electric Power Yearbook 2001-2005* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data are collected from the published official statistics. |
| Any comment: | |

| Data / Parameter: | CAPy,j |
|---|---|
| Data unit: | MW |
| Description: | the installed capacity of the y year of the fuel j in CCPG(2002~2004) |
| Source of data used: | *The 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 : | Data are collected from the published official statistics. |
| Any comment: | |

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

>>

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**Project emission**

According to ACM0002, the project is a run-of-river; therefore project emission is zero,
$$PE_y = 0$$

**Baseline emission**

As the discussion in Section B 6.1, the baseline emission factor i.e. the Combined Margin emission factor will be calculated as the average of $EF_{OM}$ and $EF_{BM}$ as Equation[12].
For CCPG, the Baseline Emission Factor is given as follows:

**Table 9**  CM calculation for CCPG (tCO$_2$e/MWh)

| $EF_{OM}$ | $EF_{BM}$ | $EF_y$ |
|---|---|---|
| 1.2776 | 0.6156 | 0.9466 |

Since the annual power supply to the grid from the Project is 49,367MWh, the annual baseline emission ($BE_y$) of the Project is calculated as follow:
$$BE_y = 49,367 \text{ MWh} \times 0.9466 \text{ tCO}_2\text{e /MWh} = 46,731 \text{ tCO}_2 \text{ e /yr}$$

**Leakage**
As mentioned in Section B.6.1, $L_y = 0$

**Emission Reductions**
Since both the project emission and leakage of the Project are zero, the estimated CER per year for the Project is obtained from the follows:
$$ER_y = BE_y - PE_y - L_y = 46,731 \text{tCO}_2\text{e /yr}$$

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

>>
The estimated project emission reductions in the first crediting period are listed in Table 10:
**Table10 The ex-ante estimation of emission reductions**

| Year | Estimation of the project activity emission reductions (tonnes of CO$_2$e) | Estimation of baseline emission reductions (tonnes of CO$_2$e) | Estimation of leakage (tonnes of CO$_2$e) | Estimation of emission reductions (tonnes of CO$_2$e) |
|---|---|---|---|---|
| 2008 | 0 | 46,731 | 0 | 46,731 |
| 2009 | 0 | 46,731 | 0 | 46,731 |
| 2010 | 0 | 46,731 | 0 | 46,731 |
| 2011 | 0 | 46,731 | 0 | 46,731 |
| 2012 | 0 | 46,731 | 0 | 46,731 |
| 2013 | 0 | 46,731 | 0 | 46,731 |
| 2014 | 0 | 46,731 | 0 | 46,731 |
| Total(tonnes of CO$_2$e) | 0 | 327,117 | 0 | 327,117 |

---

[12] Chinese DNA's Guideline of emission factors of Chinese grids

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

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

| Data / Parameter: | *EGy* |
|---|---|
| Data unit: | MWh |
| Description: | Electricity Quantity of the project to CCPG |
| Source of data to be used: | Measured by the ammeter |
| Value of data | Expected electricity quantity 49,367MWh |
| Description of measurement methods and procedures to be applied: | 1.   To monitor and record this data by ammeter continuously<br>2.   Jointly record and check the data by the Hunan power grid, Dongtian transformer substation and Tuojiang power station.<br>3.   Ammeter will be checked once every year and replaced every three years in order to assure the apparatus precision. |
| QA/QC procedures to be applied: | 1.   The power station's monitoring records should be identical to the selling receipts;<br>2.   The percentage of monitoring data is 100%;<br>3.   The written and electrical recorded data should be saved;<br>4.   The saving period is two years after the vintage;<br>5.   The ammeter should be examined by a qualified institution once every year;<br>6.   The data should be recorded by the main and auxiliary ammeters simultaneity. As if the main ammeter is failed, the auxiliary could in support. |
| Any comment: | With low uncertainty |

**B.7.2    Description of the monitoring plan:**
>>
The aim of our monitoring plan is to make sure that the emission reduction quantity monitored and evaluated during the project activities' vintage is completed, consistent, clear and precise. In order to insure the project's operation, the project owner compiled "*the handbook of monitoring and managemen t of Tuojiang Hydropower Project*". It has identified the duties of the related positions. The details are summarized as follows:

**1.   Monitoring subject**
The primary data monitored is the electricity quantity upon grids by the project activity.

**2.   Processing and managing structure**
In order to insure the monitor plan work effectively and efficiently, the project owner established the processing and managing structure as shown in chart 3, which identified the relative staffs and institution for data collection and preservation. In addition, the project owner will designate a monitoring commissioner to take charge of supervising and demonstrating all the measuring and recording tasks, such us collecting data (such as ammeter readings, selling receipts), calculating emissions reduction and preparing monitoring report etc..

