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

CONTENTS

Annexes

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. • 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

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

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The title of the project: China Xieshui Small Rundle Hydropower Project

Document version: 01

Date: 15/05/2007

A.2. Description of the small-scale project activity:

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Description of the projects activity:

China Xieshui Small Rundle Hydropower Project (hereafter referred to as "the Project"), a run-of-the-river hydropower project, is located in Shimen county, Changde city, Hunan province, P. R. C. The total installed capacity 8.29MW (1.89MW+3.2MW+3.2MW). The whole net electricity generation per year is 29,164.4MWh[1]. And the electricity will be transmitted to Taiping Substation, access to the Central China Power Grid (CCPG for short), in which the fossil-fuel power generation is dominating. The annual emission reduction will be 27,607 tCO_2e and 184,370 tCO_2e in the first crediting period.

The project contributes to the local sustainable development in following aspects:

- The project could provide clean electricity to mitigate power shortage in local place, reduce the consumption of fossil fuel and achieve greenhouse gas (GHG) emission reductions.
- The implementation of the project will promote the ecology protection project of electricity substituted for fuel of Shimen County.
- The project can help to improve the local infrastructure condition
- The project will be contributively to the development of the local economy and the alleviation of poverty, and will bring 21 employment opportunities during the operation period and improve the local production and living conditions.

[1] Xieshui Rundle Hydropower Project Feasibility Research Report

A.3. Project participants:

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Table 1 Name of Party involved

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)
P.R. China (host)	Shimen Tiande Hydropower Exploitation Com. Ltd	No
The Kingdom of Sweden	Carbon Asset Management Sweden AB	No

A.4. Technical description of the small-scale project activity:

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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Shimen County, Changde 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 Xieshui Small Rundle Hydropower Project is located in the northwest of Hunan Province which is 130 km far away from Shimen county.

Longitude: 110°20′ ~ 110°59′E,

Latitude: 29°58′~ 30°08′N.

See it in fig-1.

Fig. 1 Location of the Project

A.4.2. Type and category (ies) and technology/measure of the small-scale project activity:

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The proposed project activity falls into:

Project Type: I. Renewable energy project
Project Category: I D Renewable electricity generation for a grid

The technique of the project activity comprises:

The Project is a run-of-river plant. The main construction structures include diversion tunnel, pressure pipe and power house etc. The total installed capacity is 8.29MW. The operation period is 30 years. And the electricity will be transmitted to Taiping Substation, access to the CCPG.

Major technological parameters of the project are as follows:

Table 2 Design features and characteristics of the project[2]

	First level	Second level	Third level
Turbine			
Type	XJE-W-50B/1X11.5	HLR687-WJ-60R	HLR153-WJ-71
Number	3	4	4
Installed capacity	0.63MW	0.8 MW	0.8MW
Rated flow	1.5 m^3/s	0.83 m^3/s	$3m^3/s$
Rated rotation speed	1000r/min	1000 r/min	600 r/min
Electricity generator			
Type	SFW630-6/990	SFW800-6/990	SFW800-10/1180
Number	3	4	3
Unit capacity	630kW	800 kW	800 kW
Rated voltage	0.4kV	0.4 kV	0.4 kV
Power factor	0.8	0.8	0.8

Environmentally Safe Technology
The technology, which has been used widely in the world, is safe on environment characteristics of the project. The construction methodology will not permit a negative damage to the ecosystem, and also helpful to promote the sustainable development of the local place and the country.

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.

[2] Xieshui Rundle Hydropower Project Feasibility Research Report

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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The project chooses the renewable crediting period. The first crediting period is from January, 2008 to December, 2014. See the details in table3.

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

Year	Annual estimation of emission reductions (tCO_2e)
2008	18,737*
2009	27,607
2010	27,607
2011	27,607
2012	27,607
2013	27,607
2014	27,607
Total estimated reductions (tonnes of CO_2e)	184,370
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	26,340

* The first-level power station will begin generating electricity on 1st January, 2008, the second-level power station will begin generating electricity on 1st, April 2008 and the third-level power station will begin generating electricity on 1st August, 2008. So CERs will be calculated in stages.

A.4.4. public funding of the small-scale project activity:

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

A.4.5. Confirmation that the small-scale project activity is not a debundled 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;
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 approved baseline and monitoring methodology applied to the small-scale project activity:

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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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1. The installed capacity is 8.29MW less then the maximum qualifying capacity of 15MW;
2. The project is a run-of-water hydro power project;
3. The CCPG has a clear boundary; the related information can be obtained in public.

