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

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	48 MW Duduluo River Hydroelectric Power Plant
Version number of the PDD	6.0
Completion date of the PDD	22/08/2012
Project participant(s)	Lushui County Quande Hydroelectrical Power Development Ltd. First Climate (Switzerland) AG
Host Party(ies)	People's Republic of China
Sectoral scope and selected methodology(ies)	Sectoral Scope: 1 Energy industries Selected methodology: ACM0002 Version 06
Estimated amount of annual average GHG emission reductions	166,393 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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48MW Duduluo River Hydroelectric Power Plant, a run-of-river hydropower project, is located on the Duduluo River in the Chenggan Town, Lushui County, Nujiang Lisu Ethnic Autonomous Prefecture of Yunnan Province. It will have an installed capacity of 48 MW. The power generated will be sold to the county's power grid, which in turn is connected to the Yunnan Provincial Grid and then to the China Southern Power Grid (CSPG). The development of the project would reduce, among other benefits, the greenhouse gas emissions produced by the grid mix, which is dominated by thermal power plants. The gross average output per year in the long-term is 219.65 GWh. The projected electricity available for sale to the grid is 197.288GWh per year. The difference is due to scheduled and unscheduled plant outage, and losses before feed-in into the grid. The annual CERs generated volume would be 166,393 tCO_2e.

The proposed project is expected to have several positive impacts for sustainable development. Some of the socio-economic benefits that are expected are as follows:

a) Creating short- and long-term job opportunity in the local region in construction period and operation period respectively. 37 skilled persons and 18 unskilled ones would be hired in operational phase;

b) Stimulating the socio-economic development in the poor minority area in the remote south-west region of China, like Yunnan Province, especially in the rural infrastructure development such as creation of roads and other facilities due to the construction;

c) Meeting increasing power demands of the region and outside the region through sustainable electricity generation while contributing to a diversified energy supply structure;

d) Conserving depleting fossil fuels such as coal, oil, natural gas, currently predominantly used for power generation;

e) Promoting local environmental improvement through reducing greenhouse gases and air pollutants emission (especially NOx, SO_2, particulates) from combustion of fossil fuels.

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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Nujiang Lisu Ethnic Autonomous Prefecture/Yunnan province

A.2.3. City/Town/Community etc.

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Lushui County/Chenggan town

A.2.4. Physical/Geographical location

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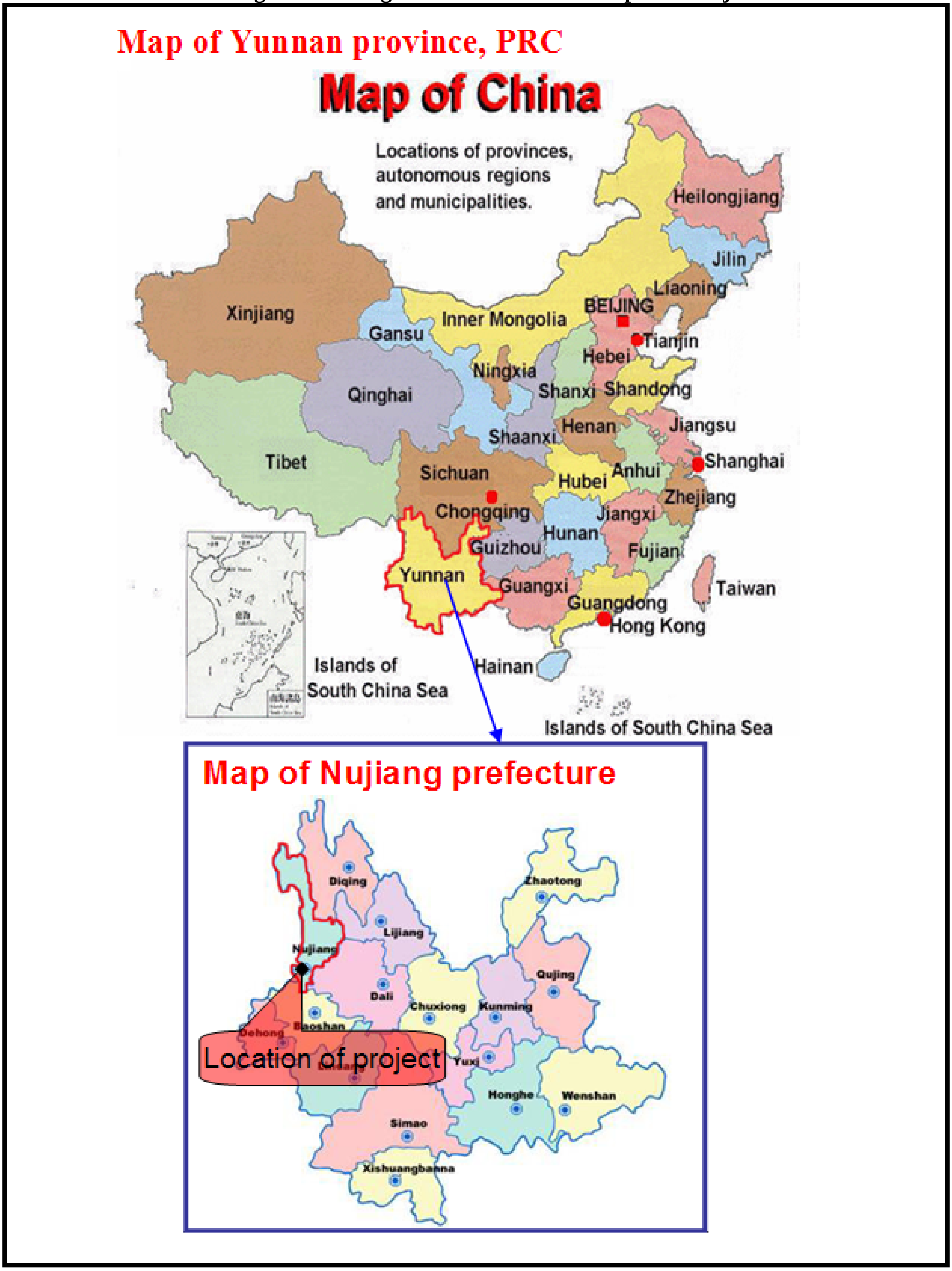
The proposed project is located in Chenggan Town, Lushui County, Nujiang Lisu Ethnic Autonomous Prefecture of Yunnan Province, in the South West of China. The power plant location is approximately 53 km from the Nujiang Prefecture capital and 600m from the town centre. The project intends to exploit the water drop of the Duduluo River, the main branch of Nu Jiang River. The geographical coordinates of the

project location is 98°40’10”-98°54’36” East and 26°13’36”-26°21’36” North. Figure 1 indicates the project location.

Figure 1 Geological Location of the Proposed Project



A.3. Technologies and/or measures

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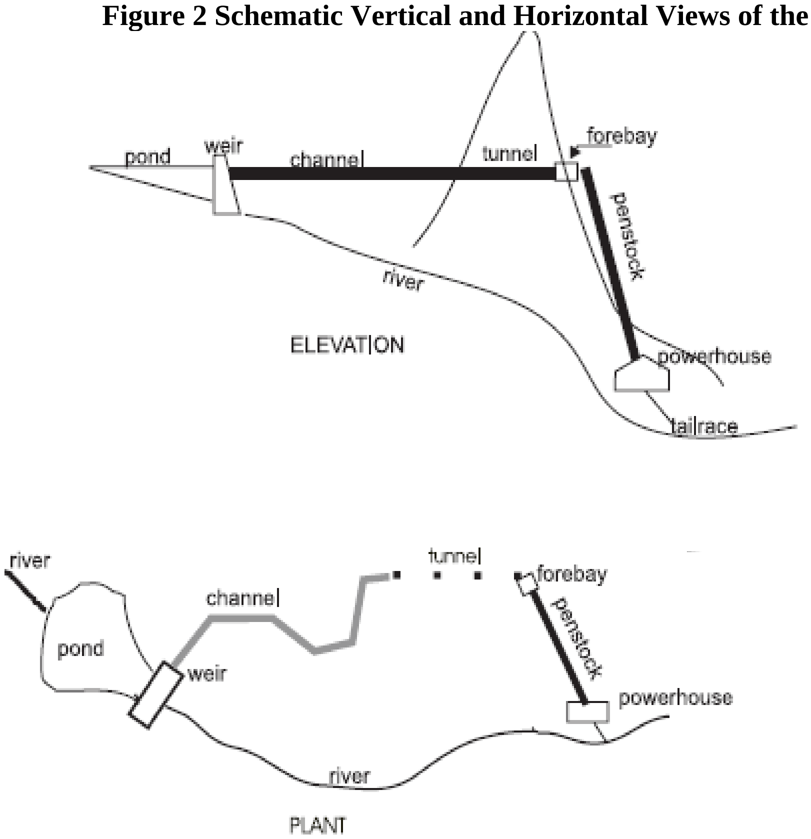
The proposed project activity is a run-of-river and deep valley hydropower plant without regulating capacity[1]. It consists of small weirs, diversion tunnels, channels and powerhouse. Water at the high up catchment area is channelled by weir #3, and then flows along a diversion tunnel to weir #1, where water pressure is boosted and channelled by another diversion tunnel to the powerhouse. The weir #2 is built at the lower catchment area, where is 400m away from the powerhouse, nearby the tunnel. The water collected by the weir #2 flows into the tunnel and, ultimately, into the powerhouse. A schematic view of the run-of-river and deep-valley type of power plant is shown in Figure 2. At the powerhouse, three Pelton turbine generators with 16MW capacity each are installed to generate electricity by utilizing the hydro potential. The technical specifications of turbines and generators are given in the Table 1.

Figure 2 Schematic Vertical and Horizontal Views of the Project



Vertical

Horizontal

Table 1 Technical Specification of Turbine and Generator

	Technical Parameters	Specification
Hydro Turbine	Turbine type	CJA475-L-170/4×11.5
	Number of units	3
	Rated head (m)	593.18
	Rated power (MW)	16.053
	Rated flow (m3/s)	3.95
	Rated speed (r/min)	600
	Generator type	SF16-10/3300

[1] The residence time is negligible (at designed flow rate is less than 1 hour)

Generator	Number of units	3
	Rated capacity (MW)	16
	Rated voltage (KV)	10.5
	Rated speed (r/min)	600

Source: Feasibility Study Report, p1-37, p1-38, p6-14

The total installed capacity is 48MW, and the expected annual average gross output is 219.65 GWh. The projected net generation available for sale to the grid is 197.288 GWh, where the difference is due to scheduled and unscheduled plant outage, and other losses before feed-in into the grid.

The technology used is environmentally friendly. As the equipments can be sourced in China, there is no specific technology transfer involved in the proposed CDM project.

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)	Lushui County Quande Hydroelectrical Power Development Ltd. (Private)	No
Switzerland	First Climate (Switzerland) AG (Formerly know as Factor Consulting + Management AG)	No

A.5. Public funding of project activity

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There is no public funding involved in the project.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

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The project activity follows the methodology: "Consolidated Baseline Methodology for grid connected electricity generation from renewable sources"(ACM0002 Version 06, 19 May 2006). For more information regarding the methodologies please refer to http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Version 05 of the Tool for the demonstration and assessment of additionality is also applied in the proposed project.