The commissioner will receive technical supports from the Hunan CDM project service centre.
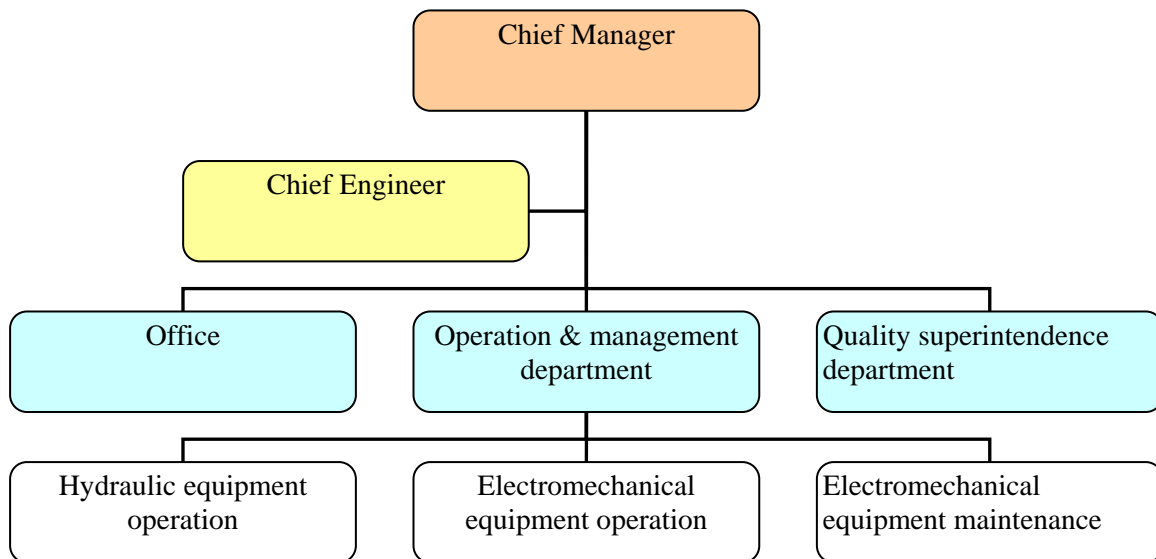
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**Chart 3   processing and management of project**

### 3.   Monitoring apparatus and instalment:

The electric ammeter will be configured as the technology requirements of "the handbook of electric ammeter" (DL/T448-2000). The electricity quantity apparatus should be examined and approved by the project owner and the quality control institution, which should be in accordance with the regulations on "the handbook of electric ammeter" (DL/T448-2000).

The project should simultaneity install main and auxiliary ammeters at two ends. One is installed at the output end of transfer substation(the output ammeter) of the power plants to measure the exports and imports of the electricity; and the other is installed at the input end of transfer substation of grids（the input ammeter）to measure the electricity up and down on grids. The net on-grid electricity quantity is the difference of the up and down electricity. The input ammeter readings shall be the benchmark.

In case of the main ammeter is failed, the auxiliary shall be in support. While the main and auxiliary input ammeters are both failed, the net on-grids electricity quantity offered shall be evaluated by the output ammeter readings and the selling and purchasing receipts.

### 4.  Data monitoring

The project owner takes charge of the regular operation of output ammeter. The grids take charge of regular operation of input ammeter. All apparatus should be maintained in well states. If the error of the input ammeter is between the accepted ranges, the on-grids electricity quantity readings recorded by input ammeter can be used to afford the selling receipts and validate emission reduction. In this case, the detailed operational processes listed bellow:

   i.   The project owner and the power grid read and record the readings of output ammeter and input ammeter at the end of every month. Then they should verify the identity of two readings;
  ii.   The power grid provide the practical electricity quantity to the project owner;
 iii.   The project owner provide power grid with selling receipts and preserve the copies of selling receipts;
  iv.   The power grid provide the project owner with purchasing receipts and the project owner should preserve the copies of receipts;

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    v.   The project owner saves records on the net on-grid electricity quantity of this project provided by the power grids, which is the difference between the up grid electricity quantity and the down grid electricity quantity;

   vi.   The project owner saves the reading records of the input ammeter and the copy of receipts provided by the power grids, which should be offered during the validation process conducted by the officers of DOE.

The principle of the processes is to guarantee the validation officers could obtain the actual ammeter readings and adjustment records.

## 5. Quality control
1) Ammeter adjustment

The ammeter periodic and on-spot periodic tests should follow the national electricity industry standards in order to insure the precision of ammeter. After the tests, the ammeter should be sealed. The project owner and the power grid should seal the ammeter collectively. Any party mustn't dismantle or change independently.

When the following circumstances occurred, all the ammeters should be tested by a qualified measurement institution in 10 days, which is commissioned collectively by the project owner and the power gird:

    i.   The error of output ammeter and input ammeter over the allowable ranges.

   ii.   The ammeter has been repaired or under repairing.

2) Data and information management

All monitoring data should be saved in electrical recording form and the electrical documents should be back in Compact Disc or Hard Disc, and printed on papers. The project owner should also keep the selling and purchasing receipts and prepare a monitoring report at the end of each year, which including the on-grid electricity quantity monitoring files, the verification files, the emission reduction evaluation files and the records on monitoring apparatus' repairs and tests.

The printed documents such as maps, forms, the environment evaluation reports shall be used in accompany with the monitoring plan to prove the authenticity of all the information. In order to make validation officers to obtain the information related to the certificated emission reduction, the project owner should provide the index of project materials and monitoring result reports.

All the monitored data should be distributed to the Hunan CDM project service centre. Moreover, the statistical works and processing works on the data collected, as well as distributing the results to the emission reduction purchaser, the DOE, and the executive board shall either be granted to the service centre.

