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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Yunnan Yizi 19.2MW Hydropower Project

Version: 5.0

Date: 20/09/2010

Version No	Date	Descriptions
1.0	16/06/2007	First edition. v1.1 Updated from ACM0002 (v6) to ACM0002 (v7). v1.2 Updated common practices v1.3 Updated IRR calculation v1.4 Added footnotes. v1.5 Optimized English.
1.5.1	27/03/2008	v1.5.1 Finalized PDD for GSP
2.0	05/06/2008	Added footnotes.
3.0	25/09/2008	Revised the PDD according to validator's opinions v3.1 Updated common practices v3.2 updated footnotes v3.3 Updated project timeline
3.3.1	03/12/2008	v3.3.1 Revised according to validation comments
4.0	10/03/2009	Updated emission factors and emission reduction calculation upon the new NDRC notice on 30/12/2008 and revised upon technical reviewer's comments.
4.1	23/07/2009	Updates upon EB 48 decisions.
4.2	30/07/2009	Minor modifications upon validator's opinions
4.3	31/07/2009	Minor modifications upon validator's opinions
4.4	03/08/2009	Added plant load factor & upgraded to ACM0002 (v 8)
4.5	05/08/2009	Minor modifications
4.6	15/10/2009	Minor modifications upon validator's opinions
4.7	20/10/2009	Minor modifications upon validator's opinions
4.8	21/10/2009	Minor modifications upon validator's opinions
4.9	28/03/2010	Modification to address the concerns raised during the completeness check
5.0	20/09/2010	Corrections incorporate the information submitted in response to the request for review

A.2. Description of the project activity:

Yunnan Yizi 19.2MW Hydropower Project (hereafter the Project) comprises a water-channel hydroelectric plant on the Wanma River in the Yongren County, Chuxiong prefecture, Yunnan Province, China. The Project is constructed and operated by Yongren County Wanyuan Hydropower Development Co., Ltd with an installed capacity of 19.2 MW generating 71,687 MWh of electricity annually to the Grid.

All the electricity generated by the Project will be transmitted to the South China Power Grid (SCPG) through the Yunnan Grid. Thus the Project will take part in the efforts to reduce the greenhouse gas (GHG) emissions produced by the fossil-fuel-fired power plant in SCPG. Annual emission reduction of

the Project is estimated at 60,460 tCO_2e during the first crediting period.

The Project will help China fulfil its goals of promoting sustainable development through following aspects:

- To alleviate power shortage in the local area, reducing greenhouse gases and air pollutants from combustion of fossil fuels;
- To assist flood control, help to protect people's lives and properties in this area;
- To provide employment opportunities in this Region and especially for local people during the construction period of the Project;
- To promote the social economic development in the remote southwest area, such as Yunnan Province, especially the infrastructure development in rural area
- To make better use of the hydropower renewable energy, improve the ecological environment, play a positive role in the local renewable energy industry.

A.3. Project participants:

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

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party (ies):

People's Republic of China

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

Yunnan Province

A.4.1.3. City/Town/Community etc:

Yongren County, Chuxiong City

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

As indicated in **Figure 1**, the Project is located in Yunnan Province, southwest of China. The power

plant of the Project is in the Chuxiong Prefecture, Yongren County, which is northern part of the Yunnan Province. The site is about 262KM away from the Kunming City and 75KM away from the local government of Yongren County. The geographical coordinates of the dam are 101 ° 26′24″ E and 26 ° 15′54″N and the geographical coordinates of the power house of the Project are 101°24′12″ E and 26°19′36″N.

Figure 1: Location of the Project

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

The project activity falls under the CDM sectoral scope 01: Energy Industry (renewable / non-renewable sources).

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

The Project is a run-of-river hydropower project, mainly consisting of the water-retaining, sluicing,

building of water diversion holes for power generation, switching station and other building components. The length of the approach channel is about 8.55 km and the discharge will be above 17.5 m^3/s .The installed capacity of the Project is finally decided to be 19.2 MW (2×8MW＋1×3.2 MW) with the annual operating hours of 4,428 hours in order to optimize the effective power production of the Project connecting to the Grid[1&2]. The technical parameters of the major equipment applied by the Project are listed below[3&4]:

Hydro turbines	Quantity	2	1
	Model	HLA575c-LJ-106	HLA179-LJ-118
	Rated water head	130m	130m
	Rated flow	7.06 m3/s	2.92 m3/s
	Rated output	8333kw	3404kw
	Rated Rotation Speed	750r/min	600 r/min
Generators	Quantity	2	1
	Model	SF8000-8/2600	SF3200-10/2150
	Rated output	8000kw	3200kw
	Rated Rotation Speed	750r/min	600 r/min
	Rated voltage	6.3kv	6.3kv
	Rated Power factor	0.8	0.8

Moreover, all technology and equipment used for the Project can be supplied within China. There is no specific technology transfer involved in the Project.

Upon the power connection agreement by the Yunnan Grid[5], all electricity produced by the Project must directly supply to the SCPG through Yunnan Grid and is prohibit for supplying to other individuals or individual grids. The Grid sets no limitation on the allowance of total electricity supplying by the Project, including the acceptance of all power supply during the ample flow period and night time. Approximate 0.8% of the total power generation will be self-consumed at the Project site[2].

According to the Economic Evaluation Code for Small Hydropower Project (SL16-95)[6], the co-efficient factor of power generation (hereafter the co-efficient factor) of the Project is given as 0.85 in the FSR[2]. Under the definition in SL16-95, the effective power generation from the Project to the Grid is estimated as:

Effective Power Generation = Design Power Generation x Co-Efficient Factor

Thus

Effective Power Generation of the Project = 19.2MW x 4428 hrs x (1-0.8%) x 0.85 = 71,687 MWh

Therefore the Project will provide an estimated annual net electricity of 71,687 MWh to the Grid.

[1] Feasibility Study Report (FSR, 16MW) by Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd. dated 09/2006.
[2] FSR Amendment (19.2MW) by Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd. dated 06/2007.
[3] Purchase contract of the generators and turbines (2 x 8000KW) signed between the project owner and Ganzhou Generating Equipment Manufacturing Co., Ltd. on 10/04/2007
[4] Purchase contract of the generators and turbines (1 x 3200 KW) signed between the project owner and Ganzhou Generating Equipment Manufacturing Co., Ltd. on 26/06/2007
[5] Grid connection agreement from Yunnan Power Company dated 22/10/2007
[6] According to the Economic Evaluation Code for Small Hydropower Project (SL16-95) published by the Ministry of Water Resources ROC, the co-efficient factor for the grid connected power station with acceptance of power supply during the ample flow period and night time shall be 0.80-0.90. The co-efficient factor of power generation for the Project is chosen as 0.85 in the FSR Amendment.

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

The first crediting period of emission reductions due to the Project is 7 years, renewable up to 21 years. The emission reductions are estimated to commence from 01/01/2010 or after the successful registration of the Project to the CDM-EB, whichever is the later date.

Table 1 Estimation of Emission Reductions in the 1st Crediting Period

Years	Annual estimation of emission reductions in tonnes of CO_{2e}
01/01-31/12/2010	60,460
2011	60,460
2012	60,460
2013	60,460
2014	60,460
2015	60,460
2016	60,460
Total estimated reductions (tonnes of CO_{2e})	423,220
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_{2e})	60,460

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

There is no public funding from Annex I Parties for this Project.

SECTION B. Application of a baseline and monitoring methodology:

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

The Project applies to the approved methodology: ACM0002 "*Consolidated Baseline Methodology for grid-connected electricity generation from renewable sources*" (Version 08).

In line with the application of the methodology the Project draws on element of the following tools and methodologies:

"*Tool for the demonstration and assessment of additionality* (Version 05.2)"; and

"*Tool to calculate the emission factor for an electricity system*" (Version 01.1).

More information could be found at: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

The Project employs a renewable electricity generation technology which replaces fossil-fuel-fired power generation technology to supply electricity to the grid. Hence the Project is applicable to the consolidated baseline methodology ACM0002 for grid-connected renewable power generation project activities under the following conditions:

1. The Project is a Run-of-river hydro power plant.
2. The Project is a new hydro electric power project with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) of 147.6W/m^2 which is greater than 4W/m^2.
3. The Project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
4. The geographic and system boundaries for the relevant electricity grid (i.e. SCPG) can be clearly identified and information on the characteristics of the grid is available.

As required by the EB 48 Annex 11: *Guidelines for the Reporting and Validation of Plant Load Factors (Version 01)*, the plant load factor (hereafter PLF) shall be defined ex-ante in the PDD for some project activities applying ACM 0002 methodology. This parameter is a vital component of ensuring the environmental integrity of the CDM.

The PLF of the Project is 50.55%[7]. It was defined and determined in accordance with the requirements of the EB 48 Annex 11 as it was:

(a) defined in the FSR Amendment[2] provided to the local DRC for approval[8]; and
(b) determined by a competent thirty party - Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd., who is a qualified engineering design organization for conducting the feasibility studies to hydropower projects in China[1].

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

[7] PLF = actual power generation capacity/ the largest of electricity generated = 19MW *4428 hrs/19MW*24hrs*365 days = 50.55%. *where*, The annual operating hours of the Project was defined in the FSR Amendment (6/2007) which provide to the local DRC for project approval in 7/2007.
[8] Project enlargement approval (19.2MW) by Chuxiong Prefecture Development and Reform Committee dated 12/07/2007.

According to ACM0002, the project boundary is defined which includes the project site and the electricity system that the hydropower station is connected to. The system boundary of the electricity system that the specific project is connected to is defined as the SCPG in following reasons:

1. In a country like China, with a layered dispatch system, grid boundary shall be defined based on regional grids.
2. The Project is connected to Yunnan Grid and finally to the SCPG. According to the delineation of grid boundary as provided by the Designated National Authority (DNA) of China[9], SCPG consists of four sub-grids: Guangdong, Guangxi, Yunnan, and Guizhou.
3. The SCPG can be clearly identified as the regional grid and information on the characteristics of this grid is publicly available.

For the calculation of emission reductions, the only type of GHG included in this Project is CO_2.

The emissions sources included and excluded from the project boundary for determination of both baseline and project emissions are listed below:

	Source	Gas	Included	Justification / Explanation
Baseline	Electricity generation from the project electricity system	CO_2	Yes	Main source of emission
		CH_4	No	Small source and not required by the methodology
		N_2O	No	Small source and not required by the methodology
Project Activity	Hydro power plant	CO_2	No	Small source and not required by the methodology
		CH_4	No	The power density of project is greater than 10W/m^2, Therefore, the project emissions will be neglected.
		N_2O	No	Small source and not required by the methodology

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

The possible alternatives scenarios to the Project that provide outputs or services comparable to the proposed CDM project activity have been identified:

1. Implementing the Project, but not as a CDM project;
2. Providing the same amount of electricity by the SCPG;
3. Building a new thermal power plant with the same installed capacity or equivalent electricity output;
4. Building a power plant using other renewable sources with the same installed capacity or equivalent electricity output.

Scenario 1: Implementing the Project, but not as a CDM project:

Based on the investment analysis illustrated in Section B.5, .The IRR of the Project without the certified emission reduction (CER) revenues is 5.88%[10], which is much lower than the benchmark IRR of 10%[6]. The Project is not financially feasible without CER revenues. Thus, **Scenario 1** cannot be considered as a credible alternative baselines scenario.

Scenario 2: Providing the same amount of electricity by the SCPG;

[9] NDRC China (09/08/2007), 2007 Baseline Emission Factors for Regional Power Grid in China. Source: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf
[10] IRR Calculation of the Project

This Scenario represents the default option of current practice. Hence it is a credible and realistic Scenario.

Scenario 3: Building a new thermal power plant with the same installed capacity or equivalent electricity output;

This Scenario cannot be considered as a credible baseline scenario alternative. According to the State Council Office (2002)[11], installation of fossil-fuel-fired power units with capacity of and below 135 MW are strictly restricted in the areas currently covered by the existing large electric power grid.

Scenario 4: Building a power plant using other renewable sources with the same installed capacity or equivalent electricity output.

In Yunnan Province, the electricity system mainly consists of hydropower plants and fossil-fuel-fired power plants. The research showed that at present time there is no other renewable resource from wind, biomass, solar, wave and tidal or geothermal that could be used for equivalent annual power generation similar to the proposed project in local area.

There is no enough wind resource nearby the proposed project site[12]. In fact, the potential wind energy is impoverished. The biomass project in Yunnan is at a very early stage. Necessary time scale for the development of the early stage biomass projects remains uncertain[13]. In addition, the technology of solar energy is not yet mature, not economic due to its high production costs, and there is no clear development policy available in China[14]. Furthermore, China's ocean energy development faces difficulties mainly due to its low energy utilization efficiency[15]. On the other hand, China has very limited resources of geothermal energy which only constitutes for a small proportion in China's energy structure[16]. According to the research, **Scenario 4** is neither a credible nor a realistic baseline scenario up to dated.