B.2. Applicability of methodology

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As specified in ACM0002, it is applicable to grid-connected renewable power generation project activities under the following conditions:

- Applies to electricity capacity additions from run-of-the river hydro power plants; hydro power projects with existing reservoirs where the volume of the reservoir is not increased
- This methodology is not applicable to project activities that involve switching from fossil fuels to

renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;

- New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m^2;
- The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

The project activity is a newly installed electricity capacity from hydropower in the China Southern Power Grid (CSPG). The proposed project meets all applicability conditions stated in methodology ACM0002 (Version 06) as follows:

1) The proposed project is a new run-of-river hydroelectric power plant with power density of 1,718.78 [2]w/m^2 which is greater than $4w/m^2$, and does not include the creation of a dam or reservoir upstream of the project locations. The small weirs to be constructed have the only function to partially deviate the water flow;
2) The proposed project does not involve switching from fossil fuels to renewable energy at the site;
3) The geographic and system boundaries of CSPG where the proposed project will be connected can be clearly identified and information on the characteristics of the grid is available. The geographic and system boundaries can be clearly identified and information on the characteristics of the grid is available.

On the basis of the above reasons, the proposed project meets applicable conditions of ACM0002 (Version 6), and project emissions from the reservoir submerging are ignored since the power density is greater than $10w/m^2$.

B.3. Project boundary

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The boundary of the proposed project includes the physical range and geographical range of the proposed project and all the power plants connected with the proposed project in CSPG. Therefore, the proposed project is within the boundary of CSPG, whose geographical range includes Guangdong Province, Guangxi Zhuang Autonomous Region, Yunnan Province and Guizhou Province[3].

According to the methodology ACM0002, a grid-connected hydropower project like the proposed project is required to consider only CO_2 emissions from fossil fuels fired power plants in baseline scenario. Emission sources included or excluded from the boundary are listed below:

	Source	Gas	Included?	Justification / Explanation
Baseline	Fossil fired power plants within CSPG	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.

[2] Surface area at full reservoir level is 27,926.8 m^2.

[3] *Notification on Determining Baseline Emission Factors of China Power Grid* issued by the National Development and Reform Commission of the Government of China (China DNA) on August 9th , 2007 (see official website: http://cdm.ccchina.gov.cn)

Project Activity	On-site fuel combustion due to the project activity	CO_2	No	Zero emissions
		CH_4	No	Zero emissions and anyway not required by the methodology
		N_2O	No	Zero emissions and anyway not required by the methodology

B.4. Establishment and description of baseline scenario

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The possible alternatives scenarios to the proposed CDM project activity are as follows:
Alternative I: To implement the proposed project activity, but not undertaken as a CDM project activity;

Alternative II: To construct a fossil fuel fired thermal power plant of similar capacity with the equivalent amount of annual electricity generation within the same site;
Alternative III: To construct a power plant using other renewable resources with the same installed capacity as the proposed project, and

Alternative IV: To be supplied with equivalent annual power output as the proposed project by CSPG.

Specific analysis on the four alternative scenarios in absence of the proposed project is as follows:

Alternative I; The investment analysis in section B.5 (Step 2) shows that the IRR of total investment of the proposed project is 7.99%, lower than the financial benchmark IRR (10%). It indicates that the development of the proposed project activity couldn't be financially attractive under a fully commercialized condition without CDM revenues. Therefore, the Alternative I is not feasible and shouldn't be considered as baseline scenario of the proposed project would not be a realistic and credible alternative.

Alternative II: According to the relevant regulation in China, the coal fired power units with capacity below 135MW are strictly restricted to be difficult to be built in the area covered by the existing large electric power grid[4]. Therefore, Alternative II is not in compliance with current laws and regulations of China and should not be the baseline scenario of the proposed project.

Alternative III: Besides hydropower, solar PV, geothermal, biomass and wind power are the possible grid-connected renewable energy technologies that could be applied in CSPG. However, Yunnan Province, where the proposed project is located lacks of economically feasible wind resources or enough biomass sources and solar sources and for constructing a power plant with the same installed capacity as the proposed project[5]. Although the geothermal energy is relatively rich in western Yunnan Province, geothermal power plant of the similar installed capacity as the proposed project are alternatives far from being attractive investment in the grid in China due to the technology development status and the high cost for power generation. Besides hydropower, none of other renewable resources have been developed in Yunnan Province in 2005[6]. Therefore, Alternative III is not feasible as an alternative baseline scenario.

Alternative IV: The installed capacity of CSPG keeps increasing for many years (see the Table A3-8 of Annex 3). The alternative means the continuation of current situation, and complies with current laws and regulations of China and economically feasible.

[4] Notice on strictly prohibiting the installation of fuel-fired generators with the capacity of 135 MW or below issued by State Council Office, decree no. 2002-6, http://www.cct.org.cn/cct/content.asp?ID=5576
[5] Medium and Long-Term Development Plan for Renewable Energy in China (see the Section 1.1 Resource Potential for details in this plan), http://en.chinagate.com.cn/reports/2007-09/13/content_8872839.htm
[6] China Electric Power Yearbook:2006, p583

In conclusion, Alternative IV is the most likely to be implemented among all the alternatives. Therefore Alternative IV is identified as the baseline scenario of the proposed project. In absence of the proposed project, CSPG will supply the equivalent annual power output as the proposed project.

B.5. Demonstration of additionality
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Prior consideration of CDM

The project owner was in an early stage aware about the potential of CDM to support its activities. The following timeline and milestone provides background information that is helpful to demonstrate that CDM was seriously considered by the project owner in the decision to proceed with this project activity.

The Feasibility Study Report (FSR) was completed by the officially accredited Water & Electric Investigation & Design Institute of Kunming University of Science & Technology in July 2005. As stipulated by Chinese relevant regulation[7], the documents that are submitted with the application for the project must include the approvals issued by the province-level local government on land, water, environmental protection, etc. (see the Table 8 in Section E), besides the FSR examined by the authorized department concerned.

Preliminary Design Report of Water and Soil Conservation was approved by Department of Water Resources of Yunnan Province on 29 May 2006. Environmental Impact Assessment (EIA) Report was conducted by the officially accredited Yunnan Institute of Environmental Science in May 2006 and approved by Yunnan Provincial Environmental Protection Bureau on 18 September 2006. Approval of Land Use was issued by Department of Land and Resources of Yunnan Province on 26 December 2006.

These approvals above should be gotten based on corresponding reports. This mean it is reasonable to get FSR approval on 10 April 2007, about two years later after FSR completion since several local governments were involved. However, the authority administration of this project activity, Yunnan Provincial Development and Reform Committee, approved the project fully based on the only FSR completed in July 2005, without considering investment change due to price inflation. Therefore, there is no variation in values between the FSR and its approval.

On 13 March 2007, the contract with DOE for validation services was signed. Subsequently, DOE make the PDD publicly available for comments during 30 March 2007 to 28 April 2007[8]. The validation on site was implemented on 10 May 2007.

On 11May 2007, the Construction Permit was issued by Nujiang Prefecture Development and Reform Committee. Accordingly, the Project started its construction of civil work. On 26 August 2007, the LoA of Chinese DNA was issued.

The timeline and milestone of proposed project is also summarized in the table below.

No.	Timeline	Milestone
1.	July 2005	FSR was completed by the officially accredited Water & Electric Investigation & Design Institute of Kunming University of Science & Technology.
2.	29 May 2006	Preliminary Design Report of Water and Soil Conservation was approved by Department of Water Resources of Yunnan Province.
3.	May 2006	Environmental Impact Assessment (EIA) Report was conducted by the

[7] http://www.ndjczx.com/jiaocheng/bszn/qybs/kbsl/bszn/200711/38492.html
[8] http://cdm.unfccc.int/Projects/Validation/DB/NIH4LRXDF7W1N6GBRJLQHUXU2H02YP/view.html

		officially accredited Yunnan Institute of Environmental Science.
4.	18 September 2006	EIA Report was approved by Yunnan Provincial Environmental Protection Bureau.
5.	26 December 2006	Approval of Land Use was issued by Department of Land and Resources of Yunnan Province.
6.	13 March 2007	the contract with DOE for validation services was signed
7.	28 March 2007 to 26 April 2007	The PDD of 15 February 2007 was made publicly available on DNV's climate change website (http://www.dnv.com/certification/climatechange/) for comments.
8.	10 April 2007	Approval of FSR was issued by Yunnan Provincial Development and Reform Committee.
9.	10 May 2007	The validation on site was implemented
10.	11May 2007	The Construction Permit was issued by Nujiang Prefecture Development and Reform Committee. Accordingly, the Project started its construction of civil work
11.	26 August 2007	LoA of Chinese DNA was issued by the National Development and Reform Commission of People's Republic of China.

In conclusion, the timeline above indicates that the starting date of the project activity is after the date of validation and therefore substantially demonstrates the incentive from the CDM was seriously considered prior to the project start.

The following steps demonstrate additionality for this project activity according to the "Tool for the demonstration and assessment of additionality" (Ver. 5) as required by the methodology:

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

The objective of this step is to identify realistic and credible alternatives to the Project activity through the following sub-steps:

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

For the propsed project, the possible alternative scenarios scenarios that provide outputs or services comparable to the project activity should be as follows:

Alternative I: To implement the proposed project activity, but not undertaken as a CDM project activity;

Alternative II: To construct a fossil fuel fired thermal power plant of similar capacity with the equivalent amount of annual electricity generation within the same site;

Alternative III: To construct a power plant using other renewable resources with the same installed capacity as the proposed project, and

Alternative IV: To be supplied with equivalent annual power output as the proposed project by CSPG.

Alternative III is not realistic due to lacks of enough wind sources, biomass sources, solar sources, or geothermal sources for constructing a power plant with the same installed capacity as the Project.

In conclusion, as discussed in Section B.4, the only practical and feasible baseline scenario is the Alternative IV.

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

The above mentioned alternatives are tested for their compliance with the applicable legal and regulatory requirements. These are mainly safety guidelines and environment regulations. Except for the Alternative II, all other alternatives are found to meet current laws and regulations in China. As already explained in section B.4, the coal fired power units with capacity of 135 MW and below are strictly restricted to be built in the area covered under the existing large electric power grid. Therefore the alternative II is not in compliance with this regulation, and hence is not a realistic and credible alternative. In conclusion, only Alternative I, Alternative III, and Alternative IV are valid in terms of compliance with the regulatory requirements.

The investment analysis below shows that in absence of the CERs sales revenue, the proposed project activity is not financially viable, and hence the Alternative I would not be a realistic and credible alternative.

Step 2. Investment Analysis

The purpose of the following investment analysis is to determine whether the proposed project activity without the revenue from the sale of Certified Emission Reductions (CERs) is the most economically or financially attractive investment option for the project participants, in which case the project would not qualify as additional. To conduct the investment analysis, following sub-steps are used:

Sub-step 2a. Determine appropriate analysis method

The three analysis methods suggested by *Tools for the demonstration and assessment of additionality* are simple cost analysis (option I), investment comparison analysis (option II) and benchmark analysis (option III). Since the proposed project will earn revenues from not only the CDM but also the electricity output, the simple cost analysis method is not appropriate. The alternative baseline scenario of the proposed project is CSPG rather than a new investment project. Therefore option II is not an appropriate method either. The proposed project will apply benchmark analysis method (Option III) based on total investment IRR.