All the data should be saved two years after the vintage.

## 6. Disposing process of urgency and abnormity
When the monitoring data is abnormal, the on-grid electricity quantity should be confirmed by the processes stated as below:

1)     When the main ammeter is failed, the project owner should read and record the auxiliary ammeter data in stead and the main ammeter and auxiliary ammeter should have the same precision. The main ammeter should be repaired and replaced rapidly, and the main ammeter can't be used before it has been tested carefully.

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2)       When the main and auxiliary ammeter fails to work normally, the on-grid electricity quantity could be determined by the output ammeter readings' records and the electricity consumed by itself. The project owner should provide the method to evaluate the on-grid electricity quantity in clear and conservative ways and demonstrate the rationality to DOE.

**7.  Training program**

Firstly, the project owner should train all the relative officers. The whole training program contains the CDM knowledge, the operational regulations, the quality control (QC) standard flows, the data recording requirements and the management rules.

If obtain further information on our monitoring plan, please refer to the *"the handbook of monitoring and management of Tuojiang Hydropower Project"*.

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

\>>
**Final Date of completion of the application of the baseline  and monitoring methodology**
     15/05/2007
Name of person/entity of completion of the application of the baseline  and monitoring methodology
**Yu Cai**   Expert
Unit: Hunan CDM Project Service Center     Email: ycai82@126.com        Tel: +86-731-4586782
**Lichun Fu**   Expert
Unit: Hunan CDM Project Service Center     Email: fulichun2004@126.com Tel: +86-731-4586782
**Hanwen Zhang**  Associate Researcher
Unit: Hunan CDM Project Service Center    Email：hncdmzhw@126.com  Tel: +86-731-4586782
**Above individuals / entities determined the baseline are not as project participants.**

| **SECTION C.   Duration of the <u>project activity</u> / <u>crediting period</u>** |
| --- |

| **C.1      Duration of the <u>project activity</u>:** |
| --- |

| **C.1.1.   Starting date of the <u>project activity</u>:** |
| --- |

\>>
13/04/2005 (time of project start)

| **C.1.2.   Expected <u>operational lifetime of the project activity</u>:** |
| --- |

\>>
30 years

| **C.2      Choice of the <u>crediting period</u> and related information:** |
| --- |

| **C.2.1.   Renewable crediting period** |
| --- |

| **C.2.1.1.        Starting date of the first <u>crediting period</u>:** |
| --- |

\>>
01/01/2008

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| **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:** |
|---|---|

>>
Not applicable

| **C.2.2.2.** | **Length:** |
|---|---|

>>
Not applicable

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| SECTION D. Environmental impacts |
|---|

>>

| D.1. If required by the <u>host Party</u>, documentation on the analysis of the environmental impacts of the project activity: |
|---|

>>

In accordance with relevant regulations of Chinese government, any hydropower project activity in China must comply with relevant environmental regulations and must carry out the environmental impact assessment. The project owner entrusted a third party: Yongzhou Environmental Protection Scientific Research Station to conduct the environmental impact assessment (EIA) on Tuojiang Hydropower project, then obtained the approval from Environmental Protection Bureau of Hunan Province.
And then the project obtained the Approval Letter (Xianghuanping [2004] No.46) from Hunan Provincial Environmental Protection Bureau.

The main comments of the EIA report are as follows:

**1. Effect to the water quality**
It's different of the effects of the project on water environment during the construction period and operation period. There will be 1100 personnel during the project construction period, and it will produce some sewage, $2500m^3/d$, <$5000 m^3/d$, which contains SS, COD, petroleum and so on. But the component is simple. There will be on water contamination during the operation period.

**2. Effect to the air quality**

During the project construction period, it will cause dust pollution and some environmental effects, which can be reduced by spraying water and other measures. During the project operation period, there is no air pollution.

**3. Noise**
The noise influence mainly comes from the operation of the machinery, basic digging and exploding in construction period. The location of the project is so lonely that there is few people to live in, therefore the effect to human beings is very limited.

**4. Effect to the ecology**

The project is a run-of-river hydropower station and no expanding area of flooding, so it will cause very little effect to the living things in river and on land. After the completion of the project, it will cause sedimentation of silt. In order to reduce the sediment in project site, it should adopt the measure of "Clear water collection and muddy water discharge" and install sand separation facility.

**5. cultural relic**

No cultural relic is destroyed.

**6. society economy**

The project will promote the local agriculture, fish, tourisms and ship development. The project do much contribution to the local society economy development.
General conclusion: The project will cause some impacts on environment, but after the finishing of the project, the impacts will disappear. Tuojiang Small Hydropower Station will be in strict accordance with

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the requirements of environmental protection. After the project being completed, it will be put into operation only after the inspection and acceptance of Environmental Protection Department.

---

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

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>>

In summary, all the necessary national legal procedures relevant to environmental impacts have been finished. The national and local environmental authorities considered that the Project had no negative impact on the environment and approved the Project.

