**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Yunnan Nanwahe River Bundled Hydropower Project of China
Version number of the PDD	04.1
Completion date of the PDD	2013-04-26
Project participant(s)	Yuanfeng Hydropower Development Co., Ltd. of Lincang City (the project owner) ACT Carbon Capital Ltd.
Host Party(ies)	P.R.China
Sectoral scope and selected methodology(ies)	Sectoral scope 1: energy industries (renewable sources). Methodology: ACM0002 (ver.13.0.0).
Estimated amount of annual average GHG emission reductions	64,088

SECTION A. Description of project activity
A.1. Purpose and general description of project activity
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Yunnan Nanwahe River Bundled Hydropower Project of China (hereafter referred to as the Project) consist of the Nanwahe River First Cascade Hydropower Project (hereafter referred to as the First Cascade Hydropower Project), Nanwahe River Second Cascade Hydropower Project (hereafter referred to as the Second Cascade Hydropower Project) and the Nanwahe Third Cascade Hydropower Project (hereafter referred to as the Third Cascade Hydropower Project), are located in Mengding Town, Gengma County, Lincang City, Yunnan Province. The Project with total installed capacity 20 MW will deliver 81,336MWh electricity per year to South China Power Grid (SCPG). According to the PDR, the Project is described as follows:

The First Cascade Hydropower Project is a newly-built hydropower station with installed capacity 5.6MW (2*2.8MW). Annual operation hours are 4311h, annual electricity generation is 24,142 MWh, and net annual delivered electricity 24,021MWh.

The Second Cascade Hydropower Project is a newly-built hydropower station with installed capacity 8MW (2*4MW). Annual operation hours are 3994h, annual electricity generation are 31,952 MWh and net annual delivered electricity 31,792MWh.

The Third Cascade Hydropower Project is a newly built hydropower station with installed capacity 6.4MW (2*3.2MW). Annual operation hours are 4008h, annual electricity generation are 25,651MWh and net annual delivered electricity 25,523MWh.

Each Cascade Hydropower Project has three dams, and the reservoir flood area of each dam at full reservoir level is listed as blow:

Reservoir flood area (m^2)	1#Dam	2#Dam	3#Dam	Total
First Cascade	867	933	800	2600
Second Cascade	1000	1862	1000	3862
Third Cascade	3600	2266	1867	7733

The power densities of any of each reservoir and each project at full reservoir level are as follows:

Power density (W/m^2)	1#Dam	2#Dam	3#Dam	Project activity calculated using equation 5
First Cascade	6459	6002	7000	2462
Second Cascade	8000	4296	8000	2069
Third Cascade	1777	2824	3427	724

As shown above, all are greater than $10W/m^2$, so there are no greenhouse gases produced in the project boundary.

In the absence of the Project, the electricity delivered by the Project would be provided by the South China Power Grid. The Project will carry out GHG reduction by replace the South China Power Grid mainly composed of fossil-fuel power plants. It is estimated the annual GHG reduction of the Project will reach 64,088tCO_2e

As a renewable energy project, The Project will produce positive environmental and economic benefits and contribute to local sustainable development as following aspects:

- Providing zero-emitting clean power to South China Power Grid which dominated by fossil fuel fired electricity.[1] Mitigating the shortage of local electricity supply;

- Decreasing environmental pollution caused by fossil-fuel fired plants, such as CO_2, NO_x and particulates associated with power generation from fossil fuel;

- Improving the local finance and stimulate the development of local economy;

- Offer 40 employing opportunities to local residents during operation and even more temporary jobs during construction.

A.2. Location of project activity

A.2.1. Host Party(ies)

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The People's Republic of China

A.2.2. Region/State/Province etc.

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Yunnan Province

A.2.3. City/Town/Community etc.

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Mengding Town, Gengma County, Lincang City

A.2.4. Physical/Geographical location

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The Project is located in Mengding Town, Gengma County, Lincang City, Yunnan Province. As per the PDR and on site measurement, the coordinates and location of each sub project's dams are as follows:

Hydropower Project	Powerhouse	1#Dam	2#Dam	3#Dam
First Cascade	E99.1175, N23.4511	E99.1633, N23.4281	E99.1500 N23.4139	E99.1422, N23.3989
Second Cascade	E99.1003 N23.4889	E99.1450, N23.4625	E99.1269, N23.4417	E99.1258, N23.4372
Third Cascade	E99.1003, N23.5294	E99.1000, N23.4892	E99.1067, N23.4936	E99.1175, N23.5267

Detailed physical location of the Project is listed in the following Fig A.1.

[1] According to *China Electric Power Yearbook 2003-2007*among the total electricity delivered into of the CSPG, the amount of fossil fuel-fired electricity accounts for about 65.34% in 2003, 68.42% in 2004,69.31% in 2005, 70.25% in 2006, 70.05% in 2007

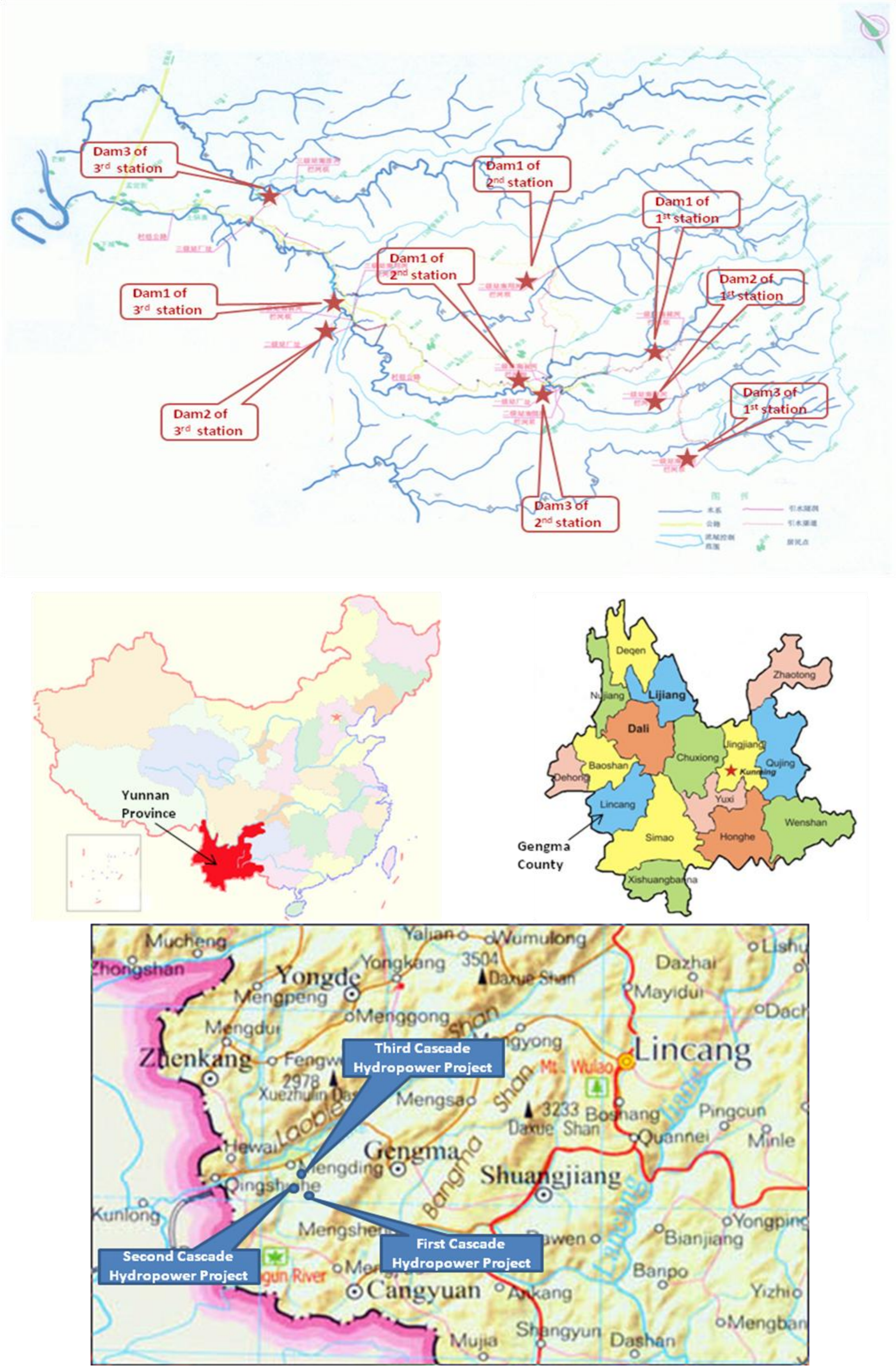

Fig A.1 Detailed physical location of the Project

A.3. Technologies and/or measures
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The project is to produce electricity from renewable hydro resource to meet the increasing energy demand of South China Power Grid.

The scenario existing prior to the start of the implementation of the project activity

The electricity delivered by the Project would be imported from the South China Power Grid in absence of the Project. The South China Power Grid (SCPG) is dominated by fuel-fired power plant. The project boundary is considered as the SCPG (including Guangdong, Guangxi, Yunnan and Guizhou) and all power plants. The greenhouse emission sources are all power plants physically connected to SCPG.

The baseline scenario is the same as the scenario existing to the start of the implementation of the project, i.e., electricity would be imported from SCPG.

The proposed project activity

The Project is a newly-built hydropower station with total installed capacity of 20MW. The main building consists of weir, diversion tunnel, surge shaft, penstock (inclined shaft) and ground plant.

As per the PDR, the First Cascade Hydropower Project is a newly-built hydropower station with three newly-built dams and with total installed capacity of 5.6MW (2*2.8MW), 415m design net water head and 1.9m^3/s design flow. Two sets of 2.8MW turbines and associated generators which are made in China will be installed in this plant. It is estimated that the delivered electricity to the South China Power Grid is approximately 24,021MWh per year, and electricity generated will be delivered to the South China Power Grid.

As per the PDR, the Second Cascade Hydropower Project is a newly-built hydropower station with three newly-built dams and with total installed capacity of 8MW (2*4MW), 312m design water head and 3.2m^3/s design flow. Two sets turbines and associated generators which are made in China will be installed in this plant. It is estimated that the delivered electricity to the South China Power Grid is approximately 31,792MWh per year, and electricity generated will be delivered to the South China Power Grid.

As per the PDR, the Third Cascade Hydropower Project is a newly-built hydropower station with three newly-built dams and with total installed capacity of 6.4MW (2*3.2MW), 108m design water head and 7.2m^3/s design flow. Two sets turbines and associated generators which are made in China will be installed in this plant. It is estimated that the delivered electricity to the South China Power Grid is approximately 25,523MWh per year, and electricity generated will be delivered to the South China Power Grid.

Detail information about the reservoir flood area of each dam and each project at full reservoir level, which are sourced from the PDR, is listed as blow:

Reservoir flood area (m^2)	1#Dam	2#Dam	3#Dam	Total
First Cascade	867	933	800	2600
Second Cascade	1000	1862	1000	3862
Third Cascade	3600	2266	1867	7733

The power densities of any of each reservoir and each project at full reservoir level, which are sourced from the PDR, are as follows:

Power density (W/m^2)	1#Dam	2#Dam	3#Dam	Project activity calculated using equation 5
First Cascade	6459	6002	7000	2462
Second Cascade	8000	4296	8000	2069
Third Cascade	1777	2824	3427	724

As shown above, the power densities of each reservoir at full reservoir level are all greater than $10W/m^2$ that no greenhouse gases produced in the project boundary.

The key technical data for the key equipment within the proposed project are summarized in Table A.1.