According to "*Economic Evaluation Code for Small Hydropower Projects*"issued by the Ministry of Water Resources of China [9] (Document No. SL16-95), the hydropower projects whose installed capacity are below or equal to 25MW fall into this code. Moreover, the hydropower projects whose installed capacity are below or equal to 50MW in rural area also fall into this code. The financial benchmark internal rate of return (after tax) of total investment for Chinese small hydropower projects is 10%. Thus, the benchmark analysis is applicable to the project.

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

As mentioned previously in Section A4.1.4, the proposed project is located in remote countryside of Lushui County, Nujiang Lisu Ethnic Autonomous Prefecture of Yunnan Province, in the South West of China. Lushui County is one of the poorest counties in China, so the proposed project is suitable for *Evaluation Code for Small Hydropower Projects* (SL16-95). According to this code, the benchmark of internal rate of return (IRR) of total investment for Chinese small scale hydropower project is 10% (after tax), which is used widely in hydropower projects in China.

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

Basic data and assumptions for the calculation of the financial indicator of the proposed project are summarized in the Table 2:

[9] see www.cws.net.cn/guifan/bz%5CSL16-95/

Table 2 Main Parameters for the Financial Analysis

Parameters	Value	Source
Total Investment	198.57 Million CNY	The feasibility study report, annual investment sheet in Section 15 (excel file)
Equity/debt ratio	30/70	The feasibility study report, p16-2
Installed Capacity	48 MW	The feasibility study report, p1-1
Annual Net Output	197,288 MWh	The feasibility study report, p16-2
Project lifetime	30 years (not including 24 months of construction)	The feasibility study report, p16-2
Depreciation	4%	Feasibility Study Report, p16-4
Expected Average Electricity Tariff[10]	0.1513 CNY/kWh	Endorsed by Yunnan Provincial Development and Reform Committee, referred as "Yun Fa Price Number [2005] No.702"
Value Added Tax	6%	The feasibility study report, p16-5
City Development and Education Tax rate	5% of VAT	The feasibility study report, p16-5
Corporate Tax rate: I°, II° year III°,IV°, V° year > V° year	 0% 16.5% 33%	The feasibility study report, p16-5
Annual O/M cost	5.90 Million CNY	The feasibility study report, p16-17.
Interest Rate on Loan	6.12%	The feasibility study report, p16-3

Based on the data listed above, the project IRR of the proposed project is calculated as 7.99% without the income from selling CERs (see Table 3). It is lower than the financial benchmark IRR (10%), which is considered that the proposed project is financially unfeasible under business-as-usual conditions and thus demonstrates the additionality. Detailed financial calculations including the details on the underlying assumptions are available to the DOE.

Table 3 Project IRR with and without the CERs revenues

	Without CERs	With CERs
IRR	7.99%	11.93%

The main impact of CDM registration is the generation of additional revenue from the sale of the CERs. At an assumed sales price of 80 CNY/tCO2e, the CER revenue increases the project IRR from 7.99% to 11.93%, bringing it well over the benchmark profitability. Therefore the CDM revenues would improve the economic feasibility of the project in a decisive manner.

However, it is important to note that the project also faces important non-quantifiable barriers, which are equally mitigated by the CDM (see Step 3 below for details). For example currency and revenue certainty:

[10] The electricity generated by the proposed project will be sold to local grid (30%) and Yunan provincial grid (70%) respectively. Average tariff for local grid is 0.18 CNY/kWh (see the grid tariff conformation of Yunnan Nujiang Grid Company dated on 17 February 2008). Average tariff for Yunnan provincial grid is 0.139 CNY/kWh (Yun Fa Price Number [2005] No.702). Therefore, the average expected tariff for the proposed project is 0.1513 CNY/kWh (inl. VAT).

CER revenues are in hard currency (typically Euro or US dollars) and come from international buyers. This helps to diversify and stabilize the revenues of the project substantially.

Sub-step 2d. Sensitivity analysis

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

The following key parameters have been selected as sensitive indicators to test the financial attractiveness for the proposed project.

(1) Total investment costs
(2) Operation & Maintenance costs
(3) Revenues from power output
(4) Expected Average Electricity Tariff

A reasonable variation range of ±10% for sensitive indicators is considered in critical assumptions. The impacts of total investment, annual O & M costs, annual power output from the proposed project and expected average electricity tariff on total investment IRR are analyzed. The results of sensitive analysis targeting the aforementioned four indicators are shown in Table 4 and Figure 3, which provides a valid argument in favor of additionality because it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be financially attractive with total investment IRR under various adverse situation less than the benchmark IRR (10%).

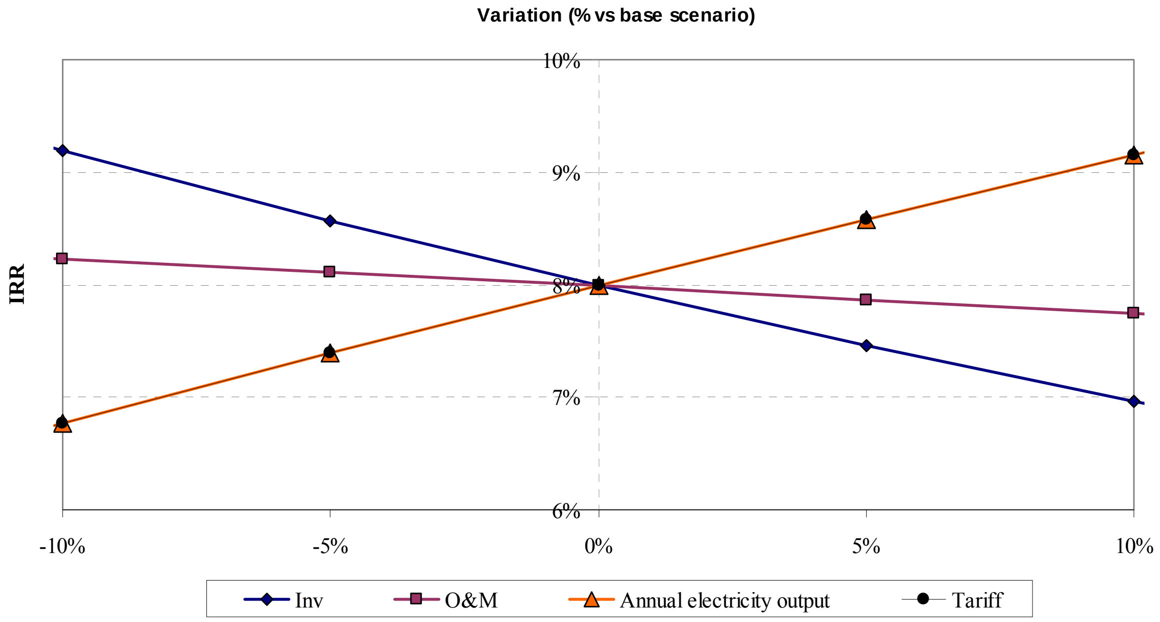


Figure 3 Outcome of the Sensitivity Analysis of Project IRR

Table 4 IRR Sensitivity to Different Financial Parameters of the Proposed Project

IRR	-10%	-5%	0%	+5%	+10%
Total Investment	9.19%	8.56%	7.99%	7.46%	6.97%
Annual O&M Cost	8.23%	8.11%	7.99%	7.87%	7.75%
Revenues from power output	6.77%	7.39%	7.99%	8.58%	9.16%
Expected Average Electricity	6.77%	7.39%	7.99%	8.58%	9.16%

Tariff

As shown in Table 4 and Figure 3, the IRR of total investment of the proposed project varies to different extents, when the above four financial indicators fluctuate within the range from -10% to +10%. However, the impacts of total investment, the annual O&M cost, revenues from power output, and expected average electricity tariff on project IRR are not very sensitive, when the four financial indicators changed within the range from -10% to +10%, the IRR of total investment is always under the benchmark.

The project IRR will reach the benchmark (10%) at the following assumptions, but it very unlikely happen due to:

a) Total investment decreases by 15.9%;

   It is not realistic as the booming Chinese economy is driving the inflation rate (inflation increased very steeply in the past years) which translates into higher investment cost. A decrease in total investment by 15.9% can't guarantee project construction as scheduled and with high quality. The total investment of the proposed project is estimated according to the bill quantity of construction works with an appropriate contingency. Therefore, the assumption that total investment decreases by 15.9% very unlikely happen.

b) Annual O&M cost decreases by 85.7%;

   It is fully impossible that a significant decrease in O&M cost as O & M cost covers necessary disbursements such as maintenance & repair expenses, insurances, payroll & welfare, etc. Also, as a result of increasing inflation in the past years, operation costs only tends to be increased.

c) Revenues from power output increase by 17.5%;

   Revenues from power output are determined by annual electricity output and electricity tariff. The annual electricity output is based on the annual load hours of the hydropower plant which is estimated from the long time series hydrographical data. Furthermore, it can't be guaranteed that local gird enterprises purchase all electricity generated by the proposed project because of challenges from large power companies which have advantages in cost and dispatching. So, the probability that annual output is higher than the estimated value is very small. As discussed in d), the electricity tariff in China tends to be fixed and therefore impossibly is adjusted to a higher level. Therefore, it is concluded that there is no probability that the revenues from output increases by 17.5%.

d) Expected average electricity tariff increase by 17.5%.

   The tariff in China tends to be fixed by the government, even though it will be different from different power grids. The expected tariff in the Table 2 is the price endorsed by Yunnan provincial relevant authorities. The project owner has no authority to determine the electricity tariff by itself. Also, once the Power Purchase Agreement is signed; the electricity tariff is fixed within the contract duration. However, what's worse that the actual tariff may be lower than it due to the increasing competition from large power grid companies. Small-scale hydropower projects are at a very distinct disadvantage. Therefore, it is very unlikely happen that average electricity tariff increase by 17.5%.

Therefore, when financial indicators change within reasonable range, the proposed project is not financially feasible without CDM support.

Step 4. Common Practice analysis

In China, with its abundant coal resource, relatively low investment risks, stable and mature national policy on coal mine exploration, and the historic use of fossil fuel, coal plays an important role in

contributing to China's social and economic development as a source of energy. Coal will not be substituted as the dominate fuel resource in the next decades, especially during the crediting period of the proposed project. Today the grid electricity is clearly dominated by thermal generation, predominantly from coal. The overall nationwide mix of thermal to hydro-electric power has deteriorated in the past five decades. Even in the regions with rich hydro potential, such as Guangdong, Guangxi, Yunnan and Guizhou which are covered by the China Southern Power Grid, the contribution of hydro generated electricity has decreased from 27.2% in 2001 to 20.2% in 2005 (see the table please).