Based on the above analysis, it can be concluded that **Scenario 2:** Providing the same amount of electricity by the SCPG is the **baseline scenario of the Project.**

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

Following steps are cited to demonstrate the additionality for this Project according to the *Tool for the Demonstration and Assessment of Additionality* (Ver.05.2) as required by the methodology:

Key events of the prior CDM consideration of the implementation of the Project could be summarized as below:

Date	Key Events of the Project Implementation
09/2006	▪ Completion of the 1st edition of Feasibility Study Report (FSR) for an installed capacity of 16MW in 9/2006[1]

[11] State Council Office PRC (2002), Notice on the Restriction of the Fossil-Fuel-Fired Power Units with Capacity of and / or below 135MW (Notice no. 2002-6). Source: http://www.cct.org.cn/cct/content.asp?ID=5576

[12] International New Energy (29/05/2007), Yunnan Province is the wind resources poor region in China. Source: http://www.in-en.com/newenergy/html/newenergy-20072007052996042.html

[13] Kunming Daily (17/08/2006), Corporation of developing biomass energy in Yunnan between Yunnan Province and China Petroleum Corporation. Source: http://www.biotech.org.cn/news/news/show.php?id=37627

[14] Xinhua Net (27/06/2007), China's development and utilization of solar energy resources survey. Source: http://www.nengyuan.net/xinnengyuan/taiyangneng/NY0AE7D.html

[15] China New Energy and Renewable Energy Net (27/02/2006), Ocean renewable energy development status and trends. Source:http://www.crein.org.cn/view/viewnews.aspx?id=20060227142540328

[16] China Network (14/05/2008), Asia and the direct use of geothermal resources in the international seminar held in Tianjin. Source: http://www.china5e.com/news/newpower/200805/200805140011.html

Date	Key Events of the Project Implementation
10/2006	▪ Signed the intention letter for CDM consultation with HZCT on 11/10/2006[17].
11/2006	▪ Project EIA approved (16MW) on 6/11/2006
12/2006	▪ Board of directors meeting held on 19/12/2006 concluded to seeking for chances of CDM incentives for the Projects
01/2007	▪ Received local DRC approval to Project (16MW) on 8/01/2007
04/2007	▪ Initial investment decision - signed the first equipment purchase contract (8000kw x 2 sets) on 10/04/2007, based on the FSR of 16MW
05/2007	▪ In early 2007, the advice of increasing the installed capacity of the proposed project from 16MW up to 19.2MW was accepted. ▪ Signed the CDM consulting contract with HZCT on 19/05/2007.
06/2007	▪ Received FSR amendment (19.2MW) in 06/2007 ▪ Signed an intention letter for selling the CERs from the Project in 14/06/2007[18]. ▪ Adaption to increase installed capacity - signed the second main equipment purchase contract (3200kw) 26/06/2007, based on the FSR Amendment of 19.2MW
07/2007	▪ Received local DRC approval to enlargement of the Project (19.2MW) on 12/07/2007 ▪ Signed the construction contract on 24/07/2007
11/2007	▪ NDRC approved the LoA of the Project on 20/11/2007 ▪ Signed ERPA with ORBEO on 26/11/2007
01/2008	▪ Received EIA approval from Yunnan province on 31/01/2008
04/2008	▪ PDD on GSP (17/04 -16/05/2008) ▪ Received LoA China dated 22/04/2008
05/2008	▪ DOE on-site validation on 12/05/2008
10/2008	▪ Signed the bank loan contract (CNY 23millions) with China Agricultural Bank Yongren County branch on 10/10/2008.
12/2008	▪ Signed the bank loan contract (CNY 15millions) with China Agricultural Bank Yongren County branch on 03/12/2008
02/2009	▪ Received a Supplementary explanation letter indicated the mistakes in the FSR Amendment on 12/02/2009
03/2009	▪ Un-expected geological conditions found in the last part of water tunnel construction

The Project was originally designed with an installed capacity of 16MW from the 1st version of FSR in 9/2006; and it subsequently increased 3.2MW of capacity up to a total installed capacity of 19.2MW from the FSR Amendment in 6/2007. The initial investment decision of the Project was made in 4/2007 based on the FSR of 16MW with CDM assistance. The adaption to increase capacity of 3.2MW was made in late 6/2007 based on the FSR Amendment of 19.2MW with CDM assistance.

Because of low investment returns from the FSR in 9/2006, the Project with 16MW capacity is not financially feasible. Thus the project owner contracted a CDM consultant seeking for CDM assistance in 10/2006. Having the confirmation from FSR amendment to that the 19.2MW option could provide better financial returns and more flexible of utilising the river flow in the peak and dry seasons, an increase of additional 3.2MW capacity to the Project was adapted (so the Project can be potentially operated in different ranges of capacity as 19.2MW, 16MW, 11.2MW, 8MW or 3.2MW) (further discussions regarding the changes of installed capacity and annual operating hours with their impact to the additionality will be made in the below Sections.) Meanwhile an intention letter for purchasing the CERs from the Project was also signed in 6/2007. The project owner therefore gained better confidence in terms of financial feasibility with CDM assistance in order to urge up the implementation of the proposed project from the second half of 2007.

More detailed information and supporting references to the key events relating to the decision process and development of the Project from 9/2006 up to dated are illustrated in the Chronology of the Progress of the Proposed Project[19]. The Chronology provides clear information that the project owner had serious

[17] Intention letter of CDM consultation signed between the project owner and HZCT on 11/10/2006
[18] Term Sheet signed between the project owner and ORBEO on 14/06/2007
[19] Yizi - Chronology of the progress of the proposed project

considerations of CDM prior to the starting date of implementing the Project.

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

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

The possible alternatives to the project activity are as follows:

1. Implementing the Project, but not as a CDM project;
2. Providing the same amount of electricity by the SCPG;
3. Building a new thermal power plant with the same installed capacity or equivalent electricity output;
4. Building a power plant using other renewable energy with the same installed capacity or equivalent electricity output.

Based on the baseline scenario discussion in section B.4, **Alternatives 3** and **4** are not applicable for the Project. **Alternative 2** is the current practice and considered as the baseline scenario of the Project. Moreover, **Alternative 1** could be a feasible choice, only if the barriers of project development are not considered. These development barriers of the Project will be discussed in later sections.

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

As discussed in Section B.4, Chinese regulations restrict the installation of fossil-fuel-fired power units with capacity of and below 135MW. Therefore **Alternative 3** is not feasible. **Alternative 4** is not feasible due to lack of resources for other renewable energy.

To conclude the above discussions in Sub-steps 1a and 1b, **Alternatives 1** and **2** are technically feasible and also comply with current consent conditions in China. They are the possible Alternatives to the Project in terms of legal compliance.

Step 2. Investment Analysis

The purpose of investment analysis is to determine whether the project activity is the most economically or financially attractive or less than other alternatives without the revenue from the sale of CERs. To conduct the investment analysis, following sub-steps are used:

Sub-step 2a. Determine appropriate analysis method

Three methods of analysis are suggested in the *Tool for the Demonstration and Assessment of Additionality*. They are: simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

Option I, the simple cost analysis, is not appropriate since the Project has additional revenues from the sale of the generated electricity.

Option II, the investment comparison analysis, has been excluded. The reason is given by the defined alternatives above that the only realistic and creditable alternative, i.e. the baseline scenario, is the continuation of electricity supply from the existing power grid to meet the electricity demand other than a new power investment project.

Option III, the benchmark analysis method, is adopted based on the consideration of benchmark IRR of the hydropower projects in China is available for the Project.

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

The installed capacity of the Project was initially as 16MW and is finally adapted and implemented as 19.2MW which located in Yongren County of Yunnan Province, in the rural area of China. According to the Economic Evaluation Code for Small Hydropower Project (SL16-95) published by the Ministry of Water Resources PRC in 1995[6,] the IRR of small hydropower projects with the installed capacity of or less than 25MW (newly-built, expansion, rebuilt or renovation projects) and located in rural are with the installed capacity less than 50MW should be higher than 10%. Therefore the benchmark IRR of 10% shall be applicable, and was chosen in the FSR (for 16MW) and the FSR Amendment (for 19.2MW), to the Project.

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

The Project is finally implemented with a total installed capacity of 19.2MW. Basic data and assumptions for the calculation of the financial indicators of the 19.2 MW Project are summarized in the **Table 2**:

Table 2. Main parameters for the financial analysis of the Project

Parameters	Value	Source
Installed capacity (MW)	19.2	FSR Amendment[2] + DRC Approval[9]
Project life, including construction period (year)	22	FSR Amendment
Annual operating hours (hour)	4,428	FSR Amendment
Co-efficient factor	0.85	FSR Amendment + FSR Explanation Letter[20] + SL16-95[6]
Electricity consumed on site (% of total power generation)	0.8%	FSR Amendment
Tariff (CNY/KWh)	0.2[21]	FSR Amendment + PPA Intention Letter[22]
Total fixed asset investment (10^3 CNY)	85,539.50	FSR Amendment
Bank loan (10^3 CNY)	47,046.70	FSR Amendment
Bank loan interest	5.8%	FSR Amendment
CER price (Euro/tCO_{2e})	8	ERPA[23]
Exchange rate (CNY/Euro)	10	Currency rate
Value Added Tax	6%	FSR Amendment
City maintenance & construction tax	1%	FSR Amendment
Educational surcharges rate	3%	FSR Amendment
Depreciation linear 20 years (estimated net remain value rate)	5%	FSR Amendment
Maintenance costs (% of fixed asset investment)	1%	FSR Amendment + FSR Explanation Letter[19]
Salary (10^3 CNY/person/year)	35	FSR Amendment
Staffs (person)	22	FSR Amendment
Welfare (% of salary)	14%	FSR Amendment
Other costs (10^3 CNY/MW)	12	FSR Amendment
Hydro resource fee (10^3 CNY/MWh)	0.006	FSR Amendment
Income tax	33%	FSR Amendment + Income Tax Regulation[24]
Discount rate	12%	FSR Amendment

According to the IRR calculation[10], the project IRR with and without the CER revenues for the 19.2MW option is summarized in **Table 3.**

Table 3. IRR of the Project

	Without CERs	With CERs

[20] Supplementary Explanation to the FSR Amendment Report of Yunnan Yizi 19.2MW Hydropower Project, issued by Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd., dated 02/2009
[21] Tariff = 0.2CNY/KWh is applied in the FSR Amendment of 19.2MW. More discussions about the IRR and sensitivity analysis of the Project applying tariff = 0.215 CNY/KWh, as applied in the FSR for 16MW, will be discussed in later sections.
[22] PPA intention letter issued by Chuxiong Electric Power Company dated 17/10/2008
[23] ERPA signed between the project owner and ORBEO on 26/11/2007
[24] Corporate Income Tax Regulation (No.1993-137), issued by State Council of PRC on 13/12/1993, Source: http://www.jscj.com/jscjlaws/taxlax/ta19.htms

IRR	5.88 %	9.67 %

As discussed in earlier section regarding the chronology of the key events of project implementation, the Project was initially designed and planned to be implemented as 16MW in 4/2007 (i.e. the starting date of the project activity) prior to the increase of total installed capacity up to 19.2MW. The IRR for 16MW option is 6.1% without CER revenues. Most of parameters applied in the IRR calculation for the 16MW option are the same as the 19.2MW option, except those listed below:

Table 4. Differences of the Input Parameters to 16MW & 19.2MW Options

Parameter for IRR Calculation	FSR for 16MW	FSR Amendment for 19.2MW
Installed capacity (MW)	16	19.2
Annual operating hours (hour)	5,014	4,428
Total Investment (103 CNY)	77,888.50	88,588.56
Total fixed asset investment (103 CNY)	75,000.30	85,539.50
Bank loan (103 CNY)	44,565.50	47,046.70
Tariff (CNY/KWh)	0.215	0.20
Annual Electricity Production (MWh)	80,224	85,018
Annual Electricity Sales (MWh)	67,645	71,687

Annual Operating Hours

According to the Design Institute[25] the annual operating hours of the Project can be further defined as "multiple year average annual operating hours" calculated as per the equation below:

$$\frac{multiple\ year\ average\ annual\ electricity\ production}{full\ installed\ capacity} = annual\ operating\ hours$$

- Where the "multiple year average annual electricity production" is estimated based on a 38 year average (1967-2004) of hydro flow in Wanma River, where the Project is located. Of which, 1978, 1970 and 1997 were chosen to represent the 3 typical years of ample, mean and dry hydrological flow for the estimation. Based on the same hydrological flow and energy from the Wanma River, the "multiple year average annual electricity production" is therefore estimated as 80,224 MWh for the 16MW option (i.e. the initial design) and 85,018 MWh for the 19.2MW option (i.e. the final adaptation). Hence the "multiple year average annual operating hours" of the Project for both options can be calculated as:

- $\frac{80,224\ MWh}{16MW} = 5,014\ h$, for the 16MW option
- $\frac{85,018\ MWh}{19.2MW} = 4,428\ h$, for the 19.2MW option

Capacity	16 MW	19.2 MW
Equipment	2 turbines (8 MW + 8 MW)	3 turbines (8 MW +8 MW +3.2 MW)
Running modes	16 MW and 8MW	19.2 MW, 16 MW, 11.2 MW, 8 MW and 3.2 MW
Electricity production (annual)	80,224 MWh	85,018 MWh

[25] Letter of explanations responding to the questions from the CDM-EB to Yunnan Yizi 19.2MW Hydropower Project, issued by Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd., dated 8/07/2010. This Letter provides explanations regarding the proposed Project including: (1) Definition & design of Annual Operating hours; (2) Determination of Coefficient of effective electricity; (3) Adoption of tariff in the FSRs.

Operation hours (annual)	5,014 h	4,428 h

The 19.2 MW option will provide approximately 4,800 MWh more electricity, as a small turbine with 3.2 MW is added to the initial design of 16 MW. Hence, the 19.2 MW plant can run even if the water flow is very low and/or very high. In total its flexibility is much higher as adapting to different hydro flows is possible by running the turbines in 5 different modes (i.e. 19.2, 16, 11.2, 8 and 3.2 MW) in high-flow, mean and dry seasons.

The 16 MW plant would have been equipped with 2 sets of 8 MW turbines which can only be operated at 2 modes of 8 or 16 MW.

Summing up, the increase of annual electricity production is achieved due to a higher capacity in total (19.2MW instead of 16MW), the more flexible mode of operation (5 modes instead of 2 modes) and the possibility to run the hydropower plant even with low water flow in dry season (3.2 MW turbine) and to minimise wasting water resource during the high-flow season (19.2MW instead of 16MW).

As the annual operating hours are based on the electricity production divided by the full capacity, they decrease due to the addition of the third small turbine although the total production increases by 6%.

Plant load factor (PLF)

Moreover, by having the annual operating hours as 4,428 hrs, the PLF of the 19.2MW option is 50.55%, which places within the typical range of 41-67% from the 'similar projects', defined and tested in the Common Practices Analysis in the PDD. It also ranks well above the average of 39.87% (i.e. the average of annual operating hours as 3,493 hrs) from the official statistics to all hydropower projects in Yunnan province[26]. Thus it can be concluded that the PLF defined in the Project is suitable and conservative.

Coefficient of Effective Electricity

Coefficient factor of effective electricity generation to the Project is determined by the Design Institute[25], as 0.85 for both 16 MW and 19.2 MW options, based on the requirements in the Economic Evaluation Code for Small Hydropower Project (SL16-95).

SL16-95 requires the coefficient factor to be chosen between 0.8-0.9 for the hydro projects that less than 50MW, connected to grid, with no regulation (i.e. run-of-river) as well as the grid accepts receiving all generated electricity in rain season and the night time, which are the applicable conditions to the Project in both 16MW and 19.2MW options. Therefore the coefficient factor of the Project is chosen as 0.85 (i.e. the mid-value of the required range by SL16-95), which shall be deemed as a suitable and reasonable input value for both options.

