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

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Luquan County Tiesuoqiao Hydropower Project
Version number of the PDD	02
Completion date of the PDD	17/07/2012
Project participant(s)	Yunnan Haolong Industry Group Luquan Hydropower Development Co., Ltd (as the project owner)
Host Party(ies)	People's Republic of China
Sectoral scope and selected methodology(ies)	Category: Renewable Energy in grid connected applications Sectoral Scope 1: Energy industries (renewable - / non-renewable sources) ACM0002-Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable sources (ACM0002, Version 13.0.0).
Estimated amount of annual average GHG emission reductions	72,044 t CO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Luquan County Tiesuoqiao Hydropower Project (hereinafter referred to as the "proposed project" or "the Project") located on Pudu River in Tiesuoqiao, Luquan County, Kunming City, Yunnan Province, PR, China. The purpose of the Project is to utilize the hydro resource to generate electricity which would otherwise have been produced by fossil fuel-fired power plants.

1. The objective of the proposed project

(1) For the proposed project, the scenario existing prior to the start of the implementation of the proposed project activity is SCPG (South China Power Grid) provides the same electricity service as the proposed project.

(2) With a total installed capacity of 24MW (12MW*2), the Project is expected to generate electricity by 123,000 MWh per annum[1], and about 113,940MWh will be delivered to the grid per annum. The implementation of the proposed project will achieve CO_2 emission reductions by replacing electricity generated by fossil fuel fired power plants.

(3) The baseline scenario is the same as the scenario existing prior to the start of implementation of the proposed project activity.

2. The approach that the proposed project achieves the GHG emission reductions

The electricity generated from the proposed project will be delivered to Yunnan Power Grid which belongs to SCPG, which is predominantly coal-fired generation. By substituting corresponding amount of electricity generated from SCPG, the proposed Project is expected to decrease greenhouse gas emission by 72,044 tCO_2e per annum. The total emission reduction of greenhouse gas during the first crediting period is 504,308 tCO_2e.

3. Contributions to the sustainable development

- Reducing GHG emission by replacing fossil fuel-fired generated electricity with renewable water resource;
- Promoting the local water resource rational development;
- Improving the local energy generation infrastructure, bridging the gap between power supply and demand and reducing the deficiency of the local grid;
- Contributing to local economic development and improving inhabitant life quality through increasing employment opportunity.

A.2. Location of project activity

A.2.1. Host Party(ies)

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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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[1] Data source: Feasibility study report

Tiesuoqiao, Luquan County, Kunming City

A.2.4. Physical/Geographical location

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The project located on Pudu River in Tiesuoqiao, Luquan County, Kunming City, Yunnan Province, PR, China. The geographical coordinate of the project is East Longitude 102°39′05″and North latitude 25°36′25″. The project location is shown in Figure A-1.

Figure A-1. The location of the Project

A.3. Technologies and/or measures

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<u>**The scenario existing prior to the start of the implementation of the Project activity (the same as the baseline scenario):**</u>

The electricity generated by the Project would have been provided by the SCPG prior to the start of the implementation of the project activity, which is the same as the baseline scenario.

The project scenario:

The Project is a diversion type run-of-river hydro power with a total installed capacity of 2×12MW. 2 sets of water turbines and generators are installed to generate renewable electricity. The submerged area of the proposed project is 36,018m^2 in total[2], thus, the power density is calculated to be $24*10^6/36,018 = 664.67$ W/m^2. The expected electricity generation is 123,000 MWh per annum, and the power load factor (PLF) is calculated as 123,000MWh/24MW/8,760h*100%=58.50%. The main technical parameters are listed in Table A-1.

Table A-1: Technical parameters of the Project[3]

Water Turbines		Data source
Model	HLA551-LJ-265	FSR
Set	2	
Rated capacity(MW)	12.5	
Rated water head (m)	30	
Rated flow (m^3/s)	44.97	
Rated rotation speed (rpm)	166.7	
Lifetime(year)	20	
Generators		
Model	SF12-36/5500	FSR
Set	2	
Rated installed capacity (MW)	12	
Rated voltage (kv)	6.3	
Power factor	0.80	
Rated rotation speed (rpm)	166.7	
Lifetime(year)	20	

The electricity supplied to SCPG and the electricity imported from SCPG by the Project will be continuously monitored through the Revenue meter. And it will be installed at the connection point of the proposed project and the power grid. Please refer to Section B.7 for detailed monitoring information.

According to the Feasibility Study Report and the Environmental Impact Assessment Report of the proposed project, the technology employed by the proposed project has been widely used in China and is environmentally safe.

Technology transfer:

All the equipments of the Project are provided by domestic manufacturers. There is no technology import through the project activity.

2 Data source: Feasibility study report (FSR)

3 Data source: Technical agreement of main equipments.

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)
People's Republic of China (host)	Yunnan Haolong Industry Group Luquan Hydropower Development Co., Ltd (as the project owner)	Yes

A.5. Public funding of project activity
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No public funding from parties included in Annex I is available to the Project activity.

SECTION B. Application of selected approved baseline and monitoring methodology
B.1. Reference of methodology
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Baseline and monitoring methodology ACM0002: "Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable sources" (ACM0002, Version 13.0.0).

Tool for the demonstration and assessment of additionality (Version 06.1.0)

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

More information on the methodologies listed above is available at the following website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2. Applicability of methodology
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The Project meets the applicable criteria of the methodology ACM0002 (Version 13.0.0) due to following reasons:

The Project is a newly-built grid-connected hydropower plant with the total installed capacity of 24MW at a site where no renewable power plant was operated prior to the implementation of the project.

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

The Project results in a new reservoir, and the power density of the proposed project is 664.67 W/m^2, as per definitions given in the Project Emission section, which is greater than 4 W/m^2;

Therefore the methodology ACM0002 (Version 13.0.0) is chosen and applicable to the Project.

B.3. Project boundary

The electricity generated by the Project will be transferred to SCPG, therefore SCPG is defined as the project boundary of the Project. According to "*2011 Baseline Emission Factors for Regional Power Grid In China,*" issued by the National Development and Reform Commission of the Government of China (China DNA), SCPG is composed of Guangdong Power Grid, Guangxi Power Grid, Yunnan Power Grid and Guizhou Power Grid.

The power house is located in Yunnan province where is covered by SCPG. The spatial extent of the Project boundary includes the Project site and all power plants connected physically to the SCPG that the

Project power plant is connected to.

The figure below shows the boundary of the Project activity.

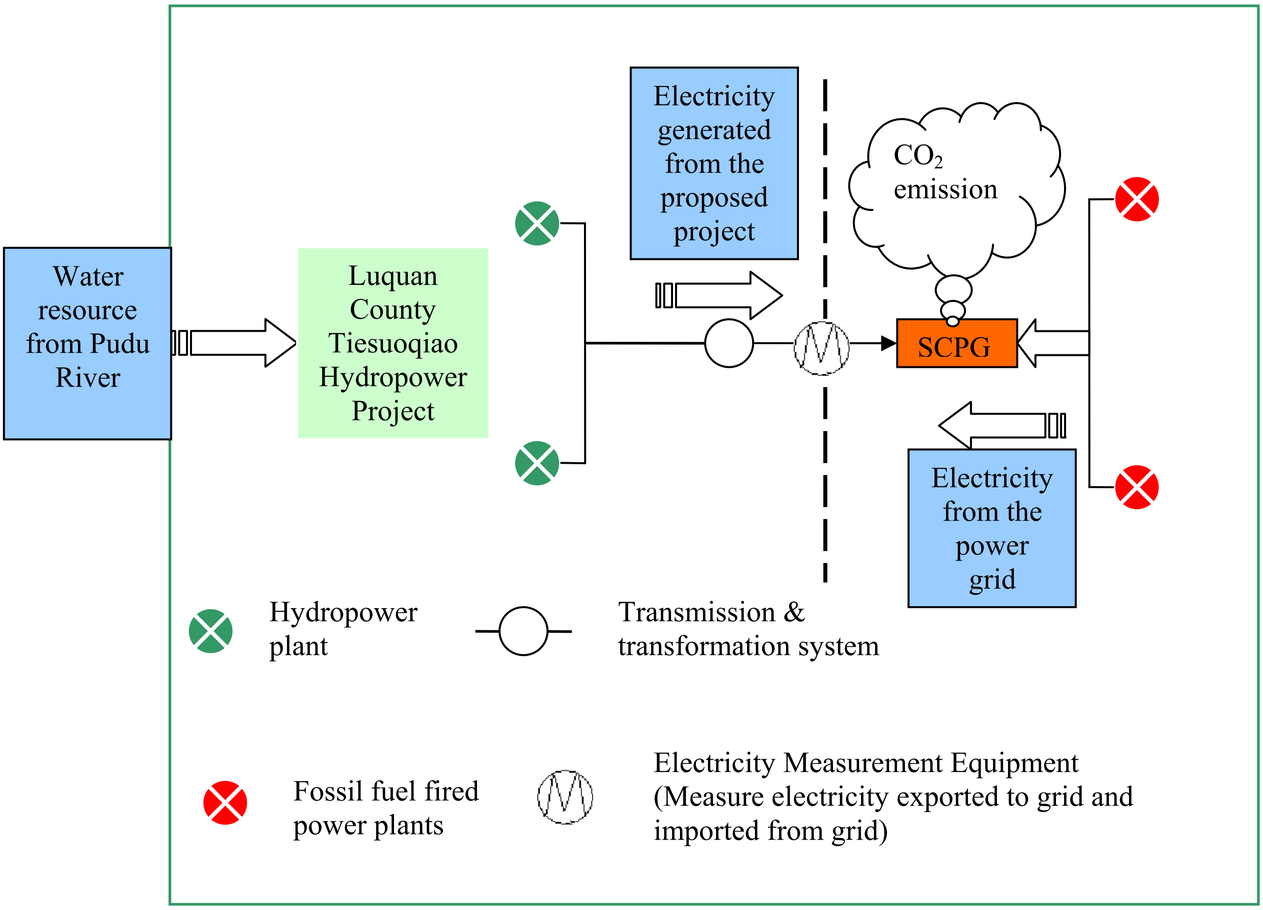

Figure B-1 Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emission from electricity generation in SCPG power plants that is displaced due to the project activity	CO_2		Main emission source.
		CH_4		Minor emission source.
		N_2O		Minor emission source.
Project scenario	The hydropower project	CO_2		Minor emission source.
		CH_4		Main emission source. However, as the power density of the project 664.67 W/m^2, greater than 10 W/m^2, the project emissions are not calculated.
		N_2O		Minor emission source

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. Therefore, the baseline is identified in the methodology and defined as:

Electricity delivered to the grid by the Project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "*Tool to calculate the emission factor for an electricity system*".