	2001	2002	2003	2004	2005
Hydro power generation (Bil. kWh)	67.895	70.121	69.073	70.790	81.139
Total power generation (Bil. kWh)	249.54	2,76.303	323.148	366.100	402.250
Contribution of hydro (%)	27.2%	25.4%	25.0%	19.3%	20.2%

Data source: China Electric Power Yearbook, 2002-2006 Edition

Although the development of renewable energy is in principle encouraged by the Chinese government, the policies in place tend to have many restrictions. Priority is still given to large and very large hydro power plants (>300MW). Only state or province owned companies, or major private companies, are encouraged to invest in those kinds of projects. The rest of the private sector – small and medium size companies - is left with the hydro resources found in remote regions and where the economic viability of the development of hydro power is less attractive.

Sub-step 4a. analyze other activities similar to the proposed project activity:

According to *China Hydropower Yearbook 2005*, Hydropower plant, with capacity less than 50MW, is defined as small scale hydropower project; Hydropower plant, with capacity less than 300MW and more than 50MW, is defined as middle scale hydropower project; Hydropower plant, with capacity more than 300MW, is defined as large scale hydropower project. Since the small scale hydropower project has quite different regulatory framework and access to financing from middle scale and large scale hydro projects. At the other end, the projects, with installed capacity between 0 MW~15 MW applying AMS-I. D, consequently are not similar to the proposed project with installed capacity of 48MW, the similar scale is defined as 15 MW~50 MW.

Table 5 shows the projects with similar installed capacity commissioned or "underway" before or during the project construction in Yunnan province.

Acording to the Tool for the Demonstration and Assessment of Additionally, Projects seeking CDM financing should not be considered in the Common Practice Analysis, therefore twenty three projects have been analysed, The first ten projects (1-10) have been developed by the State own companies before the Hydro Power Reform was introduced in February 2002 with the main objective of building a competitive and open market for power generation in China. Therefore these projects cannot be considered similar to the project activity as they have not taken place in a comparable environment with respect the regulatory framework and the investment climate.

The Wuni River Hydropower Station[11] (11) and Houqiao Hydropower Station[12] (12) have joined the West-East Electricity Transmission Project, a Government sponsored project offering favourable economic conditions to power suppliers participating in the project with the aim to secure transmission of power from West China to East China.

The Xima Xingyun Aluminion Factory Hydro Station[13] (13) is a captive station of Yunnan Yingjang Xiingyun Co. Ltd and The Chongjianghe Phase II[14] (14) is an expansion of an already existing power

[11] http://www.leica-geosystems.com.cn/newsdetail.asp?l3=0&nid=469

[12] http://www.baoshan.cn/4034/2005/10/25/707@277291.htm

plant. Therefore they cannot be considered similar to the project activity for investment and technological reasons.

Therefore the rest 9 Projects that, according to the *Tool for the Demonstration and Assessment of Additionally*, can be considered similar to the Project Activity are the last nine Projects (15-23) listed in table 6 and discussed in sub-step 4b.

Table 5 Existing Small Scale Hydropower Stations of Yunnan Province

Number	Name of hydropower plant	Installed Capacity (MW)	Location	Project owner/largest stockholder
CDM	Nandihe HydroPower Station	20	Yingjiang County of Dehong State	Yingjiang Nandihe Hydropower Co., Ltd
CDM	Maguan Daliangzi Hydropower Station	32	Maguan county of Wenshan prefecture	Maguan Daliangzi Hydropower Ltd
CDM	Yingjiangxian Mangyahe I	24.9	Yunnan Province Yingjiang County	Yunnan Province Yingjiang County Mangya River Hydropower Co., Ltd.
CDM	Yingjiangxian Mangyahe II	12	Yunnan Province Yingjiang County	Yunnan Province Yingjiang County Mangya River Hydropower Co., Ltd.
CDM	Supahe Sanjiangkou Hydro expansion	32	Tianning Village, Bizhai Town, Longling County, Baoshan City	Yunnan Baoshan Keyuan Silicon Electric Co., Ltd.
CDM	Yingiangxian Mangzhand Langwaihe	45	Mangzhang Town, Yingjiang County, Dehong Dai-Jingpo Autonomous Prefecture	Yingjiang County Binglang River Hydroelectric Power Co., Ltd.
CDM	Mengjiahe Kachang Muwen	40	Kacha ng Town, Yingjiang County, Dehong Dai-Jingpo Autonomous Prefecture	Yingjiang Mingyu Electric-Power Development Co., Ltd.
CDM	Malipo Maomaotiao power plant	40	Wenshan Prefecture	Malipo County Hongyuan Hydropower Co.,Ltd
CDM	Yunnan Lufeng plant	38	Lufeng County	Yunnan Lufeng Fengyuan Hydropower development Ltd.
CDM	Yunnan Heier plant	25	Shizong County	Shizong Heier Hydro Power Development Co.,Ltd
CDM	Yunnan Wulanghe plant	32	Lingjiang Prefecture	Lijiang Wulanghe Hydropower Development Co.,Ltd
CDM	Dali Yanger plant	49.8	Dali Prefecture	Dali Yang_er Hydropower Development Co.,Ltd
1	Jinghong Farm Hydropower Station	17	Jinghong County	State owned before 2002
2	Luoze River Hydropower Station	25	Zhaotong County	State owned before 2002
3	Xiaohegou Hydropower Station	21	Guangnan County	State owned before 2002
4	Jinghong Liusha River Hydropower Station	18.5	Jinghong County	State owned before 2002

[13] http://0871.und.cn/small/cpybase.do?companyid=D658A7E06D9B41318F44FBF1B0E6C0E7
[14] http://0871.und.cn/small/cpybase.do?companyid=D658A7E06D9B41318F44FBF1B0E6C0E7

	(seventh phase)			
5	Guangnan Xiyangjiang Hydropower Station	20	Guangnan County	State owned before 2002
6	Supa River Sanjiangkou Hydropower Station	30	Baoshan City Tengchong	State owned before 2002
7	Yisa River Hydropower Station	26.6	Yuxi City Yuanjiang County	State owned before 2002
8	Laohushan II Hydropower Station	25	Chuxiong Perefeture	State owned before 2002
9	Hongshiyan Hydropower Station	44	Yiliang County	State owned before 2002
10	Jiren River Hydropower Station	30	Diqing Prefeture Shangri-La County	State owned before 2002
11	Wuni River Hydropower Station	30	Baoshan City Longling County	Yunnan Baoshan Supahe hydropower development Co., Ltd. (sate owned)
12	Houqiao Hydropower Station	48	Baoshan City Tengchong County	Yunnan Baoshan Binlangjiang hydropower development Co., Ltd.
13	Xima Xingyun Aluminium Factory Hydropower Station	26	Dehong Prefecture Yingjiang County	Yunnan Yingjiang Xingyun Co., Ltd.
14	Chongjianghe II Phase (Expansion) Hydropower Station	48	Diqing Prefecture Yulong County	Guodian Diqing Shangri-la Generating Limited Liability Company
15	Nanting River Hydropower Station	34	Wenshan Prefecture Maguan County	Wenshan Electric Power Co., Ltd. (State owned)
16	Mengdianhe II Hydropower	30	Dehong Prefecture Yingjiang County	Yingjiang Mengdian River Second Level Power Station Co., Ltd.
17	Xiashilong Hydropower Station	25	Wenshan prefecture Guangnan County	Guangnan Xinangjiang Hydrpower Development Co., Ltd.
18	Laodukou Hydropower Station	36	Qujing City Luoping County	Yunnan Luoping Laodukou Power Co., Ltd. (State Owned)
19	Yanziya Hydropower Station	25	Dali Prefecture Heqing County	Heqing Xinyuan Yanggongjiang Power Co., Ltd. (State Owned)
20	Maomaotiao Hydropower Station	40	Wenshan Prefecture Malipo County	Maomaotiao Power Co., Ltd.
21	Luoshuidong Hydropower Station	20	Wenshan Prefecture Xichou County	Wenshan Electric Power Company (State owned)
22	Gula Tianshengqiao Hydropower Station	40	Wenshan Prefecture Gula village	Gula Hydropower Development Company Ltd (State owned)
23	Xiaopengzu Hydropower Stataion	30	Yunan province, Luquan County	Kunming Xiaopengzu Hydroelectric Development Co.Ltd.

Sources: Yearbook of China Water Resources 2006 , Yunnan Statistical Yearbook 2003-2005 Editions and Chinese DNA website.

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

The unit costs for these 9 projects are showed in Table 6:

Table 6 Unit Cost for Similar Projects to the Project Activity

Number	Name of hydropower plant	Installed Capacity (MW)	Total Investment (10^4 RMB)	Annual electricity generation (MWh)	Unit cost (RMB/kWh)
15	Nanting River Hydropower Station[15]	34	15,400	195,000	0.7897
16	Mengdianhe II Hydropower[16]	33	12,600	180,000	0.7000
17	Xiashilong Hydropower Station	25	10,150	100,545	1.0095
18	Laodukou Hydropower Station	36	19,970	189,000	1.057
19	Yanziya Hydropower Station[17]	25	12,500	150,000	0.8333
20	Maomaotiao Hydropower Station[18]	40	13200	172,280	0.6965
21	Luoshuidong Hydropower Station[19]	20	8,600	153,600	0.5599
22	Gula Tianshengqiao Hydropower Station[20]	40	17,907	172,400	1.0387
23	Xiaopengzu Hydropower Stataion[21]	30	16,505.3	132,000	1.2504
	Proposed project activity	48	19,857	219,650	1.0064

The unit costs of Nanting (15), 0.7897 RMB/ kWh, Mengdianhe (16), 0.7000RMB/kWh, Yangziya (19), 0.8333RMB/kWh, Maomaotiao (20), 0.6965 RMB/kWh, Luosuidong (21), 0.5599 RMB/kWh, are significant lower than the 1.0064 RMB/kWh of the project activities. This is due mainly to the better hydrological resources at the locations of those projects. Therefore, they are not in comparable environment as the proposed project activity. In addition, these projects are owned by state-owned or stock-exchanged listed companies and have thus better access to financing that the private project owner of the project activity.

The Xiashilong Hydropower Station[22] (17) and Laodukou Hydropower Station[23] (18) and Gula Tianshengqiao Hydropower Station (22) have similar unit costs as the project activity, but these projects are financed by large state-owned or large private shareholders including Guangnan Xinangjiang Hydropower Development Co., Ltd., Yunan Luoping Laodukou Power Co., Ltd., Ltd., Yunnan Yuxi hydroelectric group Co., Ltd., Kunming Electrical and Mechanical Service Co., Ltd. and Yunnan Wenshan Electricity Co., Ltd. Compared to the proposed project, developed by a small-size private company, these projects have better access to financing.

15 http://news.sina.com.cn/c/2004-12-30/09444669685s.shtml
16 http://finance.memail.net/050110/129,5,571873,00.shtml
17 http://www.bhi.com.cn/info/show/Show_N107.asp?ID=78270&Code=R5IDEH
18 http://www.ynws.gov.cn/docdetail_new.asp?id1=20050321081428
19 http://www.7c.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=9180
20 http://www.ynfn.gov.cn/zwgk/zwdt/200605/zwgk_4919.html
21 http://ynepb1.yn.gov.cn/doc/200503/lqxpzsdz.doc
22 http://www.leica-geosystems.com.cn/newsdetail.asp?l3=0&nid=469
23 http://www.baoshan.cn/4034/2005/10/25/707@277291.htm

The Xiaopengzu hydropower station (23) has higher unit costs that the project activity. In fact this project is on sale since it faces large financial difficulties and is hard to be implemented by the former project owner[24]. The project is in any case located nearby Kunning City whereas the proposed project activity is located in one of the poorest rural areas of the Yunnan Province making it harder to have access to financing.