In addition, taking account the concerns and requirements to previously registered hydro projects by the EB, a coefficient factor of 1.0 has been applied as the conservative input value to the sensitivity analysis for testing the additionality of the Project. The sensitivity analysis results show that the Project IRR for both 16MW and 19.2MW options remains below the benchmark in accordance with the five selected indicators (i.e. coefficient factor=1.0 plus ± 10% of total fixed asset investment, annual operation & maintenance costs, annual electricity sales and tariff).

Tariff applicable to the Project

The project developer clearly noticed that different tariffs were adopted in the IRR calculations in the Feasibility Study Reports of the 16MW and 19.2MW options. The Design Institute[25] who issued the Feasibility Study Reports explains that

[26] China Electric Power Yearbook 2008, page 577. In the Yearbook 2008, it states that "*By the end of 2007, the total installed capacity of the hydropower projects in Yunnan Province is 12.34GW…… with total power generation as 43,100GWh.*"

- Tariff of 0.215 CNY/kWh for the 16MW plant was adopted directly from the indicative average tariff from Yunnan DRC Notice 2006-28[27], with the same weight of hydro flow in different seasons.
- Whilst, tariff of 0.2 CNY/kWh was adopted for the 19.2MW option, which simulated the actual scenarios of 3 seasonal tariffs (from Yunnan DRC Notice No. 2006-28)[27] x Project monthly electricity production depending on the hydro flow of each month, based on the implementation of NDRC Notice No. 2006-1229[28] during the preparation stage of the FSR Amendment for the 19.2MW option.

The method of using a weighted average to define the expected tariff is realistic, transparent and conservative. This method of adopting seasonal tariffs is not only regulated by Yunnan DRC[27], but also agreed for new hydro projects less than 50MW by the NDRC Notice No. 2006-1229[28].

The simulation of yearly average tariff was made more precisely to daily electricity production of the Project from the original design Model used by the Design Institute (i.e. the design Model estimated the "multiple year average annual electricity production" of 85.018 MWh for the 19.2MW option)[29]. As illustrated in below table, applying the 3 seasonal tariffs (regulated by Yunnan DRC Notice 2006-28)[27] to the net daily electricity production by the Project, provided by the Model[29], gives a yearly average tariff of 0.206 CNY/kWh, which is slightly higher than the input value of the IRR calculation but still below the indicative average tariff by Yunnan DRC Notice of 0.215CNY/kWh[27].

Table 5. Simulation of Yearly Average Tariff by "Multiple Year Average Annual Electricity Production"

	Power Production	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High-Flow Season	**27,56%**							11,54%	16,03%				
Mean Season	**36,70%**					3,30%	5,90%			14,11%	13,39%		
Dry Season	**35,74%**	5,82%	4,58%	4,40%	3,82%							9,78%	7,33%
Tariff (CNY/KWh) (Yunnan DRC Notice 2006-28)	**0.215** (indicative average)	0,240	0,240	0,240	0,240	0,215	0,190	0,190	0,190	0,190	0,190	0,215	0,240
Monthly Electricity Production (MWh)	**85 018**	4 952	3 896	3 739	3 249	2 803	5 020	9 810	13 625	11 997	11 380	8 312	6 234
Monthly Electricity Sales (MWh)	**71 688**	4 175	3 285	3 153	2 739	2 364	4 233	8 272	11 489	10 116	9 596	7 009	5 257
Monthly Electricity Revenue (10^3 CNY)	**14 785**	1 002	788	757	657	508	804	1 572	2 183	1 922	1 823	1 507	1 262
Yearly Average Tariff (CNY/KWh)	**0,206**												

The Project has not yet contracted a PPA with the Grid Company[30]; therefore no real tariff applicable to the Project can be obtained as of today. The yearly average tariff of 0.206 CNY/KWh could be deemed

[27] Notice regarding to the grid-feed-in tariff from new hydropower projects (No. 2006-28), issued by the DRC of Yunnan Province on 9/01/2006. This Notice provides further adjustments of feed-in tariffs, based on the NDRC Notice No. 2004-1037, for new hydropower projects (1) with installed capacity less than 50MW the adjusted tariff is CNY 0.215, 0.19 and 0.24/kWh in different seasons of the year. The average tariff is calculated as: CNY0.215/kWh = (0.24/kWh x 5 months in Dec and Jan-Apr + 0.215/kWh x 2 months in May and Nov + 0.19/kWh x 5 months in Jun-Oct)/12 months; or (2) with installed capacity larger than 50MW applies CNY0.215/kWh.

[28] Notice regarding to regulating the feed-in tariff to SCPG (No. 2006-1229), issued by NDRC on 28/06/2006. This Notice agrees Yunnan DRC's Notice of implementing adjusted tariffs for new hydropower projects with installed capacity less than 50MW in different seasons of the year.

[29] Design Model to Yizi 19.2MW Hydropower Project (Duplicated version from the original design Model), Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd. dated 8/07/2010. The spreadsheets provide the design data and calculations to the Yizi 19.2MW Project, including following sheets: (1) Design multiple year average hydro flow and average daily hydro flow (2) Calculation of multiple year average electricity production (on daily basis), including estimated total Multiple year average electricity production = 8,501.8 MWh and Multiple year average annual operating hours = 4,4028 hrs.

[30] Project Progress Report, Yongren County Wanyuan Hydropower Development Co., Ltd., dated 8/07/2010, The Progress Report provides following info to the Project as of 8/07/2010: (1) The main construction of the Project completed and had a test run on 23/06/2010; (2) Full test run and commissioning to the Project could not be reached due to lack of water resource resulted from

as the reasonable input value to the 19.2MW option, as it is generated from the current available methods which is the most precise, scientific and transparent one to simulate the reality of the power production and sales from the Project.

Additionality of the Project

Based on the above discussions, the applicable input values of the 3 parameters applicable to the proposed Project of 19.2MW (as the implemented option) shall be:

- Annual operating hours = 4,428 hrs
- Coefficient factor = 1.0
- Tariff = 0.206 CNY/kWh

The IRR of the Project with 19.2MW will be 8.30% (without CER revenues) or 8.89% (with a tariff of 0.215 CNY/kWh, as indicated in the list of tariffs published in the information note[31]), by applying the above 3 conservative input values, which remains below the benchmark of 10%. Therefore it can be concluded that the Project is additional.

Sub-step 2d. Sensitivity analysis

The sensitivity analysis shall show whether the conclusion regarding financial attractiveness is robust to be reasonable variations in the critical assumptions. As already explained the Project was initially implemented as 16MW in 4/2007 and finally implemented as 19.2MW. The sensitivity analysis of the Project will be discussed for both 16MW and 19.2MW options.

Following key parameters have been selected as sensitive indicators to test the financial attractiveness for the Project.

(1) Total fixed asset investment
(2) Annual operation & maintenance (O&M) costs
(3) Annual electricity sales
(4) Tariff

Moreover, as the co-efficient factor is used for the investment analysis of the Project, which have an impact on the project IRR related to the additionality of the Project. Base on the assessment of the additionality, the most conservative approach has to be considered. Using co-efficient factor as 1.0 (i.e. supposing 100% of power generation by the Project will be delivered to the Grid) as the most conservative approach to justify the additionality of the Project is therefore applied in the sensitivity analysis of the Project.

Variations of ±10% on the first four sensitive indicators, and the co-efficient factor as 0.85 and 1.0 have been considered. The results of the sensitivity analysis regarding the Project IRR are listed in **Table 6 and 7**.

Table 6. Sensitivity Analysis of the Project - 16MW Option*

16MW		Project IRR (%) – without CER revenues										IRR = 10%	
		-10%		-5%		0		+5%		+10%			
Co-Efficient Factor		0.85	1.0	0.85	1.0	0.85	1.0	0.85	1.0	0.85	1.0	0.85	1.0
Total Fixed Asset	16MW	7.23	9.67	6.64	9.01	6.10	8.40	5.58	7.84	5.11	7.31	-29.10%	-12.4%

the serious drought in Yunnan this year; (3) PPA of the Project has not just contracted, expected to be approved in late July 2010, depending on the completion of full test run, when there are sufficient water resource, and the Evaluation and Certification Report by Yunnan Power Grid.

[31] http://cdm.unfccc.int/Reference/Notes/index.html

16MW		Project IRR (%) – without CER revenues										IRR = 10%	
		-10%		-5%		0		+5%		+10%			
Investment													
Annual O&M Costs	16MW	6.43	8.72	6.26	8.56	6.10	8.40	5.93	8.24	5.58	8.08	-124.30%	-51.80%
Annual Electricity Sales	16MW	4.69	6.89	5.4	7.66	6.10	8.40	6.77	9.13	7.43	9.84	+30.70%	+11.10%
Tariff	16MW	4.64	6.84	5.38	7.63	6.10	8.40	6.79	9.15	7.47	9.89	+29.80%	+10.80%

*** Input data as per FSR, 09/2006[1]. Tariff= 0.215 CNY/kwh, Annual operating hours = 5,014 hrs.**

Table 7. Sensitivity Analysis of the Project - 19.2MW Option**

19.2MW		Project IRR (%)- without CER revenues										IRR = 10%	
		-10%		-5%		0		+5%		+10%			
Co-Efficient Factor		0.85	1.0	0.85	1.0	0.85	1.0	0.85	1.0	0.85	1.0	0.85	1.0
Total Fixed Asset Investment	19.2MW	6.9	9.03	6.37	8.45	5.88	7.90	5.43	7.40	5.00	6.93	-33.00%	-17.40 %
Annual O&M Costs	19.2MW	6.10	8.11	5.99	8.01	5.88	7.90	5.77	7.80	5.66	7.69	-203.50%	-104.00 %
Annual Electricity Sales	19.2MW	4.66	6.57	5.28	7.25	5.88	7.90	6.47	8.54	7.05	9.17	+37.40%	+16.80 %
Tariff	19.2MW	4.62	6.53	5.26	7.23	5.88	7.90	6.4	8.56	7.09	9.21	+36.20 %	+16.30 %

*** Input data as per FSR Amendment, 10/04/2007[2]. Tariff= 0.20 CNY/kwh, Annual operating hours = 4,428 hrs.**

The sensitivity analysis results show that the Project IRR varies to different degrees in accordance with the fluctuation of five indicators. Project IRR without CER revenues for both 16MW and 19.2MW options in all selected indicators remains below benchmark within the variation range of ±10%.

Total fixed asset investment

Project IRR will reach 10% when the total fixed asset investment decreases by 29.1% (co-efficient factor = 0.85) or 12.4% (co-efficient factor = 1.0) for the 16MW option and by 33% or 17.4% for the 19.2MW option. The total fixed asset investment of the Project was estimated in the FSR in 9/2006 and FSR Amendment in 7/2007. It is hardly to decline by the required threshold levels with reference to the Yunnan Index showing an increase of fixed asset investment by 1.8 - 7.4% in 2005-2008[32].

In addition, the Project has been under construction with a total installed capacity of 19.2MW since mid-2007 and expected to be commissioning by the end of July 2010[30&33]. The total investment of the Project has been significantly increased mainly due to the geological challenges met during the construction of water tunnel in the second quarter of 2009[34]. The net values of the Project audited by the licensed third parties in their capital assessment reports have been 70.28 million CNY in 8/2008[35] and 108.60 million CNY in 5/2009[36]. These 2 assessed net values represent over 82% and 126% of the input value of 85.5395 million CNY in the IRR calculation of 19.2MW option.

Moreover, the accumulated value of the contracts and invoices for the procurement of equipment,

[32] Price Index in 2005-2008, published by Yunnan Bureau of Statistics, Source: http://www.stats.yn.gov.cn/TJJMH_Model/default.aspx

[33] The Project was submitted to EB requesting for registration on 26/10/2009 when the expected commissioning date was end of 12/2009. The Project received an incompleteness note on 22/02/2010. The original commissioning date of the Project has been postponed due to the delay in transmission line construction by the grid company. The new expected commissioning date of the Project is the end of 5/2010, according to the Project Implementation – Project Progress Reports by the project owner to ORBEO dated on 30/11/2009 and 30/03/2010.

[34] Project Status Report by the project owner to ORBEO, dated 6/2009.

[35] Capital Assessment Report to the Yizi Power Project (Yunnan Zhenyu No. 2008-001) conducted by Yunnan Zhenyu Asset Evaluation Co., Ltd., dated 29/08/2008.

[36] Capital Assessment Report (Yicheng No. 2009-006) conducted by Yunnan Yicheng Asset Evaluation Co., Ltd., dated 10/05/2009.

facilities, and constructions for the Project already exceeds 96.1 million CNY[37], representing over 112% of the applied total fixed asset investment. Apart from this accumulated value, additional values from the contracts without a fixed total price (such as for purchasing steel and cement, the superficial finishing for the water tunnel and final decorations) and the contracts not yet signed (such as transmission line connection) which are expected for the final part of the Project implementation shall be added on. The actual investment on the fixed asset of the Project already exceeds the input value of the total fixed asset investment for the 19.2MW option.

Therefore it could be concluded that the input value of total fixed asset investment in IRR calculation is fair conservative.

Annual O&M costs

The annual O&M costs do not have a significant impact to the Project IRR. The annual O&M costs need to reduce 124.3% (co-efficient factor = 0.85) or 51.8% (co-efficient factor = 1.0) for the 16MW option and 203.50% or 104.00% for the 19.2MW option in order to reach the threshold. Having checked the salary index of Yunnan in 2005-2008[38], the increase on labor salary is ranked between 10.9 - 20.8%, which is in the reverse direction of the required threshold.

Hence, it can be concluded that the annual O&M costs is not a sensitive indicator which does not have significant impact to the investment analysis of the Project.

Annual electricity sales

In order to increase the electricity sales, the electricity production must be increased. So the annual operating hours of the Project must be increased. As discussed in earlier section, the adaption of 19.2MW option has already increased 6% of annual electricity production and sales by its optimized flexibility to utilize the different river flow in dry and peak seasons. It is improbable to increase an additional 37.40% (co-efficient factor = 0.85) or 16.80% (co-efficient factor = 1.0) of annual electricity production for the 19.2MW option. Therefore, it is impossible to increase electricity sales to the Grid in order to enhance the project IRR.

Tariff

In order to reach the benchmark IRR, the feed-in tariff of the Project has to be as 0.2724 CNY/KWh (co-efficient factor = 0.85) or 0.2362 CNY/KWh (co-efficient factor = 1.0) for the 19.2MW option. To address the concerns recently raised by the EB, such as EB49, para 48, EB53, Annex 32, the policy changes which impact the tariff applicable to the project activity are determined and the highest tariff of the region is applied to the sensitivity test.