The proposed project is a new grid-connect renewable power plant, and is connected to the SCPG, so the baseline scenario of the proposed project is: Equivalent annual electricity supplied by SCPG.

The basic parameters used for calculating baseline emissions of the project are provided as follows:

Parameter	Data value
Operating margin emission factor $EF_{grid,OM,y}$(tCO_2e/MWh)	0.9489
Build margin emission factor $EF_{grid,BM,y}$(tCO_2e/MWh)	0.3157
Net annual electricity supply EGy (MWh)	113,940

B.5. Demonstration of additionality
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<u>Prior consideration of CDM</u>

The Feasibility Study Report (Hereafter, FSR) of the Project was completed in March 2007. According to the FSR, the IRR value of the proposed project is much lower than the benchmark of power project investment in China. However, the additional revenues from CDM can obviously improve the project IRR and make the project financially attractive, and the FSR suggested that the proposed project could be declared to a CDM project. The project owner believed that CDM was a feasible way to overcome the investment barrier. Finally, the board decision about CDM application was achieved on December 12nd 2007, and the CDM consultant contract between the project owner (hereafter as "PO") and Yunnan Huiliu Science and Technology co., Ltd (hereafter as "Huiliu").was signed on May 24th, 2008.

The construction agreement of the proposed project was signed on 10th July 2008, which is the starting date of the proposed project.

Under the coordination of Huiliu, A Terms sheet for the forward Sale and Purchase of Certified Emission Reduction between Renaissance Carbon Investment Ltd (a CER buyer) and the PO was signed on April 10th 2009. But in 2010, because the Renaissance Carbon Investment Ltd adjusted their purchase strategy for CER, they decided to not purchase the proposed project. This Term sheet between Renaissance Carbon Investment Ltd (a CER buyer) and the PO was terminated on 10th April 2010. Since Huiliu can't find a CER buyer for the Project, the CDM consultant contract between the PO and Huiliu was terminated on September 4th, 2010. And on July 25th, 2011, the consultant contract between between the PO and Hangzhou Yuneng Science and Technology co., Ltd (hereafter as "Yuneng") was signed.

Base on the suggestion from Yuneng, a Directorate resolution was made by the PO to apply the Project as a Unilateral CDM on January 30th 2012

It may therefore be clear that the project owner has fully considered the revenues from CDM when making the decision to implement the proposed project activity. An overview of key events is given in Table below:

Date	Milestones
March, 2007	The FSR finished
April 13rd,2007	The FSR was approved by DRC of Kunming City
December 12nd,2007	Directorate resolution to apply CDM
May 24th,2008	The CDM consultant contract between the PO and Huiliu was signed
July 10th,2008	Construction agreement was signed（Project starting date）
July15th 2008	The Order to commence of the Project was issued(Starting date of construction)
February 12nd 2009	The PO sent a MoU to the consultant to push the CDM development
April 10th 2009	Terms sheet for the forward Sale and Purchase of Certified Emission Reduction between Renaissance Carbon Investment Ltd and the PO was signed
April 10th 2010	Terms sheet for the forward Sale and Purchase of Certified Emission Reduction between Renaissance Carbon Investment Ltd and the PO was terminated
September 4th,2010	The CDM consultant contract between the PO and Huiliu was terminated
July 25th,2011	A new CDM consultant contract between the PO and Yuneng was signed
January 30th 2012	Directorate resolution to apply the Project as a Unilateral CDM
March 2012	The project owner conducted the stakeholders' comments survey.

The following steps are used to demonstrate the additionality of the project according to the latest version of the "*Tool for the demonstration and assessment of additionality*" (Version 06.0.0).

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

As per the clause 113 and 115 of Clean Development Mechanism Validation and Verification Standard version 02.0, the PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.

Sub-step 1a. Define alternatives to the project activity:
Two alternatives for the project scenario are considered:
Alternative 1) The proposed project activity undertaken without being registered as a CDM project activity.
Alternative 2) **Equivalent annual electricity supplied by SCPG**.

Sub-step 1b. Enforcement of applicable laws and regulations:
The Alternative 1) and 2) are in compliance with China's current laws and regulations (Electricity law of the people's Republic of China, Renewable Energy Law of People's Republic of China and so on), and valid alternative for the project scenario.

Step 2. Investment Analysis

Sub-step 2a. Determine appropriate analysis method

The *Tools for the Demonstration and Assessment of Additionality* recommends three analysis methods, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

The Project generates financial and economic benefits through the sales of electricity other than CDM income. Therefore the simple cost analysis (Option I) cannot be taken. The investment comparison analysis (Option II) is only applicable to projects whose alternatives are similar investment projects, and to provide for the same annual electricity output as the Project by SCPG (Alternative 4) is not an investment activity. Therefore the investment comparison analysis cannot be taken. And the benchmark IRR of total investment is available, therefore the benchmark analysis (Option III) is chosen.

Sub-step 2b. Apply benchmark analysis

The internal rate of return (IRR) of total investment is adopted here for the benchmark analysis. According to "*Economic Evaluation Code for Small Hydropower Projects*" issued by the Ministry of Water Resources (Document No. SL16-95), the benchmark IRR for small hydropower projects is 10% (after-tax).

Therefore, 10% is adopted as the financial benchmark IRR for the Project. If the total investment's IRR of the Project is lower than 10%, the Project will be financially unfeasible and then be additional.

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

1) Parameters needed for calculation of key financial indicators

According to the *Feasibility Study Report* of proposed Project, parameters needed for calculation of key financial indicators are as follows:

Table B-2. Basic parameters for calculation of financial indicators of the Project [4]

Items	**Unit**	**Date**	**Data source**
Installed capacity	MW	24	*Feasibility Study Report*
Annual grid-in electricity	MWh	113,940	*Feasibility Study Report*
Project lifetime	years	23[5]	*Feasibility Study Report*
Fixed assets investment	10000RMB	17,509	*Feasibility Study Report*
Electricity tariff (incl. VAT)	RMB/kWh	0.215	*Feasibility Study Report*
VAT	%	6	*Feasibility Study Report*
Income tax	%	33	*Feasibility Study Report*
Tax of expense for city maintenance and construction	%	1	*Feasibility Study Report*
Tax of education fee addition	%	3	*Feasibility Study Report*
Annual O&M cost	Million RMB	3.53	*Feasibility Study Report*

[4] Feasibility Study Report of Project

[5] 23 years contains construction period of 3 years and operation period of 20 years.

Depreciation rate	%	4.75	*Feasibility Study Report*
Residual rate	%	5	*Feasibility Study Report*
Depreciation period	year	20	*Feasibility Study Report*

2) Comparison of the Project IRR and the financial benchmark

In accordance with benchmark analysis (Option III), if the financial indicators of the Project, such as the Project IRR, are lower than the benchmark, the Project is not considered to be financially attractive.

Table B-3 shows the Project IRR with and without the sales of CERs. Without the sales of CERs, the Project IRR is 7.24 % (after-tax) which is lower than the financial benchmark. Thus the Project is not considered to be financially attractive.

Table B-3 Project IRR

Project IRR	
Without CERs	7.24 %
With CERs	10.40%

Taking into account the CDM revenues, the Project IRR is 10.40%, which is higher than the financial benchmark. Therefore the CDM revenues enable the Project to overcome the investment barrier, thus the additionality of the Project is demonstrated.

Sub-step 2d. Sensitivity analysis

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

According to *Economic Evaluation Code for Small Hydropower Projects*, the fluctuation of sensitivity analysis in construction projects could be in ±10%. Besides the proposed Project, similar hydropower projects in China always adopt ±10% as the fluctuation of sensitivity analysis, which is the common sense in China. So, the sensitivity analysis conducted by altering from -10% to +10% respectively is commonly acknowledged and used in China.

For the Project, four parameters were selected as sensitive factors to assess the financial attractiveness:

1) Fixed asset investment
2) Annual grid-in electricity
3) Electricity tariff (inl.VAT)
4) Annual O&M cost

Table B-4 Sensitivity analysis of the Project

Item	-10%	-5%	0	5%	10%
Fixed asset investment	8.38%	7.79%	7.24%	6.72%	6.24%
Annual grid-in electricity	6.09%	6.67%	7.24%	7.78%	8.30%
Electricity tariff(inl.VAT)	6.07%	6.66%	7.24%	7.79%	8.32%
Annual O&M cost	7.41%	7.32%	7.24%	7.15%	7.06%