Table A.1 The type and parameter of turbines and generators of the Project

Classification		**First Cascade Hydropower Project**	**Second Cascade Hydropower Project**	**Third Cascade Hydropower Project**	**Source**
Hydro Turbine	Type	CJA475-W-100/2×9	CJA475-W-120/2×12	HLD06a-WJ-71	PDR
	Number	2	2	2	PDR
	Rated water head	415m	312m	108m	PDR
	Rated power	2980kW	4300kW	3333kW	PDR
	Rated flow	0.95 m^3/s	1.60 m^3/s	3.6 m^3/s	PDR
	Rated speed	750r/min	600r/min	1000r/min	PDR
	Lifetime	20yr	20yr	20yr	PDR
Generator	Type	SFW2800-8/1730	SFW4000-10/1730	SFW3200-6/1730	PDR
	Number	2	2	2	PDR
	Rated Power	2800kW	4000kW	3200kW	PDR
	Rated Voltage	6.3kV	6.3kV	6.3kV	PDR
	Power factor	0.8	0.8	0.8	PDR
	Lifetime	20yr	20yr	20yr	PDR

The project adopts domestic technologies and equipments, not referring to any technologies transfer from abroad.

Two meters (bi-directional measuring) with accuracy at least 0.5 are installed to measure the electricity from the each cascade Project to the power grid. One meter is installed at the power substation (substation meter) which is operated by the grid company. Another meter is installed at plant (plant meter) which is operated by the project owner.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China(host)	Yuanfeng Hydropower Development Co., Ltd. of Lincang City (the project owner)	No
The Netherlands	ACT Carbon Capital Ltd.	No

A.5. Public funding of project activity

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

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

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ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ver.13.0.0).

For more information, please refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Tool for the Demonstration and Assessment of Additionality(ver.06.1.0).

Tool to calculate the emission factor for an electricity system (ver.02.2.1).

For more information, please refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

B.2. Applicability of methodology

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The Project meets all applicability conditions of the consolidated baseline methodology ACM0002 as follows:

- The Project is a newly-built hydropower plant;
- According the PDR, each Cascade Hydropower Project has three dams. The reservoir flood area of each dam and the power densities of any of each reservoir at full reservoir level are as follows:

Reservoir flood area of each dam at full reservoir level is listed as blow:

Reservoir flood area (m^2)	1#Dam	2#Dam	3#Dam	Total
First Cascade	867	933	800	2600
Second Cascade	1000	1862	1000	3862

Third Cascade	3600	2266	1867	7733

The power densities of any of each reservoir and each project at full reservoir level

Power density (W/m^2)	1#Dam	2#Dam	3#Dam	Project activity calculated using equation 5
First Cascade	6459	6002	7000	2462
Second Cascade	8000	4296	8000	2069
Third Cascade	1777	2824	3427	724

As shown above, the power density of each reservoir and each project at full reservoir level, as per the definitions given in the Project Emissions section, is than 4 W/m^2.

- The Project does not involve switching from fossil fuels to renewable energy at the site of the Project activity;

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

B.3. Project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Electricity supply of those fossil fuel-fired power plants connected into South China Power Grid	CO_2	Yes	Main emission sources of the Project baseline scenario.
		CH_4	No	Excluded for simplification in the Project baseline scenario. This is conservable
		N_2O	No	Excluded for simplification in the Project baseline scenario. This is conservable
Project Activity	Emissions of CH_4 from the reservoir	CO_2	No	The Project has power generation with renewable energy which has no CO_2 emission
		CH_4	No	The Project is newly-built hydropower plant with a power density of far more than 10W/m^2, so it is excluded.
		N_2O	No	It can be ignored according to ACM0002

B.4. Establishment and description of baseline scenario

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The Project is the installation of a new grid-connected renewable power plant, according to the methodology ACM0002, the baseline scenario is the following: Electricity delivered to the grid by the Project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources within SCPG as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

B.5. Demonstration of additionality
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The Project uses the ***Tool for the Demonstration and Assessment of Additionality*,** which was approved by CDM EB to demonstrate its additionality. The tool include following steps:

Step1. Identification of alternatives to the Project activity consistent with current laws and regulations

As per paragraph 10 of the ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources.

The Project activity is the installation of a new grid-connected hydro power plant, so, the baseline scenario of the Project is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources within the SCPG.

Step2. Investment analysis

Sub-step2a. Determine appropriate analysis method

We should determine whether the Project is economically and financially less attractive than alternative 4) without considering the CERs sales revenues or not through analysis of this step. We take following sub-steps to conduct investment analysis:

According to *"Tool for the demonstration and assessment of additionality"*, there are three analysis methods recommended, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).
Option I: Simple cost analysis. This analysis method can be used if the project activity produces no economic benefits other than CDM related income. However, this option is not applicable to the project because the project activity generates the revenue from the sale of generated electricity.

Option II: Investment comparison analysis. This analysis method can be only used if the alternatives to the project are similar investment projects. However, this option is not applicable to the project because the alternative to the proposed project is equivalent annual electricity supplied by SCPG, which is not a new investment project.
Option III: Benchmark analysis. According to the *Economic Evaluation Code for Small Scale Hydropower Projects* (SL16-95)[2], the financial benchmark rate of return adopted by the proposed is 10% for the IRR of static total investment. The Project is not considered financially attractive if the Internal Rate of Return (IRR) without additional revenue is lower than 10% (benchmark IRR). Thus, the benchmark analysis is applicable to the Project.

The project IRR is 7.78% which is taken from the PDR (basis for CDM consideration). This IRR is low than 10% and show the project activity is not attractive. To prove the IRR more efficiently, the PP has shown the financials on each stage of the project (each individual cascade). As per the analysis shown in the below paragraph, the IRR in cascade 1 is 7.36%, cascade 2 is 7.96%, cascade 3 is 8.20%. All the IRR in each phase proven that the project is additional and financial not attractive.

[2] http://cdm.unfccc.int/UserManagement/FileStorage/OK7Z4BSCW9DNGRVY2LT53MX1PHQ6EF

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

According to the Section 1.2 of the *Economic Evaluation Code for Small Scale Hydropower Projects* (SL16-95) issued by the Ministry of Water Resources in 1995 and to the Provision issued by the State Development Planning Commission of Farmland (Document [1992] No.138), the financial benchmark rate of return (after tax) for small-scale hydropower projects in China (the installed capacity less than 25MW and 50MW for the hydropower station located in the rural area) should higher than 10%. This benchmark is widely used for power project investments in the Host Country and serves as the sectoral benchmark rate on static total investment for hydro projects. The proposed Project has an installed capacity of 20MW. Therefore, a 10% benchmark for the IRR of this Project applies. On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

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

(1) Basic parameters for calculation of financial indicators

According to the Preliminary Design Report, the basic parameters for calculation of financial indicators of the Project are as follows:

Table B.2 Financial indicators of the Project

Parameter:	**Data:**			
The Cascade Project	First Cascade Hydropower Project	Second Cascade Hydropower Project	Third Cascade Hydropower Project	Source
Delivered electricity (MWh)	24,021	31,792	25,523	PDR
Installation capacity(MW)	5.6	8	6.4	PDR
Construction period (yrs)	1	1	1	PDR
Project lifetime (yrs)	20	20	20	PDR
Static total investment (Million RMB)	37.52	47.52	38.79	PDR
Loan (Million RMB)	24.39	30.89	25.21	PDR
Interest	7.83%			PDR
Expected bus-bar tariff(RMB/kWh, including VAT)	0.215	0.215	0.215	PDR
Annual O&M cost (Million RMB)	0.97	1.24	0.94	PDR
Value added tax rate (%)	6%	6%	6%	PDR

Lifetime (year)	20	20	20	PDR
Income tax rate (%)	25%	25%	25%	PDR
Expense for city maintenance and construction (%)	5%	5%	5%	PDR
Education fee addition (%)	3%	3%	3%	PDR
IRR of each Cascade Project (post-tax)	7.36%	7.96%	8.20%	PDR
IRR of the Project	7.78%			PDR

(2) Comparison of the financial benchmark of IRR of static total investment for the Project

In accordance with the benchmark analysis (Option III), if the financial indicators (such as static total investment IRR) of a project are lower than the benchmark, the project is not considered as financially attractive.

Based on the data above, without CERs sales revenues, the IRR (post-tax) of static total investment of the Project is 7.78%, which is much lower than the benchmark (10%). And the IRR of each cascade station are not more than 10% (see Table B.2), thus the Project is not financially attractive.

Sub-step 2d. Sensitivity analysis

The sensitivity analysis shows whether the conclusion regarding financial attractiveness is robust to reasonable variations in the critical assumptions.

According to "Guidance on the assessment of Investment Analysis": Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. For the project, following financial parameters were taken as uncertain factors for sensitive analysis of financial attractiveness:

- Static total investment
- Annual O&M cost
- Feed-in electricity
- Bus-bar tariff

Assuming that these four financial indicators vary between -10% and +10% the corresponding results of each cascade Project IRR are shown in Table B.3.

TableB.3 Cascade Project IRR sensitivity analysis (Without CERs revenues)

Range / Parameter	10%	0	-10%

The Project	**Static total Investment**	6.54%	7.78%	9.25%
	Tariff	9.18%	7.78%	6.34%
	Feed-in Electricity	9.15%	7.78%	6.36%
	Annual O&M Cost	7.51%	7.78%	8.05%
The First Cascade Hydropowe r Project	**Static total Investment**	6.14%	7.36%	8.81%
	Tariff	8.73%	7.36%	5.92%
	Feed-in Electricity	8.70%	7.36%	5.95%
	Annual O&M Cost	7.08%	7.36%	7.64%
The Second Cascade Hydropowe r Project	**Static total Investment**	6.70%	7.96%	9.46%
	Tariff	9.39%	7.96%	6.50%
	Feed-in Electricity	9.36%	7.96%	6.53%
	Annual O&M Cost	7.68%	7.96%	8.24%
The Third Cascade Hydropowe r Project	**Static total Investment**	6.95%	8.20%	9.69%
	Tariff	9.62%	8.20%	6.75%
	Feed-in Electricity	9.59%	8.20%	6.78%
	Annual O&M Cost	7.94%	8.20%	8.47%

The result of sensitivity analysis indicates that in the Project and each cascade project, the IRR of static total investment never exceed the benchmark even the fluctuation range of the sensitivity indicators reach 10%.

The IRR varieties of the Project and each cascade project are shown in Figure B.1-B.4 when four indicators varied in the range of -10% ~ +10%.