Policy changes

According to Wang (2009)[39], the regulations address power management systems and tariffs in China evolutes from a national-wide unified price to differentiate price based on types of energy and regions. The major change of power management policy and regulations in China is from the Power System Reform Program published by State Council in 2002[40] and the re-form of National Development and

[37] List of Contacts for Yizi Hydropower Project (supported by 46 contracts plus invoices), provided by the project owner dated 15/10/2009.
[38] Salary Index in 2005-2008, published by Yunnan Bureau of Statistics, Source: http://www.stats.yn.gov.cn/TJJMH_Model/default.aspx
[39] Wang Wei (2009), Tariff of Hydropower Projects - Trends & Statistics Report, Guotai Junan Securities, Source: http://www.microbell.com/UpFile/200906/200965165857575.pdf
[40] State Council PRC (10/02/2002), Power System Reform Programme. Source: http://www.lawon.cn/law/detail.dox?id=2211075. Historically, the power plants and power grids were all run jointly by the State in China. This situation has been significantly changed due to the Power System Reform Program published by State Council 2002. The 2002 Program requires: separating the operation of power plants from the power grids; reforming enterprises for the power plants and power grids; bidding to power grids, building a competitive and open power market initially; and changing the current situation of all power purchased by the state owned grid enterprises.

Reform Committee (NDRC) in 2003. The 2002 Reform Program aims at separating the ownership and operations of power plants, power grids and dispatching networks, rather than an E+/E- policy. It also introduces a market-driven approach for setting the power tariff, instead of the profit-guaranteed principle used for tariff setting prior to the 2002 Program. After the Program, tariff for power generation projects to the Grid has been regulated by NDRC and regional/local DRC.

The NDRC and Yunnan DRC regulations, as summarized in **Table 8**, illustrate that the grid feed-in tariff for hydropower projects in Yunnan province has been very stable, remaining no change from 2004 to 2009.

Table 8. Indicated Tariffs for Hydropower Projects in Yunnan

Date of Publication	Regulations	Indicated Tariff (CNY/kWh)
2004	NDRC Notice No. 2004-1037[41]	0.215
30/07/2004	Yunnan DRC Notice No. 2004-589[42]	0.215
30/08/2005	Yunnan DRC Notice No. 2005-792[43]	0.18 (by average)
06/01/2006	Yunnan DRC Notice No. 2006-28[44]	0.215 (by average)
28/06/2006	NDRC Notice No. 2006-1229[45]	-
12/07/2006	Yunnan DRC Notice No. 2006-779[46]	0.215
29/06/2008	NDRC Notice No. 2008-1682[47]	0.14 - 0.181 (for listed projects in Yunnan)
09/07/2008	Yunnan DRC Notice No. 2008-1018[48]	-
19/05/2009	Chuxiong DRC Notice No. 2009-28[49]	0.18 (by average)

In Yunnan province, the tariff:

- For new hydropower projects which are not directly dispatched by SCPG (i.e. dispatched by local grid company like the proposed Project) the tariff has not been changed since 2005 at the level of 0.18 CNY/KWh.
- For the projects directly dispatched by SCPG (which is not the case of the proposed Project but

[41] Notice regarding to the problem of feed-in tariff to SCPG (No. 2004-1037), issued by the DRC of Yunnan Province in 2004. This Notice stipulates the tariff for new hydropower projects is CNY 0.215/kWh.

[42] Notice regarding to regulating feed-in tariff to the Power Grid of Yunnan Province (No. 2004-589), issued by the DRC of Yunnan Province on 30/07/2004. This Notice stipulates the tariff for new hydropower projects is CNY 0.215/kWh.

[43] Notice regarding to the indirect dispatched feed-in tariff to the Power Grid of Yunnan Province (No. 2005-792), issued by the DRC of Yunnan Province on 30/08/2005. The feed-in tariff for small and medium scale hydropower projects which are not directly dispatched by SCPG (i.e. dispatched by local grid company like the proposed Project through Yunnan Grid to the SCPG) is CNY 0.13, 0.18 and 0.23/kWh in different seasons of the year. The average tariff is calculated as: CNY 0.18/kWh = (0.13/kWh x 5 months in Dec and Jan-Apr + 0.18/kWh x 2 months in May and Nov + 0.23/kWh x 5 months in Jun-Oct)/12 months

[44] Notice regarding to the grid-feed-in tariff from new hydropower projects (No. 2006-28), issued by the DRC of Yunnan Province on 9/01/2006. This Notice provides further adjustments of feed-in tariffs, based on the NDRC Notice No. 2004-1037, for new hydropower projects (1) with installed capacity less than 50MW the adjusted tariff is CNY 0.215, 0.19 and 0.24/kWh in different seasons of the year. The average tariff is calculated as: CNY0.215/kWh = (0.24/kWh x 5 months in Dec and Jan-Apr + 0.215/kWh x 2 months in May and Nov + 0.19/kWh x 5 months in Jun-Oct)/12 months; or (2) with installed capacity larger than 50MW applies CNY0.215/kWh.

[45] Notice regarding to regulating the feed-in tariff to SCPG (No. 2006-1229), issued by NDRC on 28/06/2006. This Notice agrees Yunnan DRC's Notice of implementing adjusted tariffs for new hydropower projects with installed capacity less than 50MW in different seasons of the year.

[46] Notice regarding to regulating the feed-in tariff to the Power Grid of Yunnan Province (No. 2006-779), issued by DRC of Yunnan Province on 12/07/2006. This Notice reconfirms the implementation of adjusted tariffs for new hydropower projects with installed capacity less than 50MW regulated by Yunnan DRC Notice No.2006-28.

[47] Notice regarding to increasing feed-in tariff to SCPG (No. 2008-1682), issued by NDRC on 29/06/2008. This Notice instructs tariff adjustments to power plants under SCPG. However, tariff for hydropower projects (except some projects listed in the document) is not changed in Yunnan province. Tariff is from 0.148 - 0.181 CNY/KWh for the listed hydropower plants (with installed capacity between 3.2 to 60 MW) in Yunnan Province.

[48] Notice regarding to regulating the feed-in tariff to the Power Grid of Yunnan Province (No. 2008-1018), issued by DRC of Yunnan Province on 9/07/2008. This Notice provide further instructions to the NDRC Notices No.2008-1682. However, there is no instruction of tariff change applicable to the Project.

[49] Notice regarding to the small hydropower grid-feed-in tariff (No. 2009-28), issued by DRC of Chuxiong Prefecture on 19/05/2009. This Notice reconfirms the small and medium scale hydropower projects in Chuxiong District are not directly dispatched by SCPG. Thus the tariff regulated by Yunnan DRC Notice No. 2005-792 shall be applied.

also good for reference and cross checking) the tariff has also been kept at the same level of 0.215 CNY/KWh from 2004 to date.

- For existing/old hydropower projects is even lower than the new projects in Yunnan. The tariff for the existing hydropower plants (with installed capacity between 3.2 to 60 MW) is in the range of 0.148 - 0.181 CNY/KWh in Yunnan Province, regulated by NDRC on 29/06/2008.

Therefore, it can be concluded that the policy changes in China in 2004-2009 have no impact to the tariff for hydropower projects in Yunnan. The national and/or sectoral policies or regulations regarding the tariff for hydropower projects in Yunnan that have been implemented since the adoption of the COP for CDM M&P in 2001 need not be taken into account in developing baseline scenario of the proposed projects.

Highest tariff in the region

Regarding the highest tariff of the region applicable to the Project, the highest tariff for hydropower projects in Yunnan is 0.24 CNY/KWh, occurring only in the dry season in December and January - April, regulated by Yunnan DRC Notice 2006-28[34].

As discussed in **Table 5** of the former section, the simulated yearly average tariff of the Project with 19.2MW option is 0.206 CNY/KWh, which is slightly higher than the input value of 0.2 CNY/KWh, but still below the indicative average tariff of 0.215 CNY/KWh. In addition, the information note sets 0.215 CNY/KWh as the highest tariff for hydro projects in Yunnan Province, China. Thus the indicative average price of 0.215 CNY/KWh on the year base could be deemed as the highest tariff or the region applicable to the project activity.

Despites, the State Electricity Regulatory Commission PRC in February 2009[50] also confirmed that: "*As result of the global financial crisis, the electricity demand in China has been significantly decreased since October 2008. Thus electricity price will be difficult to increase in a short term and be stable in the long term.*" The forecast tariff will be stable as to the current level and will not be dramatically increased in the near future.

Furthermore, it is very likely that the tariff of 0.18 CNY/KWh, from the latest regulation by the DRC of Chuxiong Prefecture (N0. 2009-28), will be applied to the Project, as the Project is still under construction and expected to be commissioning in the end of July 2010[30]. This price is over 10% lower than the calculated tariff in both 16MW and 19.2MW options.

Therefore, it can be concluded that the input tariff of 0.2 CNY/KWh to the 19.2MW option is reasonable and the simulated yearly average tariff of 0.206 CNY/KWh is acceptable as the conservative input tariff to the Project. In addition, the indicative average tariff of 0.215 CNY/KWh (in a yearly basis) could be deemed as the suitable threshold (i.e. the highest tariff of the region) to the Project.

Income tax rate

It has been observed that the income tax rate in China falls from 33% to 25% from 10/01/2008[51]. As the decision of implementing the Project with an installed capacity of 19.2MW was made in mid-2007, the Project IRR calculation applies the former rate of 33%[23]. Cross checked by the newer rate of 25%, **Table 9** summarizes the Project IRR applying income tax rate of 25% and 33%. It demonstrates that the application of newer income tax rate of 25% does not sufficiently improve the financial feasibility of the Project in order to meet the benchmark level.

Table 9. Project IRR *vs.* Income Tax Rate

[50] Short term electricity price is hard to be increased, by Mr. HUANG Shao-Jin, Vice Chair of Price and Finance Management Department, State Electricity Regulatory Commission PRC on 6/02/2009, Source: http://www.chinapower.com.cn/article/1147/art1147086.asp

[51] Corporate Income Tax Regulation (No. 2007-63), issued by the State Council of PRC on 3/16/2007.

(without CER Revenues)

Income Tax Rate	Co-Efficient Factor	Project IRR
33%	0.85	5.88 %
	1.0	7.90 %
25%	0.85	6.50%
	1.0	8.69%

To sum up, the sensitivity analysis shows that without CER revenues, the Project IRR is difficult to reach the benchmark of 10%. This result leads to conclude that **Alternative 1 -** Implementing the Project, but not as a CDM project, is not feasible. Therefore the Project is additional.

In conclusion, **Alternative 2** - Import of electricity from the SCPG, is the only practical and feasible baseline alternative scenario of the Project.

Step 3. Barriers Analysis

According to the *Tool for Demonstration and Assessment of Additionality* (version 05.2), Step 3 is not applicable (only step 2 is selected).

Step 4. Common Practice analysis

Sub-step 4a. Analyze other activities similar to the Project activity:

The purpose of the common practices is to analyse the projects with similar conditions to the proposed project, such as investment conditions (including technology, scale, regulatory, tax and financing conditions, etc.) and natural conditions (including geographical, climate, development conditions, etc.) in order to demonstrate the additionality of the Project.

In addition, according to the *Tool for the Demonstration and Assessment of Additionality*, projects are considered 'similar' (hereafter as 'similar project') in case they are located in the 'same country/region', are of 'similar scale', and 'take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.'.

Hydropower projects located in the SCPG covering provinces (i.e. Guangdong, Guangxi, Guizhou and Yunnan) do not have similar investment and natural conditions in terms of regulatory framework, tax, financing, geographical, climate, and development conditions[52]. Therefore the SCPG region is rather too large to be chosen as with 'similar conditions' to the proposed project.

Hydropower projects with installed capacity of 15-50 MW in Yunnan Province which are in operation after 1993 have been chosen as the 'similar project' to the Project by following reasons:

- Yunnan Province covers an area of 394,000 km^2 [53] which is comparatively larger than many countries in the world. Besides, Yunnan is one of the provinces rich in hydro-electric potentials in China. Yunnan's hydro-electric potentials mainly distribute alongside its six main river systems - Jinsha River, Lancang River, Nu River, Yuan River, Nanpan River and Yilowadi River, which account for approximate one-fourth of total hydro-electric potentials in China[54]. Of which, 92% of the potential hydro-electric resources are in Jinsha River, Lancang River and Nu River systems. The proposed Project is located on Wanma River, a branch of Jinsha River system[1]. Thus, Yunnan

[52] Introduction to hydro-electric resources in China, Investment & Forecast Report on China Hydropower Industry – the Year 2009-2012 (Volume I) published by China Investor Consultancy in 1/2009, p5-14
[53] Yunnan e-Government, Source: http://www.yn.gov.cn/yunnan,china/74590868828323840/20051218/1031489.html
[54] Yunnan hydro-electric development forecast, Investment & Forecast Report on China Hydropower Industry – the Year 2009-2012 (Volume II) published by China Investor Consultancy in 1/2009, p218.

Province could be considered as the 'similar project' - with a suitable size of 'same region', and suitable in 'a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.' to this analysis.

- The Economic Evaluation Code for Small Hydropower Project (SL16-95) has been applied in the FSR and FSR amendment for the proposed project. SL16-95 is applicable to hydropower projects with the installed capacity is or below 25MW (newly-built, expansion, rebuilt or renovation projects) and located in rural are with installed capacity less than 50MW[6]. Moreover, hydropower project with capacity is and below 15MW are applicable to small scale CDM projects which apply to different methodology from the Project. Therefore the installed capacity of the projects between 15-50 MW are considered to be as the 'similar project' - with 'similar scale' and also 'a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.' to this analysis.
- Hydro-electric system in China has been reformed in depth from the period of 1993-2002 and significantly changed in the period of 2003-2007[55]. Before 1993, hydropower plants in China were totally operated by the State and mainly equipped by foreign technology and imported equipment. This differs from current situation of having good level of local technology and equipment like the proposed Project. Therefore hydropower projects in operation after 1993 are considered as the 'similar projects' - with suitable time in terms of 'a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc.' to this analysis.

Existing hydropower projects fall into the above criteria of the 'similar projects' are listed in **Tables 10** and **11**.