Figure B-2 **Sensitivity analysis of the Project**

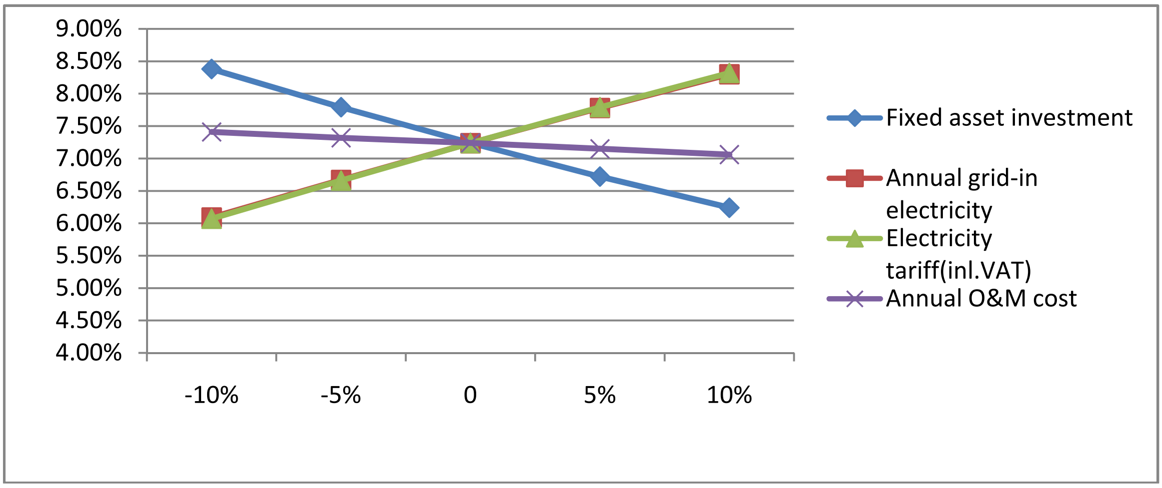

Table B-5 Sensitive analysis

	Fixed asset investment	Annual grid-in Electricity	Electricity tariff(inl.VAT)	**Annual O&M cost**
Variation of the parameters to make IRR reach the benchmark 10%	-22.00%	27.20%	26.70%	-100%(even it decrease by 100%, the IRR can't reach to 10%, just can change to 8.86%)

We conducted sensitivity analysis by using Fixed asset investment, Annual grid-in electricity, Electricity tariff (inl.VAT) and Annual O&M cost as critical parameters, without CDM, to test if the proposed Project could be economically attractive. The proposed Project IRR varies to different degrees in accordance with the fluctuation of four parameters within the range of -10% to +10%.

It could be seen that the Project IRR is still below the benchmark IRR when the Electricity tariff (inl.VAT) increases by 10%, or Annual grid-in electricity increases by 10%, or Fixed asset investment decreases by 10%. Compared with the other parameters, the Annual O&M cost has little effect on the impact of IRR. Thus, the Annual O&M cost shall be regarded as an insensitive factor.

If the Fixed asset investment decreases by 22.00%, the Project IRR would be close to the benchmark. However, according to the *GDP and Social Development Statistical Bulletin* published by National Bureau of Statistics of China from 2005 to 2010[6], the price of static investment, industrial products and raw materials keep continuous growth. Furthermore, although the construction of the Project has not been finished, according to the contracts which have been signed by now, the total already contracted investment was 17812.5 ten thousand CNY as yet. The estimated fixed asset investment in the FSR were 17509 ten thousand Yuan. It means that the already contracted investment was higher than that estimated in the FSR by 1.70%. So the fixed asset investment used in the financial analysis is reasonable. Thus, it's unlikely for the total investment in fixed assets decreased by 22.00%

[6] The *GDP and Social Development Statistical Bulletin 2006-2011,* published by National Bureau of Statistics of China.

If the Annual grid-in electricity increases by 27.20%, the project IRR value of the Project will increase up to the benchmark of 10%. However, the Annual grid-in electricity was calculated based on long-term hydrological data. According to the FSR, the hydrological data was the average value of 48 years (1954-2001)[7]. Thus, it's unlikely for the annual electricity output increased by 27.20%.

And if the electricity tariff increases by 26.70%, the IRR value of the Project will rise up to the benchmark of 10%. The electricity tariff applied in PDD sourced from FSR, which has been approved by Development and Reform Commission of Kunming City. On 06/01/2006, Yunan DRC issued Notification about Issues Regarding Trail Implementation of Wet season Tariff and Dry season Tariff for New Operation Hydropower Unit(Yunfagaijiage [2006] No. 28), in which it regulated that the tariff of hydropower project in Yunnan should be 0.215 RMB/kWh (including VAT). This document is the latest available document at the time of decision was made. Moreover, as per the information note issued by EB, the highest tariff for hydro projects in Yunnan Province is also 0.215 RMB/kWh (including VAT), which is the same tariff as that applied for the Project. Therefore, a 26.70% increase in the electricity tariff is highly improbable, and as such, the IRR is not likely to reach the 10% benchmark.

As for the Annual O&M cost, the influence on the project IRR value is quite weak. Even when the Annual O&M cost decrease to 0 (see Table B-5), the project IRR still can't reach the benchmark. Therefore, it is highly impossible to improve the economic attractiveness with a decrease in Annual O&M cost.

From the analysis above, it can be seen that the proposed Project is not financially attractive to the Project owner. Without further incentive, in this case from the CDM, Project owner would not be able to carry out the proposed Project.

It is concluded that the Project is not financially attractive without consideration of CERs sales revenue.

Step 3. Barrier analysis
This step is not selected.

Step 4. Common practice analysis

According to *Tool for the Demonstration and Assessment of Additionality* (version 06.0.0), there're four steps for the common practice.

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

The installed capacity of the project is 24MW, the applicable installed capacity between +/-50% of the project are 12MW～36MW.

Sub-step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

First, identify the applicable geographical area. According to the tool, the Project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions.

According to the requirements of common practice, the projects with similar conditions, such as

[7] Date source: Feasibility Study Report.

investment conditions and natural conditions (including geographical conditions, climate conditions, development conditions and so on), are necessary to be analyzed. Projects located in different provinces have not the similar investment conditions and natural conditions..Yunnan Province with an area of 39.4 ten thousand km^2, is comparatively and considerably larger than many countries. According to the requirements of common practice, the projects with similar conditions, such as investment conditions and natural conditions (including geographical conditions, climate conditions, development conditions and so on), are necessary to be analyzed. Projects located in different provinces of SCPG do not have the similar investment conditions and natural conditions:

- Guangdong Province has much lower water resources than Yunnan province and Guizhou Province.
-
- Yunnan Province and Guizhou Province both are rich in water resources, with very abundant water resources.
-
- Yunnan Province and Guizhou Province both are rich in water resources, with very abundant water resources.
- But the economic development of Yunnan province and Guizhou province is different. In 2008, per capital GDP of Yunnan province and Guizhou province is 12,547 Yuan and 8,788 Yuan respectively. The per capital GDP of Yunnan province is higher than Guizhou by 42.8%[8]. So the investment condition of Yunnan and Guizhou differs greatly.
- In addition, Guangxi Zhuang Autonomous Region is an autonomous region, which has more different conditions from normal provinces like Yunnan, Guangdong and Guizhou provinces. The Autonomous Region of China has special right. The autonomous region can publish autonomous rule, policy and regulation in politics, economy and culture. If the decision, orders, regulations and direction cannot accord with the local actual situation of autonomous region, the autonomous region can choose alternative method or cease it.
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Therefore, the PDD selects geographical area, i.e. Yunnan Province, as a common practice region.

Power System Reform Blue Print, published by State Council, February 10, 2002. The power plants operating before were developed by the state under a power system environment that is substantially different from the current power system environment, because, the first Power System Reform Blue Print has been published by State Council in February 2002, and the reform content mainly include: Power plants separating from the power grid, reforming enterprises for power plants and power grids; bidding to power grid, building a competitive and open power market initially; changing the current situation of all power purchased by the state owned grid enterprises. Therefore, the hydropower stations operated before 2002 can be excluded.

Thus, we selected the projects operated after 2002 and before 10th July 2008 which is starting date of the proposed project, with an installed capacity of between 12 MW to 36MW in Yunnan Province as "N_{all}". Projects have been applied to CDM were excluded.

We selected the Hydropower projects operated after 2002 and before 10th July 2008, with an installed capacity of between 12 MW to 36MW in Yunnan Province as "$N_{hydropower}$". And, other energy sources projects will be defined as "N_{other}".

Table 5 Hydropower plants operated after 2002 and before 10th July 2008 in Yunnan Province similar to the proposed project[9]

No.	Name of the	Installed	Operation	Remark	Unit investment

[8] http://www.stats.gov.cn/tjsj/ndsj/2009/indexch.htm

[9] Data source: Hydro Power Yearbook of China Water Resources (2006-2009)

	hydro plant	capacity (MW)	starting year		cost (Yuan/kWh)
1	**Xima Xingyun Aluminium Factory Hydropower Station**	26	-	Captive project[10]	
2	**Supahe Wunihe hydropower station**	30	2004	（West-East Electricity Transmission Projects）[11]	
3	**Xiashilong hydropower station**[12]	25	2004		0.725[13]
4	**Nantinghe hydropower station**[14]	34	2005		0.769
5	**Houqiao phase Ⅱ hydropower station**	32	2005	（West-East Electricity Transmission Projects）[15]	
6	**Mendianhe phase Ⅱ hydropower station**[16]	30	2005		0.636
7	**Yanziya hydropower station**[17]	25	2005		0.800

Therefore, N_{all}= $N_{hydropower}$+ N_{other}= 7+ N_{other}(other mean different energy sources)

Sub-step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

The energy sources of N_{other} are different with the proposed project. Obviously, N_{other} belong to N_{diff}.

Xima Xingyun Aluminium Factory Hydropower Station is the captive station of Yunnan Yingjiang Xingyun Co., Ltd. It is not connected to the grid. **Supahe Wunihe hydropower station** and **Houqiao phase Ⅱ hydropower station** belong to the *West-East Electricity Transmission Projects*. The *West-East Electricity Transmission Projects* are government sponsored projects offering favourable conditions to electricity suppliers participating in the project with the aim to secure transmission of power from West China to East China. *West-East Electricity Transmission Projects* including the Three Gorges project are planned by national department, and must be built on the basis of the strategy of regional development.