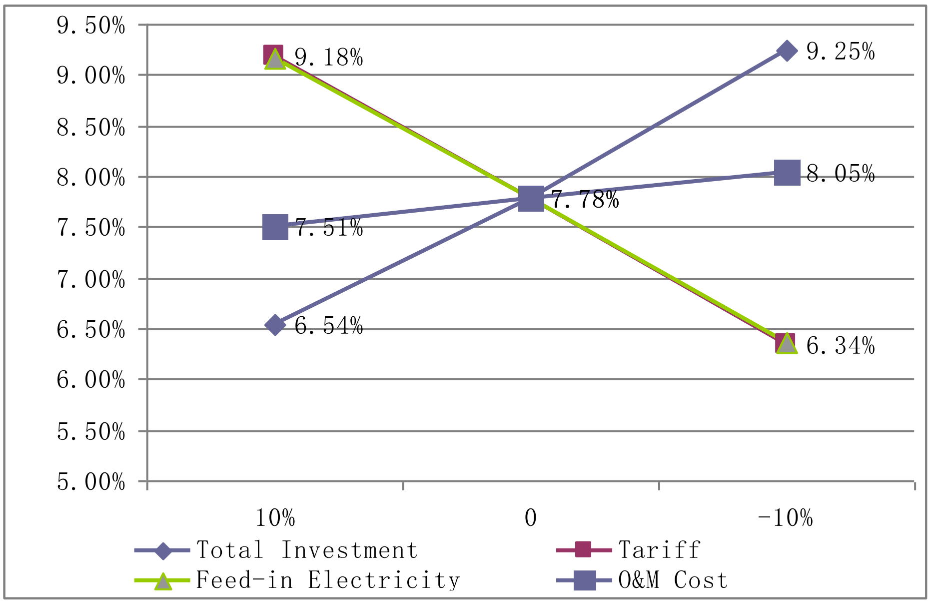

Fig.B.1 Project IRR sensitivity analysis (Without CERs revenues)

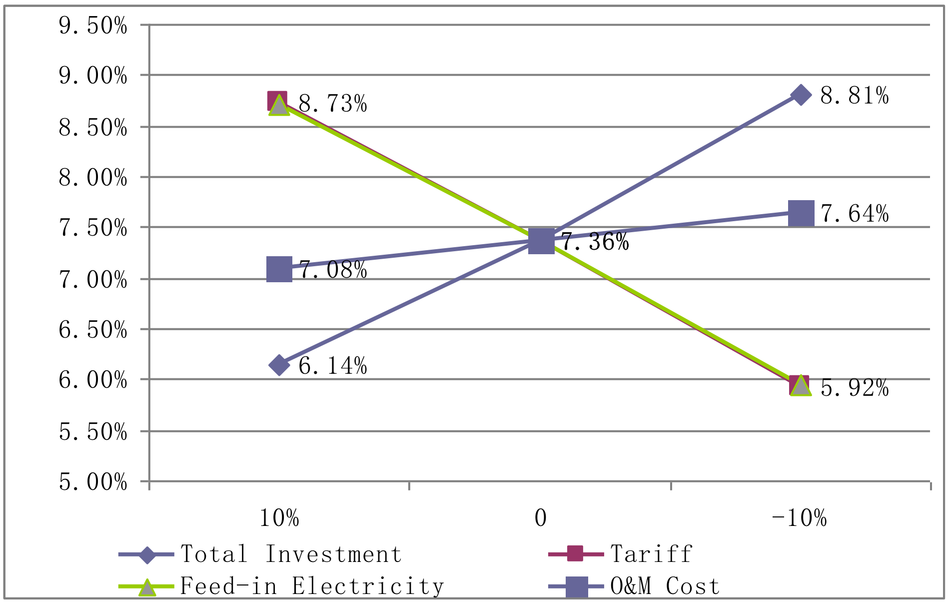

Fig.B.2 The first cascade project IRR sensitivity analysis (Without CERs revenues)

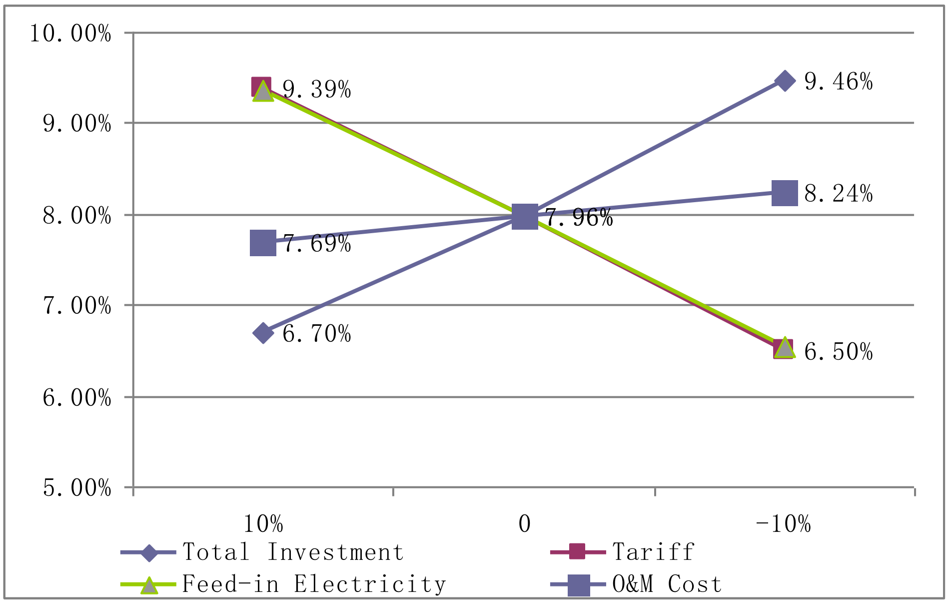

Fig.B.3 The second cascade project IRR sensitivity analysis (Without CERs revenues)

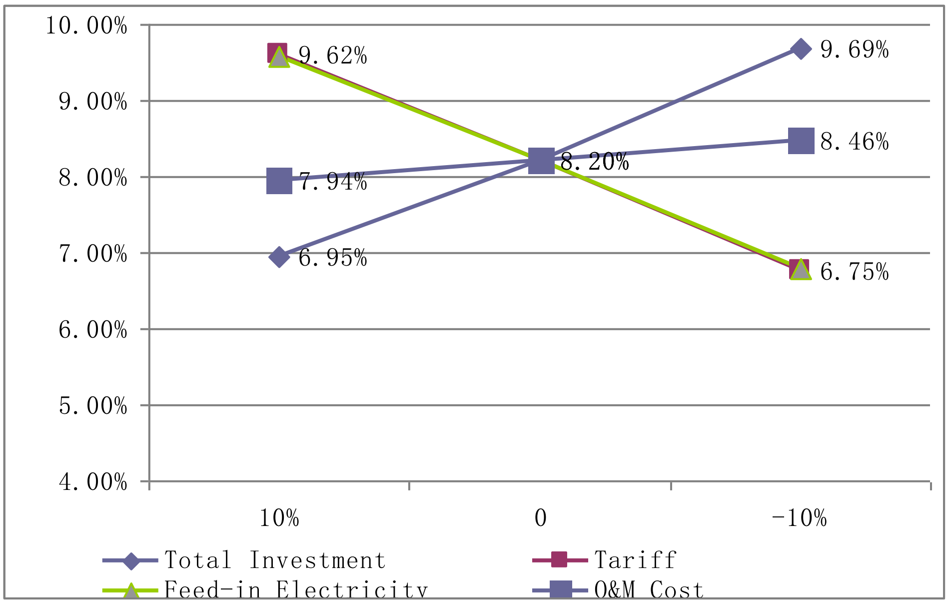

Fig.B.4 The third cascade project IRR sensitivity analysis (Without CERs revenues)

As showed on table B.4, even the uncertain factors vary in the range of -10% to +10%, the Project IRR couldn't reach the benchmark (10%) which indicates that alternative 2) is not feasible. As showed on Fig B.1-B.4, the IRR is more sensitive to tariff and static total investment but less sensitive to O&M cost.

When the IRR of the Project reaches the benchmark IRR, the variation range of four indictors are shown in Table B.4.

Table B.4 the variation range of four indictors when the IRR of static total investment =10%

sensitivity analysis	variation range	The IRR of static total investment =10%

static total investment	-14.46 %	10.00%
annual O&M cost	-83.35%	10.00%
feed-in electricity	16.15%	10.00%
bus-bar tariff	15.85%	10.00%

For static total investment, if IRR reached to 10%, the static total investment should decrease by 14.46%. The investment of the Project mainly comprises of construction materials, mechanical & electrical equipments and their installation, the main constructions and purchase contracts of the Project actually were implemented or signed in the year 2009, when inflation is still dominant in most sectors. According to the official statistics (price index for hydropower project construction)[3], each project item and production factor for hydropower project is rising in price. Therefore, a 14.46% off in static total investment is impossible.

For feed-in electricity, if IRR reached to 10%, the annual feed-in electricity should increase by 16.15%. Because of annual feed-in electricity is the result of operating hours multiplies by installed capacity, and the installed capacity is fixed, on the other hand, the operating hours were calculated based on multi-years data of official hydrological statistics. Therefore, the IRR is very unlikely to reach benchmark due to an increase in operating hours.

For bus-bar tariff, if IRR reached to 10%, the bus-bar tariff should increase by 15.85% to 0.249RMB/kWh. According to the PDR, the tariff is 0.215RMB/kWh (including VAT), and the highest bus-bar tariff applied to the similar hydro project in Yunnan province is 0.215RMB/kWh[4]. On the other hand, according to the latest governmental notification Yundianjiaoyi [2009]100[5] the tariff for hydropower projects with installed capacity between under 50WM should be the season tariff, which namely 0.19RMB/kWh for rain season, 0.215RMB/kWh for common season and 0.24RMB/kWh for the dry season. Since the electricity generation in rain season is much more than dry season, the electricity sales base on season tariff will much lower than using the tariff of 0.215RMB/kWh, which means the average tariff is much lower than the assumed tariff used in PDD. Therefore, the tariff used in PDD is conservative and it is unlikely increasing too much in near future to make IRR reach benchmark. Moreover, the bus-bar tariff is controlled by the government but not controlled by the project owner. Thus the Project is always lack of attractiveness within the reasonable range of tariff.

For the annual O&M cost, it has little effect on the impact of IRR, since when the annual O&M cost decrease by 83.35%, the Project IRR post-tax can reach the benchmark. The assumed annual O&M cost of the project includes maintenance fee, water resource, salary and welfare fund and other cost. All these parameters are consistent with the relevant national regulations such as Economic Evaluation Code for Small Hydropower Project (SL 16-95), so the assumed annual O&M cost is reliable. Furthermore, even

only the salary being considered, the IRR of the project is still lower than the benchmark of 10%. Therefore, the project is always lack of financial attractiveness no matter what changes with the annual O&M cost.

If the Project can be successfully registered as a CDM project, considering the CERs revenues (calculated with €8.0/tCO_2e, 21yrs crediting period), IRR of the Project will be increased to 11.80%. Therefore the CERs generated from CDM eliminate the financial obstacles of the proposed project, the Project is financially attractive.

[3] http://www.hydrocost.org.cn/price/priceIndex.jsp
[4] http://peml.xxgk.yn.gov.cn/newsview.aspx?id=38780
[5] http://blog.coob.cn/login//uploadfile/21783049-4/2010/20101206162556984.doc

In conclusion the practical and feasible scenario is Alternative 4), the provision of equivalent amount of annual electricity supply by the SCPG into which the Project is connected.

Step 3. Barrier Analysis

It is not analyzed in the Project.

Step 4 Common practice analysis

The proposed project is a new built project utilizing renewable hydraulic energy to generate electricity which is in compliance with the (b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies) in Para 6 of Tool for the demonstration and assessment of additionality (Version 06.1.0). As per the tool a stepwise approach for common practice analysis is conducted as below.

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The total installed capacity of the Proposed Project Activity is 20MW, therefore the applicable output range is 10MW to 30MW.

Step 2: ***Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:***

(a) *The projects are located in the applicable geographical area;*

Since the hydro resources, tariff policy, investment environment are different among different provinces in China. Therefore the validation team confirms the it is appropriate that the Yunnan Province is selected as applicable geographical area for the project activity.

(b) *The projects apply the same measure as the proposed project activity;*

Since the project is renewable hydropower project, the similar projects are identified as projects using renewable energies.

(c) *The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;*

The project is a hydropower project utilizing hydro resources, so similar projects are identified as hydropower projects.

(d) *The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;*

The project is a hydropower project utilizing hydro resources, so similar projects are identified as projects which produce electricity.

(e) *The capacity or output of the projects is within the applicable capacity or output range calculated in Sub-Step 1;*

As the proposed project is a hydropower project with installed capacity of 20MW, +/- 50% of which should be selected as projects with installed capacity within 10MW~30MW.

(f) *The projects started commercial operation before the project design document (CDM-PDD) is* *published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.*

The start date of the proposed project activity is 01/03/2009 which is the date. Therefore, the projects started commercial operation before 01/03/2009 (i.e. which is earlier than starting date) is selected. Therefore, non-CDM hydropower projects within the scope of 10MW~30MW in Yunnan Province, started commercial operation before 01/03/2009 should be taken for common practice. Projects information is from *China Water Resources Yearbook 2003~2010,* UNFCCC website and other publicly available sources.