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| SECTION E. Stakeholders' comments |
|---|

>>

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

>>

The project participates, government of Tuojiang County put up affiche to collect the stakeholders' comments. On the 5th, April, 2006, the colloquium of the stakeholders was hold in building site headquarters of Tuojiang hydropower station in Tuojiang County[13]. The informants included local residents, emigrations, project workers, government officers of different sex, different careers, different ages and different educational levels. During the colloquium, the project participates introduced the general situation of the project and emphasized the importance of the stakeholders' comments. Meanwhile the local government officer expressed the recognition of the government to the project, and encouraged all the people to give more suggests about the project.

The results of the colloquium was summarized and analyzed in E.2.

| E.2. Summary of the comments received: |
|---|

>>

The conference representatives and informants all consider that the project will relieve the local electrotonic situation and promote the local economic development. The basic establishment built by the project owner will bring much convenience to the local people. All the people consider the proposed project an advantaged one and support to start the project. And some problems that need to be solved are listed below.

1. The project participates should communicate and assort with the local government.
2. Worrying about the project will affect the local environment and plants, and where the wastewater will be let out.
3. The residents along the channel line are worried about the effects to the water source and that they can not drink and irrigation normally.
4. Require the project participates provide the full land compensating fund.
5. Because of the ruin of the plants along the channel line, the residents are worried about the soil and water loss.
6. Because of the high flow speed of the channel, the residents are worried about the hidden trouble to the children's safety.
7. Require the project participates to bring the lowest construction pollution.

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

>>

The project participaties attached importance to the comments received and took positive measures to the following parts.

1. The project participates will hold colloquium with the local government regularly to discuss the problems of the construction and operation periods then put up the results to the residents.
2. The environmental safeguards in the environmental impact report will be brought into effect strictly. The disadvantages of the project will be minimized and the advantages will be maximized.
3. According to the irrigation problem, the project participates will make sure the downstream flow not under 13m$^3$/s. And to the dehydration section, the dehydration section irrigation

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[13] Conference summary of stakeholders' comments about Tuojiang hydropower station

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plan will be actualized and make sure that there will be no effect to the irrigation of the dehydration section[14].

4. The land compensations of the dam area have been finished. The land compensations of the storeroom area in under investigation, and now the government is collecting the results.
5. According to the drinking and irrigation problem, the project participates will build 6 new wells and 4 water pool along the channel line.
6. The project participates will build protecting fence along the channel and put up warning brand to protect the safety of the residents as possible as they can.
7. The Institute of Water Conservancy and Hydroelectric Power Research of Shaoyang City was consigned by the project participates to investigate and design the project. And the project participates will supervise and examine the construction quality to make sure the quality of the project.

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[14] Document(promise letter) of Jianghua Jianqiao Hydropower Plant Co., Ltd

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**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

| | |
|---|---|
| Organization: | Jianghua Jianqiao Hydropower Plant Co., Ltd |
| Street/P.O.Box: | Number 187, Changzheng Road, Tuojiang, Jianghua, Yongzhou,Hunan |
| Building: | Tuojiang Jianqiao Hydropower Plant Co., Ltd |
| City: | Yongzhou |
| State/Region: | Hunan |
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| FAX: | +86-746-2323390 |
| E-Mail: | jianqiao_sd@hotmail.com |
| URL: | / |
| Represented by: | Dongmei He |
| Title: | President |
| Salutation: | Ms |
| Last Name: | Dongmei |
| Middle Name: | / |
| First Name: | He |
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| | |
|---|---|
| **Organization:** | Carbon Asset Management Sweden AB |
| **Street/P.O.Box:** | Drottninggatan 92-94 |
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| **E-Mail:** | co2@tricorona.se |
| **URL:** | www.tricorona.se |
| **Represented by:** | Niels Von Zweigbergk |
| **Title:** | President & CEO |
| **Salutation:** | Mr. |
| **Last Name:** | Zweigbergk |
| **Middle Name:** | Von |
| **First Name:** | Niels |
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# Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

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

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## ANNEX 3
## BASELINE INFORMATION[15]

The installed capacity, fuel consumption data used for OM and BM calculation are derived from *China Energy Statistical Yearbook*, *China Electric Power Yearbook*. Furthermore, the data are compiled by Chinese DNA, for more information, please refer to following link:
http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1235

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

| Fuel | Low Calorific Value | Emission Factor ($tCO_2/TJ$) | Oxidation Factor |
|------|---------------------|------------------------------|------------------|
| Raw Coal | 20908 kJ/kg | 94.6 | 100% |
| Cleaned Coal | 26344 kJ/kg | 94.6 | 100% |
| Other Washed Coal | 8363 kJ/kg | 94.6 | 100% |
| Coke | 28435 kJ/kg | 107 | 100% |
| | | | |
| Crude Oil | 41816 kJ/kg | 73.3 | 100% |
| Gasoline | 43070 kJ/kg | 69.3 | 100% |
| Diesel Oil | 42652 kJ/kg | 74.1 | 100% |
| Fuel Oil | 41816 kJ/kg | 77.4 | 100% |
| | | | |
| Natural Gas | 38931 kJ/m$^3$ | 56.1 | 100% |
| Coke Oven Gas | 16726 kJ/m$^3$ | 44.4 | 100% |
| Other Gas | 5227 kJ/m$^3$ | 44.4 | 100% |
| LPG | 50179 kJ/kg | 63.1 | 100% |
| Refinery Dry Gas | 46055 kJ/kg | 57.6 | 100% |

Data Source:

The net calorific values are quoted from *China Energy Statistical Yearbook 2005, Page 365*.