Therefore, it is concluded that the proposed project is not common practice in the area. The project activity therefore satisfies Step 4.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
>>
The emission reductions for a given year are calculated as baseline emissions minus the project emissions and leakage:

$$ER_y = BE_y - PE_y - L_y$$

The power density of the proposed project is 1718.78 $w/m^2 > 10\ w/m^2$. According to the ACM0002 methodology, the project emissions (PE_y) are zero. As stated in ACM0002 methodology, there is no need for the proposed project to consider the leakage (L_y). Therefore, the emission reductions are equal to the baseline emissions:

$$ER_y = BE_y$$

According to the methodology the baseline emissions are the amount of electricity produced (EG_y) times the grid emission factor which is the Combined Margin emission factor (EF_{CM}), calculated as the simple average of the Operating Margin emission factor (EF_{OM}) emission factor and the Build Margin emission factor (EF_{BM}). Hence the emission reductions can be calculated as:

$$ER_y = BE_y = EF_{CM} * EG_y = (0.5 \times EF_{OM} + 0.5 \times EF_{BM}) * EG_y$$

The following procedure was adopted to determine EF_{CM} and BE_y:
Step 1 – Calculation of the Operating Margin Emission Factor (EF_{OM})
Step 2 – Calculation of the Build Margin Emission Factor (EF_{BM})
Step 3 – Calculation of the Baseline Emission Factor (EF_{CM})
Step 4 – Calculation of the Baseline Emissions Reductions (BE_y)

Step 1 – Calculation of the Operating Margin

Methodology ACM0002 provides four options to calculate OM, which are:
a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or
d) Average OM.

The approved consolidated methodology recommends the use of dispatch data as the first methodological choice. However, in China accurate data on grid system dispatch order for each power plant in the system and the amount of power dispatched from all plants in the system during each hour is not available. In view of this it is proposed to apply other choices as suggested in the ACM0002. Since historical data available for the last five years show that the ratio of electricity generated by low operating cost and must run sources, identified in the CSPG as hydro and nuclear power plants, to the total electricity generated in

[24] http://www.zj71.com/show.php?id=289

the CSPG are 34% in 2001, 32% in 2002, 31% in 2003, 31% in 2004 and 28% in 2005[25] respectively, all less than 50%, which accords with the defined condition of method (a), but not method (d). Consequently, it was decided to apply the Simple OM method a) to calculate the Operating Margin emission factor of the proposed project as suggested in ACM0002[26].

Simple OM

In the Simple OM method a), the emission factor is calculated as generation weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants as defined in ACM0002. The data vintage option selected is the ex-ante approach, where a 3-year-average OM is calculated based on the most recent power production statistics - with fuel type details - available at the time of the PDD submission (2003-2004-2005). Given the increasing ratio of thermal energy, the ex-ante approach is conservative.

The formula for calculating OM is:

$$EF_{OM} = \frac{\sum F_{i,j,y} \times COEF_{i,j}}{\sum GEN_{j,y}} \qquad (1)$$

Where:

EF_{OM} is emission factor of the Operating Margin by Simple method, in tCO_2/MWh
$F_{i,j,y}$ is the quantity of fuel i (tons or m^3 of fuel) consumed by relevant power sources j in years y; j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid[27],
$COEF_{i,j}$ is the CO_2 emission coefficient of fuel i for relevant power sources j in the years y in tCO_2/tons taking into account carbon content and the percent of oxidation of the fuel
$GEN_{j,y}$ is the electricity delivered to the grid by power source j in the year y in MWh. The data is not available in *China Electric Power Yearbook*, so the $GEN_{j,y}$ is calculated as follow:

GENj,y＝Electricity generation of power plants in CSPG ×(1 －Internal use rate of power plants)

The CO2 emission coefficient COEFi is obtained as:

$$COEF_i = NCV_i * OXID_i * EF_{CO2,i} \qquad (2)$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*.
EF*CO2, i* is the CO2 emission factor per unit of energy of the fuel *i*.
$OXID_i$ is the oxidation factor of the fuel.

According to the deviation approach[28] agreed by the 22nd CDM EB meeting for OM and BM calculation for Chinese power grids, if the detailed data at the power plant level of the grids, such as power generation quantity, internal use rate of power plants, fuel types, fuel consumption and fuel emission

[25] China Electric Power Yearbook, 2002-2006 Edition
[26] Methodology ACM0002 states "The Simple OM method (a) can only be used where low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production."
[27] As described above, the electricity import from the connected electricity grid system can be seen as a source j.
[28] http://cdm.unfccc.int/User/Management/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

factors, etc., are not publicly available for the $EF_{OM,y}$ calculation, then as an alternative, the statistical data on aggregated power generation quantity, the internal use rate of power plants and fuel consumption which publicly available by the fuel types *i* and by province *j* covered by the power grid, can be used. So, the average power generation efficiencies (gce/kWh) and average emission factors of fuel *i* can be used. The fuel *i* based aggregated power generation and the related fuel consumption data are publicly available in *China Electric Power Yearbook* and *China Energy Statistical Yearbook*. Thus, the data quoted from these two kinds of yearbooks are used for $EF_{OM,y}$ calculation.

At the same time, according to ACM0002, the Simple OM can be calculated using either of the two following data vintages for years(s) *y*:

- (*ex-ante*) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,
- the year in which project generation occurs, if *EFOM,y* is updated based on *ex-post* monitoring.

There are power imports from the Central China Power Grid (CCPG) to CSPG, thus the imports are taken into account when calculates the OM.

EFOM,y is calculated as 1.0119 tCO2e/MWh according to the statistics information of recent 3 years (from 2003 to 2005), the data are the latest and available at the time of this PDD submission, the detailed calculations are shown in Table A2-Table A9 of Annex 3.

The operating margin is fixed ex-ante and doesn't need to be updated.

Step 2 – Calculation of the Build Margin

The ACM0002 offers two options: ex ante and ex post determination of the Build Margin emission factor (EFBM). In the latter case the build margin emission factor is required to be updated annually in the first crediting period. It has been observed that the power plants built in the past few years and those expected to be built in the next couple of years are thermal plants based on fossil fuels. As such the build margin emission factors have increased in the past and are likely to continue so. Nevertheless, option 1 is selected wherein the build margin emission factor is calculated ex ante based on most recent information available on plants already built for sample group *m* at the time of PDD submission. This simplifies the monitoring procedures, but also offers a conservative approach of EFBM calculation.

The Build Margin emission factor (EFBM*, y*) *ex-ante* is defined as the generation-weighted average emission factor of the greater annual generation of:

a) The five power plants that have been built most recently, or
b) The power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Both sets of plants exclude registered CDM project activities.

Given the size of the CSPG, the annual generation of the most recently built 20% of capacity far exceeds the annual generation of the five most recently built plants. Hence option (b) is selected and we calculate EFBM using the most recently built 20% of capacity.

According to baseline methodology ACM0002, the Build Margin emission factor (*EFBM, y*) is calculated by utilizing an *ex-ante* 3 years data vintage for CSPG, the formulae as follow:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}} \qquad (3)$$

Where *Fi,m,y*, *COEFi,m* and *GENm,y* are analogous to the variables described for the simple OM method above for plants *m*.

More details can be found in Table A10 to Table A14 of Annex 3.

Following guidance issued by the Executive Board in response to a request for guidance from an accredited DOE (DNV letter to the CDM EB; request for guidance: application for AM0005 and AMS-I-D in China, dated 7/10/2005) on the determination of the Build Margin in approved methodologies in China, *EFBM* is calculated as the capacity weighted average emissions factor of new installed capacity rather than the generation weighted factor. Furthermore it is suggested in the same guidance note that the efficiency level of the best technology commercially available in the provincial/regional or national grid of China is used as a conservative proxy for each fuel type in estimating the fuel consumption when calculating the Build Margin. It shall be pointed out that CDM EB decision on the agreed deviations is a formal response to the DNV's request for deviation: "the application of AM0005 and AMS-I.D in China". Nevertheless it can be reasonably understood that these agreed deviations are also effective to ACM0002, since the simple OM and BM method applied by the AM0005 and ACM0002 methodology are almost the same[29]. Moreover this approach is in line with the Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on August 9th 2007 [30].

The BM is calculated by direct comparison of total installed capacity in the CSPG in the most recent year where data is available, in this case 2005, and with historical data from previous year until the 20% threshold is achieved. The percentage is calculated as follows: % of recent Capacity Additions = [(C2005-Cn)/C2005*100], where C2005 is the capacity 2005 (most recent year for which the data is available); and Cn is the capacity in the reference year n.

The capacity installed in year 2005 to year 2002 is given in Annex 3. The total newly capacity installed is also given, 11.96% up to year 2005, 21.42% up to year 2004, 31.61% up to year 2003. Therefore, newly installed capacity from 2003 to 2005 shall be used as m for calculating BM.

Note that the data used can not distinguish the capacity installed in coal, fossil fuel, and gas from total fire power generation. Therefore, the calculation used as following:

Step a, percentage of CO_2 emitted, λ, for each solid, liquid and gas power generation:

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (4)$$

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

[29] In fact, CDM EB holds the same understanding, and accepts requests for registration of such kind PDDs, in which ACM0002 methodology is applied and those deviations originally agreed by CDM EB for AM0005 are applied as well. Especially, given that the AM0005 has been cancelled and its major elements are intergraded into ACM0002, decided by the CDM EB 23 meeting, legally we can apply these three deviation approaches into the ACM0002 application.

[30] See http://cdm.ccchina.gov.cn/web/index.asp and in particular http://cdm.ccchina.gov.cn/website/cdm/upfile/file1051.pdf for the calculation process of the baseline BM

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \tag{6}$$

where:

$F_{i,j,y}$ is the fuel, i (tce), consumption of province, j, in year, y;

$COEF_{i,j,}$ is the EF of fuel, i, carbon composition of oxidiation rate must take into account。

λ_{Coal}=89.48%， λ_{Oil}=10.24%， λ_{Gas}=0.28%。

Step b: calculating $EF_{Thermal}$。

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \tag{7}$$

Where:$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are emission factors of the most advanced commercial coal, oil and gas power generation technologies.