Table 10 Existing Hydropower Plants Similar to the Proposed Project (without CDM)

	Project	Capacity (MW)	Start Operation	Project Developer (PD)	Company Attribute	CDM	Remarks
1	Sanjiangkou Hydro Project[56]	30	1993	Yunnan Baoshan Supahe Electricity Co., Ltd	State owned	No	▪ PD owns 4 hydropower plant in Yunnan ▪ Unit investment cost: 12,266 CNY/KW ▪ Annual operating hours: 4140h
2	Yisahe II Hydro Project[57]	25	1994	Sinohydro Corporation[58]	State owned	No	▪ PD is Top 84/500 company in 2008, the largest hydropower developers in China ▪ Annual operating hours: 3412h
3	Laohushan II Hydro Project[59]	25	1998	Yunnan Dianneng Group	State owned	No	▪ PD owns 8 hydropower plant in Yunnan ▪ Unit investment cost: 6,096 CNY/KW
4	Jirenhe Hydro Project[60]	30	2001	Diqing prefecture Shangri-La Diqing Electric Power Co., Ltd.	State owned	No	▪ PD is the grid company, the owner of grids, power networks and power stations in Yunnan
5	Luoshuidong Hydro Project[61]	20	2003	Yunnan Wenshan Electric Power Co., Ltd	State owned & Listed company	No	▪ Unit investment cost: 4,430 CNY/KW ▪ Annual operating hours: 7000h
6	Maomaotiao Hydro Project[51]	40	2004	Maomaotiao Electricity Co.,	State owned & Listed	No	▪ Unit investment cost: 3,000 CNY/KW ▪ Annual operating hours: 6000h

[55] Four major evolution stages of hydro-electric system reform in China, Investment & Forecast Report on China Hydropower Industry – the Year 2009-2012 (Volume I) published by China Investor Consultancy in 1/2009, p61-62

[56] Introduction of Yunnan Baoshan Supahe Electricity Co., Ltd. Source: http://www.ynsph.com.cn/

[57] http://slx.zjwchc.com/sdz/sdz1/604.htm

[58] http://baike.baidu.com/view/174009.htm

[59] http://shuangbai.mofcom.gov.cn/aarticle/gzdy/200611/20061103849752.html

[60] http://xxgk.yn.gov.cn/canton_model17/newsview.aspx?id=215941

[61] http://www.ynws.gov.cn/docdetail_new.asp?id1=20060328081326

	Project	Capacity (MW)	Start Operation	Project Developer (PD)	Company Attribute	CDM	Remarks
				Ltd	company		
7	Nantinghe Hydro Project [62]	34	2004	Yunnan Wenshan Electric Power Co., Ltd[63]	State owned & Listed company	No	▪ Unit investment cost: 4,529 CNY/KW ▪ Annual operating hours: 6464h
8	Xiashilong Hydro Project[51]	25	2005	Guangnan County Power Co., Ltd.[64]	State owned & Listed Company	No	▪ Unit investment cost: 4,603 CNY/KW ▪ Annual operating hours: 5533h
9	Wunihe Hydro Project[46]	30	2005	Yunnan Baoshan Supahe Electricity Co., Ltd	State owned	No	▪ Unit investment cost: 5,845 CNY/KW ▪ Annual operating hours: 5750h
10	Houqiao Hydro Project [65]	48	2005	Yunnan Baoshan Electricity Co., Ltd	State owned	No	▪ Annual operating hours: 4986h
11	Yanziya Hydro Project[66]	25	2005	Heqing Xinyuan Yanggongjiang Power Co., Ltd.	State owned	No	▪ Unit investment cost: 4,800 CNY/KW ▪ Annual operating hours: 6000h
12	Baixianglin Hydro Project [67]	50	2006	Yunnan Dianneng Group	State owned	No	▪ Unit investment cost: 6,060 CNY/KW
13	Chongjianghe (Expansion) Hydro Project[68]	48	2006	Guodian Diqing Shangri-la Generating Ltd., Co.	State owned & Listed company	No	▪ PD owns over 30 hydropower stations ▪ Annual operating hours: 6500h
14	Laodukou Hydro Project [69]	36	2007	Luoping Zinc & Electricity Co., Ltd	State & Listed Co.	No	▪ Unit investment cost: 5,545 CNY/KW ▪ Annual operating hours: 5250h

Table 11 Existing Hydropower Plants Similar to the Proposed Project (with CDM)

CDM -Ref.	Project	Capacity (MW)	Annual Operating Hours (Hr)	PLF (%)	Start Operation	Project Developer Attribute
1074	Yunnan Yingjiang Nandihe Hydro Power Project	20	4550	51.94	2007	Private
1102	Yunnan Heier 25MW Hydropower Project	25	4963	56.66	2007	Private
1388	Yunnan Dali Yanger 49.8MW Hydropower Project	49.8	3631	41.45	2008	Private
1862	Yunnan Lushui County Laowohe 25MW Hydropower Project	25	4684	53.47	2008	Private
1983	Yingjiang Songpo Hydropower Station	20	4571	52.18	2010	Private
2003	Yunnan Guangnan Duimen River Hydropower Station	20	4927	56.24	2008	Private
2006	Yunnan Nujiang Fugong Guquan River Hydropower Station	22	5351	61.08	2008	Private
2010	Dachunhe 50 MW Hydropower Project	50	4794	54.73	2008	Private

[62] http://www.7c.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=9179
[63] http://www.wsdl.com.cn/introduce/
[64] http://www.yngn.gov.cn:Jichujianshe/ShowArticle.asp?ArticleID=61
[65] http://www.khidi.com:8083/ShowMess.asp?ArticleID=934
[66] http://www.bofcom.gov.cn/bofcom/432911834190708736/20070124/103037.html
[67] http://news.sina.com.cn/c/2004-07-08/11543027389s.shtml
[68] http://www.gdxds.com.cn/Colligate.asp?classid=4
[69] http://xxgk.yn.gov.cn/canton_model64/newsview.aspx?id=35101

CDM -Ref.	Project	Capacity (MW)	Annual Operating Hours (Hr)	PLF (%)	Start Operation	Project Developer Attribute
2015	Yunnan Dayao County Yupao River 3rd Level Hydropower Station	20	3880	44.29	2008	Private
2016	Yunnan Yingjiang Xiangbai River Zhina Hydropower Station	21	5086	58.06	2008	Private
2045	Mujiajia Yiji 18.9MW Hydropower Project	18.9	3828	43.70	2009	Private
2048	Lufeng 36MW Hydropower Project	36	3773	43.07	2010	Private
2050	Shangri-La Langdu River 1st Level Hydropower Station	21.6	4548	51.92	2009	Private
2057	Shangri-La Langdu River 4th Level Hydropower Station	24	4714	53.81	2007	Private
2059	Shangri-La Langtayong Hydropower Station	18	4648	53.06	2009	Private
2063	Yunnan Longchuan Nanwanhe 2nd Level Hydropower Station	20	5320	60.73	2011	Private
2064	Yunnan Jinping Miao-Yao-Dai Autonomous County Kesikou Hydropower Station	17	4776	54.52	2009	Private
2075	Expansion Project of Sanjiangkou Hydro-electric Power Station	32	5984	68.31	2008	Private
2080	Binglang River Tucang Hydropower station	35	5131	58.57	2009	Private
2106	Yunnan Lianghe Hulukou Hydropower Station	20	5876	67.08	2008	Private
2114	Lijiang Wulanghe Secondary Hydropower Project	32	4557	52.02	2008	Private
2116	Yunnan Yingjiang Mangya River 1st Hydropower Station	24.9	5837	66.63	2008	Private
2164	Zilenghe 24MW Hydropower Project in Yunnan Province	24	4113	46.95	2008	Private
2376	Yunnan Tengchong Longchuan River Stage I Hydropower Plant	24	5235	59.76	2006	Private

Source: UNFCCC website[70]

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

The proposed Project is developed by a private small and medium enterprise (SME) who is a new enterer to the hydropower development market formed in 2007. The proposed Project developed with an annual operation hour of 4,428 hrs and an unit investment cost of exceeding 4,455 CNY/KW[71].

Considering the 'similar projects' without CDM, as listed in **Table 10**, it can be clearly identify that all of remaining 14 projects enjoying favourable conditions in at least one, by mostly several, of the benchmarks of annual operation hours and unit investment cost.

[70] UNFCCC CDM website search dated on 3/08/2009, http://cdm.unfccc.int/Projects/projsearch.html
[71] Unit investment of the Project = total fixed asset investment / installed capacity = 85.5359 million CNY / 19.2 MW = 4,455.18 CNY/KW.

In addition all these 'similar projects' are owned by state owned companies and many of these state owned companies are also listed companies. In China, these projects have easier access to capital and higher capacity of resisting risks since they are backed up by the government. Although the development of renewable energy is encouraged by the Chinese government, it is still restricted by regional policies. Priority of such development is still given to large and ultra-large hydro power plants[72]. Though the private SMEs contribute over a half of China's economy, they still face severe financing difficulties[73]. In China, less than 10% of total bank loans have been granted to the SMEs due to their weaker fund and collateral strength[74].

The project owner of the proposed Project is a private SME with no previous experiences, proven records and advantage for accessing to the power grids, acquiring a better tariff, and in granting financing supports for the proposed Project. Thus the project owner faces great difficulties in obtaining the financial supports from the bank and in PPA negotiation with the Grid which would prevent the implementation of the proposed Project. Meaning that without the CDM, the proposed Project is not a feasible project.

Having counted the proposed Project as a CDM project will help to build up the confidence to the Grid and the bank as to the reputation and image, strength of monitoring and implementation, and capability of repayment of the Project because:

- State recognition resulting from the approval and publication by the NDRC China;
- Transparency of the project is enhanced and updated on the UNFCCC website;
- Assistance to monitoring from third parties, such as the CER buyer and the Designated Operation Entity (DOE), and
- The expected CER revenues could cover the annual operating costs of the proposed project[75].

In conclusion, the Project fulfils all criteria of the *Tool for Demonstration and Assessment of Additionality*. It faces prohibitive financial barriers without CER revenues. Therefore, the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The consolidated methodology ACM0002 (Version 08) is applied in the context of the project in the following four steps:

1. Calculate the project emissions;
2. Calculate the baseline emissions;
3. Calculate the project leakage;
4. Calculate the emission reductions.

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

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

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

[75] As shown in the IRR calculation, the expected annual CER sales are 4, 837,000 CNY, which is higher that the annual O&M costs of 2,394,000 CNY of the Project.

1. Project Emissions

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for project emissions, estimated as follows:

(a) If the power density (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = \frac{EF_{Res} \cdot TEG_y}{1000} \qquad \text{(Equation B.1)}$$

Where:

PE_y = Emission from reservoir expressed as tCO_2e/year;
EF_{Res} = is the default emission factor for emissions from reservoirs, and the default value as per EB23 is 90 Kg CO_{2e} /MWh.
TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

(b) If the power density (PD) of the power plant is greater than 10 W/ m^2

$$PE_y = 0 \qquad \text{(Equation B.2)}$$

The PD of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \qquad \text{(Equation B.3)}$$

Where:

PD = Power density of the project activity, in W/ m^2.
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W). This installed capacity of the Project is 19.2MW.
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m2). A new reservoir will be built, and the surface of water is 130,000m^2 when the reservoir is full[76]
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero.

The proposed project is a new hydropower station with reservoir, the power density is 147.6 W/m^2, greater than 10 W/m^2, according to methodology ACM0002 (Version07), PE_y=0. Thus, (b) is chosen to calculate the project emission.

2. Baseline emission

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

76 Explanation regarding the surface area calculation for Yizi 19.2MW hydropower project issued by Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd. in 09/2006,.

$$BEy = (EGy - EG_{baseline})\, EF_{grid,CM,y} \quad \text{(Equation B.4)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).
EG_y = Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.
$EF_{grid,CMy}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

The methodology assumes that all project electricity generation above baseline levels ($EG_{baseline}$) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in EF_y.

The emission factor (EF_y) of the proposed project is calculated *ex-ante*. According to baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated using the latest version of the *Tool to calculate the emission factor for an electricity system.* The *Tool to calculate the emission factor for an electricity system* referred by ACM0002 determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project

According to the methodology, the calculation of emission factor should use the methodology tool -*Tool to calculate the emission factor for an electricity system* (version 01.1), following steps are applied:

Step1. Identify the relevant electric power system

In China, the delineation of the project electricity system and connected electricity system is published by Chinese DNA, which is clearly defined. So the project electricity system and the connected electricity system delineated by China DNA will be used. The electricity generated by the project is connected to the SCPG. Therefore, the relevant electric power system is the SCPG which consists of Guizhou, Yunnan, Guangdong, Guangxi provincial grids.

In addition, there is net imported power to the SCPG from the Central China Power Grid (CCPG). Therefore, the CCPG is considered as part of the relevant electric power system. To determine the CO_2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from the CCPG, the tool provides four options:

a) 0 tCO2e/MWh, or
b) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in step 3 (d) below; or
c) The simple operating margin emission rage of the exporting grid, determined as described in step 3(a), if the conditions for this method, as described in step 2 below, apply to the exporting grid; or
d) The simple adjusted operating margin emission rate of the exporting grid, determined as described in step 3 (b) below.

The Project will choose option b) since it is not possible to identify the specific power plants exporting electricity from CCPG to the SCPG.

Step 2. Select an operating margin (*OM*) method

Tool to calculate the emission factor for an electricity system (Version 01.1) provides four options to calculate OM, which are:

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

From 2001 to 2005, in the composition of gross annual power generation for SCPG, the ratio of power generated by hydro-power and other low cost/compulsory resources is as following: 36.86% in 2001, 35.99% in 2002, 33.53% in 2003, 29.95% in 2004, 30.42% in 2005, obviously far lower than 50%. Based on these considerations, the OM has been calculated according to the Simple OM. Simple OM is appropriate, because low cost/ must run resources account for far less than 50% of the power generation in the China South Power Grid in most recent years.

For simple OM, the emission factor can be calculated using either of the two following data vintages:

- Ex ante option: A 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year *y*.

The "ex-ante vintage" will be employed for OM calculation of the project, without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 3 <u>Calculation of the Operating Margin</u>

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2e/MWh) of all generating power plants serving the system, not including low-cost/must-run power/units. It may be calculated:

- (Option A) Based on data on fuel consumption and net electricity generation of each power plant/unit, or
- (Option B) Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit, or
- (Option C) Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A should be preferred and must be used if fuel consumption data is available for each power plant/unit. However, the fuel consumption and net electricity generation data for each power plant/unit is not available, therefore, Option A and Option B is not available. Meanwhile, only nuclear and renewable power generation is considered as low-cost/must-run power sources. Only Option C can be used.