The emission factors are quoted from *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories* , Table 2.2, Page 2.16, Chapter 2, Volume 2.

The default oxidation factor is assumed to be 1 on Page 2.6, Chapter 2, Volume 2 of *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

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[15] Chinese DNA's Guideline of emission factors of Chinese grids

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## Step 1: Calculating the Operating Margin emission factor ($EF_{OM,y}$)

**Table A2   Simple OM Emission Factors Calculation of CCPG for Year 2002**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | EF | Oxidation | Average Low Calorific Value | CO₂ Emission (tCO₂e) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | $(tCO_2/TJ)$ | (%) | $(MJ/t,km^3)$ | $K=G*H*I*J$ /10000 (for mass unit) |
| | | A | B | C | D | E | F | $G=A+B+C+D+E+F$ | H | I | J | $K=G*H*I*J$ /1000 (for volume unit) |
| Raw Coal | $10^4$ t | 1062.63 | 4679.02 | 1710 | 1113.78 | 398.57 | 1964.32 | 10928.32 | 94.6 | 100 | 20908 | 211827873.7 |
| Cleaned Coal | $10^4$ t | 2.72 | | | | | | 2.72 | 94.6 | 100 | 26344 | 66430.54781 |
| Other Washed Coal | $10^4$ t | 3.66 | 26.49 | | | 249.99 | | 280.14 | 94.6 | 100 | 8363 | 2171973.055 |
| Coke | $10^4$ t | | 1.15 | | | | | 1.15 | 107 | 100 | 28435 | 34289.48215 |
| Coke Oven Gas | $10^8$ m³ | | | 1.11 | | | | 1.11 | 44.4 | 100 | 16726 | 82432.4184 |
| Other Gas | $10^8$ m³ | | 2.16 | | | | | 2.16 | 44.4 | 100 | 5227 | 50129.0208 |
| Crude Oil | $10^4$ t | | 0.67 | 1.17 | | | 0.81 | 2.65 | 73.3 | 100 | 41816 | 81225.4892 |
| Diesel Oil | $10^4$ t | 1 | 1.34 | 1.08 | 2.19 | 0.51 | 0.51 | 6.63 | 74.1 | 100 | 42652 | 209542.0252 |
| Fuel Oil | $10^4$ t | 0.33 | 0.16 | 0.34 | 0.69 | | 1.51 | 3.03 | 77.4 | 100 | 41816 | 98067.71952 |
| LPG | $10^4$ t | | 0.02 | | | | | 0.02 | 63.1 | 100 | 50179 | 633.25898 |
| Refinery Dry Gas | $10^4$ t | 0.49 | | | 1.9 | | | 2.39 | 57.6 | 100 | 46055 | 64992.816 |
| Natural Gas | $10^8$ m³ | | | | | | 1.75 | 1.75 | 56.1 | 100 | 38931 | 382205.0925 |
| | | | | | | | | | | | **Total** | **215069794.7** |

Data Source: *China Energy Statistical Yearbook 2000-2002*

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**Table A3   Fuel-fired Electricity Generation of CCPG for Year 2002**

| Province | Electricity Generation ($10^8$ kWh) | Electricity Generation (MWh) | Auxiliary Power Ratio (%) | Supplied Electricity (MWh) |
|---|---|---|---|---|
| Jiangxi | 186.48 | 18648000 | 7.67 | 17217698 |
| Henan | 847.34 | 84734000 | 8.03 | 77929860 |
| Hubei | 343.01 | 34301000 | 7.73 | 31649533 |
| Hunan | 200.58 | 20058000 | 7.73 | 18507517 |
| Chongqing | 147.27 | 14727000 | 10.21 | 13223373 |
| Sichuan | 278.79 | 27879000 | 9.59 | 25205404 |
| **Total** | | | | 183733385 |

Data Source: *China Electric Power Yearbook 2003*

According to table A2, the total $CO_2$ emissions of CCPG is 219439194 tCO$_2$e in year 2002. According to table A3, the total supplied electricity of CCPG is 183733384.7 MWh. According to formula (3) in section B.6.1, the $EF_{OM, Simple, 2002}$ is 1.1943349 tCO$_2$e/MWh.