Table 7 Emission factors of the most advanced commercial power plant[31]

	Variable	Efficiency of Power Supply A	Emission Factor of the Fuel (tc/TJ) B	Oxidation Factor C	Emission Factor (tCO2/MWh) D=3.6/A/1000*B*C*44/12
Coal-fired power plant	$EF_{Coal\ Adv}$	35.82%	25.80	1	0.9508
Oil-fired power plant	$EF_{Oil\ Adv}$	47.67%	21.1	1	0.5843
Gas-fired power plant	$EF_{Gas\ Adv}$	47.67%	15.3	1	0.4237

therefore:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9117\ tCO_2/MWh$$

Step c: calculating $EF_{BM,y}$:

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}\ , \tag{8}$$

where, CAP_{Total} is total newly capacity installed, $CAP_{Thermal}$ capacity of thermal generation installed。

The calculation of the EF_{BM} is done as indicated in the Notification on Determining Baseline Emission Factor of China's Grid published on the official web site of the Chinese DNA on August 9th 2007 [32] and the result is as follows (detailed step-by-step calculations can be found in Annex 3):

EFBM = 0.6748tCO2e/MWh

<u>Step 3 – Calculation of the baseline emission factor (Combined Margin)</u>

The Combined Margin, EF_{cm}, baseline emission factor in year *y* is calculated as the simple average of the *EFOM* and *EFBM* emission factors, i.e. *EFOM* and *EFBM* are each weighted with 50%:

$EF_{CM} = W_{OM} \times EF_{OM} + W_{BM} \times EF_{BM}$=0.5×1.0119+0.5×0.6748

=0.8434 tCO_2e/MWh

[31] Source: http://cdm.ccchina.gov.cn/web/index.asp (August 9th 2007 update)

[32] See http://cdm.ccchina.gov.cn/web/index.asp and in particular http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls for the calculation process of the baseline OM emission factor

<u>Step 4 – Calculation of the baseline emissions</u>

The baseline emissions in year *y* are calculated as

$BE_y = EF_{CM} * EG_y$

where: EGy is the electricity produced by the project activity in year *y*, and EF_{CM} the baseline emission factor determined above.

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$F_{i,j,y}$
Unit	ton or m^3
Description	Quantity of fuel i consumed by relevant power sources j delivering electricity to the grid in years y. Hydro, nuclear power generation and low cost/must-run power sources are excluded.
Source of data	Chinese Energy Statistical Yearbook, 2004 - 2006 Editions
Value(s) applied	Varies for each fuel and year, see Annex 3 for details.
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities
Purpose of data	Baseline Emission Calculation
Additional comment	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter	$GEN_{j,y}$
Unit	MWh
Description	Electricity delivered to the grid by power source j in the year y. Hydro, nuclear power generation and low cost/must-run power sources are excluded.
Source of data	"Chinese Electric Power Yearbook", 2004 - 2006 Editions
Value(s) applied	Varies for each type of fuel used and year, see Annex 3 for detail.
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities
Purpose of data	Baseline Emission Calculation
Additional comment	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter	NCV_i
Unit	TJ/ton or TJ/m^3
Description	Net calorific value (energy content) per mass or volume unit of a fuel *i*.
Source of data	Chinese Energy Statistical Yearbook, 2006 edition, p 288
Value(s) applied	Varies depending on fuel source: coal 20.908, oil 41.816, gas 38.931
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities
Purpose of data	Baseline Emission Calculation
Additional comment	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter	$OXID_{i,}$
Unit	not applicable
Description	Oxidation factor of the fuel i
Source of data	"Chinese Energy Statistical Yearbook" 2006 Edition 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1.00 for solid fuel (coal), 1.00 for fuel oil, 1.00 for gas
Choice of data or Measurement methods and procedures	No specific local value available, adopt the IPCC default value
Purpose of data	Baseline Emission Calculation
Additional comment	See Annex 3 for detailed data, low degree of data uncertainty.

Data / Parameter	$EF_{CO2,i,}$
Unit	tC/TJ
Description	CO_2 emission factor per unit of energy of the fuel *i*.
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	25.8 for coal, 21.10 for oil and 15.30 for gas
Choice of data or Measurement methods and procedures	No specific local value available, adopt the IPCC default value
Purpose of data	Baseline Emission Calculation
Additional comment	Please note that to get to CO_2 emission factor per unit of energy it is necessary to multiply by 44/12. Low degree of data uncertainty.

Data / Parameter	Installed capacity
Unit	MW
Description	Installed capacity by different sources of CSPG in 2003, 2004, 2005
Source of data	"China Electric Power Yearbook" 2004 - 2006 Editions,
Value(s) applied	Detailed in Annex 3
Choice of data or Measurement methods and procedures	The choice of data satisfies the guidance in the methodology ACM0002 for the purpose of calculating BM. Data is from an official national source.
Purpose of data	Baseline Emission Calculation
Additional comment	See Annex 3 for detailed data. Low degree of data uncertainty.

Data / Parameter	Electricity generation of power plants in CSPG
Unit	MWh
Description	Electricity generation by province j in CSPG
Source of data	China Electric Power Yearbook, 2004 – 2006 Editions
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	Detailed electricity generation data at plant-level by source is considered confidential and is therefore not available. The China Electric Power Yearbook provides power generation data at provincial level for thermal, hydro, nuclear and 'other' power generation. The choice of data satisfies the guidance in the methodology ACM0002. Data is from an official national source.
Purpose of data	Baseline Emission Calculation
Additional comment	See Annex 3 for further details

Data / Parameter	Electricity imported from Central China Power Grid
Unit	MWh
Description	The electricity imported from Central China Power Grid
Source of data	Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th 2007 (http://cdm.ccchina.gov.cn)
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	Internal use rate of power plant
Unit	%
Description	The internal power consumption rate of power plants in province *j* in CSPG
Source of data	China Electric Power Yearbook, 2004 – 2006 Editions
Value(s) applied	See Annex 3 for details
Choice of data or Measurement methods and procedures	Data used are from Chinese authorities
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	λ_{Coal}, λ_{Oil}, λ_{Gas}
Unit	%
Description	The percentage of CO2 emitted for each source, coal, oil and gas, in the total emission at year 2005.
Source of data	"Chinese Energy Statistical Yearbook" 2006 edition,
Value(s) applied	λ_{Coal} is 89.48%, λ_{Oil} is 10.24% and λ_{Gas} is 0.28%
Choice of data or Measurement methods and procedures	The choice of data satisfies the guidance in the methodology ACM0002. Data is from an official national source. See section B.6.1. Step 2 for details.
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	$EF_{Coal, Adv}$ $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$
Unit	tCO_2/MWh
Description	Emission Factor of the best available commercial power plants for coal, oil and gas power plants.
Source of data	Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th 2007 (http://cdm.ccchina.gov.cn)
Value(s) applied	Derived from applying the values: Coal 343.33 gce/kWh, oil/gas 258 gce/kWh
Choice of data or Measurement methods and procedures	The choice of data satisfies the guidance in the methodology ACM0002 for the purpose of BM calculation. Data is from an official national source.
Purpose of data	Baseline Emission Calculation
Additional comment	See Table 7 for details. Low degree of data uncertainty.

B.6.3. Ex ante calculation of emission reductions

>>

The emission reductions for a given year are calculated as baseline emissions minus the project emissions and leakage:

$ER_y = BE_y – PE_y – L_y$

The baseline emissions in year *y* (BEy) are calculated as

$BEy = EF_{CM} * EG_y$

where: EGy is the electricity produced and sold by the project activity in year *y*, and EF_{CM} the combined margin baseline emission factor determined above.

According to the ACM0002 methodology, the project emissions (PE_y) as well as the leakage (L_y) are zero for hydro power projects, and therefore the emission reductions are equal to the baseline emissions:

$ER_y = BE_y = EF_{CM} \times EG_y = EF_{CM} \times EG_y = 0.8434\ tCO_2e/MWh \times 197{,}288MWh = 166{,}393\ tCO_2e$

The proposed hydro power plants will sell approx. 197.288 GWh of power to the grid. Annual baseline GHG emissions based on the above methodology and data sources are estimated at 166,393tCO_2/y

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2009	166,393	0	0	166,393
2010	166,393	0	0	166,393
2011	166,393	0	0	166,393
2012	166,393	0	0	166,393
2013	166,393	0	0	166,393
2014	166,393	0	0	166,393
2015	166,393	0	0	166,393
2016	166,393	0	0	166,393
2017	166,393	0	0	166,393
2018	166,393	0	0	166,393
Total	**1,663,930**	**0**	**0**	**1,663,930**
Total number of crediting years	**10**			
Annual average over the crediting period	166,393	0	0	166,393

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	EG_y
Unit	MWh
Description	Electricity quantity supplied to the grid by the project
Source of data	Reading of the electricity energy meters
Value(s) applied	197,288
Measurement methods and procedures	The electricity supplied to the grid will be hourly measured and monthly recorded. Data will be archived for 2 years following the end of the crediting period by means of electronic and paper backup.
Monitoring frequency	continuously
QA/QC procedures	Invoices of electricity sold to the grid operator will be used for double check (see Section 7.2 for details).
Purpose of data	Baseline Emission Calculation
Additional comment	-

Data / Parameter	Surface Area
Unit	m^2
Description	Surface area at full reservoir level
Source of data	Feasibility Study Report
Value(s) applied	27,926.8 m^2
Measurement methods and procedures	The area was monitored based on topographical data and the height of the dam.
Monitoring frequency	According to ACM0002, the data is needed to be monitored only one time before the operation.
QA/QC procedures	-
Purpose of data	Project Emission Calculation
Additional comment	The data measured by professional design institute is reliable and creditable.

B.7.2. Sampling plan

>>

Not applicable

B.7.3. Other elements of monitoring plan

>>

This section describes the monitoring organization, parameters and variables, monitoring practices, QA and QC procedures, data storage and archiving in order to ensure on-site monitoring of greenhouse gas (GHG) emission reductions accrued by the project activity. Its general objective is to provide credible, accurate, transparent and conservative monitoring data of the emission reductions, based on which the real, measurable and long term global environmental benefits relating to the GHG emission reduction emission reduction accrued by the proposed project activity can be verified and certified.

Data to be monitored

As detailed in the project design document under Section B.6.1, the Combined Margin emission factor is fixed ex-ante and need not be monitored. One of the monitoring parameters, the surface area of the reservoir, is needed to be monitored only one time before the operation according to ACM0002. Although the expected emission reductions in PDD are ex-ante estimated, the actual emission reductions achieved

by the proposed project activity will be calculated on ex-post basis and ultimately verified by DOE. Therefore, electricity supplied to the grid by the project activity (EG_y) will be key data to be monitored under this monitoring plan using calibrated electricity energy meters.

Monitoring Organization and training

The authority and responsibility for monitoring, reviewing, reporting and recording of data rests with the management or the Board of Directors of Lushui County Quande Hydroelectrical Power Development Ltd. who will designate a CDM manager in charge of the monitoring activities.