Therefore, all applicability conditions for the use of simplified baseline methodology category I.D have been satisfied.

B.3. Description of the project boundary:

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According to methodology AMS I.D, renewable energy and power generation activities of the project is the project boundary for physical and geographical places of the renewable energy projects. The generated electricity of the project will be delivered to CCPG, which includes Jiangxi Province, Henan Province, Hubei Province, Hunan Province, Sichuan Province and Chongqing Municipality Power Grid[3]. The main emission sources and type of GHGs in project boundary 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	As the project is a run-of-river hydropower project with no submerge area, the project emission is not needed to be calculated.
		N_2O	No	Excluded by the methodology

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

B.4. Description of baseline and its development:

>> There are four plausible alternative options to provide the equivalent electricity service.

Project Option 1: Project activity not undertaken as CDM project activity.

This option is one of feasible alternatives. However, the IRR of the power station is 7.73% 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.

Project Option 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 (8.29MW). 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.

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

The alternative is to construct power plants using other renewable energy resources, which can generate equivalent electricity annually to the project. However, there are not enough renewable energy resources, such as photovoltaic, tidal/wave, wind, geothermal and renewable biomass etc., to support the construction of power plants. It can be seen from Table A10 that there are only fuel-fired power plants and hydropower plants in CCPG. Furthermore, due to the limitation of technology development and high costs, constructing an alternative renewable power plant is not financially attractive.
Thus, the Project Option 3 is not available with the Project and is excluded.

Project Option 4: Equivalent electricity service provided by the CCPG.

The alternative is permitted by the national and local laws and regulations, and there is no obstacle in economical, technical or any other aspects to realize this scenario. Meanwhile, the CCPG is increasing its installed capacity through expansion of existing power plants and construction new power plants for decades, and the CCPG is a fuel-fired dominant power grid, that is, a majority of the electricity provided by CCPG is generated by the fuel-fired power plants.
For the analysis above, this alternative is feasible and could be the realistic and credible baseline scenario.

As a conclusion of the above assessment, the only alternative available of the project and hence the

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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).

baseline scenario is: **Alternative 4-Get equivalent electricity supply from the CCPG annually**

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
- Practice barrier
- Other barrier

Investment analysis

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 *Xieshui Small Rundle Hydropower Project Feasibility Research Report*, the IRR was only 7.73% far lower than benchmark IRR 10%, but the IRR would increase by 4%-5% if the project took into account of the CERs income[7].

[7] Xieshui Rundle Hydropower Project Feasibility Research Report

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	8.29	Feasibility report
Total Investment	Million RMB￥	45.2174	Feasibility report
Annual Output	MWh	29,164.4	Feasibility report
Electricity price (Incl. VAT)	RMB￥/kWh	0.30	Feasibility report
Annual operation investment	Million RMB￥	1.5994① 1.1619②	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.

The IRR with and without CERs refer to as follow:

Table 6 Comparative table of the financial indicators with or without CERs income

Parameter	unit	Benchmark IRR	Without CERs	With CERs
IRR	%	10	7.73	12.43

According to the benchmark analysis, IRR was only 7.73% for the project, which were obviously below the benchmark of 10%. The project was not financially attractive. It was found that the financial situation is obviously improved under the situations with CERs income.

2. Sensitivity analysis

In order to check the stability and credibility of the results obtained above, the financial sensitivity analysis is shown in table 7:

Table 7 Sensitivity Analysis (IRR)

parameter	Variation rate（%）			
	+10%	+5%	-5%	-10%
Total investment	6.87	7.28	8.21	8.72
Sale income	8.84	8.29	7.15	6.56
Management costs	7.37	7.55	7.9	8.08

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.

Financing barrier

According to *Xieshui Small Rundle Hydropower Project Feasibility Research Report*, the IRR of the project was 7.73%, and the economic indexes were weak. The analysis of the financing barrier as follows:

The Shimen Tiande Hydropower Exploitation Co.Ltd. registered in Shimen County, Changde City, Hunan Province. The company invested and constructed the Tianfu Hydropower Project, which failed for the atrocious weather and construction status. In 2003, the main leaders of the company withdrew the capital which made the company suffered a huge loss. The result was the Company Directorate changed frequently and the project exploitation plan was not considered.