10 http://dehongzhou.mofcom.gov.cn/aarticle/jigou/200805/20080505566733.html
11 http://www.chinaccm.com/46/4607/460701/news/20031105/093002.asp
12 http://www.guquanwang.com/ImportItem/Detail/23670
13 http://www.lunwenchina.net.cn/xsqk/Science/403227.html
14 http://www.ynws.gov.cn/Detail.aspx?ID=6991
15 http://www.baoshan.cn/4034/2005/10/25/707@277291.htm
16 http://www.dhtjb.com/Html/20041230111017-1.html
17 http://www.sp.com.cn/zgsd/zjgcdt/200410/t20041022_8909.htm

Therefore, these two projects are different with the proposed project. So Xima Xingyun Aluminium Factory Hydropower Station, Supahe Wunihe hydropower station and Houqiao phase Ⅱ hydropower station clearly belong to N_{diff}.

Nantinghe hydropower station

The unit cost of output of Nantinghe hydropower station is 0.769 Yuan/kWh. While the unit cost of output of proposed project is 1.42 Yuan/kWh[18]. It means that the unit cost of output of Nantinghe Hydropower Station is 45.85% less than the proposed project. So Nantinghe hydropower station is technology different with the proposed project in unit cost of output.

Yanziya hydropower station

The unit cost of output of Yanziya hydropower station is 0.800 Yuan/kWh, which is 43.66% less than the proposed project. So Yanziya hydropower station is technology different with the proposed project in unit cost of output.

Xiashilong hydropower station

The unit cost of output of Xiashilong hydropower station is 0.725 Yuan/kWh, which is 48.94% less than the proposed project. So Xiashilong hydropower station is technology different with the proposed project in unit cost of output.

Mendianhe phase Ⅱ hydropower station

The unit cost of output of Mendianhe phase Ⅱ hydropower station is 0.636 Yuan/kWh, which is 55.21% less than the proposed project. So Mendianhe phase Ⅱ hydropower station is technology different with the proposed project in unit cost of output.

Thus, **Nantinghe hydropower station, Yanziya hydropower station, Xiashilong hydropower station** and **Mendianhe phase Ⅱ hydropower station** belong to N_{diff}.

It can therefore be concluded that $N_{diff} = N_{hydropower} + N_{other} = 7 + N_{other}$.

Sub-step 4: 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.

According to the analysis above, $N_{diff}/N_{all}=(7+ N_{other}) /(7+ N_{other}) =1$, and the factor $F=1-N_{diff}/N_{all}=1-(7+ N_{other}) /(7+ N_{other}) =0$.

Therefore, the Result of common practice assessment are:
$F_{max}=0 < 20\%$
$N_{all}-N_{diff}=0 < 3$

Therefore, the proposed activity is not a common practice in the region. And we can conclude that the start of the proposed project activity was just under CDM incentive. Without CDM, the proposed project would not be carried out due to the investment barrier; consequently, no emission reduction will be achieved. Therefore, the proposed project activity is additional.

[18] It was calculated as: 175,090,000yuan / 123000000 kWh =1.42Yuan/kWh

B.6. Emission reductions
B.6.1. Explanation of methodological choices
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The emission reduction by the Project activity is the difference between baseline emissions, project activity emissions and leakage, as follows:

Project Emissions

According to formula (5) of ACM0002, the power density of the project activity is calculated as follows:

$$PD = (Cap_{PJ} - Cap_{BL})/(A_{PJ} - A_{BL})$$

Where:
PD = Power density of the project activity, in W/m^2.
Cap_{PJ} = Installed capacity of the hydropower plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydropower plant before the implementation of the project activity (W). For new hydropower plants, this value is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

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

The project is a new hydropower plant resulting in new reservoir, thus both of Cap_{BL} and A_{BL} are zero. Then the power density equals to:

$$PD = Cap_{PJ}/A_{PJ} = 24*10^6/36{,}018 = 664.67 W/m^2.$$

The power density of the project is 664.67 W/m^2, greater than 10 W/m^2, thus PE_y=0.

Baseline Emissions

According to ACM0002, the baseline emissions include only CO_2 from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. All project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions of the project are calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (1)$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$ = 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)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculated the emission factor for an electricity system" (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for (a) Greenfield plants, (b) retrofits and replacements, and (c) capacity additions. The project is the installation of a new grid-connected hydropower plant at a site where no renewable power plant was operated prior to the implementation of the project. Then the $EG_{PJ,y}$ is calculated as follow:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where:

$EG_{PJ,y}$ = 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)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year *y* (MWh)

Calculation of $EF_{grid,CM,y}$

The latest data prior to the commencement of validation of the project are used for $EF_{grid,CM,y}$ in the PDD. According to latest "*Tool to calculate the emission factor for an electricity system*", the following six steps are applied to calculate the $EF_{grid,CM,y}$:

STEP 1. Identify the relevant electricity systems.
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity systems

According to "*Tool to calculate the emission factor for an electricity system*", if the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD.

The project is connected to SCPG, according to the delineation of grid boundaries defined by Chinese DNA, the SCPG covers Guangdong Province, Guangxi Zhuang Autonomous Region, Yunnan Province and Guizhou Province [19].

There are net power imports from Central China Power Grid (CCPG) to SCPG. The weighted average operating margin (OM) emission rate of the exporting grid is used to determine the CO_2 emission for net power imports.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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.

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

Option I is chosen by project participants for the project, i.e. only grid power plants are included in the calculation.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid, OM, y}$) is based on one of the following methods:

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

The method (a) can only be used if low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages data for hydroelectricity production. It can be found from Table B-7 that the low-cost/must run resources constitute less than 50% of SCPG during year 2005 to 2009. Thus, method (a) is used to calculate $EF_{grid,OM,y}$.

Table B-7 Constitution of low-cost/must run resources in SCPG during year 2005～2009[20]

Year	2005	2006	2007	2008	2009
Percentage (%)	30.08%	28.43%	29.28%	35.63%	36.06%

For the simple OM, the emissions factor is calculated using *ex ante* option: 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 to the DOE for validation.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. It may be calculated:

Option A: Based on the net electricity generation and CO_2 emission factor of each power unit; or

Option B: 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.

Due to the data on fuel consumption, net electricity generation, average efficiency etc of each specific power plant/unit serving the grid are not available publicly in China, the Option A cannot be used for simple OM emission factor calculation. Thus, Option B is used for calculating simple OM emission factor under following conditions for the project:

(1) Only nuclear 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
(2) Off-grid power plants are not included in the calculation (i.e., Option I has been chosen in Step 2).

[20] *China Electric Power Yearbook 2006～2010*

Under Option B, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad (3)$$

Where:

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

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

$NCV_{i,\ y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,\ i,\ y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)

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

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

y = The relevant year as per the data vintage chosen in Step 3

For the project, the subscript *m* refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid (if any).

For the project, $EF_{grid,\ OMsimple,\ y}$ is calculated according to the statistics information of recent 3 years (from 2007 to 2009), the data are the latest and available at the time of this PDD submission. The result of $EF_{grid,\ OMsimple,\ y}$ is 0.9489 tCO_2e/MWh, the detailed calculations are shown in Table A1-Table A9 of Annex 3.

Step 5: Calculate the build margin (BM) emission factor.

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.

The set of power units that comprises the larger annual generation should be used.

The direct application of the approach is difficult in China. The Executive Board (EB) has provided guidance on this matter with respect to the application of the AMS-I.D and AM0005 methodologies for projects in China on 7 October 2005 in response to a request for deviation by DNV on this matter. The EB accepted the use of capacity additions to identify the share of thermal power plants in additions to the grid instead of using power generation. The relevance of this EB guidance is also applicable to the "*Tool to calculate the emission factor for an electricity system*". The calculation details are described in step 6below.

According to "*Tool to calculate the emission factor for an electricity system*", there are two options regarding vintage of data choices:

Option 1: For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the 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.

For the project, the option 1 is chosen for BM calculation.

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (4)$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

Because of the unavailability of the data at the power plant level in China, the 22nd CDM EB meeting agreed the following deviation[21] approaches for $EF_{grid,BM,y}$ calculation:

1) Use the efficiency level of the best technologies commercially available in the provincial/regional or national grid of China, as a conservative proxy, for fuel *i* consumption estimation to estimate the $EF_{grid,BM,y}$.

2) Use capacity additions during last several years for estimating the $EF_{grid,BM,y}$, i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity.

[21] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

3) Use installed capacity to replace annual power generation to estimate weights.

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total thermal installed capacity, the $EF_{grid, BM, y}$ will be calculated as:

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

2) Based on the best technologies commercially available which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the emission factor of thermal power plants in SCPG. This approach is more conservative as it assumes all recently built plants have the fuel efficiency as that of the most advanced commercialized technologies;

3) Calculating the $EF_{grid, BM, y}$ through emission factor of thermal power plants times the percentage share of thermal power plants installed capacity addition within all recently built installed capacity. The proper year is selected so that it is the closest time when the last 20% of installed capacity was built.

The above calculation approach has been used by several recently registered China projects. The BM emission factor in this PDD is calculated as following sub-steps.

Sub-Step 5a: Calculating the percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in CO_2 emissions from total thermal power plants

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

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

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (7)$$

Where:

λ_{Gas}, λ_{Oil} and λ_{Coal} = The respective percentages of CO_2 emissions from the gas-fired, oil-fired, coal-fired power plants in CO_2 emissions from total thermal power plants;

$F_{i, j, y}$ = Amount of fuel *i* (tce) consumed by the power sources province *j* in year *y*;

$COEF_{i, j}$ = CO_2 emission coefficient (tCO_2/tce) of fuel *i*, taking into account the carbon content of the fuels used by the grid and the percent oxidation of the fuel in year *y*.

Sub-Step 5b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)

$$EF_{Thermal} = \lambda_{Coal} \times EF_{coal,\ adv} + \lambda_{Oil} \times EF_{oil,\ adv} + \lambda_{Gas} \times EF_{gas,\ adv} \quad (8)$$

Where:

$EF_{Thermal}$ = The emission factor of thermal power plants;

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

Sub-Step 5c: Calculating the Build Margin (BM) emission factor ($EF_{grid,\ BM,\ y}$)

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (9)$$

Where:

$EF_{grid,\ BM,\ y}$ = Build Margin (BM) emission factor with advanced commercialized technologies for year *y*;

CAP_{Total} = Installed capacity of all recently built power plants;

$CAP_{Thermal}$ = Newly installed capacity of recently built thermal power plants;

$EF_{Thermal}$ = Emission factor of thermal power plants.