No.	Project Name	Installed Capacity (MW)	Commissioned date	Operating hours (hour)	Investment per kW (RMB/kW)
1	Luozehe Hydro Station	25	1987	N/A	N/A
2	Laohushan Hydropower station	25	1998	N/A	N/A
3	Yisahe Hydropower Station	26.6	1994	N/A	N/A
4	Supahe Sanjiangkou Hydropower Station	30	1993	N/A	N/A
5	Jirenhe Hydropower Station	30	2000	N/A	N/A
6	Wunihe Hydropower Station	30	2005	5333	5846
7	Yanziya Hydropower Station	25	2005	6000	4780
8	Xiashilong Hydropower Project	25	2005	5520	4000
9	Xima Xingyun Aluminum Factory Hydropower Station	26	2004	6538	6233
10	Yunnan Heier 25MW Hydropower Project	25.0	2007	4963	4358
11	Yunnan Lushui County Laowohe 25MW Hydropower Project	25.0	2008	4694	4823

Step 3: ***within the projects identified in Sub-step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.***

Totally 11 hydropower projects have been identified within the range of 10~30MW with a commercial operation date before 01/03/2009 in Yunnan Province. Therein, Project No. 10~11 are registered CDM project activities, project activities submitted for registration, or project activities undergoing validation. Therefore, N_{all} is determined as 9.

Sub-step 4: within similar projects identified in Sub-step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

According to Guidelines on common practice"(version 02.0.0), different technologies in the context of common practice are technologies that deliver the same output and differ by at least one of the following:
(a) Energy source/fuel;
(b) Feed stock;
(c) Size of installation (power capacity):
(i) Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
(ii) Small (as defined in paragraph 28 of Decision 1/CMP.2);
(iii) Large;
(d) Investment climate in the date of the investment decision, inter alia:
(i) Access to technology;
(ii) Subsidies or other financial flows;
(iii) Promotional policies;
(iv) Legal regulations;
(e) Other features, inter alia:
(i) Nature of the investment (example: unit cost of capacity or output is considered different if the costs differ by at least 20 %).

The power industry in P. R. of China underwent a significant reform in 2002 and the investment environment of power production projects in P. R. China changed significantly in 2002. Therefore, the investment climate of the projects prior to 2002 on the investment decision date is considered different with the proposed project in line with the paragraph 4(d) of the Guidelines on common practice"(version 02.0.0). Since the Project No. 1~5 listed in the table above was commissioned before 2002, it is reasonable that they are considered technology different with the project activity

According to "Guidance on Common Practice" (Version 02.0) paragraph 4(e), nature of the investment (example: unit cost of capacity or output is considered different if the costs differ by at least 20 %).

Project No. 9 (Ximaxingyun Aluminium Factory Hydro Project) is a captive power plant of Yunnan Yingjiang Xingyun Co., Ltd., which is not connected to the grid. According to "Guidance on Common Practice" (Version 02.0) paragraph 4(e) , the nature of the investment of Project No. 9 is different from that of the proposed project.So, it has essential distinctions with the proposed project.

Project No. 6 (Wunihe Hydropower Station) belongs to the West-East Electricity Transmission Project. The West-East Electricity Transmission Projects are government sponsored projects offering favourable conditions (be able to gain higher tariff and financial support from national bank much easier) to electricity suppliers participating in the project with the aim to secure transmission of power from West China to East China. According to "Guidance on Common Practice" (Version 02.0) paragraph 4(e), the nature of the investment of Project No. 6 is different from that of the proposed project. Therefore, it has essential distinctions with the proposed project.

Since the unit investment of the proposed project is 6192 RMB/kW, the projects are considered different if the unit investment of hydropower projects are below 4954 RMB/kW or above 7431 RMB/kW. The unit investment of Project No. 7 (Yanziya Hydropower Station) and No. 8 (Xiashilong Hydropower Station) are both lower than 4954 RMB/kW. . According to "Guidance on Common Practice" (Version 02.0) paragraph 4(e), the nature of the investment of Project No. 7 and 8 are different from that of the proposed project. Therefore, they have essential distinctions with the proposed project.

In conclusion, all projects identified are proved to have different technologies with the project.
N_{diff} =9

Step 5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

Sub-step 5: Calculate factor F

Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

In line with the para. 10 of the *Guidelines on common practice", version 02.0*, the proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:
(a) the factor F is greater than 0.2, and
(b) N_{all}-N_{diff} is greater than 3.

According to the analysis above,
$F=1-N_{diff}/N_{all}=0$, $N_{all} - N_{diff} =9-9=0<3$, therefore the proposed project is not a common practice.

In sum, if there is no financial support from CDM, the proposed project will be difficult to implement and equivalent annual generated electricity will be supplied by SCPG. Therefore the proposed project should be deemed to be additional and not a baseline scenario according to ACM0002.

***CDM* consideration**

Timeline of the First Cascade Project implementation

Date	Milestone	Remark
Sep. 2008	EIA completion	Yunnan University
29th Sep. 2008	Approval letter of EIA	Lincang City Environment Protection Bureau
Oct. 2008	Feasibility Study Report	Lincang Hydropower Investigation Design Academy
25th Dec. 2008	The Project Approval	Lincang City DRC
Jan. 2009	Preliminary Design Report	Lincang Hydropower Investigation Design Academy
23th Jan. 2009	The board decision on CDM implementation	
26th Feb. 2009	PDR Approval	Lincang City DRC
20 May 2009	Notification to NDRC (By enquiring EB UNFCCC secretariat regarding prior consideration of CDM, the notification sent to	

	DNA between 02 August 2008 and 17 July 2009 is sufficient and no re-submission to UNFCCC is necessary.)	
28th Oct. 2009	1st & 2nd & 3rd Cascade stations Metal structures equipment and installation contract	This is the first contract of the First Cascade Project, therefore the signing date is considered as the Starting date of the 1st cascade station
21st Dec. 2009	1st & 2nd stations Penstock purchase and installation Contract	
5th Nov. 2010	1st station Channel and Dam Construction Contract	
13th Jan. 2011	1st station main construction contract	
Jan. 2012	Expected the 1st cascade station starts commission	

Timeline of the Second Cascade Project implementation

Date	Milestone	Remark
Sep. 2008	EIA completion	Yunnan University
29th Sep. 2008	Approval letter of EIA	Lincang City Environment Protection Bureau
Oct. 2008	Feasibility Study Report	Lincang Hydropower Investigation Design Academy
25th Dec. 2008	The Project Approval	Lincang City DRC
Jan. 2009	Preliminary Design Report	Lincang Hydropower Investigation Design Academy
23th Jan. 2009	The board decision on CDM implementation	
26th Feb. 2009	PDR Approval	Lincang City DRC
20 May 2009	Notification to NDRC (By enquiring EB UNFCCC secretariat regarding prior consideration of CDM, the notification sent to DNA between 02 August 2008 and 17 July 2009 is sufficient and no re-submission to UNFCCC is necessary.)	
28th Oct. 2009	1st & 2nd & 3rd Cascade stations Metal structures equipment and installation contract	This is the first contract for the Second Cascade Project, therefore the signing date is considered as the Starting date of the 2nd cascade station
21st Dec. 2009	1st & 2nd stations Penstock purchase and installation Contract	

26th Jun. 2010	2nd station Tunnel Construction Contract	
24th Mar. 2010	2nd station Channel Construction Contract	
13th Sept. 2010	2nd station Channel and Dam Construction Contract	
11th Jan. 2011	2nd station main construction contract	
Jan. 2012	Expected the 2nd cascade station starts commission	

Timeline of the Third Cascade Project implementation

Date	Milestone	Remark
Sep. 2008	EIA completion	Yunnan University
29th Sep. 2008	Approval letter of EIA	Lincang City Environment Protection Bureau
Oct. 2008	Feasibility Study Report	Lincang Hydropower Investigation Design Academy
25th Dec. 2008	The Project Approval	Lincang City DRC
Jan. 2009	Preliminary Design Report	Lincang Hydropower Investigation Design Academy
23th Jan. 2009	The board decision on CDM implementation	
26th Feb. 2009	PDR Approval	Lincang City DRC
1st Mar. 2009	Contract of Nangunhe Diversion Engineering for Third Cascade Station	This is the first contract fot the Third Cascade Project, therefore the signing date is considered as the Starting date of the third cascade station
1st Mar. 2009	3rd station Channel & Tunnel Construction Contract	
20 May.2009	Notification to NDRC (By enquiring EB UNFCCC secretariat regarding prior consideration of CDM, the notification sent to DNA between 02 August 2008 and 17 July 2009 is sufficient and no re-submission to UNFCCC is necessary.)	
8th Oct. 2009	3rd station Forebay & Sluice channel Contruction Contract	
3rd Feb. 2010	3rd station Electrical equipments Purchase and Installation Contract	

14th Sept. 2010	3rd station Dam construction contract	
Jan. 2012	Expected the 3rd cascade station starts commission	

The starting date of First and Second Cascade Hydropower Station is 28 October 2009 and the starting date of Third Cascade Hydropower Station is 01 March 2009. The project owner notified NDRC on prior consideration of CDM for the project on 20 May 2009.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
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The consolidated methodology ACM0002 is applied in the context of the Project in the following four steps:

- calculate the project GHG emissions;
- calculate the baseline GHG emissions;
- calculate the project leakage;
- calculate the emission reductions

1. Calculate the project GHG emissions

The Project is a newly-built hydropower plant and the power density of the Project is calculated with the follow formula:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \qquad (1)$$

PD is power density of the project activity, in W/m^2;

Cap_{PJ} is installed capacity of the hydro power plant after the implementation of the project activity (W);

Cap_{BL} is 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} is area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

A_{BL} is area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

The power densities of the Project are 2,462W /m^2, 2,069W /m^2 and 724W /m^2 respectively, which are far more than 10 W/m^2. According to ACM0002 the project GHG emissions can be neglected. So PEy=0.

2. Calculate the baseline GHG emissions

Baseline emissions are calculated with combined baseline emission factor and the electricity delivered to the grid by the project as follows:

$$\mathbf{BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}} BE_y = (EG_y - EG_{baseline}) \cdot EF_{grid,CM,y}$$
(2)

Where:

BE_y is the baseline emissions in year y (tCO_2/yr);

$EG_{PJ,y}$ is quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr).

$EF_{grid,CM,y}$ is 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”.

<u>*Calculation of $EG_{PJ,y}$*</u>

For Greenfield renewable erengy power plants,

$$\mathbf{EG_{PJ,y} = EG_{facility,y}} \quad (3)$$

Where:

$EG_{PJ,y}$ is quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr).

$EG_{facility,y}$ is quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr).

<u>*Calculation of $EF_{grid,CM,y}$*</u>

According to ACM0002, the calculation of emission factor should use the methodology *“Tool to calculate the emission factor for an electricity system”*. The CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system is determined by calculating the “operating margin”(OM) and “build margin”(BM) as well as the “combined margin”(CM).

The tool provides procedures to determine the following parameters:

Parameter	**SI Unit**	**Description**
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for grid connected power generation in year y

$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for grid connected power generation in year y

The following is the detailed process of calculating the baseline CO_2 emission factor of the grid which the Project connected to according to the steps provided by the *Tool to calculate the emission factor for an electricity system (*hereafter referred to as the *Tool).*

STEP 1. Identify the relevant electricity systems.

Chinese DNA has published a delineation of the project electricity system and connected electricity system. The project physically connects through transmission and distribution lines to the South China Power Grid. It is composed of Guizhou Power Grid, Yunnan Power Grid, Guangdong Power Grid and Guangxi Power Grid, the project selects the South China Power Grid for the calculation of baseline emission factor.