In 2004, the failure of the prophase investment lead to a huge loss of the company and also influenced the credit standing of the company, which made the external investors have not enough confidence on the project.

In December, 2005, the project owner get touch with CDM during the founding cause for capital support. With the help of the consultants, the IRR of the project would increase by 4%-5% if the CERs income had been taken into consideration. Then the project owner determined to apply CDM project on the chance of strengthening the economic index and attracting the external investment. In June, 2006, the project owner signed the trust deed with Hunan CDM Project Service Centre[8], as well as the term sheet with CAM at the end of the same month.

In February, 2006, several new shareholders joint in the company[9]. In April, 2006, the shareholders increased the register capital[10] to ensure the project can start smoothly due to the CERs income can increase the IRR, meanwhile, decrease the risk of investment The total investment belonged to self-financing without bank loan and the project started in November, 2006.

In summary, without the consideration of CDM, the project would have investment and financial barrier, which was not attractive enough. Therefore, it is concluded that the Project is additional.

B.6.	**Emission reductions:**

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

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Project Emissions

[8] Trust Deed of CDM Project

[9] capital verification report (xiangdeyuanyanzi[2006]No.4004)

[10] capital verification report (xiangdeyuanyanzi[2006]No.4017)

According to baseline methodology ACM0002, the project emissions calculation formula is as follow:

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

Where:

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 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[11]

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:

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

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 (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; 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:

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

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.

[11] China Electric Power Yearbook 2001～2005

$EF_{OM,y}$ 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 (*$EF_{BM,y}$*)
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:

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

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[12] 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

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

Where:

λ_{Gas}, λ_{Oil} and λ_{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 (tCO_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 (*$EF_{Thermal}$*)

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

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

Where:

$EF_{Thermal}$ is the fuel-fired emission factor;
$EF_{Coal, Adv}$, $EF_{Oil, Adv}$ 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 (*$EF_{BM,y}$*)

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

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 ($EF_{BM, y}$):

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

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_2e/MWh.

Leakage

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

Emission Reductions

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

$$ER_y\ (tCO_2e/yr) = BE_y - PE_y - L_y \qquad (10)$$

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

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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 description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
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	Data used are from Chinese authorities.

procedures actually 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_{pq}
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:	

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:

>>

Project emission

According to ACM0002, the project is a run-of-river hydropower station; 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 [13].
For CCPG, the Baseline Emission Factor is given as follows:

Table 9 CM calculation for CCPG (tCO_2e/MWh)

OM	BM	CM
1.2776	0.6156	0.9466

Since the annual power supply to the grid from the Project is 29,164.4MWh, the annual baseline emission (BE_y) of the Project is calculated as follow:

$$BE_y = 29{,}164.4 \text{ MWh} \times 0.9466 \text{ tCO}_2\text{e /MWh} = 27{,}607 \text{ tCO}_2 \text{ e /yr}$$

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:

$$ER_y = BE_y - PE_y - L_y = 27{,}607 \text{ tCO}_2\text{e /yr}$$

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

>>

Table 10 the ex-ante estimation of emission reductions

Year	Estimation of the project activity emission reductions (tones of CO_2e)	Estimation of baseline emission reductions (tones of CO_2e)	Estimation of leakage (tones of CO_2e)	Estimation of emission reductions (tones of CO_2e)
2008	0	18,737*	0	18,737*
2009	0	27,607	0	27,607
2010	0	27,607	0	27,607
2011	0	27,607	0	27,607
2012	0	27,607	0	27,607
2013	0	27,607	0	27,607
2014	0	27,607	0	27,607
total (tCO2e)	0	184,379	0	184,379