For the project, $EF_{grid,\ BM,\ y}$ is calculated according to the statistics information of recent 3 years (from 2007 to 2009), the data are the latest and available at the time of this PDD submission. The result of $EF_{grid,\ BM,\ y}$ is 0.3157tCO_2e/MWh, the detailed calculations are shown in Table A8-Table A11 of Annex 3.

Step6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (10)$$

Where:
$EF_{grid,\ BM,\ y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,\ OM,\ y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = weighting of operating margin emissions factor (%)

w_{BM} = weighting of build margin emissions factor (%)

According to "*Tool to calculate the emission factor for an electricity system*", the weighs w_{OM} and w_{BM}, by default, are 50% and 50% for the project (i.e., w_{OM}=50%, w_{BM}= 50%). The calculated result of $EF_{grid,\ CM,\ y}$ is 0.6323 tCO_2e/MWh.

The $EF_{grid,\ CM,\ y}$ applied in this PDD is fixed for a crediting period and may be revised at the renewal of the crediting period.

Leakage

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

Emission Reductions

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

ER_y (tCO_2e/yr) = $BE_y - PE_y$ (11)

B.6.2. Data and parameters fixed ex ante

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

Data / Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	*China Energy Statistical Yearbook 2010.*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions;
Additional comment	-

Data / Parameter	$F_{i,j,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by the relevant provinces *j* in year *y*
Source of data	*China Energy Statistical Yearbook 2007-2010*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions;
Additional comment	-

Data / Parameter	$EF_{CO2, i, y}$
Unit	tCO_2/TJ
Description	CO_2 emission factor of fossil fuel type *i* used in year *y*
Source of data	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	Electricity generation of power plants in SCPG
Unit	MWh
Description	The electricity generated by province *j* in SCPG in year *y*.
Source of data	*China Electric Power Yearbook 2007-2010*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	Electricity imported from Central China Power Grid
Unit	MWh
Description	The electricity imported from Central China Power Grid in year *y*.
Source of data	China's DNA : "*2011 Baseline Emission Factors for Regional Power Grid In China*,"
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	Internal use rate of power plant
Unit	%
Description	The internal power consumption rate of power plants in province *j* in SCPG in year *y*.
Source of data	*China Electric Power Yearbook 2007-2010*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

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 2007-2010*
Value(s) applied	See Annex 3 for details.
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$GENE_{best, coal,}$
Unit	/
Description	The power supply efficiency of most advanced commercialized coal-fired power plants
Source of data	China's DNA : "*2011 Baseline Emission Factors for Regional Power Grid In China*,"
Value(s) applied	39.45%
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$GENE_{best, oil/gas}$
Unit	/
Description	The power supply efficiency of most advanced commercialized oil-fired power plants and gas-fired power plants
Source of data	China's DNA : "*2011 Baseline Emission Factors for Regional Power Grid In China*,"
Value(s) applied	51.77%
Choice of data or Measurement methods and procedures	*Official data.*
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	Project site
Value(s) applied	0
Choice of data or Measurement methods and procedures	For new hydro power plants, this value is zero
Purpose of data	Calculation of project emissions
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	Project site
Value(s) applied	0
Choice of data or Measurement methods and procedures	For new reservoirs, this value is zero
Purpose of data	Calculation of project emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

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Project Emissions

The project is hydropower project with new reservoir and the power density is 664.67 W/m^2, greater than 10 W/m^2, there is no need to take the project emissions into account, thus PE_y = 0.

Baseline emissions
According to formulae (3)-(10) in section B.6.1, the figures of emission factors of SCPG are as follows, the detailed calculation processes are shown in Annex 3.

- $EF_{grid,OM,y}$: 0.9489tCO_2e/MWh;
- $EF_{grid,BM,y}$: 0.3157tCO_2e/MWh;
- $EF_{grid,CM,y}$: 0.6323tCO_2e/MWh.

According to formula (1) and (2) in section B.6.1, the annual baseline emission (BE_y) of the project in a typical year is calculated as follow:

$$BE_y = EG_{facility,\ y} \cdot EF_{grid,\ CM,\ y} = 113,940 \times 0.6323 = 72,044\ tCO_2$$

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

Emission Reductions
According to formula (11) in section B.6.1, the annual emission reductions (ER_y) of the project in typical year is calculated as follow:

$$ER_y = BE_y - PE_y = 72,044 - 0 = 72,044\ tCO_2e$$

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

The renewable crediting period is adopted by the proposed project (3×7 years). It is expected that the proposed project will generate emission reductions for about 72,044tCO_2e per year over the first 7-year crediting period from 01 January 2013 to 31 December 2019.

Year	**Baseline emissions ($t\ CO_2e$)**	**Project emissions ($t\ CO_2e$)**	**Leakage ($t\ CO_2e$)**	**Emission reductions ($t\ CO_2e$)**
01/01/2013-31/12/2013	72,044	0	0	72,044
01/01/2014-31/12/2014	72,044	0	0	72,044
01/01/2015-31/12/2015	72,044	0	0	72,044
01/01/2016-31/12/2016	72,044	0	0	72,044
01/01/2017-31/12/2017	72,044	0	0	72,044
01/01/2018-31/12/2018	72,044	0	0	72,044
01/01/2019-31/12/2019	72,044	0	0	72,044
Total	504,308	0	0	504,308
Total number of crediting years	7			
Annual average over the crediting period	72,044	0	0	72,044

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

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

Data / Parameter	$EG_{export,y}$
Unit	MWh
Description	Electricity supply from the proposed project to the Grid during year *y*.
Source of data	Revenue Meter readings
Value(s) applied	113,940
Measurement methods and procedures	The electricity supply from the proposed project to the Grid is monitored by the Revenue Meter, which is a bi-direction electricity meter.
Monitoring frequency	Continuously measured and monthly recorded
QA/QC procedures	The Revenue Meter will be jointly read by the project owner and the grid company once a month. Data measured by the Revenue Meter will be cross checked by electricity sales receipts. The data is to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.
Purpose of data	Calculation of baseline emissions
Additional comment	See section B.7.2 for more detail

Data / Parameter	$EG_{import,y}$
Unit	MWh
Description	Electricity imported from the Grid to proposed project during year *y*.
Source of data	Revenue Meter Readings
Value(s) applied	0
Measurement methods and procedures	The Electricity imported from the Grid to proposed project is monitored by the Revenue Meter, which is a bi-direction electricity meter.
Monitoring frequency	Continuously measured and monthly recorded
QA/QC procedures	The Revenue Meter will be jointly read by the project owner and the grid company once a month. Data measured by the Revenue Meter will be cross checked by electricity sales receipts. The data is to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.
Purpose of data	Calculation of baseline emissions
Additional comment	See also section B.7.2 for more detail

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Net annual electricity supply from the proposed project to the Grid during year *y*.
Source of data	Calculated
Value(s) applied	113,940MWh
Measurement methods and procedures	$EG_{facility,y}$ (the net annual electricity supply from the proposed project to the grid during year *y*) is calculated by the formula as: $EG_{facility,y} = EG_{export,y} - EG_{import,y}$

Monitoring frequency	Refers to *$EG_{export,y}$ and $EG_{import,y}$ above*
QA/QC procedures	Double check by receipt of sales and purchases.
Purpose of data	Calculation of baseline emissions
Additional comment	See also section B.7.2 for more detail

Data / Parameter	Cap_{PJ}
Unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Value(s) applied	24
Measurement methods and procedures	Determine the installed capacity based on recognized standards
Monitoring frequency	yearly
QA/QC procedures	The data is to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.
Purpose of data	Calculation of project emissions
Additional comment	See also section B.7.2 for more detail

Data / Parameter	A_{PJ}
Unit	m^2
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Value(s) applied	36,018
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Monitoring frequency	yearly
QA/QC procedures	The data is to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.
Purpose of data	Calculation of project emissions
Additional comment	See also section B.7.2 for more detail

B.7.2. Sampling plan

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N/A

B.7.3. Other elements of monitoring plan

>>

The main data monitored are the electricity delivered to SCPG by the project ($EG_{export,y}$) and electricity consumed by the project activity from the SCPG ($EG_{import,y}$), the Quantity of net electricity generation supplied by the proposed project to the grid in year *y* ($EG_{facility,y}$) which is the difference of $EG_{export,y}$ and $EG_{import,y}$. So $EG_{export,y}$ and $EG_{import,y}$ are defined as the key data to be monitored. The monitoring plan is drafted to focus on these data. For the installed capacity and the reservoir's surface area of the Project, monitoring will be conducted yearly.

1. Implementation of the monitoring plan

The Project owner will take the responsibility for the monitoring plan implementation. A CDM working team, which is supervised by a manager, will be established. It consists of CDM principal, technical staff, and statistic staff. Organizational structure of the CDM team is shown as figure B.3. The staff concerned will receive training on monitoring and measurement to ensure the implementation of this monitoring plan before project operation. In the following years within the crediting period, the training will also be provided.