One of the following options to determine the CO_2 emission factors(s) for net electricity imports from a connected electricity system within the same host country(ies):

a) $0tCO_2/MWh$,or
b) The weighted average operating margin (OM) emission rate of the exporting grid;or
c) The simple operating margin emission rate of the exporting grid, if the conditions for this method, as described in step 3 below, apply to the exporting grid;or
d) The simple adjusted operating margin emission rate or of the exporting grid.
   The PDD will choose option b).

STEP 2. Choose whether to include off-grid power plants in the project electricity system(*optional*).
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off- grid power plants are included in the calculation.
Because the data of off-grid power plants is unavailable, option I is chosen.

STEP 3. Select a method to determine the operating margin (OM).
According to the *Tool*, four methods compute the Operating Margin Emission factor can be used as follows:

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

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount of grid generating output 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. Among the total electricity generations of the SCPG which the Project is connected into, the amount of low-cost/must run resources accounts for about 34.66% in 2003 and 31.58% in 2004, 30.69% in 2005, 29.75% in 2006, 29.95% in 2007[6] all less than 50%. Thus, the method (a) Simple OM is used to calculate the baseline emission factor of operating margin ($EF_{grid,OM,y}$) for the Project.

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

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation, or

[6] *China Electric Power Yearbook*, 2003,2004,2005,2006,2007.

- Ex post option: If the ex post option is chosen, the emission factor is determined for 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 usually only available later than six months after the end of year y.

Project participant employs "ex-ante" for its operation margin calculation with two reasons as follows:

1) The full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission; and

2) The calculation adopts *Notification on Determining Baseline Emission Factor of China's Grid (2nd Jul 2009)*, which is published by Chinese DNA, therefore it is considered as authoritative data. In this notification, the OM is calculated *ex-ante*.

STEP 4. Calculate the operating margin emission factor according to the selected method.

From the *Tool to calculate the emission factor for an electricity system*, ($EF_{grid,simple,OM}$) may be calculated:

• Based on the net electricity generation and a CO_2 emission factor of each power plant / unit (Option A), or

• Based 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 B)

Option B can only be used if:

(a) The necessary data for Option A is not available; and
(b) Only unclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

As the necessary data for Option A is not available, and only nuclear and renewable power generation is considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by those sources is known, meanwhile, off-grid power plants are not included in the calculation (as option I has been chosen in Step 2), so Option B was chosen.

Where Option B is used, the simple OM method formula of $EF_{Grid,OM,Simple,y}$ calculation is:

$$EF_{OM,Simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j,y}}{\sum_j GEN_{j,y}} \qquad (2)$$

Where:

$EF_{grid,OMsimply,y,}$ is simple operating margin CO_2 emission factor in year y(tCO_2/MWh)
$FC_{i,y}$ is amount of fossil fuel type i consumed in the project electricity system in year y;
$NCV_{i,y}$ is net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit);
$EF_{CO2,i,y}$ is CO2 emission factor of fossil fuel type i in year y (tCO2/GJ) and
EG_y is net electricity generated and delivered to the grid by power plant / unit m in year y (MWh);
i is all fossil fuel types combusted in power sources in the project electricity system in year y
y is the relevant year as per the data vintage chosen in Step 3.

When there exists net electricity imports from a connected electricity system within the same host country(ies):

(1) the emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known, or

(2) the emission factor of the exporting grid, if the specific plants are not clearly known.

The data on electricity generation and auxiliary electricity consumption are obtained from the *China Electric Power Yearbook* from 2006 to 2008 (published annually). The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2006 to 2008 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

The detailed calculation can be find in Annex 3, the $EF_{grid,OM,y}$ = 0.9987tCO_2/MWh

STEP 5. Identify the group of power units to be included in the build margin (BM).

The sample group of power units *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 (in MWh) and that have been built most recently[7].

Project participants should use the set of power units that comprises the larger annual generation.

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 (in MWh) and that were built most recently. Taking notice of this situation, EB accepts[8] the following deviation in methodology application:

1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity, i.e. the capacity addition over 1-3years, whichever results in a capacity addition that is close to 20% 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 commercially available in the provincial/regional or national grid of China, as a conservative proxy.

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,

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[7] If 20% falls on part capacity of a unit, that unit is fully included in the calculation.

[8] Http://cdm.unfccc.int/Projects/Deviations

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 PDD choose Option 1.

STEP 6. Calculate the build margin emission factor.

According to the *Tool to calculate the emission factor for an electricity system*, the following equation (3) is adopted to calculate $EF_{grid,BM,y}$.

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (3)$$

where:

$EF_{grid,BM,y}$ is build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$ is net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ is CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m is power units included in the build margin
y is most recent historical year for which power generation data is available

In China, EB accepts the following deviation in methodology application:
The build margin calculations featured below is derived from the *"Notification on Determining Baseline Emission Factor of China's Grid"*, which has been renewed by the Chinese DNA on2nd Jul., 2009.

Therefore for the Project:
First, calculate the share of different power generation technology in recent capacity additions;
Second, calculate the weight for capacity additions of each power generation technology; and
Finally, calculate the emission factor use the efficiency level of the best technology commercially available in China.

Since data of installed capacities cannot be separated to coal based, oil based and gas based at present, BM is calculated with following steps and formula:

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.

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,j,y}} \quad (4)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,j,y}} \quad (5)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,j,y}} \quad (6)$$

where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power plant j in year(s) y,
$NCV_{i,y}$ is the net caloric value of fuel i in year(s) y,
$EF_{CO2,i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/tGJ).

COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

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.

$$EF_{Thermal,y} = \lambda_{Coal,y} \cdot EF_{Coal,Adv,y} + \lambda_{Oil,y} \cdot EF_{Oil,Adv,y} + \lambda_{Gas,y} \cdot EF_{Gas,Adv,y} \quad (7)$$

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

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.

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

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

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2006 to 2008 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from the *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the weighted average fuel consumption for power generation of the top 30 sets of 600 MW lowest coal-consumed power generators built in 2006 (322.5 gCe/kWh) and the 200 MW oil/gas based combined cycle power generators (246 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

The Build Margin emission factor ($EF_{BM,y}$) of the SCPG is 0.5772tCO_2e/MWh (see Annex 3 for details).

STEP 7. Calculate the combined margin (CM) emissions factor.
Based on the Tool, the baseline emission factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$), as

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

According to the Tool, both the weight w_{OM} and the weight w_{BM} take 0.5 as default value. Therefore the combined baseline emission factor:

EF_y =0.5×0.9987tCO_2e/MWh +0.5×0.5772 tCO_2e/MWh =0.78795tCO_2e/MWh.

3. Calculate the project leakage GHG emissions

The Project can take no account of leakages, $L_y = 0$ tCO_2e.

4. Calculate the emission reductions

The project activity will generate GHG emission reductions by avoiding CO_2 emissions from electricity generation by fossil fuel power plants. The emission reduction (ER_y) during a given year y is calculated as follows:

$$ER_y = BE_y - PE_y - L_y \quad (12)$$

Changes required for methodology implementation in 2nd and 3rd crediting periods

At the start of the second and third crediting period the Project have to address two issues:

- Assess the continued validity of the baseline; and,
- Update the baseline.

In assessing the continued validity of the baseline, a change in the relevant national and/or sectoral regulations between two crediting periods has to be examined at the start of the new crediting period. If at the start of the project activity, the project activity was not mandated by regulations, but at the start of the second or third crediting period regulations are in place that enforce the practice or norms or technologies that are used by the project activity, the new regulation (formulated after the registration of the project activity) has to be examined to determine if it applies to existing plants or not. If the new regulation applies to existing CDM project activities, the baseline has to be reviewed and, if the regulation is binding, the baseline for the project activity should take this into account. This assessment will be undertaken by the verifying DOE.

For updating the baseline at the start of the second and third crediting period, new data available will be used to revise the baseline scenario and emissions. Project participants shall assess and incorporate the impact of new regulations on baseline emissions.

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Data / Parameter	EG_y
Unit	MWh
Description	net electricity generated and delivered to the grid by power plant / unit m in year y
Source of data	*China Electric Statistical Yearbook, 2006-2008*
Value(s) applied	Values depend on specifically fuel, referring to Annex 3.
Choice of data or Measurement methods and procedures	According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	$FC_{i,y}$
Unit	mass or volume unit
Description	Amount of fossil fuel type i consumed in the project electricity system in year y
Source of data	*China Energy Statistical Yearbook, 2006-2008*
Value(s) applied	Values depend on specifically fuel, referring to Annex 3.
Choice of data or Measurement methods and procedures	According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	$F_{i,j,y}$
Unit	Mass or volume
Description	The fuel consumption of fuel i in power plant j during year y
Source of data	*China Energy Statistical Yearbook, 2006-2008*
Value(s) applied	Values depend on specifically fuel, referring to Annex 3.
Choice of data or Measurement methods and procedures	According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	$NCV_{i,y}$
Unit	TJ/t, TJ/km^3
Description	Net calorific value (energy content) per mass or volume unit of a fuel *i* in year *y*
Source of data	*China Energy Statistical Yearbook, 2008*
Value(s) applied	Values depend on specifically fuel, referring to Annex 3.
Choice of data or Measurement methods and procedures	According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	$EF_{CO2,i,y}$
Unit	tC/TJ (tCO_2e/TJ)
Description	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
Source of data	*IPCC 2006 Revised Guidelines*
Value(s) applied	Values depend on specifically fuel, referring to Annex 3.
Choice of data or Measurement methods and procedures	According to the *Tool to calculate the emission factor for an electricity system* requirement, use IPCC default value.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	$OXID_{i,y}$
Unit	%
Description	Oxidation factor of the fuel *i* in year *y*
Source of data	*IPCC 2006 Revised Guidelines*
Value(s) applied	Values depend on specifically fuel, referring to Annex 3.
Choice of data or Measurement methods and procedures	According to the *Tool to calculate the emission factor for an electricity system* requirement, use IPCC default value.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	Internal use rate of power plant
Unit	%
Description	The internal power consumption of power plants in year(s) *y*
Source of data	*China Electric Power Yearbook 2006-2008*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	$CAP_{i, j, y}$
Unit	MW
Description	Installed capacities of power plant category *i* of province *j* in years *y*.
Source of data	*China Electric Power Yearbook 2006-2008*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities.
Purpose of data	For the purpose of calculation of EF_y.
Additional comment	Reasonable

Data / Parameter	Cap_{BL}
Unit	MW
Description	Installed capacity of the hydro power plant before the implementation of the Project activity.
Source of data	Base on the methodology ACM0002 for new hydro power plants, this value is zero.
Value(s) applied	0
Choice of data or Measurement methods and procedures	Prior to the implementation of the project activity, there was no hydropower plant at the project site..
Purpose of data	For the calculation of PD.
Additional comment	-

Data / Parameter	EF_{Res}
Unit	$kgCO_2e/MWh$
Description	Default emission factor for emissions from reservoirs.
Source of data	Based on the methodology ACM0002, The default value 90 kgCO2e/MWh is used.
Value(s) applied	90
Choice of data or Measurement methods and procedures	Data used from the methodology ACM0002.
Purpose of data	For the calculation of PE_y.
Additional comment	-

Data / Parameter	A_{BL}
Unit	m^2
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2).
Source of data	Base on the methodology ACM0002 for new reservoirs, this value is zero.
Value(s) applied	0
Choice of data or Measurement methods and procedures	Prior to the implementation of the project activity, there was no hydropower plant at the project site..
Purpose of data	For the calculation of PD.
Additional comment	--

B.6.3. Ex ante calculation of emission reductions

>>

1. Estimated project activity emissions:

According to *PDR of the Project*, area of the reservoirs are 2,600m^2 (First Cascade Hydropower Project), 3,862m^2 (Second Cascade Hydropower Project) and 7733m^2 (Third Cascade Hydropower Project) respectively,

$$PD_{First} = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BJ}} = \frac{(6.4-0)\times 10^6 W}{2600\, m^2} = 2{,}462 W/m^2.$$

$$PD_{Second} = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BJ}} = \frac{(8-0)\times 10^6 W}{3867\, m^2} = 2{,}069 W/m^2.$$

$$PD_{Third} = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BJ}} = \frac{(5.6-0)\times 10^6 W}{7733\, m^2} = 7{,}24 W/m^2.$$

All the PDs>10 W/m^2, so project emission should be neglected according to ACM0002.