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**Table A4   Simple OM Emission Factors Calculation of CCPG for Year 2003**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | EF | Oxidation | Average Low Calorific Value | $CO_2$ Emission $(tCO_2e)$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | $(tCO_2/TJ)$ | (%) | $(MJ/t, km^3)$ | $K=G*H*I*J$ /10000 (for mass unit) |
| | | A | B | C | D | E | F | G=A+B+ C+D+E+F | H | I | J | $K=G*H*I*J$ /1000 (for volume unit) |
| Raw Coal | $10^4$ t | 1427.41 | 5504.94 | 2072.44 | 1646.47 | 769.47 | 2430.93 | 13851.66 | 94.6 | 100 | 20908 | 273971539.9 |
| Cleaned Coal | $10^4$ t | | | | | | | 0 | 94.6 | 100 | 26344 | 0 |
| Other Washed Coal | $10^4$ t | 2.03 | 39.63 | | | 106.12 | | 147.78 | 94.6 | 100 | 8363 | 1169146.396 |
| Coke | $10^4$ t | | | | 1.22 | | | 1.22 | 107 | 100 | 28435 | 37119.049 |
| Coke Oven Gas | $10^8$ m$^3$ | | | 0.93 | | | | 0.93 | 44.4 | 100 | 16726 | 69064.9992 |
| Other Gas | $10^8$ m$^3$ | | | | | | | 0 | 44.4 | 100 | 5227 | 0 |
| Crude Oil | $10^4$ t | | 0.5 | 0.24 | | | 1.2 | 1.94 | 73.3 | 100 | 41816 | 59463.18832 |
| Diesel Oil | $10^4$ t | 0.52 | 2.54 | 0.69 | 1.21 | 0.77 | | 5.73 | 74.1 | 100 | 42652 | 181097.4064 |
| Fuel Oil | $10^4$ t | 0.42 | 0.25 | 2.17 | 0.54 | 0.28 | 1.2 | 4.86 | 77.4 | 100 | 41816 | 157296.7382 |
| LPG | $10^4$ t | | | | | | | 0 | 63.1 | 100 | 50179 | 0 |
| Refinery Dry Gas | $10^4$ t | 1.76 | 6.53 | | 0.66 | | | 8.95 | 18.2 | 100 | 46055 | 75018.9895 |
| Natural Gas | $10^8$ m$^3$ | | | | | 0.04 | 2.2 | 2.24 | 56.1 | 100 | 38931 | 489222.5184 |
| | | | | | | | | | | | **Total** | **276208969.2** |

Data Source: *China Energy Statistical Yearbook 2004*

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**Table A5   Fuel-fired Electricity Generation of CCPG for Year 2003**

| Province | Electricity Generation ($10^8$ kWh) | Electricity Generation (MWh) | Auxiliary Power Ratio (%) | Supplied Electricity (MWh) |
|---|---|---|---|---|
| Jiangxi | 271.65 | 27165000 | 6.43 | 25418291 |
| Henan | 955.18 | 95518000 | 7.68 | 88182218 |
| Hubei | 395.32 | 39532000 | 3.81 | 38025831 |
| Hunan | 295.01 | 29501000 | 4.58 | 28149854 |
| Chongqing | 163.41 | 16341000 | 8.97 | 14875212 |
| Sichuan | 327.82 | 32782000 | 4.41 | 31336314 |
| **Total** | | | | 225987719 |

Data Source: *China Electric Power Yearbook 2004*

According to table A4, the total $CO_2$ emissions of CCPG is **276208969.2** $tCO_2e$ in year 2003. According to table A5, the total supplied electricity of CCPG is 225987719.2 MWh. According to formula (3) in section B.6.1, the $EF_{OM, Simple, 2003}$ is 1.22223 $tCO_2e$/MWh.

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**Table A6   Simple OM Emission Factors Calculation of CCPG for Year 2004**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | EF | Oxidation | Average Low Calorific Value | $CO_2$ Emission (t$CO_2$e) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | (t$CO_2$/TJ) | (%) | (MJ/t,km$^3$) | $K=G*H*I*J$ /10000 (for mass unit) |
| | | A | B | C | D | E | F | $G=A+B+$ $C+D+E+F$ | H | I | J | $K=G*H*I*J$ /1000 (for volume unit) |
| Raw Coal | $10^4$ t | 1863.8 | 6948.5 | 2510.5 | 2197.9 | 875.5 | 2747.9 | 17144.1 | 94.6 | 100 | 20908 | 339092605.3 |
| Cleaned Coal | $10^4$ t | | 2.34 | | | | | 2.34 | 94.6 | 100 | 26344 | 58316.13216 |
| Other Washed Coal | $10^4$ t | 48.93 | 104.22 | | | 89.72 | | 242.87 | 94.6 | 100 | 8363 | 1921441.232 |
| Coke | $10^4$ t | | 109.61 | | | | | 109.61 | 107 | 100 | 28435 | 3334933.575 |
| Coke Oven Gas | $10^8$ m$^3$ | | | 1.68 | | 0.34 | | 2.02 | 44.4 | 100 | 16726 | 150012.1488 |
| Other Gas | $10^8$ m$^3$ | | | | | 2.61 | | 2.61 | 44.4 | 100 | 5227 | 60572.5668 |
| Crude Oil | $10^4$ t | | 0.86 | 0.22 | | | | 1.08 | 73.3 | 100 | 41816 | 33103.21824 |
| Gasoline | $10^4$ t | | 0.06 | | | 0.01 | | 0.07 | 69.3 | 100 | 43070 | 2089.3257 |
| Diesel Oil | $10^4$ t | 0.02 | 3.86 | 1.7 | 1.72 | 1.14 | | 8.44 | 74.1 | 100 | 42652 | 266747.3141 |
| Fuel Oil | $10^4$ t | 1.09 | 0.19 | 9.55 | 1.38 | 0.48 | 1.68 | 14.37 | 77.4 | 100 | 41816 | 465093.4421 |
| LPG | $10^4$ t | | | | | | | 0 | 63.1 | 100 | 50179 | 0 |
| Refinery Dry Gas | $10^4$ t | 3.52 | 2.27 | | | | | 5.79 | 57.6 | 100 | 46055 | 153595.2672 |
| Natural Gas | $10^8$ m$^3$ | | | | | | 2.27 | 2.27 | 56.1 | 100 | 38931 | 495774.6057 |
| | | | | | | | | | | | Total | 346034284.1 |