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 29,164.4 MWh

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

Description of measurement methods and procedures to be applied:	1.Watt-hour meters are installed at the transformer substation exit, generator exits and within the powerhouse to monitor the power generated, power supplied to the grid and power consumed by itself, the data are measured continuously and are recorded automatically, the designated persons from the grid company and the project company record the power output supplied to the grid together according to the reading of the same meter at the Transformer substation exit at the end of per month. 2. the grid company and the project company together authorize a qualified unit to check the meter of measuring the power supplied to the grid quarterly at site according to “Technical Regulations for Electricity Measurement and Power Energy Metered Device Design (DL/T5137-2001) ” and “Management Regulations for Power Energy Metered Device Technology (DL/T448-2000)”, and the unit will take charge of the test at irregular intervals, fix breakdowns and decide whether the meters should be Exchanged to ensure the accuracy of the measurement. 3. The Operation Section of the plant will undertake the monitoring, and the Director of the operation section is the responsible person of the monitoring.
QA/QC procedures to be applied:	1. Sales record to the grid and other records are used to ensure the consistency. 2. Proportion of the data monitored is 100%. 3. The data will be archived in electronic manner and in paper. 4. The data are kept during the crediting period and two years after. 5. The ammeter will be regulated by a qualified institution. 6. Besides the main ammeter, the auxiliary should be equipped to back the data in The case of the main fail to work as usual. 7. The meters and their accuracy degree will meet the requirements of “Technical Regulations for Electricity Measurement and Power Energy Metered Device Design (DL/T5137-2001)”.
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 *CDM Manual for Monitoring and Management of Xieshui Hydropower Station*. 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 figure 2, 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.

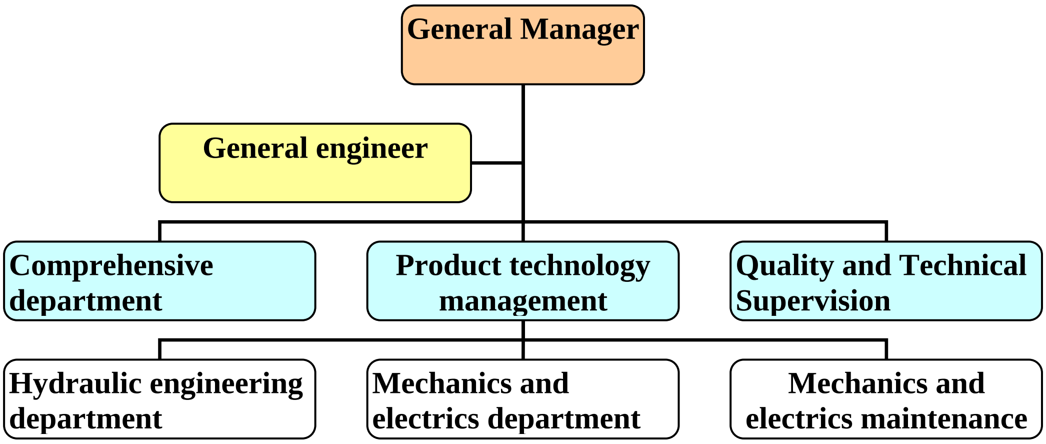

Fig 2 processing and management of project

3. Monitoring apparatus and installment:

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.

The principal diagram of the meter positions are as follows:

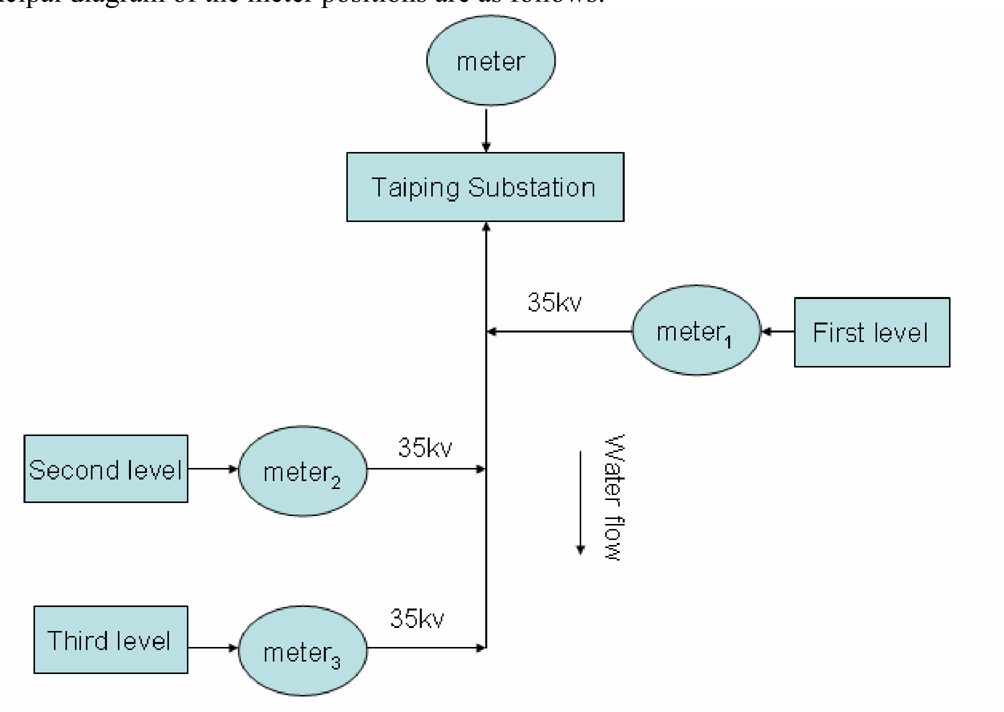

Figure 3 Meter positions of the project

4. Data monitoring

The readings of Master Meter are used for calculating the emission reductions when the Meter is in normal operation state. The monitoring steps are as follows:
(1) The duty staff record the readings of meters which are inside power house everyday;
(2) Project owner and Power Grid Company collect as well as record the Master Meter readings together monthly;
(3) The Power Grid Company provides the project owner with the net electricity generation data;
(4) The project owner provides the Power Grid Company with sales receipts and preserves the copies of the sales receipts.
(5) The project owner records the net electricity generation of the project.
(6) The project owner provides DOE with readings record of Master Meter and copies of sales receipts.

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:
(1) The error of output ammeter and input ammeter over the allowable ranges.
(2) 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.

The monitoring system would be set up with the help of the Hunan CDM Project Service Centre, which would collect and manage the monitored data for the project owner. Then DOE will collect the monitored data and submit the CERs application to EB.

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.

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.

To obtain further information on our monitoring plan, please refer to *the handbook of monitoring and management*.

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

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Above individuals / entities are not as project participants.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
01/01/2008 (Operation starting date of the first generator)

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

>>
The project is expected to have a minimum operating life of 22 years and 0 month.

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

C.2.1. Renewable crediting period

>>

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

>>
01/01/2008

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

In 2006, the project obtained the approval (Xianghuanping [2006] No.20) from Environmental Protection Bureau of Hunan Province. The main comments of the EIA report are as follows: "The project has no emigration or submerge area. The effect on ecosystem is quite little, and the site-chosen is reasonable. The project construction will be approved in the case of the project could carry out the environmental protection measure well."[14]

The main comments of the EIA report are as follows:

Impact items	Assessment and Views on environmental impacts	Measures for environmental protection
Construction period		
Water quality	During the project construction period, the wastewater discharged from the sand & process system, concrete mixer and oil wastewater will have impact on the whole water quality. The main contamination are SS、COD、oil and coliform etc.	（1）Setup the sediment detention basin in constructing place; （2）Setup the special washing district to dispose waste oil; （3）Living sewage will be used as fertilizer by the local peasants.
Air quality	The dust influence area generally distribute in concrete mixer, drilling and transport area. The main contaminations are TSP and NO_2.	（1）Adopt a less-dust technique ; （2）Sprinkle water in the construction area to prevent the fly ash, plant some trees around the construction area; （3）Collocate the vehicle reasonable and reduce the traffic density to decrease the gas discharge.
noise	Immobile noise source: driller, concrete mixer and digging process Floating nosie souse: Vehicle transportation	（1）enhance the maintenance of the facilities to low the noise of construction ; （2）Setup the sound insulation guards; （3）Avoid constructing at night.
Solid waste	The solid garbage mainly includes the earth and stone caused by the construction and living rubbish.	（1）Collect and transport the solid garbage to the settled deposit place; （2）Carry out the related water conservation measure.

[14] approve of the EIA of Xieshui Rundel Hydropower Project

Human health	There will be a large amount of garbage and sewage with the increase of the population density. The living condition and health epidemic prevention will not very perfect, so the diseases are easily happen if the workers do not care about the diet and living habitation.	（1）Setup the health & epidemic prevention institute, register the health condition of the workers，provide the medicine and take examinations termly. （2）Appoint special people to take charge of the sanitation of the construction site to ensure the water safety.
Operation period		
Water environment quality	The raise of water lever of the reservoir and the slow down of the flow velocity will cause the degradation of the self-purification of water, but in another aspect, that will helpful for the SS sedimentation.。	（1）Wastewater discharged from the construction site should be treated according to the Discharge Standard; （2）The oil wastewater should be disposed by oil separating pond; （3）Enhance the control and management of construction site. Reinforce the treatment of the contamination.
Hydrobiology	The category, distribution and quantity of the fish in the reservoir almost keep the same as former, but the project would have impact on the fish spawn place.	Put in fry to the reservoir termly to multiplicate the category of the fish. （

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:

>>

Both of the Host Party and the project owner regard that the proposed project will not bring significant impacts to the environment. After the completion of the project construction, the project will be put into operation only after the inspection and acceptance of local environmental protection department.