PE_y=0 tCO_2e。

2. Estimated baseline emissions:

Baseline emissions are calculated with combined baseline emission factor and the electricity delivered to the grid by the project. The electricity delivered to the grid by the Project in year y ($EG_{facility,y}$) is calculated as subtracting the electricity import ($EG_{aux,y}$)from the electricity exported to the grid in year y ($EG_{output,y}$):

$EG_{facility,y} = EG_{output,y} - EG_{aux,y}$

Assuming the $EG_{aux,y}$=0 in ex-ante calculation of emission reductions for the Project.

According to the *PDR* of the Project, the electricity delivered to the grid are 24,080MWh/yr, 31,874MWh/yr and 25,590MWh/yr for three cascade projects. According to the calculation in B6.1 and data in B6.2, the baseline emission factor for the Project is 0.78795tCO_2e/MWh, the annual baseline emission of the Project is calculated below:

$BE_y = EG_{facility,y} \cdot EG_{grid,CM,y}$

$= (24{,}021+31{,}792+25{,}523)MWh \times 0.78795tCO_2e/MWh = 64{,}088tCO_2e$

3. Estimated project leakage emissions:

As above ACM0002, the leakage of the Project is not considered, i.e. L_y =0 tCO_2e.

4. Estimated emission reductions

As formula (12), the annual emission reductions of the Project are 64,253tCO_2e as calculated below.

$ER_y = BE_y - PE_y - L_y = 64{,}088tCO_2e - 0\ tCO_2e - 0\ tCO_2e = 64{,}088tCO_2e$

B.6.4. Summary of ex ante estimates of emission reductions

Renewable crediting period (7yrs×3) is adopted by the Project. It is expected that the Project will generate emission reductions for about 448,616tCO_2e over the first 7-year crediting period from 01/06/2013 to 31/05/2020.

Year	**Baseline emissions (t CO_2e)**	**Project emissions (t CO_2e)**	**Leakage (t CO_2e)**	**Emission reductions (t CO_2e)**
01/06/2013~31/05/2014	64,088	0	0	64,088
01/06/2014~31/05/2015	64,088	0	0	64,088
01/06/2015~31/05/2016	64,088	0	0	64,088
01/06/2016~31/05/2017	64,088	0	0	64,088
01/06/2017~31/05/2018	64,088	0	0	64,088
01/06/2018~31/05/2019	64,088	0	0	64,088
01/06/2019~31/05/2020	64,088	0	0	64,088
Total	**448,616**	**0**	**0**	**448,616**
Total number of crediting years	**7**			
Annual average over the crediting period	64,088	0	0	64,088

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$\mathbf{EG_{facility,y}}$
Unit	MWh
Description	Net electricity generation supplied by the project plant/unit to the grid in year y, which is the sum of all the net electricity exported to the grid
Source of data	Measured on site by meters. A difference between quantity of electricity supplied by the project plant/unit to the grid and quantity of electricity delivered to the project plant/unit from the grid.
Value(s) applied	1st cascade project: 24,021 2nd cascade project: 31,792 3rd cascade project: 25,523 the project: 24,021+31,792+25,523=81,336
Measurement methods and procedures	Net electricity generation supplied by the project plant/unit to the grid in year y ($EF_{facility,y}$) is the difference between the Electricity generation exported by the project plant/unit to the grid in year y ($EG_{output,y}$)and Electricity imported by the Project from the grid in year y($EG_{input,y}$)
Monitoring frequency	Continuously monitored through sealed meters equipment and monthly recording by the project owner.
QA/QC procedures	Sales receipts/records which are sourced from the gird meter are used to ensure the consistency. The conservative value recorded data and sales receipt values will be considered for emission reduction calculation.
Purpose of data	For the calculation of baseline emission.
Additional comment	- Measured by multi-function electronic energy meters

Data / Parameter	$\mathbf{EG_{output,y}}$
Unit	MWh
Description	Electricity generation exported by the project plant/unit to the grid in year y, which is the sum of all the output electricity exported to the grid
Source of data	Measured on site by meters..
Value(s) applied	1st cascade project: 24,021 2nd cascade project: 31,792 3rd cascade project: 25,523 the project: 24,021+31,792+25,523=81,336
Measurement methods and procedures	The power generation for each of the cascade power station is read from M1, M2,M3 respectively, and total power generation to the grid is read from M4 (Please see Figure B.6)
Monitoring frequency	Continuously monitored through sealed meters equipment and monthly recording by the project owner.
QA/QC procedures	Sales receipts/records which are sourced from the gird meter are used to ensure the consistency. The conservative value recorded data and sales receipt values will be considered for emission reduction calculation.
Purpose of data	For the calculation of baseline emission.
Additional comment	Measured by multi-function electronic energy meters

Data / Parameter	$\mathbf{EG_{input,y}}$
Unit	MWh
Description	Electricity imported by the Project from the grid in year y. Electricity generation imported by the project plant/unit from the grid in year y, which is the sum of all the imported electricity from the grid
Source of data	Measured on site by meters.
Value(s) applied	0
Measurement methods and procedures	The electricity imported by each of the cascade power station is from reverse reading of M1, M2,M3 respectively, and total electricity imported from the grid is from reverse reading of M4 (Please see Figure B.6)
Monitoring frequency	Continuously monitored through sealed meters equipment and monthly recording by the project owner.
QA/QC procedures	Sales receipts/records which are sourced from the gird meter are used to ensure the consistency. The conservative value recorded data and sales receipt values will be considered for emission reduction calculation.
Purpose of data	For the calculation of baseline emission.
Additional comment	Measured by multi-function electronic energy meters

Data / Parameter	$\mathbf{A_{PJ,First\ ,\ 1\#\ reservoir}}$
Unit	m^2
Description	Area of the 1# reservoir measured in the surface of the water, after the implementation of the first cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	867, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	--

Data / Parameter	$\mathbf{A_{PJ,First\ ,\ 2\#\ reservoir}}$
Unit	m^2
Description	Area of the 2# reservoir measured in the surface of the water, after the implementation of the first cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	933, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$A_{PJ,First\ ,\ 3\#\ reservoir}$
Unit	m^2
Description	Area of the 3# reservoir measured in the surface of the water, after the implementation of the first cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	800, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$A_{PJ,Second\ ,\ 1\#\ reservoir}$
Unit	m^2
Description	Area of the 1# reservoir measured in the surface of the water, after the implementation of the second cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	1,000, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$A_{PJ,Second\ ,\ 2\#\ reservoir}$
Unit	m^2
Description	Area of the 2# reservoir measured in the surface of the water, after the implementation of the second cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	1,862, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$A_{PJ,Second\ ,\ 3\#\ reservoir}$
Unit	m^2
Description	Area of the 3# reservoir measured in the surface of the water, after the implementation of the second cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	1,000, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$A_{PJ,Third\ ,\ 1\#\ reservoir}$
Unit	m^2
Description	Area of the 1# reservoir measured in the surface of the water, after the implementation of the third cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	3,600, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$\mathbf{A_{PJ,Third\ ,\ 2\#\ reservoir}}$
Unit	m^2
Description	Area of the 2# reservoir measured in the surface of the water, after the implementation of the third cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	2,266, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$\mathbf{A_{PJ,Third\ ,\ 3\#\ reservoir}}$
Unit	m^2
Description	Area of the 3# reservoir measured in the surface of the water, after the implementation of the third cascade station, when the reservoir is full.
Source of data	project site
Value(s) applied	1,867, which is consistent with that in the PDR
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc. This data will kept until 2 years after the end of the total credit period of the proposed project.
Monitoring frequency	one time measurement after the implementation with full reservoir
QA/QC procedures	The investigation will be carried out by the authorized third party design institute.
Purpose of data	For the calculation of power density
Additional comment	---

Data / Parameter	$\mathbf{Cap_{PJ,First}}$
Unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the Project activity.
Source of data	Nameplate of the power units.
Value(s) applied	5.6
Measurement methods and procedures	Verified on site.
Monitoring frequency	One time measurement after the installation is completed
QA/QC procedures	The value can be indicated by the nameplate and cross-checked with purchase contract
Purpose of data	To verify the applicability of the methodology.
Additional comment	---

Data / Parameter	$Cap_{PJ,Second}$
Unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the Project activity.
Source of data	Nameplate of the power units.
Value(s) applied	8
Measurement methods and procedures	Verified on site.
Monitoring frequency	One time measurement after the installation is completed
QA/QC procedures	The value can be indicated by the nameplate and cross-checked with purchase contract
Purpose of data	To verify the applicability of the methodology.
Additional comment	---

Data / Parameter	$Cap_{PJ,Third}$
Unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the Project activity.
Source of data	Nameplate of the power untis.
Value(s) applied	6.4
Measurement methods and procedures	Determine the installed capacity based on recognized standards
Monitoring frequency	One time measurement after the installation is completed
QA/QC procedures	The value can be indicated by the nameplate and cross-checked with purchase contract
Purpose of data	To verify the applicability of the methodology.
Additional comment	---

B.7.2. Sampling plan
>>
Not applicable to the project.

B.7.3. Other elements of monitoring plan
>>

1. Purpose

Baseline emission factor of the Project is determined ex ante. Therefore the electricity delivered by the Project to the SCPG is defined as the key data to be monitored.

2. Monitoring Structure

The Project owner assigns the person in charge of CDM operation with assistance of the technological departments and financial department. The structure was shown as the following Figure B.5.

Project owner

Personal in charge of CDM

In full charge of issues related to CDM projects, in particular:

(1) track the development of CDM, keep communication with related agencies;
(2) supervise the project operation status related to data monitoring and the monitoring process as well, ensure a smooth and orderly monitoring process;
(3) in charge of activities related to CER issuance, ensure the completeness and accuracy of related data.

Technical Department

In charge of calibrating and maintaining the power meter, and checking, archiving and managing data

Financial Department

In charge of collecting data required by the checking activity, including power meter readings records, electricity sales records and copies of electricity sales receipts.

Statistician

In charge of measuring and recording the power meter readings ;
In charge of measuring the installed capacity of the hydro power plant and surface area of the reservoir after the implementation of the Project activity when the reservoir is full on the end of each year;

Figure B.5. Management Structure of Monitoring Plan

3. Equipment and Installation of Monitoring

Distribution and calibration of electric meter should be implemented according to the technical requirements of ***Technical administrative code of electric energy metering*** (DL/T448-2000).