Data Source: *China Energy Statistical Yearbook 2005*

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**Table A7  Fuel-fired Electricity Generation of CCPG for Year 2004**

| Province | Electricity Generation | Electricity Generation | Auxiliary Power Ratio | Supplied Electricity |
|---|---|---|---|---|
|  | ($10^8$ kWh) | (MWh) | (%) | (MWh) |
| Jiangxi | 301.27 | 30127000 | 7.04 | 28006059 |
| Henan | 1093.52 | 109352000 | 8.19 | 100396071 |
| Hubei | 430.34 | 43034000 | 6.58 | 40202363 |
| Hunan | 371.86 | 37186000 | 7.47 | 34408206 |
| Chongqing | 165.2 | 16520000 | 11.06 | 14692888 |
| Sichuan | 346.27 | 34627000 | 9.41 | 31368599 |
| **Total** |  |  |  | 249074186 |

Data Source: *China Electric Power Yearbook 2005*

According to table A6, the total $CO_2$ emissions of CCPG is 346034284.1 $tCO_2e$ in year 2004. According to table A7, the total supplied electricity of CCPG is 249074186 MWh. According to formula (3) in section B.6.1, the $EF_{OM, Simple, 2004}$ is 1.389282 $tCO_2e$/MWh.

The Operating Margin (OM) emission factor is the weighted average emission factors of year 2002-2004, as follow:

$$EF_{OM} = 1.2776 \text{ } tCO_2e/MWh$$

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

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

Table A8   Percentages of $CO_2$ emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired $CO_2$ emissions

| | | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | Average Low Calorific Value | Emission Factor (tCO$_2$/TJ) | Oxidation | CO$_2$ Emission (tCO$_2$e) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel | Unit | A | B | C | D | E | F | G=A+…+F | H | I | J | K=G*H*I*J/100 |
| Raw Coal | 10$^4$ t | 1863.80 | 6948.50 | 2510.50 | 2197.9 | 875.50 | 2747.90 | 17144.1 | 20908 kJ/kg | 94.6 | 100% | 339092605.3 |
| Cleaned Coal | 10$^4$ t | 0 | 2.34 | 0 | 0 | 0 | 0 | 2.34 | 26344 kJ/kg | 94.6 | 100% | 58316.13216 |
| Other Washed Coal | 10$^4$ t | 48.93 | 104.22 | 0 | 0 | 89.72 | 0 | 242.87 | 8363 kJ/kg | 94.6 | 100% | 1921441.232 |
| Coke | 10$^4$ t | 0 | 109.61 | 0 | 0 | 0 | 0 | 109.61 | 28435 kJ/kg | 107 | 100% | 3334933.575 |
| **Subtotal** | | | | | | | | | | | | **344407296.2** |
| Crude Oil | 10$^4$ t | 0 | 0.86 | 0.22 | 0 | 0 | 0 | 1.08 | 41816 kJ/kg | 73.3 | 100% | 33103.21824 |
| Gasoline | 10$^4$ t | 0 | 0.06 | 0 | 0 | 0.01 | 0 | 0.07 | 43070 kJ/kg | 69.3 | 100% | 2089.3257 |
| Diesel Oil | 10$^4$ t | 0.02 | 3.86 | 1.70 | 1.72 | 1.14 | 0 | 8.44 | 42652 kJ/kg | 74.1 | 100% | 266747.3141 |
| Fuel Oil | 10$^4$ t | 1.09 | 0.19 | 9.55 | 1.38 | 0.48 | 1.68 | 14.37 | 41816 kJ/kg | 77.4 | 100% | 465093.4421 |
| **Subtotal** | | | | | | | | | | | | **767033.3001** |
| Natural Gas | 10$^7$ m$^3$ | 0 | 0 | 0 | 0 | 0 | 22.7 | 22.7 | 38931 kJ/m$^3$ | 56.1 | 100% | 495774.6057 |
| Coke Oven Gas | 10$^7$ m$^3$ | 0 | 0 | 16.8 | 0 | 3.4 | 0 | 20.2 | 16726 kJ/m$^3$ | 44.4 | 100% | 150012.1488 |
| Other Gas | 10$^7$ m$^3$ | 0 | 0 | 0 | 0 | 26.1 | 0 | 26.1 | 5227 kJ/m$^3$ | 44.4 | 100% | 60572.5668 |
| LPG | 10$^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50179 kJ/kg | 17.2 | 100% | 0 |
| Refinery Dry Gas | 10$^4$ t | 3.52 | 2.27 | 0 | 0 | 0 | 0 | 5.79 | 46055 kJ/kg | 57.6 | 100% | 153595.2672 |
| **Subtotal** | | | | | | | | | | | | **859954.5885** |
| Total | | | | | | | | | | | | **346034284.1** |