The simple OM using Option C is calculated as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad \text{(Equation B.5)}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit) $EF_{co2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)

EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants/units, in year y (MWh)

i = All fossil fuel types combusted in power sources in the project electricity system in year y

y = Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

According to Tool to calculate the emission factor for an electricity system, when data on individual plants is not available in a consistent manner, $EF_{OM,simple,y}$ may be calculated by using the aggregated generation and fuel consumption data from the provincial grids within SCPG. As data ($F_{i,j,y}$ and $GEN_{j,y}$) per each plant is not available in a consistent manner the aggregated generation fuel consumption data for the provincial grids which constitutes SCPG are used as indicated in the Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on 09/08/2007. Data on different fuel consumption for power generation in the SCPG are taken from the Energy Balance Table of Yunnan, Guizhou, Guangxi and Guangdong (Year 2003 through 2005) from the China Energy Statistical Yearbook.

The Operating Margin emission factors for 2003, 2004 and 2005 are calculated. The three-year average is calculated as a 3-year generation-weighted average of the emission factors. The operating margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period of the project activity. $EF_{grid\ OMy}$, , adopts the calculation process updated by Chinese DNA on 9/08/2007 (see more details in Annex 3). The exact calculation process of $EF_{grid\ OMy}$ can be found from: http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=2530

The parameter of coke and refinery gas published by the Chinese DNA are not consistent with IPCC data, the calculation process adopted IPCC data. Thus, Operation Margin Emission Factor of the SCPG is 1.0119 tCO_{2e}/MWh.

Step 4 Identify the cohort of power units to be included in the build margin

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

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

b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (MWh) and that have been built most recently; (If 20% falls on part capacity of a plant, that plant is fully included in the calculation.)

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the

build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The Project chooses *Option 1* to calculate without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 5 Calculation of the build margin emission factor*:*

The build margin emissions factor is the generation-weighted average emission factor (tCO_{2e}/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follow:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad \text{(Equation B.6)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO_{2e}/MWh)
$EG_{m,y}$ = Net electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO2 emission factor of power unit m in the year y (tCO_{2e}/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

In China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (MWh) and that were built most recently. Taking notice of this situation, EB accepts the following deviation in methodology application (DNV letter to the CDM EB; request for guidance: application for AM0005 and AMS-I-D in China, dated 7/10/2005):

1. Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1-3 years, whichever results in a capacity addition that is closest to 0% of total installed capacity.
2. Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Since there is no way to separate the different generation technology capacities as coal, oil or gas etc from thermal power based on the present statistical data, the following calculating measures will be taken:

- First, according to the energy statistical data of most recent one year, determine the ratio of CO_2 emissions produced by solid, liquid, and gas fuels consumption for power generation;
- Second, multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency;
- Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid.

The calculation is conducted as follows:

Sub-step a. Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year.

$$\lambda_{coal,} = \frac{\sum_{i \in COAL_{,j}} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \quad \text{(Equation B.7)}$$

$$\lambda_{oil} = \frac{\sum_{i \in OIL,j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \quad \text{(Equation B.8)}$$

$$\lambda_{gas} = \frac{\sum_{i \in GAS,j} F_{i.j,y} * COEF_{i.j}}{\sum_{i,j} F_{i.j.y} * COEF_{i,j}} \quad \text{(Equation B.9)}$$

where:

$\boldsymbol{F}_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power plant j in year(s) y,

$\boldsymbol{COEF}_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_{2e}/GJ), taking into account the carbon content of the fuels used by power plant j and the percent oxidation of the fuel in year(s) y, and COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

Sub-step b. Calculate emission factor for thermal power of the grid based on the result of Step a. and the efficiency level of the best technology commercially available in China.

$$\boldsymbol{EF}_{Thermal} = \lambda_{Coal} \times \boldsymbol{EF}_{Coal,Adv} + \lambda_{Oil} \times \boldsymbol{EF}_{Oil,Adv} + \lambda_{Gas} \times \boldsymbol{EF}_{Gas,Adv} \quad \text{(Equation B.10)}$$

Where $\boldsymbol{EF}_{Coal,Adv}$, $\boldsymbol{EF}_{Oil,Adv}$ and $\boldsymbol{EF}_{Gas,Adv}$ are emission factor proxies of efficiency level of the best coal-fired, oil-based and gas-based power generation technology commercially available in China.

Sub-step c. Calculate BM of the grid based on the result of **Step b** and the share of thermal power of recent 20% capacity additions.

$$\boldsymbol{EF}_{BM,y} = \frac{\boldsymbol{CAP}_{Thermal}}{\boldsymbol{CAP}_{Total}} \times \boldsymbol{EF}_{Thermal} \quad \text{(Equation B.11)}$$

Where CAP_{Total} is total capacity additions while $CAP_{Thermal}$ is capacity additions of thermal power.

As mentioned above, the build margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period. $EF_{grid,BM,y}$ adopts the data updated by China DNA on 9/08/2007. (See more details in Annex 3) The exact calculation process of $EF_{grid,BMy}$, can be found at: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

The published Build Margin Emission Factor as 0.6748tCO_{2e}/MWh.

The data resources for calculating OM and BM are:

- Installed capacity, power generation and the rate of internal electricity consumption of thermal power Plants. (*China Electric Power Yearbook 2002-2006*)
- Fuel consumption and the net caloric value of thermal power plants. (*China Energy Statistical Yearbook 2004-2006*)
- Carbon emission factor and carbon oxidation factor of each fuel. (*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy*, Table 1.3 and Table 1.4 of Page 1.21-1.24 in Chapter one.)

Step 6 – Calculation of the baseline emission factor (Combined Margin)

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \text{(Equation B.12)}$$

Where:

$EF_{grid,BM,y}$	= Build margin CO_2 emission factor in year *y* (tCO_{2e}/MWh)
$EF_{grid,OM,y}$	=Operating margin CO_2 emission factor in year *y* (tCO_{2e}/MWh)
W_{OM}	= Weighting of the operating margin emission factor (%)
W_{BM}	= Weighting of build margin emission factor (%)

According to the *Bulletin on the Baseline Emission Factors of the China's Grid* renewed by Director Office of National Climate Change Coordination of NDRC (China DNA) on 9/08/2007, the Operating Margin Emission Factor ($EF_{grid,OM,y}$) of the SCPG is 1.0119 tCO_{2e}/MWh and the Build Margin Emission Factor ($EF_{grid,BM,y}$) is 0.6748 tCO_{2e}/MWh. The defaults weights value for hydropower projects are used as specified in the "*Tool to calculate the emission factor for an electricity system*" (Version 1) (ωOM = 0.5*;* ωBM = 0.5).

Using above mentioned values the Combined Baseline Emission Factor of the SCPG corresponds to 0.8434 tCO_{2e}/MWh.

3. Project leakage

According to ACM0002, no leakage from the proposed project activity is considered.

4. Emission reductions

Since the project emission and leakage are both zero, the emission reduction of the Project is equal to the baseline emission.

$$BE_y = (EG_y - EG_{baseline})\, EF_{grid,CM,y} \quad \text{(Equation B.4)}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr).
EG_y = Electricity supplied by the project activity to the grid (MWh). Net quantity of electricity supplied by the Project is 71, 687 MWh;
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh).
For new power plants this value is taken as zero.
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

Therefore, the emission reduction of the Project is 60,460 tCO_{2e}.

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

The data and parameters used in the calculations of the baseline emissions and project emissions are listed below. Details are provided in the Annex 3.

Data / Parameter:	$FC_{i,j,y}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type i consumed by power plant *j* in year *y*
Source of data used:	*Chinese Energy Statistical Yearbook, 2004-2006*
Value applied:	Varies for each fuel and year, see Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Chinese Energy Statistical Yearbook* is an official publication.
Any comment:	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter:	$NCV_{i,}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	*Chinese Energy Statistical Yearbook 2006*
Value applied:	See Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Chinese Energy Statistical Yearbook* is an official publication.
Any comment:	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter:	$EF_{co2,i}$
Data unit:	t CO_{2e}/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy*
Value applied:	See Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	No local specific value is available. Therefore using the default values from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Any comment:	See Annex 3 for details. Low degree of data uncertainty.

Data / Parameter:	$GEN_{i,j,y}$
Data unit:	MWh
Description:	In SCPG, power generation resource I in province *j* power generation amount in year *y*
Source of data used:	*Chinese Energy Statistical Yearbook, 2004-2006*
Value applied:	Varies for each type of fuel used and year, see Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Chinese Energy Statistical Yearbook* is an official publication.
Any comment:	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter:	$PR_{j,y}$
Data unit:	%
Description:	In SCPG, plant own consumption rate from province *j* in year
Source of data used:	"Chinese Energy Statistical Yearbook" 2006
Value applied:	See Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Chinese Energy Statistical Yearbook is an authoritative publication.
Any comment:	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	The oxidation rate of fuel *i*
Source of data used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy*
Value applied:	See Annex 3 for detail.
Justification of the choice of data or description of measurement methods and procedures actually applied :	No local specific value is available. Therefore using the default values from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.
Any comment:	Please note that to get to CO_2 emission factor per unit of energy it is necessary to multiply by 44/12. Low degree of data uncertainty.

Data / Parameter:	CAP_y
Data unit:	MW
Description:	In SCPG, power installed capacity from resource I in province m in year *y*
Source of data used:	*Chinese Electricity Yearbook, 2004-2006*
Value applied:	Varies with province and year
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Chinese Energy Statistical Yearbook* is an official publication.

Any comment:	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter:	*GENE* $_{best,\ coal}$
Data unit:	%
Description:	The optimum commercial, coal-fired power supply efficiency
Source of data used:	*2007 Baseline Emission Factors for Regional Power Grid in China*. http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf
Value applied:	35.82%
Justification of the choice of data or description of measurement methods and procedures actually applied :	National fixed value
Any comment:	To calculate OM

Data / Parameter:	$GENE_{best,\ gas/oil}$
Data unit:	%
Description:	The optimum commercial, coal-fired power supply efficiency
Source of data used:	*2007 Baseline Emission Factors for Regional Power Grid in China* http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf
Value applied:	47.67%
Justification of the choice of data or description of measurement methods and procedures actually applied :	National fixed value
Any comment:	To calculate OM

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Surface area at full reservoir
Source of data used:	Feasibility Study Report[1] and Explanation regarding the surface area calculation by Chuxiong Xinyuan Hydro-Electric Survey and Design Co., Ltd. in 09/2006[54]
Value applied:	130,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured from topographical surveys by a competent third party.
Any comment:	

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

According to section B.6.1, the baseline emission factor of the project is 0.8434tCO_{2e}/MWh in the first crediting period. And the annual power supplied to the grid by the project is 71,687MWh. Therefore, BE_y during the first crediting period is to be calculated as follows:

$$BE_y = EF_y \times EG_y = 0.8434\ tCO_{2e}/MWh \times 71{,}687MWh = 60{,}460\ tCO_{2e}$$

To sum up, the Project will supply net electricity of 71,687MWh to the SCPG annually. Therefore, the annual emission reduction is estimated as 60,460 tCO_{2e} per year.

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

As the project starting date of the first crediting period is 01/01/2010 with the renewable crediting periods, the emission reductions during the first crediting period are estimated as:

Year	Estimation of project activity emissions (tonnes of CO_{2e})	Estimation of baseline emissions (tonnes of CO_{2e})	Estimation of leakage (tonnes of CO_{2e})	Estimation of overall emission reductions (tonnes of CO_{2e})
01/01-31/12/2010	0	60,460	0	60,460
2011	0	60,460	0	60,460
2012	0	60,460	0	60,460
2013	0	60,460	0	60,460
2014	0	60,460	0	60,460
2015	0	60,460	0	60,460
2016	0	60,460	0	60,460
Total (tonnes of CO_{2e})	0	423,220	0	423,220

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

B.7.1. Data and parameters monitored:

Data / Parameter:	TEG_y
Data unit:	MWh
Description:	Total annual amount of power generated by the Project in year y.
Source of data to be used:	Electricity meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	85,018
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording
QA/QC procedures to be applied:	The meters will be maintained and calibrated according to relevant regulations and industry standards.
Any comment:	

Data / Parameter:	$EG_{PJ\ to\ Grid,\ y}$
Data unit:	MWh

Description:	Net electricity delivered by the Project to grid in year y
Source of data to be used:	Electricity meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	71,687
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording
QA/QC procedures to be applied:	The meters will be maintained calibrated according to relevant regulations and industry standards.
Any comment:	

Data / Parameter:	$EG_{Grid\ to\ PJ,\ y}$
Data unit:	MWh
Description:	Net electricity use of Project supplied by the SCPG in year y
Source of data to be used:	Electricity meter
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording
QA/QC procedures to be applied:	The meters will be maintained and calibrated according to relevant regulations and industry standards.
Any comment:	

Data / Parameter:	CAP_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Project site. Manufacturer's specification
Value of data applied for the purpose of calculating expected emission reductions in section B.6	19.2
Description of measurement methods and procedures to be applied:	The capacity of the project will be recorded annually according to the installed units.
QA/QC procedures to be applied:	The installed capacity will not be changed during the crediting period will not affect the calculation of emission reductions by the Project.
Any comment:	

Data / Parameter:	A_{PJ}

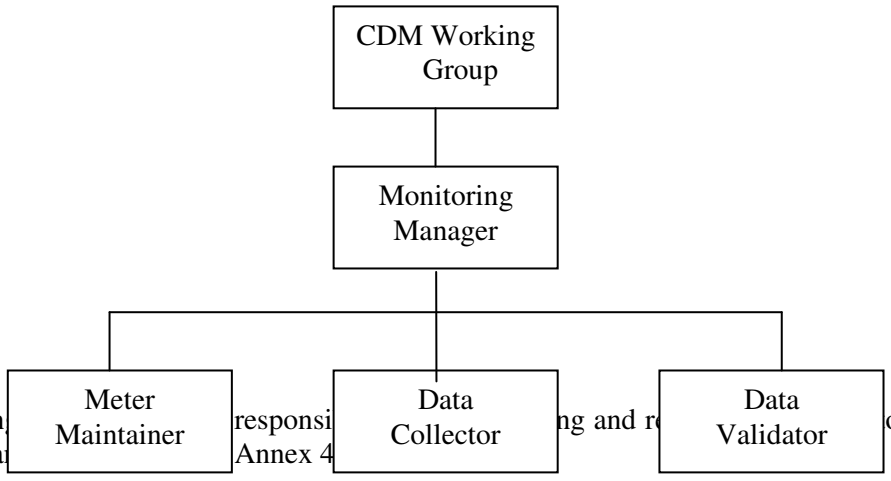
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the Project activity, when the reservoir is full.
Source of data to be used:	Site survey
Value of data applied for the purpose of calculating expected emission reductions in section B.6	130,000
Description of measurement methods and procedures to be applied:	Measured from topographical surveys annually by competent third party.
QA/QC procedures to be applied:	The power density of the Project is well above 10 W/m^2 and therefore substantial deviations from the calculated design surface area will not affect the calculation of emission reductions by the Project.
Any comment:	

B.7.2. Description of the monitoring plan:

The project owner will establish and implement the Monitoring Protocol before the start up of the Project. The objective of the Monitoring Protocol is to provide credible, accurate transparent and conservative monitoring data of the emission reductions. Moreover, the real, measurable and long term global environmental benefits relating to the GHG emission reduction accrued by the Project can be verified and certified.