The electricity generated by each sub project would be boosted to 35KV respectively, and then be delivered to the grid together via the 110KV line. Three meters (check meter, M1,M2,M3) with precision 0.5 is installed at outlet of transformer in each cascade station to measure electricity output of the each sub Project, the power meter M4 (duty meter) with precision 0.5 will be installed at the outlet of the 110 KV transformer of project site to measure electricity delivered to South China Power Grid. The meters will be measured continuously and recorded monthly, and calibration will be carried out according to regulation DL/T448-2000 once every year. The meters locations are as follow:

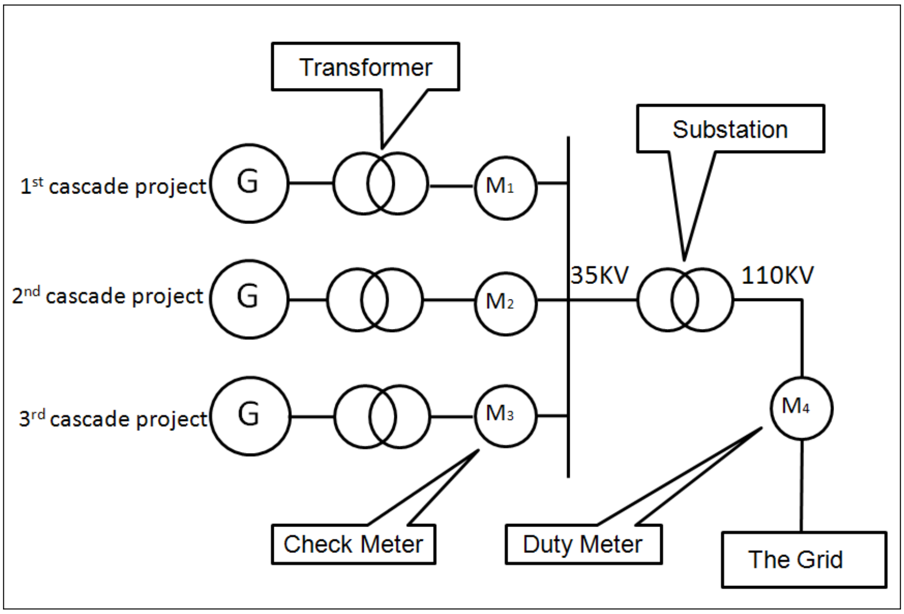

Figure B.6. Grid connection Diagram

The Grid Company takes full responsibility for the operation &maintenance of the duty meters.

4. Data Collection

The data on the duty meter is recorded by the grid company at the certain time of each month. The data is aggregated monthly and used for emission reduction.

The project owner records data of check meter, if the data of duty meter is not available, the data of check meter is adopted to calculate emission reductions.

If both of the meters are not available, the net power delivery is assumed as zero.

5. QA/QC

The financial department keeps all relevant sales evidences for double-checking.

The monitoring equipments will be calibrated once a year according to relevant standards and regulars (such as DL/T448-2000) before operation. The certificated staffs are in charge of operation and maintenance monitoring equipment.

If any emergency occurs, the protection devices must be firstly insured and power grid company must report immediately. The reasons of the emergency must be identified and deal with it accordingly. All details about the emergency should be recorded and stored, including the location of the equipment, the phenomenon and data while emergency occurs, the reasons of the emergency and the detailed process to deal with it. Damaged equipment will be displaced immediately.

The specification and technical documents of all equipment are kept for any emergency. All records of calibration or adjustment to the meters should be documented and maintained for DOE's verification.

6. Data Management

The monitoring data should be saved at the end of each month; the regular summary should be made and reported to technology department by statistician monthly; all the data should be saved up to 2 years after the end of the crediting period.

7. Verification

It is expected that the verification of emission reductions generated from the Project will be done annually. The monitoring team should cooperate with DOE. The documents will be prepared for verification including, but not limited to:

- PDD, including the electronic spreadsheets and supporting documentation(assumptions, estimations, measurement, etc);

- Report on maintenance and calibration of meters;

- Monitoring Report.

8. Person Training

All staffs working within monitoring team should be trained. Through the training, staffs will know the necessary knowledge about CDM and monitoring requirement, familiar with the equipment operating principle and basic structure, master the cause and solution of common problem.

During the operating period, project owner will hold irregularly scheduled training to improve the professional level of worker.

The application of the baseline study and monitoring methodology of the Project was completed on 11/07/2012 by Mr. Xia Wang in Accord Global Environment Technology Co., Ltd. (The person/entity is not project participant listed in Annex 1.)

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SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity
>>

The starting date of 3rd Cascade Project: 1st March. 2009[9] **(first real action)**

The starting date of 2nd Cascade Project: 28th Oct. 2009[10]

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[9] Date of signing the construction contract for the 3rd cascade project which is the first real action of 3rd cascade project begins.
[10] Date of signing the 1st & 2nd & 3rd Cascade stations Metal structures equipment and installation contract for the 2nd cascade project which is the first real action of 2nd cascade project begins.

The starting date of 1st Cascade Project: 28th Oct. 2009 [11]

C.1.2. Expected operational lifetime of project activity
>>

20years (excluding construction period)

C.2. Crediting period of project activity
C.2.1. Type of crediting period
>>
The Project adopts 7yrs×3 renewable crediting period.

C.2.2. Start date of crediting period
>>

01/06/2013 or on the date of registration of the CDM project activity, whichever is later.

C.2.3. Length of crediting period
7 years

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
>>
All the EIA reports of the Projects were completed by Environment Engineering Institute of Hohe prefecture and approved by the Lincang City Environmental Protection Bureau. And the approved dates of all projects are on 29/09/2008. According to the EIA report of the Projects, environmental impacts possibly caused by the Project and corresponding measures adopted by the project owner are analyzed as follows:

Land use

The total land occupation of the First Cascade Hydropower Project is 7.49ha, of which the permanent and the temporary land occupation are 4.37ha and 3.12ha respectively.

The total land occupation of the Second Cascade Hydropower Project is 7.15ha, of which the permanent and the temporary land occupation are1.4.17ha and 2.97ha respectively.

The total land occupation of the Third Cascade Hydropower Project is 5.02ha, of which the permanent and the temporary land occupation are 2.58ha and 2.44ha respectively.

The Project owner has already offered compensation for the villagers whose land was occupied.

Air pollution

The main pollutants which affect the air quality are dusts and wastes such as SO_2, which comes from the concrete mixing, sand-gravel material grinding and sieving, tail gas of transportation vehicle and explosion process. Since the operation point is scattered, and the negative effect caused by the waste gases and dust is very limited.

The labor protection measures such as watering regularly should be adopted for the sake of the air quality and the constructer's health.

Noise

[11] Date of signing the 1st & 2nd & 3rd Cascade stations Metal structures equipment and installation contract for the 1st cascade project which is the first real action of 1st cascade project begins.

The noise mainly comes from concrete mixing, comprehensive processing plant, explosion and other flow sound resource.

The constructors are provided with labour protection instruments such as ear mask and earplug in order to reduce the damage. In addition, the working hours should be arranged not at night to avoid disturbing the residents around.

Waste water

There will be waste water coming from production process and daily life. The former, whose major pollutants are suspended solid, mainly comes from sand-stone washing, concrete mixing, foundation pit wastewater and concrete curing, the later is from the emission of the domestic water.

The production wastewater will be first sedimentated then to the second precipitated, during which most suspended solid can be removed. After processing, the waste water will reach the emission standard and can be recycled. Furthermore, the domestic sewage faces and domestic wastes should be disposed in order and can be used for farm and forest land irrigation.

In summary, the Project will not bring significant impacts to the environment.

D.2. Environmental impact assessment

>>

The Project use clean renewable energy to generate electricity whose environmental impact comply with relevant national laws and regulations. Environmental impacts are considered not significant.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The stakeholders identified for the Projects are the residents near the Project and local government. An announcement about stakeholder survey was published in a poster which was put up in the villages which near the Project, after that a project Staff of the Yuanfeng Hydropower Development Co., Ltd visited villagers living near the project site to introduce the project information and all the stakeholders were invited to finish a questionnaire to express their comments and concerns about the project. The following is the questions that the questionnaires referred:

For the Three Hydropower Projects:

50 questionnaires are distributed and 50 questionnaires are returned. 37 male clients and 13 female clients and a full list of stakeholders consulted are available from the project developer. The questionnaires mainly focus on following issues:

What is the attitude of the stakeholders on the construction and operation of the Project?

What positive impacts will be introduced by the implementation of the Project from the view of stakeholders?

What negative impacts will be introduced by the implementation of the Project from the view of stakeholders?

What measures should be applied to reduce the negative impacts from the view of stakeholders?

E.2. Summary of comments received
>>

Based on the 50 returned questionnaires, the summary of the comments are shown as follows:

- All people surveyed (100%) support the construction of the Project.

- Possible positive impacts considered by the people surveyed to be caused by the construction of the Project include improvement of living conditions (68%), creation of employment opportunities (48%), increases in income (58%), decreasing electricity price (68%), and increases in electricity supply (36%).

- 96% of surveyed persons think the Project do not induce any neglect effects

- Two surveyed person think the Project will cause land occupied, and one person think it will reduce the fish production.

E.3. Report on consideration of comments received
>>

Analysis on the desires expected by the people surveyed to be resolved by the Project is as follows:

- The Project is a run of river hydropower plant, so there is no useful land occupied.

- The Project will set a permanent channel in dam to avoid the water reduction in the downstream for protect the fish living environment.

To sum up, construction of the Project satisfies the interests and requirement of stakeholders and has gained the necessary support. Based on the comments received from stakeholders, there has been no need to modify the design, construction and operation pattern of the Project.

SECTION F. Approval and authorization
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Appendix 1: Contact information of project participants

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Appendix 2: Affirmation regarding public funding

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

Appendix 3: Applicability of selected methodology

Please refer to B.2 of the PDD.

Appendix 4: Further background information on ex ante calculation of emission reductions

BASELINE INFORMATION

Data recommended in the *Notification on Determining Baseline Emission Factor of China's Grid* for the South China Power Grid are adopted for the Project.

The emission factors of OM and BM are calculated based on the approved Tool *"Tool to calculate the emission factor for an electricity system"* The information provided by the tables includes data, data sources and the underlying calculations.

Table 3.1 Electricity generation of the South China Power Grid in 2005

Province	**Electricity generation (MWh)**	**Auxiliary electricity consumption (%)**	**Electricity delivered to the grid (MWh)**
Guangdong	176,453,000	5.58	166,606,923
Guangxi	25,023,000	7.95	23,033,672
Guizhou	58,430,000	7.34	54,141,238
Yunnan	27,281,000	6.94	25,387,699
Total			269,169,531

Data source: China Electric Power Yearbook 2006

Table 3.2 Electricity generation of the South China Power Grid in 2006

Province	**Electricity generation (MWh)**	**Auxiliary electricity consumption (%)**	**Electricity delivered to the grid (MWh)**
Guangdong	188,429,000	5.27	178,498,792
Guangxi	27,967,000	4.45	26,722,469
Guizhou	76,039,000	6.06	71,431,037
Yunnan	39,791,000	4.12	38,151,611
Total			314,803,908

Data source: China Electric Power Yearbook 2007

Table 3.3 Electricity generation of the South China Power Grid in 2007

Province	**Electricity generation (MWh)**	**Auxiliary electricity consumption (%)**	**Electricity delivered to the grid (MWh)**
Guangdong	215,700,000	6.01	202,736,430
Guangxi	36,100,000	7.42	33,421,380
Guizhou	84,300,000	6.62	78,719,340
Yunnan	47,400,000	7.23	43,972,980
Total			358,850,130

Data source: China Electric Power Yearbook 2008

Table 3.4 Calculation of simple OM emission factor of the South China Power Grid in 2005