SECTION E. Stakeholders' comments

>>

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

>>

For the purpose of letting the stakeholders realize the project situation and collecting their opinions and recommendations on the project, the project owner made an investigation in the form of questionnaire in Oct. 2006. Stakeholders of the project included the government and non-government parties, local population, NGO's, social organisations of that region etc., who were involved in the project activity with different roles and at different stages. The age of the participants was between the ranges of 20 to 62.

The project developer had sent out questionnaires to the stakeholders in the Meiziya village and Maziping Village for the comments of the proposed project construction. 30 copies of questionnaire were distributed, and 26 pieces of reply were received.

The questions listed in questionnaire are as follows:

Questions:

1. Do you know the project?
2. Do you agree with the exploitation the project?
3. Do you think the project will be helpful the local economy development?
4. What is your opinion about the influence on the employment-obtained to the local residents?
5. What is your opinion about the influence on water and air environment?
6. Whether the project can cause the Soil & Water Lost?
7. What your opinion about the actuality status of the local place?
8. Do you have any other suggestion for the project?

More details show in E.2 part.

E.2. Summary of the comments received:

>>

The results of the questionnaires show as follows:

100% informant knew the project;

100% informant agreed with the exploitation of the project;

88.5% informant thought the project would be helpful to the local economy development; the other informant thought the project would have no remarkable promotion;

100% informant thought the project would be helpful for the residents to obtain more employment opportunities;

100% informant thought the project would not influence the water and air quality;

100% informant thought the project would have little impact on the water & soil loss.

All of the stakeholders consider the project had much more advantages such as alleviating the local power shortage and promoting the economy development. In addition, they also put up some questions:

1. Hope the project owner to establish good relationship with local municipal and township;
2. Hope more work opportunities could be provided to local people.

3. Hope the vegetation's protection could be carried out well during the project construction and operation period;
4. The Solid waste and waste water should be disposed well when the project is under construction;
5. The project owner should maintain the road;
6. the project should reinforce and protect of edge and slope to prevent the water-soil loss.

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

>>

According to the comments of the local villagers in E.2., the project owners will adopt the following measures:
1. The project owner would support local residents to develop tourism business, furthermore, the project owner will build traffic infrastructure around the Village by using part of tourism revenue;
2. The project owner would employ local residents participate in maintain the hydropower station in the construct course;
3. The project owner would reduce dust, noise, and water pollution to the best of their abilities, and they will plant trees and grasses to recover vegetation after completion of the project construction;

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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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.

Annex 3

BASELINE INFORMATION[1]

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*. There is no better information available to change it.

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

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	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	1062.63	4679.02	1710	1113.78	398.57	1964.32	10928.32	94.6	100	20908	216150891.6
Cleaned Coal	10^4 t	2.72						2.72	94.6	100	26344	67786.27328
Other Washed Coal	10^4 t	3.66	26.49			249.99		280.14	94.6	100	8363	2216299.036
Coke	10^4 t		1.15					1.15	107	100	28435	34989.2675
Coke Oven Gas	10^8 m^3			1.11				1.11	44.4	100	16726	82432.4184
Other Gas	10^8 m^3		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 m^3						1.75	1.75	56.1	100	38931	382205.0925
											Total	**219439194**

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

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

Province	Electricity Generation	Electricity Generation	Auxiliary Power Ratio	Supplied Electricity
	(10^8 kWh)	**(MWh)**	**(%)**	**(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_2e 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_2e/MWh.

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*

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

Province	Electricity Generation	Electricity Generation	Auxiliary Power Ratio	Supplied Electricity
	(10^8 kWh)	**(MWh)**	**(%)**	**(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.

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 (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	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*

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:

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

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_2e)**
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:

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

Due to the sum of λ_{Oil} and λ_{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_2e/MWh

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*

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)	3986.4	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:

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

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 *CDM Manual for Monitoring and Management of Xieshui Hydropower Station* for more details.