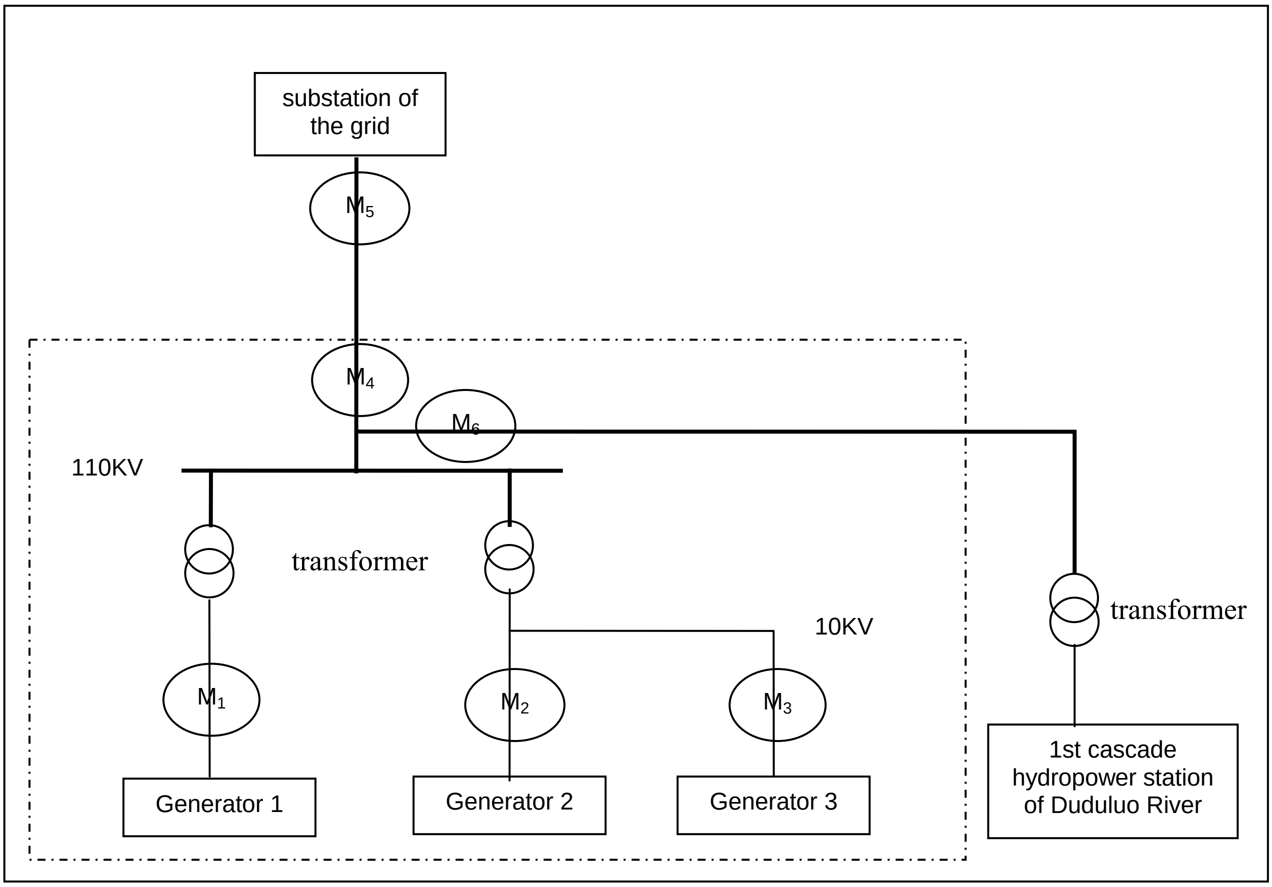
The CDM manager will collect, record and review the data collected with reference to the criteria determined in the Section B.7.1.He will be responsible to make sure that any person who contributes to collect, record and review the data collected with reference to the criteria determined in the Section B.7.1 are properly trained and provides written documents supporting his activity. To this end a written document describing the main tasks and procedures related to monitoring will be prepared under the responsibility of the Board of Directors of Lushui County Quande Hydroelectrical Power Development Ltd. The document will be based on the technical Annexes to the Power Purchase Agreement signed with the grid operator[33].

Monitoring activities

The electricity energy meters will be installed in accordance with *Technology & Management Regulations for Power Metering Devices* (DL/T448-2000). The net electricity delivered to CSPG by the proposed project will be determined through calculating the difference between electricity supplied to and drawn from the Grid, and all these data will be continuously monitored. The accuracy of meter used in measuring net electricity supplied to the grid (which is related to calculation of emission reduction) would not be lower than 0.5s and the meter will be bidirectional type.
As the 1st Cascade Hydropower Station of Duduluo River put into operation, it has to use the same transmission line as the project used to delivery the electricity to the grid, that is the electricity generated by the 1st Cascade Hydropower Station of Duduluo River is delivered to the output side of transformer of the project first, and then delivered to the substation of the grid via the common transmission line. See figure 4 below.

Figure 4 the installation of electricity energy meters

[33] The technical Annexes to the Power Purchase Agreement provides procedures for monitoring the energy fed to the grid, emergency preparedness, calibration of monitoring equipment, company's Operation and maintenance responsibilities etc.



Therefore, the electricity supplied by the project can be calculated as the difference between the electricity delivered to the substation via the common transmission line and the electricity input from the 1st Cascade Hydropower Station of Duduluo River. M4 is the electricity energy meter installed at the output side of the transformer of the project, M5 is the electricity energy meter installed at the substation side of common transmission line, and M6 is the electricity energy meter installed at the input point from the 1st Cascade Hydropower Station of Duduluo River to the project.

In addition, as one meter is added to measure the net electricity supplied by the project, it is necessary to consider the propagation of error of monitoring system. The accuracy of M5 and M6 is 0.5, after the propagation of error, the accuracy of M5-M6 is 0.71[34]. Therefore, the accuracy decrease of 0.21 should be separately deducted from the measuring result of EG_{out} and EG_{in} for the conservativeness.

$$EG_{out} = \left(EG_{out,M5} - EG_{out,M6}\right) \times (1 - 0.21\%) = \left(EG_{out,M5} - EG_{out,M6}\right) \times 0.9979$$

$$EG_{in} = \left(EG_{in,M5} - EG_{in,M6}\right) \times \left(1 + 0.21\%\right) = \left(EG_{in,M5} - EG_{in,M6}\right) \times 1.0021$$

$$EG_y = EG_{out} - EG_{in}$$

All the installed meters must be pasted with seal after installation or calibration. The seal is forbidden to rip by either party independently.

Quality Assurance and Quality Control

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be implemented as part of this CDM project activity according to EB rules and real practice in terms of

34 According the formula of propagation of error, $S_{M5-M6}^2 = S_{M5}^2 + S_{M6}^2$, $S_{M5-M6} = \sqrt{0.5^2 + 0.5^2} = 0.71$

the need for verification of the emission reductions on an annual basis according to this PDD. The measuring meters will be calibrated at least once in a year by an officially accredited entity in accordance with relevant national standards and sectoral regulations to ensure the accuracy. The measuring meters must be pasted with seal after calibration. And all the calibration records will be documented and archived by the project owner for DOE's verification. Hence, high quality is ensured for all the above parameters.

The value presented on sales invoices will be used as a cross check of the value measured by meters. For conservative principle, the lower value would be taken as EGy and would be used in the calculation of the project's emission reductions after the crosscheck.

In case of the malfunction of meters M5 or M6, the project owner will adopt a conservative way to measure the electricity supplied to the grid (EGy), such as the sales invoices. M4 is deemed as the backup meter of M5.

In addition, the management will introduce an internal audit system for the GHG compliance. The auditor so appointed will be given clear instructions about his scope of work and reporting requirements. He will carry out his work on a periodic basis. His report will indicate the compliance requirements and achievements. He will work directly under the control of the Board of Directors and all his reports will be addressed to the Board. The internal auditor will report to the management in particular on non-compliance of corrective actions, if any, by the operating staff.

Data storage and Archiving

All the data monitored under the monitoring plan will be kept in electronic and hard copy format for 2 years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later. The monitored data will be presented to the verification agency or DOE to whom verification of emission reductions is assigned.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
11/05/2007 (construction start date)

C.1.2. Expected operational lifetime of project activity

>>
30years 0 months

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Fixed crediting period

C.2.2. Start date of crediting period

>>
01/01/2009 or after the date of registration whatever is later

C.2.3. Length of crediting period

>>
10 years 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

According to China's environmental regulations, an Environmental Impact Assessment (EIA) Report of this project was conducted by the officially accredited Yunnan Institute of Environmental Science in May 2006 and approved by Yunnan Provincial Environmental Protection Bureau on September 18, 2006. The detailed assessment finds that, while delivering tangible environmental benefits, the project will also generate a few negative environmental impacts. The impacts are common to other infrastructural projects, concentrated during the construction period and confined within a limited geographical scope. The following potential environmental issues were identified during the impact assessment:

- Water and fisheries: Since the project is a run-of-river scheme, impact on fisheries is not predictable. There is no discharge of polluted water and the water quality will remain as in the pre-project period. Only during the construction phase - limited to 24 months - wastewater from contractor's residential uses, tunnel construction and sand and rock processing may silt the water body. The dam will reduce water flow and during the dry season there may be an impact of the aquatic life and surrounding flora down the dam. In order to minimize the impact and according to the Environmental Bureau indications, a minimum flow throughout the year (0.22 m^3/s) will be ensured.
- Flora and Fauna: No sensitive areas like national parks, wild life sanctuaries, biosphere reserve are affected by the project.
- Air quality: The project does not have any impact on air quality as the hydro plants do not have any emissions during its operation. The only impact may be envisaged during construction where dust emission will occur due to the procurement of construction material and due to the operation of heavy vehicles and movement of machinery/equipment.
- Noise: the hydro power plant does not have any adverse impact as little noise is emitted during operation. During construction noise is limited to the level associated to traffic, crushing plants and material handling.
- Submerged area: as it is a run-of-river project the submerged area is negligible.
- Soil erosion: during the construction period, it is necessary to conduct earth and rock excavation and collect soil, sand and gravel from a small quarry. Some temporary routes, residences and workshops will be built. These activities will disturb land surfaces and aquatic ecosystems. Some erosion is likely to occur.

D.2. Environmental impact assessment

>>

The environmental impacts are not considered significant as explained above and even minor impacts are being addressed by the project proponent by taking suitable steps as described in section D.1.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The project participants have conducted public meetings through a questionnaire-based survey to solicit comments, views, objections and suggestions from the public – including local residents - on the proposed project. The project participants have also approached other identified stakeholders for the approval of the project activity. The public meetings were advertised in the local language.