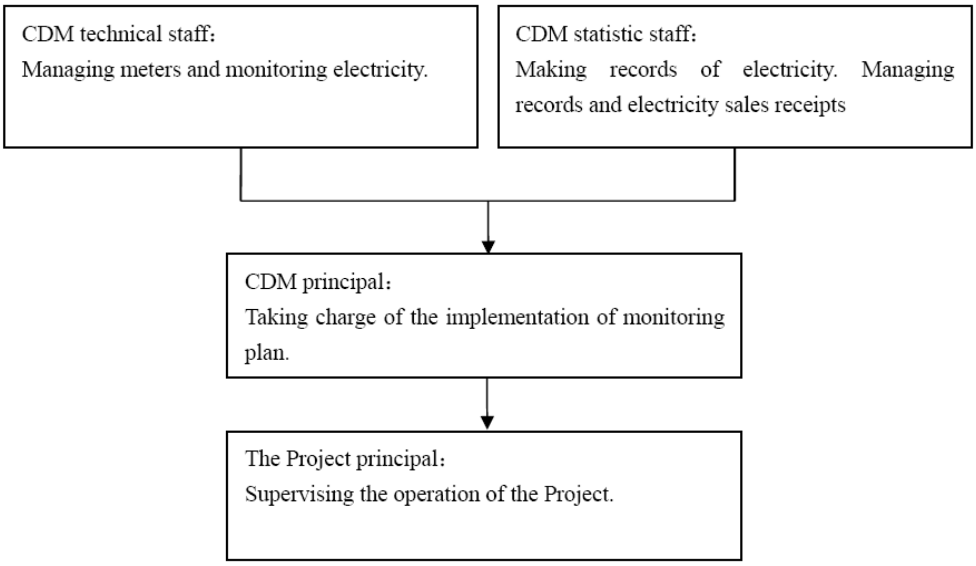
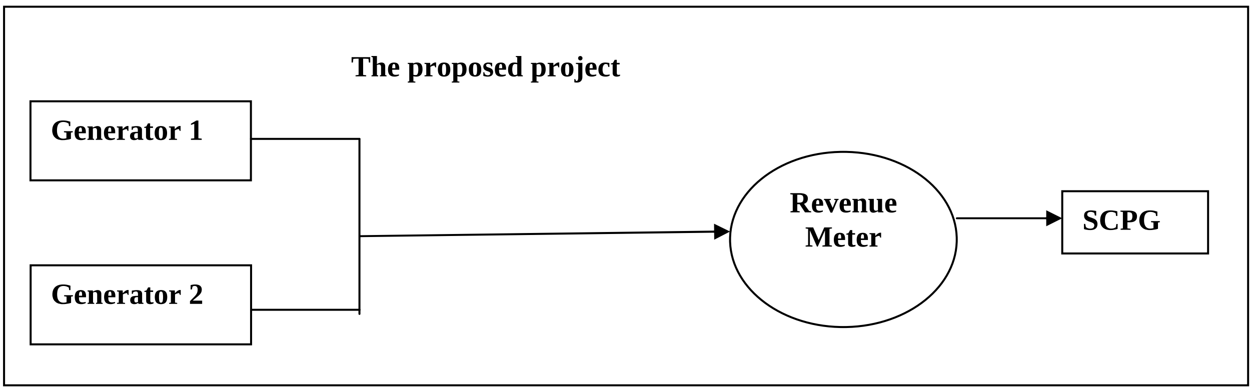


Figure B.3 Structure of the CDM team

2. Monitoring equipment and installation

The electricity supplied to SCPG and the electricity imported from SCPG by the Project will be continuously monitored through the Revenue meter. And it will be installed at the connection point of the proposed project and the power grid. The meters will be installed in accordance with “Technology & Management Regulations for Power Metering Devices”(DL/T448-2000), the accuracy of the meters is no less than 0.5.The monitoring diagram of the proposed project is showed as follow:



Installed capacity of the proposed project

The installed capacity of the proposed project was approved by the local government, and the installed capacity will be check out using the nameplate of turbines and generators yearly, and will be cross check with the equipment purchase agreements and FSR.

Surface area of the reservoir

The surface area of the reservoir will be measured from topographical surveys, maps, satellite pictures, etc yearly. Photographs of the reservoir at several key locations will be taken after the implementation of the project activity when the reservoir is full to check whether the actual reservoir does not deviate substantially from the design.

3. Data Collection:

The project owner and the Grid Company are responsible for monitoring equipment, and guarantee the measuring equipments are in good operation.

The electricity recorded by the Revenue Meter alone will suffice for the purpose of invoices and emission reduction verification as long as the accuracy of the revenue meter is within the permissible tolerance. The revenue monitoring process is as follows:

- i The project owner and the Grid Company read and check the Revenue Meter, and records the data on an appointed day of every month;
- ii The grid Company supplies the electricity reading to the project owner;
- iii The project owner provides electricity sales invoices to the Grid Company. A copy of the invoices is stored by the project owner, together with a record of the payment by the grid company;
- iv The Grid Company provides electricity sales invoices to the project owner based on the electricity use of power plant supplied by the grid company, and the invoices are stored by the project owner;
- v The project owner records the net electricity supplied to the grid;

The project owner keeps and safeguards the records of the revenue meter's data readings for verification by the DOE.

4. QA/QC

If inaccuracy of the reading data from the revenue meter exceeds the allowable tolerance or otherwise the meter malfunctioned will occur in one month, the grid-connected electricity generated by the proposed project shall be followed by:

- i The proposed project owner and the Grid Company shall jointly prepare an new agreement of the correct readings; and
- ii If the proposed project owner and the Grid Company fail to reach an agreement concerning the correct reading, then the matter will be submitted for arbitration according to agreed procedures. The emission reduction during this period will not be claimed.

The meter reading shall be readily accessible for the DOE. Calibration test records shall be maintained for verification.

Calibration

The revenue meter will be calibrated by a qualified third party once a year.

All the meters installed shall be tested by the qualified metrical organization co-authorized by the project owner and the Grid Company within 30 days if:

- i The error of the meters exceeds the allowable error ;
- ii The meter was repaired.

Training

The staff concerned will receive training on monitoring and measurement to ensure the implementation of this monitoring plan before project operation. And a regular training for the staffs involved in the project operation will be conducted once a year. If any new staffs join the team, he/she would also be trained before taking position.

5. Data Management

Data will be archived at the end of each month using electronic spreadsheets. The electronic files will be stored on hard disk and CD-ROM. In addition, a hard copy printout will be archived. Physical documentation such as, paper-based maps, diagrams and environmental assessment, will be collected in a central place, together with the monitoring plan. In order to facilitate the auditor's reference, monitoring results will be indexed. All paper-based information will be stored by the project owner. The data is to be kept for two years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later.

6. Monitoring Report

The project owner will collect sales invoices for the power supplied to the grid as a cross-check, and purchasing invoices will be provided for the electricity use of power plant supplied by the grid as a cross-check.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

July 10, 2008 (The date when construction agreement was signed)

C.1.2. Expected operational lifetime of project activity

>>

20years 0 month

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Renewable crediting period
First crediting period

C.2.2. Start date of crediting period

>>

01/01/2013 (or registration date whichever is later)

C.2.3. Length of crediting period

7 years 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

The *Environmental Impact Assessment* report (EIA) has been approved by local Environment Protection Bureau. According to the EIA, Environmental impacts possibly caused by the Project and relevant protect & control measures adopted by the project owner are analyzed as follows:

1. Water pollution

Wastewater produced during the construction period mainly derives from industrial wastewater and domestic wastewater.

The industrial wastewater will be produced by rock processing water, washing sandstone and the mixing of concrete. And the industrial wastewater will be treated by sedimentation pool and neutralization pool, and then be reused.

The domestic wastewater mainly comes from daily life of the project workers. For the domestic wastewater, septic tank will be set up and then it will be used for agriculture and don't drain indirectly.

2. Air pollution

During the construction period, the main dust is mainly produced during the process of mixing up concretes, sieving materials, drilling hole, blasting etc. in order to minimum the negative impact caused by the dust, some measures such as wet method, low-dust technique and providing dust shield for workers will be employed. In addition, the construction period is short. Therefore, the construction will not have much negative impacts on the local air environment.

3 Sound pollution

The sources of noise in the construction period derive from the operation of machines such as excavation, boring, blasting, sand crushing and concrete pouring etc., transportation of vehicles and reparation & maintenance of machines. The following measures will be taken to reduce noise: use low-noise equipment; properly schedule the transport time; corresponding protective measures and arranging work time properly for the workers etc.

4 Solid waste

The solid wastes will mainly come from construction wastes and domestic wastes. The project owner will build a dumping site to store the solid wastes. The solid wastes come from construction waste will be reused for the construction of road and some other purpose. The solid wastes come from domestic wastes will be treat by landfill.

5 Ecological Impacts

There will not cause impact on region climate, after the Project start operation. Moreover, it will not have direct influence to the nearby lives biological population, such as few birds and beasts, due to broad sphere. It also can submerge some farming and forestland after reservior impounding, but there are quite common in the construction region. Therefore the project has not affected to the species resources. In addition, the ecological water flow will be designed to satisfy the ecological water demand at the downriver.

6 Social environmental Impact

The construction of the project will promote the development of local society and economy. During the construction period, many labours will come to the project site and demand for commodity will increase a lot, then it will stimulate the local economic development and increase the income of local residents. The implementation of the Project will increase the local tax income. It is very necessary to build this project, for it can improve the Pudu river basin cascade exploitation and promote local economic development.

It can be concluded that the proposed project activity does not have obvious negative effect to the environment on the whole, and will reduce both GHG emissions and local environmental pollutants

caused by coal combustion. And there are many beneficial effects such as increase in local residents' living standards, improvement in infrastructure level etc. Therefore the proposed project will have positive impact on socioeconomic environment.

D.2. Environmental impact assessment

>>

The Project has not significant impacts on local environment and the *EIA* of the Project has been approved by the local environmental protection authority. With mitigation controls planned, and taking into consideration the contribution made by the proposed project to sustainable development for the local and national area, the proposed project will have an overall positive impact on the local and global environment.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

According to the requirement by the *Measures for Operation and Management of Clean Development Mechanism Projects in China*, and in order to collect public comments and attitudes towards the Project, the Project had carried out a survey to local residents which may be impacted in the area where the Project is sited. The survey was conducted through distributing and collecting the questionnaires. The main consulted people were the direct relative employees, local official and the inhabitants around the proposed project site. Total 30 questionnaires were distributed, all of the distributed questionnaires had been returned.