Fuel	Unit	Guang dong A	Guangxi B	Guizhou C	Yunnan D	Toal fuel E=A+B+C+D	Default carbon content (tC/TJ) F	Oxidation Rate(%) G	Emission factor of fuel(kgCO$_2$/TJ) H	NCV (MJ/t or 1000m^3) I	Emission (tCO$_2$e) J=E*H*I/1000 00(quality) J=E*H*J/100000(volume)
Coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	87,300	20,908	243,113,522
Cleaned coal	10^4t				0.15	**0.15**	25.8	100	87,300	26,344	3,450
Other washed coal	10^4t			10.39	33.88	**44.27**	25.8	100	87,300	8,363	323,211
Coke	10^4t	4.79			8.05	**12.84**	29.2	100	95,700	28,435	349,406
Coke oven gas	10^8m^3				0.79	**0.79**	12.1	100	37,300	16,726	49,287
Other gas	10^8m^3	1.87			15.96	**17.83**	12.1	100	37,300	5,227	347,626
Crude oil	10^4t	10.91				**10.91**	20	100	71,100	41,816	324,367
Gasoline	10^4t	0.68				**0.68**	18.9	100	67,500	43,070	19,769
Diesel oil	10^4t	31.96	2.02		1.81	**35.79**	20.2	100	72,600	42,652	1,108,250
Fuel oil	10^4t	887.21				**887.21**	21.1	100	75,500	41,816	28,010,178
LPG	10^4t					**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	4.92				**4.92**	15.7	100	48,200	46,055	109,217
Nature gas	10^8m^3	0.93				**0.93**	15.3	100	54,300	38,931	196,598
Other oil products	10^4t	1.7				**1.7**	20	100	75,500	41,816	53,671
Other coking products	10^4t					**0**	25.8	100	95,700	28,435	0
Other energy	10^4tCe	104.66	133.15		59.72	**297.53**	0	0	0	0	0
Total emission of the South China Power Grid (tCO$_2$e) J						274,008,550					
Fossil power supply by the South China Power Grid (MWh) K						269,169,531					
Imported electricity from the Central China Grid (MWh) L						20,264,000					
Emission factor of Central China Grid (tCO$_2$e/MWh) M						1.16148					
Total emission (tCO$_2$e) N=J+L*M						297,544,857					
Total electricity delivered to the grid (MWh) O=K+L						289,433,531					

Data sources: China Energy Statistical Yearbook 2006

Table 3.5 Calculation of simple OM emission factor of the South China Power Grid in 2006

Fuel	**Unit**	**Guang dong A**	**Guangxi B**	**Guizhou C**	**Yunnan D**	**Toal fuel E=A+B+C+D**	**Default carbon content (tC/TJ) F**	**Oxidation Rate(%) G**	**Emission factor of fuel($kgCO_2$/TJ) H**	**NCV (MJ/t or 1000m^3) I**	**Emission (tCO_2e) J=E*H*I/1000 00(quality) J=E*H*J/100000(volume)**
coal	10^4t	7303.19	1490.01	4001.54	2735.88	**15530.62**	25.8	100	87,300	20,908	283,475,499
Cleaned coal	10^4t					**0**	25.8	100	87,300	26,344	0
Other washed coal	10^4t			19.53	45.8	**65.33**	25.8	100	87,300	8,363	476,968
Briquette		133.75				**133.75**	26.6	100	87,300	20,908	2,441,296
Coke	10^4t				1.31	**1.31**	29.2	100	95,700	28,435	35,648
Coke oven gas	10^8m^3		0.84		2.06	**2.9**	12.1	100	37,300	16,726	180,925
Other gas	10^8m^3	0.89			19.15	**20.04**	12.1	100	37,300	5,227	390,714
Crude oil	10^4t	0.87				**0.87**	20	100	71,100	41,816	25,866
Gasoline	10^4t					**0**	18.9	100	67,500	43,070	0
Diesel oil	10^4t	29.92	1.26		3	**34.18**	20.2	100	72,600	42,652	1,058,396
Fuel oil	10^4t	685.85	0.09			**685.94**	21.1	100	75,500	41,816	21,655,867
LPG	10^4t					**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t					**0**	15.7	100	48,200	46,055	0
Nature gas	10^8m^3	7.92				**7.92**	15.3	100	54,300	38,931	1,674,251
Other oil products	10^4t	0.67				**0.67**	20	100	75,500	41,816	21,153
Other coking products	10^4t					**0**	25.8	100	95,700	28,435	0
Other energy	10^4tCe	93.54	189.68		20.29	**303.51**	0	0	0	0	0
Total emission of the South China Power Grid (tCO_2e) J						311，436，583					
Fossil power supply of the South China Power Grid (MWh) K						314,803,908					
Imported electricity from the Central China Grid (MWh) L						21,730,840					
Emission factor of Central China Grid (tCO_2e/MWh) M						1.12157					
Total emission (tCO_2e) N=J+L*M						335,809,186					
Total electricity delivered to the grid (MWh) O=K+L						336,534,748					

Data sources: China Energy Statistical Yearbook 2007

Table 3.6 Calculation of simple OM emission factor of the South China Power Grid in 2007

Fuel	Unit	Guang dong A	Guangxi B	Guizhou C	Yunnan D	Toal fuel E=A+B+C+D	Default carbon content (tC/TJ) F	Oxidation Rate(%) G	Emission factor of fuel($kgCO_2/TJ$) H	NCV (MJ/t or $1000m^3$) I	Emission (tCO_2e) J=E*H*I/1000 00(quality) J=E*H*J/100000(volume)
coal	10^4t	8214.78	1750.63	4298.8	3170.79	**17435**	25.8	100	87,300	20,908	318,235,546
Cleaned coal	10^4t	3.46				**3.46**	25.8	100	87,300	26,344	79,574
Other washed coal	10^4t		0.65	21.58	14.64	**36.87**	25.8	100	87,300	8,363	269,184
Briquette	10^4t	271.25				**271.25**	26.6	100	87,300	20,908	4,951,041
Coke	10^4t	0.04	1.69		2.15	**3.88**	29.2	100	95,700	28,435	105,584
Coke oven gas	10^8m^3		0.96	3.19	1.8	**5.95**	12.1	100	37,300	16,726	371,208
Other gas	10^8m^3		30.77		21.63	**52.4**	12.1	100	37,300	5,227	1,021,628
Crude oil	10^4t					**0**	20	100	71,100	41,816	0
Gasoline						**0**	18.9	100	67,500	43,070	0
Diesel oil	10^4t	21.37	2.13		2.29	**25.79**	20.2	100	72,600	42,652	798,596
Fuel oil	10^4t	467.97	0.41			**468.38**	21.1	100	75,500	41,816	14,787,262
LPG	10^4t					**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.37				**0.37**	15.7	100	48,200	46,055	8,213
Nature gas	10^8m^3	32.17				**32.17**	15.3	100	54,300	38,931	6,800,588
Other oil products	10^4t	8.47				**8.47**	20	100	75,500	41,816	267,407
Other coking products	10^4t					**0**	25.8	100	95,700	28,435	0
Other energy	10^4tCe	118.04	81.89	44.1	50.3	**294.33**	0	0	0	0	0
Total emission of the South China Power Grid (tCO_2e) J						347,695,831					
Fossil power supply of the South China Power Grid (MWh) K						358,850,130					
Imported electricity from the Central China Grid (MWh) L						24,237,240					
Emission factor of Central China Grid (tCO_2e/MWh) M						1.10197					
Total emission (tCO_2e) N=J+L*M						374,404,628					
Total electricity delivered to the grid (MWh) O=K+L						383,087,370					

Data sources: China Energy Statistical Yearbook 2008

$EF_{OM,y}=(N_{2003}+N_{2004}+N_{2005}) / (O_{2003}+O_{2004}+O_{2005}) = 0.9987tCO_2e/MWh$

Table 3.7 Data and result of Step (1)

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total fuel E=A+B+C+D	NCV (MJ/t 或 1000m^3) F	Default carbon content (tC/TJ) G	Oxidation Rate H	Emission (tCO_2e) I
Coal	10^4t	8,214.78	1,750.63	4,298.8	3,170.79	17,435	20,908	87,300	1	318,235,546
Cleaned coal	10^4t	3.46	0	0	0	3.46	26,344	87,300	1	79,574
Other washed coal	10^4t	0	0.65	21.58	14.64	36.87	8,363	87,300	1	269,184
Briquete	10^4t	271.25	0	0	0	271.25	20,908	87,300	1	4,951,041
coke	10^4t	0.04	1.69	0	2.15	3.88	28,435	95,700	1	105,584
Other coke product		0	0	0	0	0	28,435	95,700	1	0
Total solid fuel										**323,640,928**
Oil	10^4t	0	0	0	0	0	41,816	71,100	1	0
Gasoline	10^4t	0	0	0	0	0	43,070	67,500	1	0
Diesel oil	10^4t	21.37	2.13	0	2.29	25.79	42,652	72,600	1	798,596
Fuel oil	10^4t	467.97	0.41	0	0	468.38	41,816	75,500	1	14,787,262
Other oil products	10^4t	8.47	0	0	0	8.47	41,816	75,500	1	267,407
Total liquid fuel										**15,853,266**
Nature gas	10^7m^3	321.7	0	0	0	321.7	38,931	54,300	1	6,800,588
Coke oven gas	10^7m^3	0	9.6	31.9	18	59.5	16,726	37,300	1	371,208
Other coal gas	10^7m^3	0	307.7	0	216.3	524	5,227	37,300	1	1,021,628
LPG	10^4t	0	0	0	0	0	50,179	61,600	1	0
Finery gas	10^4t	0.37	0	0	0	0.37	46,055	48200	1	8,213
Total gas fuel										**8,201,637**
Total										**347,695,831**

Data sources: China Energy Statistical Yearbook 2008

Table 3.8 Emission factor of best technology

	Variable	Electricity supply efficiency	Carbon content of fuel* (tC/TJ)	Oxidation rate*	Emission factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1000*B*C44/12
Coal-based power plants	$EF_{Coal,Adv}$	38.10	87,300	1	0.8249
Gas-based power plants	$EF_{Gas,Adv}$	49.99	75,500	1	0.5437
Oil-based power plants	$EF_{Oil,Adv}$	49.99	54,300	1	0.3910

Calculate with formula (4), (5) and (6), the value for λ_{Coal} is 93.08%, the value for λ_{Oil} is 4.56% and the value for λ_{Gas} is 2.36%. Therefore $EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$ = 0.8018 tCO_2/MWh

Table 3.9. Installed capacity of the South China Power Grid in 2007

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	44,710	9,310	10,630	15,960	80,610
Hydro power (MW)	10,110	10,440	11,580	8,210	40,340
Nuclear power (MW)	3,780	0	0	0	3,780
Wind power and Other (MW)	250	0	0	0	250
Total (MW)	58,850	19,750	22,210	24,170	124,980

Data source: China Electric Power Yearbook 2008.

Table 3.10. Installed capacity of the South China Power Grid in 2006

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	40,615	5,434	8,564	14,350	68,963
Hydro power (MW)	9,320	7,624	9,698	7,534	34,176
Nuclear power (MW)	3,780	0	0	0	3,780
Wind power and Other (MW)	183	0	0	0	183
Total (MW)	53,898	13,058	18,262	21,884	107,102

Data source: China Electric Power Yearbook 2007

Table 3.11. Installed capacity of the South China Power Grid in 2005

	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power (MW)	35,182.6	4,931.2	4,758.4	9,634.8	54,507
Hydro power (MW)	9,035.7	6,085.3	7,993.1	7,233	30,347.1
Nuclear power (MW)	3,780	0	0	0	3,780
Wind power and Other (MW)	83.4	0	0	0	83.4
Total (MW)	48,081.7	11,016.5	12,751.5	16,867.8	88,717.5

Data source: China Electric Power Yearbook 2006

Table 3.12 Calculation of BM emission factor of the South China Power Grid

	Installed capacity in 2005 (MW) A	**Installed capacity in 2006 (MW) B**	**Installed capacity in 2007 (MW) C**	**Capacity additions from 2005 to 2007 (MW) D=C-A**	**Share in total capacity additions**
Thermal power	54,507	68,963	80,610	26,103	71.98%
Hydro power	30,347.1	34,176	40,340	9,992.9	27.56%
Nuclear power	3,780	3,780	3,780	0	0.00%
Wind power and other	83.4	183	250	166.6	0.46%
Total	**88,717.5**	**107,102**	**124,980**	**36,262.5**	**100.00%**
Share in 2005	70.99%	85.70%	100%		

$EF_{BM,y}$ =0.8018×71.98%=0.5772 tCO_2/MWh

Appendix 5: Further background information on monitoring plan

Please refer to B.7 of PDD.

Appendix 6: Summary of post registration changes

Not applicable.

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
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