Data Source: *China Energy Statistical Yearbook 2005*

According to table A8 and formula (6) in section B.6.1, the percentages of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired $CO_2$ emissions are calculated as:

$$\lambda_{Coal} = 99.53\%, \quad \lambda_{Oil} = 0.22\%, \quad \lambda_{Gas} = 0.25\%$$

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Due to the sum of $\lambda_{Oil}$ and $\lambda_{Gas}$ account for only 0.47% of total fuel-fired $CO_2$ emissions, it is reasonable to replace $EF_{Thermal}$ with $EF_{Coal, Adv}$. As a conservative approach, the final $EF_{Thermal}$ is calculated as follow:

$$EF_{Thermal} = EF_{Coal, Adv} \cdot (1 - \lambda_{Oil} - \lambda_{Gas})$$

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

The best available technologies in China are mainly sub-critical and super critical power plants, with the standard coal consumption of power generation of 327g/kWh and 323g/kWh respectively. It is conservative for standard coal to adopt the value 320g/kWh. It can be found from <China Electric Power Yearbook 2005> that the standard coal consumption of power generation is 371kg/kWh in Central China Power Grid. Thus, the value 320g/kWh is very conservative to calculation BM.

Parameters used for calculating coal-fired plant emission factor are shown in table A9 below:

**Table A9   Parameters used for calculating coal-fired plant emission factor**

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| NCV of standard coal | TJ/t coal | 0.02927 | The data is derived from General Code Comprehensive Energy Consumption Calculation (GB2589-81) |
| Coal consumption of power generation | t/MWh | 0.32 | Conservative value |
| Emission factor of coal | $tCO_2$/TJ | 94.6 | The data is derived from IPCC2006 |
| Oxidation factor of coal | / | 100% | The data is derived from IPCC2006 |

The $EF_{Thermal}$ is 0.8819 $tCO_2$e/MWh

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

**Table A10   Installed Capacities of CCPG in Year 2004**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 5496 | 21788.5 | 9509.3 | 6779.5 | 3271.1 | 6900.3 | 53744.7 |
| Hydro | MW | 2549.9 | 2438 | 7415.1 | 7448.2 | 1407.9 | 13382.9 | 34642 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & Others | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | |
| Total | MW | 8045.9 | 24226.5 | 16924.4 | 14227.8 | 4679 | 20283.2 | 88386.8 |

Data Source: *China Electric Power Yearbook 2005*

**Table A11  Installed Capacities of CCPG in Year 2001**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 4869.8 | 15349 | 8077.3 | 4997.8 | 2898.3 | 6377 | 42569.2 |
| Hydro | MW | 2067.8 | 2438 | 7125.6 | 5966.1 | 1268 | 11531.5 | 30397 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & Others | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | |
| Total | MW | 6937.6 | 17787 | 15202.9 | 10963.8 | 4166.3 | 17908.5 | 72966.1 |

Data Source: *China Electric Power Yearbook 2002*

**Table A12  Installed Capacities of CCPG in Year 2000**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 4474.3 | 13789 | 8038.8 | 4477.4 | 2995 | 6090.1 | 39864.6 |
| Hydro | MW | 1846 | 1528 | 7070.5 | 5858 | 1327 | 11008.3 | 28637.8 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & Others | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | |
| Total | MW | 6320.3 | 15317 | 15109.3 | 10335.4 | 4322 | 17098.4 | 68502.4 |

Data Source: *China Electric Power Yearbook 2001*

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**Table A13   Installed Capacity from Year 2000-2004**

|  | Year 2000 | Year 2001 | Year 2004 | New Capacity Additions from Year 2000-2004 | Percentage of New Capacity Additions |
|---|---|---|---|---|---|
|  | A | B | C | D=C-A |  |
| Fuel-fired (MW) | 39864.6 | 42569.2 | 53744.7 | 13880.1 | 69.80% |
| Hydro (MW) | 28637.8 | 30397 | 34642 | 6004.2 | 30.20% |
| Nuclear (MW) | 0 | 0 | 0 | 0 | 0.00% |
| Wind & Others (MW) | 0 | 0 | 0 | 0 | 0.00% |
| Total （MW） | 68502.4 | 72966.2 | 88386.7 | 19884.3 | 100.00% |
| Percentage of Year 2004 | 77.5% | 82.55% | 100% | 22.50% |  |

It can be concluded from table A13 that capacity additions from year 2000 to 2004 is closer to 20% of the total additions and it is obvious the capacity additions during year 2000 to 2004 are larger than the capacity of five plants, so year 2000 and 2004 are chosen to calculate the BM emission factor of CCPG.

According to table A13 and formula (8) in section B.6.1, the $EF_{BM}$ is calculated as:

$$EF_{BM} = 0.6156 \text{ tCO}_2\text{e/MWh}$$

**Step 3: Calculating the baseline emission factor ($EF_y$)**

According to formula (9) in section B.6.1, the baseline emission factor of CCPG is calculated as:

$$EF_y = 0.9466 \text{ tCO}_2\text{e/MWh}$$

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**Annex 4**

**MONITORING INFORMATION**

The monitoring plan of the Project was described in Section B.7.2, and hence will not be repeated here. Please refer to section B.7.2 and "Manual for Monitoring and Management of Tuojiang Hydropower Station" for more details.

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