Monitoring Organization and training

A CDM Working Group will be established by the project owner to undertake the monitoring tasks. The CDM Working Group structure is illustrated as following:



The Monitorin responsi ng and r oring tasks. The monitoring pla Annex 4

Firstly, the Data Collector is responsible for taking the prescribed, regular collection of the meter readings of the monitored parameters listed in section B.7.1. He will submit the results to the Data Validator.

The Data Validator will check the validity of the data by comparing with previous recorded data and data from third party such as the Grid Company. If there is a huge difference identified, it must be reported to the Monitoring Manager. The validated data will be retained according to the CDM data management system and archived electronically by the Data Validator.

The Meter Maintainer is responsible for the organization of calibration tasks and regular maintenance of the meters equipped in the Project. The meters will be calibrated and maintained by specific technical staff and third party verification in accordance to relevant regulations and industry standards.

All the personnel shall be trained and competent according to the training manual.

Data to be monitored

Since the emission factor is calculated as *ex-ante* and according to the Monitoring Methodology ACM0002, the following data must be monitored:

a) Total electricity generated by the Project (TEG_y)

b) Electricity delivered by the Project to the Grid ($EG_{Pj\ to\ grid,\ y}$)

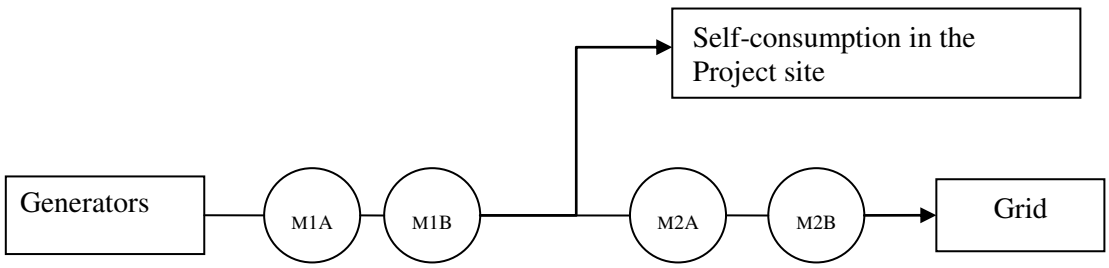
c) Electricity delivered from the Grid to the Project ($EG_{Grid\ to\ Pj,\ y}$)

d) Surface area of the reservoir at full reservoir level of the Project (A_{PJ})

e) The installed capacity of the Project ($CAPpj$)

Installation and maintenance of monitoring meters

According to the design of the measuring equipment (DL/T448-2000: the Technical Rules for Ammeter), the monitoring meters shall be properly installed and checked by the project owner and the Grid Company before the Project in operation. The accuracy of the monitoring meters for electricity generation is 0.5(S). Following diagram shows the position of the meters:



Monitoring Diagram of Yizi Project

Four (4) meters will be installed in the Project:

- M1A is to measure the total electricity generation (TEG_y) that will be installed at the end of output generators at the Project site. M1B is the backup of M1A to assure the measurement in case of defect or calibration of M1A.

- M2A is a two-way meter to measure the electricity delivered by the Project to the Grid ($EG_{Pj\ to\ grid,\ y}$) and the electricity delivered by the Grid to the Project ($EG_{Grid\ to\ Pj,\ y}$). M2B is the backup of M2A to assure the measurement in case of defect or calibration of M2A.

The net electricity supplied by the Project to the Grid is the difference between $EG_{Pj\ to\ grid,\ y}$ and $EG_{Grid\ to\ Pj,\ y}$. The invoices of the electricity sales shall be kept in order to cross check the net electricity supply to the Gird.

In urgent cases, the project owner must notify the Grid Company. The amount of electricity consumed during the period when the all meters are out of function will be determined by both parties through consultation.

The quality assurance and quality control (QA&QC) procedures for recording, maintaining and archiving data shall be optimized to ensure the quality of the data produced by the project activity.

Calibration

The project owner and the Grid Company will sign an agreement to provide measurement and calibration quality control procedures to ensure the accuracy of the data. Ammeter cycle test and inspection should be executed in accordance with national standards.

All monitoring meters must be calibrated by qualified organization in accordance to the relevant regulations and industry standards. The calibration records should be kept and retained according to the record management procedures. After verification and calibration, the monitoring meters must be sealed. All meters must be jointly inspected and sealed by authorized personnel on behalf of the project owner and Grid Company.

In addition, all monitoring meters must be tested by a qualified metering verification institution commissioned jointly by the project owner and the Grid Company within 10 days after:

(a) Detection of a difference larger than the allowable error in the readings of both meters;

(b) Repair and/or replacement the faulty meter caused by improper operation.

Data collection

The QA&QC procedures for recording, maintaining and archiving data shall be established and implemented as part of this CDM project.

On a fixed day of each month, the project developer and the Grid Company will read the meters and record the read figures in the generation statement note. The project owner is responsible for monitoring of all the meters. The data will be recorded and collected daily, and archived in electronic form monthly.

The surface area of the reservoir at full reservoir level (A_{PJ}) will be measured and monitored by the competent third party annually while the Project is in commission. The data will be recorded and archived in electronic form annually.

The installed capacity of the Project (CAP_{PJ}) is indicated in the documentation of the supplier of the hydro-turbines. The data will be recorded and archived in electronic form.

Maintenance records and any calibration documents will be retained by the project owner.

The QA&QC procedures for recording, maintaining and archiving data shall be optimized to ensure the Project which shall be able to provide credible, accurate, transparent and conservative monitoring data in order to calculate the emission reductions by the Project.

In case of instrumentation default or incoherent data, the dedicated manager, i.e. the Monitoring manager, in charge of the Monitoring Report shall correct the data following the "data handling protocol" that will be written during the implementation of the Project. In case of defaults not covered by the "data handling protocol", the Monitoring manager is responsible for validating or correcting the default data with a conservative approach and for writing a detailed report.

Monitoring report

The monitoring report is prepared by Monitoring Manager, and be submitted to related framework after final judgment based on the CDM project principal. The report should cover the monitoring of grid-connected power generation, the surface area of the reservoir, calculation reports of the emission reduction as well as maintenance and calibration reports. All written documentation such as maps, drawings, the Environmental Impact Assessment, should be well maintained and retained and should be available to the verifier. Thus the creditability, reliability, transparency and traceability of the project records and calculation of emission reductions could be ensured.

Record management

All records generated by the projects shall be managed according to the record management procedure. The monitoring data shall be continuously recorded; the electronic documents and paper documents shall also be collected. All these data should be kept until two years after the end of the crediting period.

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

The study of the baseline and monitoring methodology was concluded on 25/09/2008 by the following organization and person.

Hangzhou Carbon Trade Environment Engineering Co., Ltd.

Room 5298, 5308 of Qianjiang Keji Building, No.388 Wensan Rd, West Lake District, Hangzhou City, Zhejiang Province, China.

Contact person：Tina Wang

Tel: +86 0571 5683 4629

Fax: +86 0571 5683 4630

Email: wmn1432000@yahoo.com.cn

The entity is not the project participants in annex 1.

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:

10/04/2007 [3]

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

22 years

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

C.2.1. Renewable crediting period

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

01/01/2010 or the registration date which ever the later one

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Environmental impacts

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

The Environmental Impact Assessment (EIA) for this Project was carried out by Chuxiong Yi Autonomous Prefecture Environmental & Science Institute. The EIA report was approved respectively by Chuxiong Yi Autonomous Prefecture Environmental Protection Bureau on 6 November, 2006[77] and Yunnan Provincial Environmental Protection Bureau on 31/01/2008[78] in accordance with current consent conditions. The major conclusions are presented as follows:

Construction period:

The project will have several impacts on the environment around the project location during the construction period. The pollutants mainly include: waste gas, dust, noise, solid waste, waste water, etc.

[77] EIA Approval by Chuxiong Yi Autonomous Prefecture Environmental Protection Bureau on 06/1102006
[78] EIA Approval by Yunnan Provincial Environmental Protection Bureau on 31/01/2008,

The impacts caused by dust and noise are comparatively obvious on the local environment.

Solid Waste

There will be 130 thousand cubic meters of solid waste produced during the project construction period which mainly consist of construction and household garbage in the construction area. Most of the construction solid waste will be considered to be fully utilized by combining with the backfilling of permanent and temporary constructible site. The remaining solid waste will be piled to the designated solid markets. In addition, to prevent the soil erosion and land sliding during heavy raining season, the field wall should be designed at the bottom of the refuse dump and the surface of the refuse dump should be planted. The disposal site should be set up nearby or within the construction area to collect the household garbage.

Soil Erosion:

It is necessary to excavate earth and rock during the construction period, and these activities will disturb land surfaces and aquatic ecosystems. Project owner has set apart special funds to minimize the impacts on the land surfaces and the aquatic ecosystems caused by the Project. At the end of construction, constructible traces should be conducted a comprehensive restoration. Meanwhile, in order to avoid vegetation and soil destroying caused by construction workers, the strict delineating of the scope of land requisition will be applied for the project at the designing time, and the warning signs will be set up in construction zone to indicate the construction activities.

Dust

Dust pollution mainly comes from the digging and piling up of earthwork, loading and transporting of construction material, garbage from construction, and so on. The residents nearby are fewness, so the dust impact is relatively small. Furthermore, the Project will take strict management to the construction fields which can reduce the dust emission effectively. Road of construction and the working area should daily irregular watered to reduce the dust. Construction workers will wear dust masks, hats, and glasses to protect themselves from the heavy dust.

Noise

Noise mainly comes from the high noisy construction machinery. The project owner will enforce the management of the Project constructing to reduce the impact caused by noise. Reasonable arrangements will be applied to the Project during the construction period. Low-noise equipment and techniques will be used to enhance the maintenance of equipment and maintenance in construction procedure. Silencers will be used to reduce noise and depress the noise intensity of mechanical equipment. To strengthen the construction of staff's personal protection, the earplugs and earmuffs will be used. After completion of the Project, the noise will disappear.

Operating period:

Waste Water Discharge

There are two kinds of waste water produced by the Project: the aggregate washing, projects stir and construction machinery cleaning and living sewage. Wastewater treatment pond will be set at the place which most of wastewater is produced, and the wastewater will be discharged into the river after sediment disposal. Living sewage will be treated as far as possible to avoid downstream river pollution before discharging into the river.

Wildlife, Aquatic Organism

The constructible area does not subject to the terrestrial animals protection. The river hydrological and biological impact is not very significant because the power project involves a relative small reservoir which is used to maintain the basic shape of the natural river.

Submerged area and Resettlement

As it is a run-of-river project the submerged area will not lead to the inundation of farmland, only can submerge the original river bed. There is no resettlement for the project activity.

Overall, a lot of clean energy will be produced for the southwest region after the Project commissioning. The development of hydropower resources will give contributions to avoid non-renewable resource depletion, to mitigate the pressure on the transportation industry and to reduce greenhouse gas emissions; With the widespread use of energy, it will also avoid a large number of forest resources depletion, contributing to the achievement of "a power switching" which makes contributions to protect the ecological environment in the region.

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

There are no significant environmental impacts for the Project.

SECTION E. Stakeholders' comments

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

In order to reflect the suggestion and attitude of the stakeholders and make them understand the Project objectively and realistically, the project owner noticed the stakeholders to conduct a public consultation meeting in the meeting room on 17/09/2006[79]. All relevant stakeholders from the local residents, mainly including Yizi village and Yongxing village were invited to the stakeholder consultation meeting. At the same time, the local communities also participated in the meeting. Questionnaires (in Chinese) were used to carry out the survey of stakeholder comments to the project. 50 questionnaires have been issued, and 48 recycled.

E.2. Summary of the comments received:

The results of the survey are summarized:

The details of the stakeholders of the Project (local villagers)

item	Gender		Age				Educational			Profession		
	Male	Female	≤20	21-40	41-60	≥ 60	illiteracy	Elementary school	Junior high school	cadre	farmer	student
Number	18	6	3	12	7	2	1	12	11	3	18	3
%	75.0	25.0	12.5	50.0	29.2	8.3	4.2	50.0	45.8	12.5	75	12.5

[79] Notice of Stakeholder consultation meeting on 11/09/2006

The results of the public participating survey (local villagers)

Serial number	Content of the survey	Idea and suggestion	Statistical result	
			Number	Percent
1	The degree of realizing to the Project	Well know	21	87.5
		Know about	3	12.5
2	The impact on the local economic development	Large	20	83.3
		Common	3	12.5
		Small	1	4.2
3	The impact on the local environment	Large	3	12.5
		Common	1	4.2
		Small	20	83.3
4	Whether support to the Project	Support	21	87.5
		Object	0	0
		Indifferent	3	12.5
5	Satisfaction to the land confiscation and compensation	Satisfied	21	87.5
		Object	3	12.5
		Indifferent	0	0
6	The impact on water loss and soil erosion	Large	0	0
		Common	6	25.0
		Small	16	66.7
		Unknown	2	8.3
7	Whether know the project land area impact the contracted land	Well know	23	95.8
		Unknown	1	4.2
8	Satisfaction to the land confiscation and compensation	Satisfied	23	95.8
		Object	0	0
		Indifferent	1	4.2
9	Whether support to the Project	Support	23	95.8

The results of the public participating survey (local communities)

1. The construction of the Project is benefit for the local socio-economic sustainable development, for example: increasing the local tax revenue and promoting employment.
2. The construction of the Project has some impact on the local nature and livelihood environment. The project owner will start the Project complying with the relevant rules and regulations.
3. All of the investigated local communities think that the Project construction has more advantages than disadvantages.
4. All of the investigated local communities support the Project construction.

According to public participation in the survey, the local villagers and communities possess strong positive comments on the Project and support the project construction. They are of the view that the Project construction can bring a lot of benefits.

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

There is no need to modify the project due to comments received. In order to avoid the impact on the local residents, the environmental concern from the survey will be seriously considered by the project owner and will be solved by applying the reasonable measures.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the Project.