Major investigated issues are show as follows：

1. Do you know Luquan County Tiesuoqiao Hydropower Project?
2. Do you know about the Clean Development Mechanism?
3. What's your opinion to the construction of the proposed project?
4. What impact on the local economy due to the proposed project?
5. How about the environment situation in the project site?
6. What are the main impacts on the local environment due to the proposed project activities? (If there is any)
7. What kind of impact on the daily life of local inhabitants due to the proposed project construction?
8. Are there other comments from you?

E.2. Summary of comments received

>>

Total 30 questionnaires were distributed, all of the distributed questionnaires had been returned. All of the opinions from the local stakeholders had been collected and considered. Detailed information of respondents lists as follows：

Comments from these questionnaires for local people are summarized in the table below:

No	Item	Opinion	person	Percentage (%)

1	Do you know Luquan County Tiesuoqiao Hydropower Project ?	Yes	30	100
		No	0	0
2	Do you know about the Clean Development Mechanim?	Yes	12	40%
		No	18	60%
3	What's your opinion to the construction of the proposed project?	Agree	29	96.7%
		Don't agree	0	0
		Don't care	1	3.3%
4	What impact on the local economy due to the proposed project?	Positive impact	27	90%
		Negative impact	0	0
		No impact	3	10%
5	How about the environment situation in the project site?	Acceptable	16	53.33%
		Quite satisfied	14	46.67%
		unacceptable	0	0
6	What are the main impacts on the local environment due to the proposed project activities? (If there is any)	Water and soil erosion	0	0
		Noise pollution	0	0
		Water pollution	0	0
		No impact	30	100%
7	What kind of impact on the daily life of local inhabitants due to the proposed project construction?	Positive impact	27	90%
		Negative impact	0	0
		No impact	3	10%
8	Are there other comments from you?			

E.3. Report on consideration of comments received

>>

In conclusion, the local government and inhabitants support the project activities. The proposed project will benefit the local economic development. No negative comments were received.

SECTION F. Approval and authorization

>>

The letters of approval from All the Parties for the proposed project activity is not available at the time of submitting the PDD to the validating DOE.

Appendix 1: Contact information of project participants

Organization:	Yunnan Haolong Industry Group Luquan Hydropower Development Co., Ltd
Street/P.O.Box:	Cuihua Town, Luquan County
Building:	2nd floor, 25#, Jinrong Street
City:	Kunming
State/Region:	Yunnan Province
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FAX:	0871-3631921
E-Mail:	Pandaliu2004@163.com
URL:	/
Represented by:	Hui Li
Title:	Project manager
Salutation:	Mr
Last Name:	Li
Middle Name:	
First Name:	Hui
Department:	Project Department
Mobile:	13378718692
Direct FAX:	0871-3631921
Direct tel:	0871-3631921
Personal e-Mail:	Pandaliu2004@163.com

Organization:	Department of Climate Change, National Development and Reform Committee
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City:	Beijing
State/Region:	Beijing
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FAX:	+86-(0)10-68502338
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URL:	
Represented by:	Cuihua Sun
Title:	
Salutation:	Ms.
Last Name:	Sun
Middle Name:	
First Name:	Cuihua
Department:	
Mobile:	
Direct FAX:	+86-(0)10-68502338
Direct tel:	+86-(0)10-68502963
Personal e-Mail:	sunch@ccchina.gov.cn

Appendix 2: Affirmation regarding public funding

N/A

Appendix 3: Applicability of selected methodology

The Project is a newly-built grid-connected hydropower plant with the total installed capacity of 24MW at a site where no renewable power plant was operated prior to the implementation of the project. The geographic and system boundaries for SCPG that the Project is connected into can be clearly identified and information on the characteristics of the Grid is available.

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

The power density of the proposed project is 664.67 W/m^2, as per definitions given in the Project Emission section, which is greater than 4 W/m^2;

Therefore the methodology ACM0002 (Version 13.0.0) is chosen and applicable to the Project.

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

BASELINE INFORMATION

1. Calculation of Operating Margin (OM) Emission Factor

Table A1. Operating margin data for the South China Power Grid（2007）

Fuel Types	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Subtotal E=A+B+C+D+E	Emission factor（tc/TJ） F	Oxidate rate（%） G	Emission factor ($kgCO_2/TJ$) H	Low Caloric Value（MJ/t,km3） I	CO_2 Emission (tCO2e) J=F*I*J/100000(t) J=F*I*J/10000 (m3)
Raw coal	10^4t	8214.78	1750.63	4298.8	3170.79	**17435**	25.8	100	87,300	20,908	318,235,545.54
Cleaned coal	10^4t	3.46				**3.46**	25.8	100	87,300	26,344	79,574.16
Other washed coal	10^4t		0.65	21.58	14.64	**36.87**	25.8	100	87,300	8,363	269,184.15
Cellular Coal	10^4t	271.25				**271.25**	26.6	100	87,300	20,908	4,951,040.54
Coke	10^4t	0.04	1.69		2.15	**3.88**	29.2	100	95,700	28,435	105,583.70
Coke oven gas	10^8m^3		0.96	3.19	1.8	**5.95**	12.1	100	37,300	16,726	371,208.48
Other coal gas	10^8m^3		30.77		21.63	**52.4**	12.1	100	37,300	5,227	1,021,627.60
Crude oil	10^4t					**0**	20	100	71,100	41,816	0.00
Gasoline	10^4t					**0**	18.9	100	67,500	43,070	0.00
Diesel	10^4t	21.37	2.13		2.29	**25.79**	20.2	100	72,600	42,652	798,596.43
Fuel oil	10^4t	467.97	0.41			**468.38**	21.1	100	75,500	41,816	14,787,262.45
LPG	10^4t					**0**	17.2	100	61,600	50,179	0.00
Refinery gas	10^4t	0.37				**0.37**	15.7	100	48,200	46,055	8,213.45
Natural gas	10^8m^3	32.17				**32.17**	15.3	100	54,300	38,931	6,800,587.77
Other oil products	10^4t	8.47				**8.47**	20	100	72,200	41,816	255,719.06
Other coal chemicals	10^4t					**0**	25.8	100	95,700	28,435	0.00
Other energy	10^4t ce	118.04	81.89	44.1	50.3	**294.33**	0	0	0	0	0.00
										Total	347,684,143

Data sources: China Energy Statistical Yearbook 2008

Table A2. Fire power generation of South China Power Grid (2007)

Name of the province	Generation	Rate of electricity used by factory	Power Supply
	(MWh)	(%)	(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 sources: The State Electric Industry Yearbook 2008

Table A3. Emission factor of South China Power Grid (2007)

The net power imported from Central China Power Grid in 2007(MWh)	24,237,240
OM of Central China Power Grid in 2007	1.10197
Total emission amount tCO2	374,392,855
Total power supply MWh	383,087,370
Emission factor in 2007	0.97730

Data sources: The State Electric Industry Yearbook 2008

Table A4. Operating margin data for the South China Power Grid （2008）

Fuel Types	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Subtotal E=A+B+C+D+E	Emission factor （tc/TJ） F	Oxidate rate （%） G	Emission factor ($kgCO_2/TJ$) H	Low Caloric Value （MJ/t,km3） I	CO_2 Emission (tCO2e) J=F*I*J/100000(t) J=F*I*J/10000 (m3)
Raw coal	10^4t	8001.54	1513.1	4117.45	2766.85	**16398.94**	25.8	100	87,300	20,908	299,324,669.75
Cleaned coal	10^4t	2.31				**2.31**	25.8	100	87,300	26,344	53,126.10
Other washed coal	10^4t		0.08	13.38	57.11	**70.57**	25.8	100	87,300	8,363	515,224.44
Cellular Coal	10^4t	297.43				**297.43**	26.6	100	87,300	20,908	5,428,895.80
Coke	10^4t	3.24	1.73		2.74	**7.71**	29.2	100	95,700	28,435	209,806.79
Coke oven gas	10^8m^3		1.55	3.92	2.17	**7.64**	12.1	100	37,300	16,726	476,644.17
Other coal gas	10^8m^3	1.09	29.6		35.71	**66.4**	12.1	100	37,300	5,227	1,294,581.54
Crude oil	10^4t					**0**	20	100	71,100	41,816	0.00
Gasoline	10^4t	0.01				**0.01**	18.9	100	67,500	43,070	290.72
Diesel	10^4t	10.46	0.97		2.28	**13.71**	20.2	100	72,600	42,652	424,534.98
Fuel oil	10^4t	344.59	0.24			**344.83**	21.1	100	75,500	41,816	10,886,655.52
LPG	10^4t					**0**	17.2	100	61,600	50,179	0.00
Refinery gas	10^4t	0.76				**0.76**	15.7	100	48,200	46,055	16,870.87
Natural gas	10^8m^3	35.6				**35.6**	15.3	100	54,300	38,931	7,525,673.75
Other oil products	10^4t	7.3				**7.3**	20	100	72,200	41,816	220,395.41
Other coal chemicals	10^4t					**0**	25.8	100	95,700	28,435	0.00
Other energy	10^4t ce	120.17	103.26	89.44	42.63	**355.5**	0	0	0	0	0.00
										Total	326,377,370

Data sources: The State Electric Industry Yearbook 2009

Table A5. Fire power generation of South China Power Grid (2008)

Name of the province	Generation	Rate of electricity used by factory	Power Supply
	(MWh)	(%)	(MWh)
Guangdong	210,700,000	6.18	197,678,740
Guangxi	34,200,000	7.14	31,758,120
Guizhou	81,300,000	7.04	75,576,480
Yunnan	41,800,000	7.29	38,752,780
Total			343,766,120

Data sources: The State Electric Industry Yearbook 2009

Table A6. Emission factor of South China Power Grid (2008)

The net power imported from Central China Power Grid in 2008(MWh)	22,342,090
OM of Central China Power Grid in 2008	1.04205
Total emission amount tCO2	349,658,905
Total power supply MWh	366,108,210
Emission factor in 2008	0.95507

Data sources: The State Electric Industry Yearbook 2009

Table A7. Operating margin data for the South China Power Grid （2009）

Fuel Types	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Hainan E	Subtotal F=A+B+C+D+E	Emission factor （tc/TJ） G	Oxidate rate （%） H	Emission factor ($kgCO_2$/TJ) I	Low Caloric Value （MJ/t,km3） J	CO_2 Emission (tCO2e) K=F*I*J/100000(t) K=F*I*J/10000 (m3)
Raw coal	10^4t	8011.98	1815.41	4925.23	3311.44	376.59	**18440.65**	25.8	100	87,300	20,908	336,591,357
Cleaned coal	10^4t	1.8					**1.8**	25.8	100	87,300	26,344	41,397
Other washed coal	10^4t			11.67	44.92		**56.59**	25.8	100	87,300	8,363	413,158
Cellular Coal	10^4t	195.86					**195.86**	26.6	100	87,300	20,908	3,574,971
Coke	10^4t	4.9	1.6		1.63		**8.13**	29.2	100	95,700	28,435	221,236
Coke oven gas	10^8m^3		2.89	2.02	2.48		**7.39**	12.1	100	37,300	16,726	461,047
Other coal gas	10^8m^3	1.11	20.88		48.61		**70.6**	12.1	100	37,300	5,227	1,376,468
Crude oil	10^4t						**0**	20	100	71,100	41,816	0
Gasoline	10^4t						**0**	18.9	100	67,500	43,070	0
Diesel	10^4t	6.46	0.52		0.49	0.12	**7.59**	20.2	100	72,600	42,652	235,027
Fuel oil	10^4t	157.37	0.09				**157.46**	21.1	100	75,500	41,816	4,971,182
LPG	10^4t						**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.51					**0.51**	15.7	100	48,200	46,055	11,321
Natural gas	10^8m^3	47.21				6.19	**53.4**	15.3	100	54,300	38,931	11,288,511
Other oil products	10^4t	45.31				0.83	**46.14**	20	100	72,200	41,816	1,393,020
Other coal chemicals	10^4t						**0**	25.8	100	95,700	28,435	0
Other energy	10^4t ce	152.99	98.56	23.01	49.01	20	**343.57**	0	0	0	0	0
											Total	360,578,694

Data sources: China Energy Statistical Yearbook 2010

Table A8. Fire power generation of South China Power Grid (2009)

Name of the province	Generation	Rate of electricity used by factory	Power Supply
	(MWh)	(%)	(MWh)
Guangdong	214,300,000	6.16	201,099,120
Guangxi	42,800,000	6.69	39,936,680
Guizhou	97,800,000	6.68	91,266,960
Yunnan	54,800,000	6.52	51,227,040
Hainan	11,400,000	8.17	10,468,620
Total			393,998,420

Data sources: The State Electric Industry Yearbook 2010

Table A9. Emission factor of South China Power Grid (2009)

The net power imported from Central China Power Grid in 2009 (MWh)	21,852,270
OM of Central China Power Grid in 2009	0.95455
Total emission amount tCO2	381,437,884
Total power supply MWh	415,850,690
Emission factor in 2009	0.91725

Data sources: The State Electric Industry Yearbook 2010

The simple OM emission factor is weighted average value of the simple OM emission factors of SCPG in 2007, 2008, 2009, as follows:

$EF_{OM,y}$ =0.9489 tCO_2e/MWh

2.Calculation of Build Margin (*BM*) Emission Factor
Table A10. Calculating the proportion of solid fuel, liquid fuel and gas fuel in total thermal power emission

Fuel types	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Hainan	Total	NCV	Emission factor	Oxidation factor	CO_2 emission (tCO_2e)
								kj/kg,m^3	kgCO2/TJ		H=G×D×E×F/100,000 (Mass unit)
		A	B	C			D=A+B+C+D+E	E	F	G	H=G×D×E×F/10,000 (Volume unit)
Raw coal	10^4t	8,011.98	1,815.41	4,925.23	3,311.44	376.59	18,440.65	20,908	87,300	1	336,591,357
Cleaned coal	10^4t	1.8	0	0	0	0	1.8	26,344	87,300	1	41,397
Other washed coal	10^4t	0	0	11.67	44.92	0	56.59	8,363	87,300	1	413,158
Cellular coal	10^4t	195.86	0	0	0	0	195.86	20,908	87,300	1	3,574,971
Coke	10^4t	4.9	1.6	0	1.63	0	8.13	28,435	95,700	1	221,236
Other coke products	10^4t	0	0	0	0	0	0	28,435	95,700	1	0
Total											340,842,119
Crude oil	10^4t	0	0	0	0	0	0	41,816	71,100	1	0
Gasoline	10^4t	0	0	0	0	0	0	43,070	67,500	1	0
Diesel	10^4t	6.46	0.52	0	0.49	0.12	7.59	42,652	72,600	1	235,027
Fuel oil	10^4t	157.37	0.09	0	0	0	157.46	41,816	75,500	1	4,971,182
Other oil products	10^4t	45.31	0	0	0	0.83	46.14	41,816	72,200	1	1,393,020
Total											6,599,229
Natural gas	10^8m^3	472.1	0	0	0	61.9	534	38,931	54,300	1	11,288,511
Coke oven gas	10^8m^3	0	28.9	20.2	24.8	0	73.9	16,726	37,300	1	461,047
Other coal gas	10^8m^3	11.1	208.8	0	486.1	0	706	5,227	37,300	1	1,376,468
LPG	10^4t	0	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10^4t	0.51	0	0	0	0	0.51	46,055	48,200	1	11,321
Total											13,137,347
											360,578,694

Data sources: China Energy Statistical Yearbook 2010

According to the data and related calculation formula， λ_{Coal} =94.53%， λ_{Oil} =1.83%， λ_{Gas} =3.64%.

Table A11. Emission factor of coal in SCPG

Technology	Variable	Efficiency of power supply	Emission Factor（kgCO2/TJ）	Oxidation rate	Emission Factor（tCO2/MWh）
		A	B	C	D=3.6/A/1000000*B*C
Coal fired plant	$EF_{Coal,Adv}$	39.45 %	87,300	1	0.7967
Gas fired plant	$EF_{Gas,Adv}$	51.77 %	75,500	1	0.5250
Oil fired plant	$EF_{Oil,Adv}$	51.77 %	54,300	1	0.3776

Data sources:
Electricity supply efficiency: China Energy Statistical Yearbook 2010;
Default carbon content: IPCC Guideline 2006
$OXID_i$: IPCC Guideline 2006

$EF_{thermal}=\lambda_{Coal}\times EF_{Coal,Adv}+\lambda_{Oil}\times EF_{Oil,Adv}+\lambda_{Gas}\times EF_{Gas,Adv}=0.7765$ tCO_2/MWh

Table A12. Installed capacity of the South China Power Grid 2009

Installed capacity	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Hainan	Total
Fire power	MW	48,300	10,770	10,710	17,310	3,090	90,180
Hydro power	MW	11,260	14,750	20,900	13,610	700	61,220
Nuclear power	MW	3,950	0	0	0	0	3,950
Wind power and other	MW	560	0	80	0	60	700
Total	MW	64,070	25,520	31,690	30,920	3,850	156,050

Data sources: The State Electric Industry Yearbook 2010

Table A13. Installed capacity of the South China Power Grid 2008

Installed capacity	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Hainan	Total
Fire power	MW	45,730	10,270	10,030	17,170	2,370	85,570
Hydro power	MW	10,280	13,970	15,740	9,470	410	49,870
Nuclear power	MW	3,780	0	0	0	0	3,780
Wind power and other	MW	290	0	80	0	10	380
Total	MW	60,080	24,240	25,850	26,640	2,790	139,600

Data sources: The State Electric Industry Yearbook 2009

Table A14. Installed capacity of the South China Power Grid 2007

Installed capacity	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Hainan	Total
Fire power	MW	44,710	9,310	10,630	15,960	2,400	83,010
Hydro power	MW	10,110	10,440	11,580	8,210	590	40,930
Nuclear power	MW	3,780	0	0	0	0	3,780
Wind power and other	MW	250	0	0	0	24	274
Total	MW	58,850	19,750	22,210	24,170	3,014	127,994

Data sources: The State Electric Industry Yearbook 2008

TableA15. Capacity additions of the South China Power Grid from 2007 to 2009

	Installed capacity in 2007	Installed capacity in 2008	Installed capacity in 2009	New added installed capacity 2007-2009	New added installed capacity 2007-2008	The fraction of newly added installed capacity
	A	B	C	D=C-A	E=C-B	
Thermal power（MW）	83010.0	85570.0	90180.0	14, 446. 90	8, 705. 60	40.66 %
Hydro power（MW）	40930.0	49870.0	61220.0	20, 487. 90	11, 350	57.66 %
Nuclear power（MW）	3780.0	3780.0	3950.0	170.0	170.0	0.48 %
Wind power（MW）	274.0	380.0	700.0	426.0	320.0	1.20 %
Total（MW）	127994.0	139600.0	156050.0	35530.8	20545.6	100.00 %
The fraction of installed capacity compared with 2009	82.02 %	89.46 %	100.00 %	22.77 %	13.17 %	

Data sources: The State Electric Industry Yearbook 2008-2010
*Calculated with the consideration of installed, shut-down and pumped storage capacity.

Table A16. Calculation of BM in NWCPG

A	**B**	**F=A*B**
EFt_{hermal} (kg/MWh)	Share of thermal power plants in newly added total capacity	$EF_{BM,y}$ (tCO_2/MWh)
0.7765	40.66%	0.3157

So, $EF_{BM,y}$ =0.3157 tCO_2e/MWh

3.Calculating the baseline emission factor (EF_y)

The baseline emission factor was calculated as the weighted average of the OM Emission Factor (0.9987tCO_2e/MWh) and the BM Emission Factor (0.5772tCO_2e/MW). The defaults weights for hydropower projects are used as 0.5 respectively, the baseline emission factor of SCPG is calculated as:

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} = 0.6323 \text{ tCO}_2\text{e/MWh}$$

Appendix 5: Further background information on monitoring plan

N/A

Appendix 6: Summary of post registration changes

N/A

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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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