Annex 3

BASELINE INFORMATION

Tables A3-1 Fossil Fuel-fired Power Generation of SCPG in 2003

Province	Electricity Generation (MWh)	Rate of Electricity Consumption（%）	Electricity Supply to Grid（MWh)
	(MWh)	(%)	(MWh)
Guangdong	143351000	5.5	135,466,695
Guangxi	17079000	8.43	15,639,240
Guizhou	43295000	7.4	40,091,170
Yunnan	19055000	8.01	17,528,695
Total			208,725,800

Power transmitted from CCPG to SCPG (MWh)	11,100
The average emission factor of CCPG（tCO_2/MWh）	0.797442
Total emission (tCO_2)	198,755,407
Total Electricity Supply（MWh）	208,736,900

Data source: China Electric Power Yearbook 2004

Tables A3-2 Calculate the Operating Margin Emission Factor of SCPG in 2003

Fuel	**Unit**	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	**Total**	**$EF_{CO2,i}$**	**NCV_i**	**$CO_2(tCO_2e)$**
							(tc/TJ)	**($MJ/t,km^3$)**	I=G*H*F*E*44/12/10000(mass)
		A	**B**	**C**	**D**	**E=A+B+C+D**	**F**	**H**	I=G*H*F*E*44/12/1000 (volume)
Raw coal	10^4t	4491.79	831.84	2169.11	1405.27	**8898.01**	25.8	20908	175993455.05
Cleaned coal	10^4t	0.05				**0.05**	25.8	26344	1246.07
Other washed coal	10^4t			36.38	20.37	**56.75**	25.8	8363	448971.84
Coke	10^4t				0.5	**0.5**	25.8	28435	13449.76
Coke oven gas	10^8m^3				0.04	**0.04**	12.1	16726	2968.31
Other gas	10^8m^3	3.21			11.27	**14.48**	12.1	5227	335797.81
Crude oil	10^4t	6.85				**6.85**	20	41816	210055.71
Gasoline	10^4t	0.02				**0.02**	18.9	43070	596.95
Diesel oil	10^4t	31.9			0.76	**32.66**	20.2	42652	1031759.27
Fuel oil	10^4t	627.22	0.3			**627.52**	21.1	41816	20301304.48
PLG	10^4t					**0**	17.2	50179	0.00
Refinery gas	10^4t	2.85				**2.85**	18.2	46055	87592.00
Nature gas	10^8m^3					**0**	15.3	38931	0.00
Other petroleum products	10^4t	11.35				**11.35**	20	38369	319357.98
Other coking products	10^4t					**0**	25.8	28435	0.00
Other energy	10^4tce	93.21			22.35	**115.56**	0	0	0.00
								Total	198746555.23

Data source: China Energy statistical Yearbook 2004

Tables A3-3 Fossil Fuel-fired Power Generation of SCPG in 2004

Province	Electricity Generation (MWh)	Rate of Electricity Consumption（%）	Electricity Supply to Grid（MWh)
	(MWh)	(%)	(MWh)
Guangdong	169389000	5.42	160,208,116
Guangxi	20143000	8.33	18,465,088
Guizhou	49720000	7.06	46,209,768
Yunnan	24322000	7.56	22,483,257
Total			247,366,229

Power transmitted from CCPG to SCPG (MWh)	10,951,240
The average emission factor of CCPG（tCO_2/MWh）	0.826448
Total emission (tCO_2)	274, 226,117
Total Electricity Supply（MWh）	258,317,469

Data source： China Energy Statistical Yearbook 2005

Tables A3-4 Calculate the Operating Margin Emission Factor of SCPG in 2004

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	$EFCO_{2,i}$	$OXID_i$	NCV_i	Emission of CO_2(tCO_2e)
							(tc/TJ)	(%)	(MJ/t,km^3)	I=G*H*F*E*44/12/10000 （quantity）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10000 （volume）
Raw coal	10^4t	6017.7	1305	2643.9	1751.28	11717.88	25.8	100	20908	231,767,573.55
Cleaned coal	10^4t	0.21				0.21	25.8	100	26344	5,233.5
Other washed coal	10^4t					0	25.8	100	8363	0
Coke	10^4t					0	29.2	100	28435	0
Coke oven gas	10^8m^3					0	12.1	100	16726	0
Other gas	10^8m^3	2.58				2.58	12.1	100	5227	59,831.38
Crude oil	10^4t	16.89				16.89	20	100	41816	517,932.98
Petrol	10^4t					0	18.9	100	43070	0
Diesel oil	10^4t	48.88			1.83	50.71	20.2	100	42652	1,601,975.28
Fuel oil	10^4t	957.71				957.71	21.1	100	41816	30,983,494.25
PLG	10^4t					0	17.2	100	50179	0
Refinery gas	10^4t	2.86				2.86	15.7	100	46055	87899.34
Nature gas	10^8m^3	0.48				0.48	15.3	100	38931	104,833.40
Other petroleum products	10^4t	1.66				1.66	20	100	38369	46,707.86
Other coking products	10^4t					0	25.8	100	28435	0
Other energy	10^4tce	79.42				79.42	0	100	0	0
									Total	265,175,481.54

Data Source: China Energy statistical Yearbook 2005

Tables A3-5 Fossil Fuel-fired Power Generation of SCPG in 2005

Province	Electricity Generation (MWh)	Rate of Electricity Consumption（%）	Electricity Supply to Grid（MWh)
	(MWh)	(%)	(MWh)
Guangdong	176453000	5.58	166,606,923
Guangxi	25023000	7.95	23,033,672
Guizhou	58430000	7.34	54,141,238
Yunnan	27281000	6.94	25,387,699
Total			269,169,531

Power transmitted from CCPG to SCPG (MWh)	96,363,000
The average emission factor of CCPG（tCO_2/MWh）	0.771225
Total emission (tCO_2)	369,521,975
Total Electricity Supply（MWh）	365,532,531

Data source： China Energy Statistical Yearbook 2006

Tables A3-6 Calculate the Operating Margin Emission Factor of SCPG in 2005

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	$EFCO_{2,i}$	$OXID_i$	NCV_i	Emission of CO_2(tCO_2e)
							(tc/TJ)	(%)	($MJ/t,km^3$)	I=G*H*F*E*44/12/10000 （quantity）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10000 （volume）
Raw coal	10^4t	6696.47	1435	3212.31	1975.55	13319.33	25.8	100	20908	263442601.85
Cleaned coal	10^4t				0.15	0.15	25.8	100	26344	3738.21
Other washed coal	10^4t			10.39	33.88	44.27	25.8	100	8363	350237.59
Coke	10^4t	4.79			8.05	12.84	29.2	100	28435	345389.71
Coke oven gas	10^8m^3				0.79	0.79	12.1	100	16726	58624.07
Other gas	10^8m^3	1.87			15.96	17.83	12.1	100	5227	413485.84
Crude oil	10^4t	10.91				10.91	20	100	41816	334555.88
Petrol	10^4t	0.68				0.68	18.9	100	43070	20296.31
Diesel oil	10^4t	31.96	2.02		1.81	35.79	20.2	100	42652	1130638.84
Fuel oil	10^4t	887.21				887.21	21.1	100	41816	28702703.26
PLG	10^4t					0	17.2	100	50179	0.00
Refinery gas	10^4t	4.92				4.92	15.7	100	46055	151211.46
Nature gas	10^8m^3	0.93				0.93	15.3	100	38931	203114.71
Other petroleum products	10^4t	1.7				1.7	20	100	38369	47833.35
Other coking products	10^4t					0	25.8	100	28435	0.00
Other energy	10^4tce	104.66	133.15		59.72	297.53	0	100	0	0.00
									Total	295204431.07

Data Source: China Energy statistical Yearbook 2006

Tables A3-7 The OM EF of SCPG

Year	2004	2005	2006
Emission factor（tCO_2/MWh）	0.952181	1.061586	1.010914
The average emission factor（tCO_2/MWh）	1.011911		

Table A3-8 $EF_{Coal, Adv}$, $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$

	Variation	Efficiency	Fuel EF (tc/TJ)	Emission factor (tCO_2/MWh)
		A	B	D=3.6/A/1000 *B*C*44/12
Coal-fired power plant	$EF_{Coal,Adv}$	35.82%	25.8	0.9508
Gas-fired power plant	$EF_{Gas,Adv}$	47.67%	15.3	0.4237
Oil-fired power plant	$EF_{Oil,Adv}$	47.67%	21.1	0.5843

Table A3-9 Breakdown per fuel of annual emissions

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	$EFCO_{2,i}$	$OXID_i$	NCV_i	Emission of CO_2(tCO_2e)
							(tc/TJ)	(%)	($MJ/t,km^3$)	I=G*H*F*E*44/12/10000 （quantity）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10000 （volume）
Raw coal	10^4t	6696.47	1435	3212.31	1975.55	13319.33	25.8	100	20908	263442601.85
Cleaned coal	10^4t				0.15	0.15	25.8	100	26344	3738.21
Other washed coal	10^4t			10.39	33.88	44.27	25.8	100	8363	350237.59
Coke	10^4t	4.79			8.05	12.84	29.2	100	28435	345389.71
Coke oven gas	10^8m^3				0.79	0.79	12.1	100	16726	58624.07
Other gas	10^8m^3	1.87			15.96	17.83	12.1	100	5227	413485.84
Crude oil	10^4t	10.91				10.91	20	100	41816	334555.88
Petrol	10^4t	0.68				0.68	18.9	100	43070	20296.31
Diesel oil	10^4t	31.96	2.02		1.81	35.79	20.2	100	42652	1130638.84
Fuel oil	10^4t	887.21				887.21	21.1	100	41816	28702703.26
PLG	10^4t					0	17.2	100	50179	0.00
Refinery gas	10^4t	4.92				4.92	15.7	100	46055	151211.46
Nature gas	10^8m^3	0.93				0.93	15.3	100	38931	203114.71
Other petroleum products	10^4t	1.7				1.7	20	100	38369	47833.35
Other coking products	10^4t					0	25.8	100	28435	0.00
Other energy	10^4tce	104.66	133.15		59.72	297.53	0	100	0	0.00
									Total	295204431.07

Thus

$\lambda_{Coal,y}$ =89.48%， $\lambda_{Oil,y}$ =10.24%， $\lambda_{Gas,y}$ =0.28%。

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =0. 9117 tCO_2/MWh

Table A3-10 Installed Capacity of SCPG in 2005

Installed Capacity	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal	MW	35182.6	4931.2	4758.4	9634.8	54507
Hydro	MW	9035.7	6085.3	7993.1	7233	30347.1
Nuclear	MW	3780	0	0	0	3780
Wind	MW	83.4	0	0	112.2	83.4
Total	MW	48081.7	11016.5	12751.5	16867.8	88717.5

Data source： China Energy Statistical Yearbook 2006

Table A3-11 Installed Capacity of SCPG in 2004

Installed Capacity	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal	MW	30172.9	4378.1	4306.9	7801.8	46659.7
Hydro	MW	8584.6	5040.4	7058.6	6896.5	27580.1
Nuclear	MW	3780	0	0	0	3780
Wind	MW	83.4	0	0	0	83.4
Total	MW	42621	9418.5	11365.5	14698.3	78103.3

Data source： China Energy Statistical Yearbook 2005

Table A3-12. Installed Capacity of SCPG in 2003

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Thermal	MW	27231.4	3190.1	3556.8	6465.8	0	40444.1
Hydro	MW	8107.2	4525.2	6543.2	3713.7	2520	25409.3
Nuclear	MW	3780	0	0	0	0	3780
Other	MW	83.4	0	0	0	0	83.4
Total	MW	39202	7715.3	10100	10179.5	2520	69716.8

Data source: China Electric Power Yearbook 2004

Table A3-13. Installed Capacity of SCPG in 2002

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Thermal	MW	25237.8	3156.2	2932.7	4642.5	0	35969.2
Hydro	MW	7775.3	4363.3	5836.3	2426.1	2520	22921
Nuclear	MW	2790	0	0	0	0	2790
Other	MW	76.8	0	0	0	0	76.8
Total	MW	35879.9	7519.5	8769.1	7068.6	2520	61757.1

Data source: China Electric Power Yearbook 2003

Table A3-14 BM EF of SCPG

	Installed Capacity of 2003	Installed Capacity of 2004	Installed Capacity of 2005	Increase Installed Capacity of year 1995-2005 (MW)	Cumulative increase (%)
	A	B	C	D=C-A	
Thermal(MW)	40444.1	46659.7	54507	14062.9	74.01%
Hydro(MW)	25409.3	27580.1	30347.1	4937.8	25.99%
Nuclear(MW)	3780	3780	3780	0	0.00%
Wind(MW)	83.4	83.4	83.4	0	0.00%
Total	69716.8	78103.2	88717.5	19000.7	100.00%
% versus 2005	78.58%	88.04%	100%		

$EF_{BM, y}$ =0. 9117×74.01%=0.6748tCO_2/MWh

Annex 4

MONITORING INFORMATION

Monitoring Plan of the Project

	Monitoring Point (1)	Monitoring Point (2)	Monitoring Point (3)	Monitoring Point (4)	Monitoring Point (5)
Purpose	To determine the total electricity generated by the Project	Annual amount of power supplied by the Project to the Power Grid Corporation.	Annual amount of power supplied by the Power Grid Corporation to the Project.	To determine the surface area of the reservoir at full reservoir level.	Total installed capacity of the Project.
Device	PLC-1/ M1A & M1B	PLC-2/ M2A & M2B	PLC-3/ M2A & M2B	A_{PJ}	CAP_{PJ}
Frequency	Hourly	Hourly	Hourly	Annually	Annually
Responsible	Data Collector / Data Validator				
Record Type	electronic				
Record Name	PLC-1/M1A & M1B	PLC-2/ M2A & M2B	PLC-3/ M2A & M2B	A_{PJ}	CAP_{PJ}
Record Management	1. Data Collector is responsible for taking the prescribed, regular collection of the meter. He will submit the results to the Data Validator. 2. Data Validator checks the validity of the data by comparing with previous recorded data and data from third party such as the Power Corporation. If a big difference does exist, it should be reported to Monitoring Manager. 3. The validated data will be retained according to the CDM data management system and archived electronically by the Data Validator 4. Meter Maintainer is responsible for the calibration tasks and regular maintenance of the meters equipped in the Project. The accuracy of the electricity generation meter is 0.5(S).The meters will be calibrated and maintained by specific technical staff and third party verification in accordance to relevant regulation and standards.				
Approve	Monitoring Manager				
Review	CDM Working Group				