In particular, project participants have approached directly various institutions / organizations such as Lushui County Development and Reform Commission, Lushui County Environmental Protection Bureau, Yunnan Provincial Development and Reform Commission, Water Resources Department of Yunnan Province, Department of Land and Resources of Yunnan Province, Yunnan Provincial Environmental Protection Bureau and Forestry Department of Yunnan Province for obtaining necessary clearances and

approvals for setting up the project. All required clearances and approvals have been received for implementing the project as detailed in the table below:

Table 8 Governmental Permits and Approvals

Clearance	***Institution or Organization***
River Resources Plan of Dinquin Prefecture	Nujiang Prefecture Development and Reform Commission
River Resources Plan and Environmental Protection of Prefecture County	Nujiang Prefecture Environmental Protection Bureau
Approval of pre-feasibility study	Yunnan Provincial Development and Reform Commission
Initial Assessment feasibility study	Yunnan Provincial Development and Reform Commission
Water Resources Management	Water Resources Department of Yunnan Province
Water and Soil Conservation	Water Resources Department of Yunnan Province
Geological risk assessment	Department of Land and Resources of Yunnan Province
Underground resources assessment	Department of Land and Resources of Yunnan Province
Environnemental impact assessment	Yunnan Provincial Environnemental Protection Bureau
Land use	Department of Land and Resources of Yunnan Province
Forestry Land use	Forestry Department of Yunnan Province
Approval feasibility study	Yunnan Provincial Development and Reform Commission

The communities or individuals likely to be affected directly by the proposed CDM project activity and preparation actions are mainly inhabitants of Shuangkui Viliage of the Chenggan Town. To facilitate the conduction of questionnaire-based survey On Dec 12th 2005, On March 13 2006 a public notice – providing a description of the project and inviting the inhabitants of Shuangkui Viliage of Chenggan Town to a meeting was placed in various locations of the village. On March 14, 2006 a meeting, organized by the head of the village, was held followed by direct contacts. A two page questionnaire was designed to be easily filled in and structured in the following four sections: a) Awareness about the planned project, b) Level of awareness about the possible negative and positive impacts, c) Comments about the perceived negative impacts d) Comments about the possible mitigations measures. Questionnaires have been distributed according to the principle of both representation and randomness in order to reflect the public opinions and comments in a fair and real manner. 28 questionnaires were distributed and returned in the public consultation. They are all valid and reliable.

E.2. Summary of comments received

>>

Most of the stakeholders expressed support for the Project and there were no opposing comments on the project *per se* received in either the public meetings or via written documents. The local residents are welcoming the project due to various benefits such as development of infrastructure in the area, increase of employment opportunities due to implementation of the proposed project and improvement in their standards of living level. The outcomes of the consultations – as written comments about the project – and approvals received from other stakeholders are available for validation by the validator. A summary of comments received from stakeholders is furnished below:

The stakeholders' comments were collected through a questionnaire-based survey. Totally 28 distributed questionnaires were returned with 100% response rate. The main comments based on returned questionnaires are integrated and summarized below.

Table 9 Summary of Questionnaires

No	Question	Comments	Rate
1.	Are aware of the construction of the proposed project?	Yes	100%
		No	0
2.	Do you know that the characteristic of the hydropower project will have some positive and negative impact on the villages and residents?	Yes	100%
		No	0
3.	Do you think the proposed project would have some negative impacts?	Yes	0
		None	100%
4.	Do you think what countermeasures can mitigate potential hazards caused by the project activity if have?	Yes, there are some hazards. The countermeasures are:	0
		No hazards.	100%
5.	**What are your expected benefits from the proposed project? (multiple choices)**	**Creation of employment opportunity**	**3.5%**
		Local power supply	14.3%
		Increase in local residents' revenues	25.0%
		Improvement of living quality	17.9%
		Promoting local economic and environmental development	39.3%
6.	What is your general opinion on the proposed project?	Extremely good	0.06%
		Good	99.4%
		Average	0
		Bad	0
		Extremely bad	0
7.	Do you have any suggestion about the proposed project?	None	82.1%
		Accelerating project construction	17.9%
8.	Do you support the proposed project?	Support	100%
		Don't support	0

The survey shows that the local residents support the proposed project strongly. It is generally considered that the proposed project will generate diverse positive impacts on local people.

E.3. Report on consideration of comments received

>>

The project proponents have accepted the suggestions and views expressed during the public hearing process and will implement them for the benefit of the local stakeholders. The important suggestions made by the local stake holders which are being implemented as part of the project activity are summarized as follows:

- The farmers will be adequately compensated for the agricultural land requisition and for the property to be displaced;

- Creating short- and long-term employment opportunity in the local region in construction period and operation period respectively. Over 520 people are expected to be employed in construction period. More importantly, in operation period, over 50 skilled persons will be employed after the proposed project is put into operation, hence stimulating economic development to the village;

- The road to the in-take structure and the powerhouse sites will be built in a way that can serve the needs of the villagers. Currently there is no road that leads to the site and many scattered houses of the village are reachable only though narrow paths. During the planning phase for the construction of the service road, particular care will be taken in order to ensure an easier mobility to the inhabitants of those houses. Although very few can afford a transport vehicle, an easy access to the road will facilitate mobility in the future;

- Individuals and households affected by the project have and will continue to take part in the negotiating process for measuring the impacts on land and reaching compensation agreements. Land claim agreements have been signed with villagers on different occasions after fair negotiations.

In conclusion, the project owner has taken full consideration of the comments and suggestions given by stakeholders during the project implementation. Therefore, there is no need to modify the proposed project due to the comments received.

SECTION F. Approval and authorization

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Letter of Approval of China DNA

- - - - -

Appendix 1: Contact information of project participants

Organization name	Lushui County Quande Hydroelectrical Power Development Ltd.
Street/P.O. Box	Bayi Road, Liuku Town,
Building	-
City	Nujiang Lisu Ethnic Autonomous Prefecture
State/Region	Yunnan Province
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E-mail	quande@vip.163.com
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Salutation	Mr.
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Contact person	Thomas Stetter
Title	Member of the Board
Salutation	Mr.
Last name	Stetter
Middle name	-
First name	Thomas
Department	Director Board
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Direct fax	+41 44 298 2899
Direct tel.	+41 44 298 2805
Personal e-mail	thomas.stetter@firstclimate.com

Appendix 2: Affirmation regarding public funding

The project has not received any public funding

Appendix 3: Applicability of selected methodology

No further information

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

The following tables summarise the numerical results from the equations listed in the Baseline Methodology ACM0002 for grid-connected electricity generation from renewable sources. The information provided by the tables includes data, data sources and underlying computations.

1. Calculation of $EF_{OM,y}$

Table A1-A9 are the basic data for calculation the Operating Margin Emission Factor ($EF_{OM,y}$). Based on

these data and the calculation formula of $EF_{OM, simple,y}$, the Operating Margin Emission Factor ($EF_{OM,y}$) of the CSPG is equal to Emission of CO_2/Fuel-fired power generation = 1.0119tCO_2/MWh (See the table below).

	2003	2004	2005	Total	OM
CO2 emission(tCO_2)	198,755,406.83	274,226,111.94	369,521,985.75	842,503,504.52	**1.0119**
Total fossil power supply of CSPG (MWh)	208,736,899.80	258,317,469.10	365,532,530.70	832,586,899.60	

Data source: Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th 2007 (http://cdm.ccchina.gov.cn)

Note: Total fossil power supply of CSPG include both power imports from Central China Power Grid and electricity delivered to CSPG by power sources.

The Table A1-A9 is given as follows:

Table A1. Fossil Fuel-fired Power Generation of CSPG in 2003

Regions	Electricity Generation (MWh)	Internal Use Rate of Power Plants (%)	Electricity Delivered to CSPG by Power Sources (MWh)
Guangdong	143,351,000	5.5	135,466,695
Guangxi	17,079,000	8.43	15,639,240
Guizhou	43,295,000	7.4	40,091,170
Yunnan	19,055,000	8.01	17,528,695
		Total	**208,725,800**

Data source: 1) China Electric Power Yearbook 2004; 2) Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th, 2007 (http://cdm.ccchina.gov.cn)

Table A2. Power Import of CSPG in 2003

Power Import from CCPG (MWh)	11,100
Emission Factor of CO_2 (tCO_2/MWh)	0.797442
Total Emission of CO_2 in CCPG (tCO_2)	276,404,544
Total Power Supply of CCPG (MWh)	346,613,868

Data source: Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th, 2007 (http://cdm.ccchina.gov.cn)

Table A3. Calculation of the Operating Margin Emission Factor of CSPG in 2003

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	Emission Factors[35] tc/TJ	Oxidation Factor[36] %	Average Low Calorific Value MJ/t,km^3	Emission of CO_2 tCO_2e
Raw Coal	10^4t	4,491.79	831.84	2,169.11	1,405.27	**8,898.01**	25.8	100	20,908	175993455.05
Cleaned Coal	10^4t	0.05				**0.05**	25.8	100	26,344	1246.07
Other Washed Coal	10^4t			36.38	20.37	**56.75**	25.8	100	8,363	448971.84
Coke	10^4t				0.5	**0.5**	25.8	100	28,435	13449.76
Coke Oven Gas	10^8m^3				0.04	**0.04**	12.1	100	16,726	2968.31
Other Gas	10^8m^3	3.21			11.27	**14.48**	12.1	100	5,227	335797.81
Crude Oil	10^4t	6.85				**6.85**	20	100	41,816	210055.71
Gasoline	10^4t	0.02				**0.02**	18.9	100	43,070	596.95
Diesel Oil	10^4t	31.9			0.76	**32.66**	20.2	100	42,652	1031759.27
Fuel Oil	10^4t	627.22	0.3			**627.52**	21.1	100	41,816	20301304.48
PLG	10^4t					**0**	17.2	100	50,179	0.00
Refinery Gas	10^4t	2.85				**2.85**	18.2	100	46,055	87592.00
Nature Gas	10^8m^3					**0**	15.3	100	38,931	0.00
Other Petroleum Products	10^4t	11.35				**11.35**	20	100	38,369	319357.98
Other Coking Products	10^4t					**0**	25.8	100	28,435	0.00
Other Energy	10^4tce	93.21			22.35	**115.56**	0	100	0	0.00
									Subtotal	198,746,555.23

Data source: China Energy Statistical Yearbook 2004

[35] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[36] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Table A4. Fossil Fuel-fired Power Generation of CSPG in 2004

Regions	Electricity Generation (MWh)	Rate of Electricity Consumption (%)	Electricity Supply to Grid (MWh)
Guangdong	169,389,000	5.42	160,208,116
Guangxi	20,143,000	8.33	18,465,088
Guizhou	49,720,000	7.06	46,209,768
Yunnan	24,322,000	7.56	22,483,257
		Total	**247,366,229**

Data source: 1) China Electric Power Yearbook 2005; 2) Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th, 2007 (http://cdm.ccchina.gov.cn)

Table A5. Power Import of CSPG in 2004

Power Import from CCPG (MWh)	10,951,240
Emission Factor of CO_2 (tCO_2/MWh)	0.826448
Total Emission of CO_2 in CCPG (tCO_2)	345,671,697
Total Power Supply of CCPG (MWh)	418,261,666

Data source: Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th, 2007 (http://cdm.ccchina.gov.cn)

Table A6. Calculate the Operating Margin Emission Factor of CSPG in 2004

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	Emission Factors[37] tc/TJ	Oxidation Factor[38] %	Average Low Calorific Value MJ/t,km^3	Emission of CO_2 tCO_2e
Raw Coal	10^4t	6,017.7	1,305	2,643.9	1,751.28	**11,717.88**	25.8	100	20,908	231767573.55
Cleaned Coal	10^4t	0.21				**0.21**	25.8	100	26,344	5233.50
Other Washed Coal	10^4t					**0**	25.8	100	8,363	0.00
Coke	10^4t					**0**	25.8	100	28,435	0.00
Coke Oven Gas	10^8m^3					**0**	12.1	100	16,726	0.00
Other Gas	10^8m^3	2.58				**2.58**	12.1	100	5,227	59831.38
Crude Oil	10^4t	16.89				**16.89**	20	100	41,816	517932.98
Gasoline	10^4t					**0**	18.9	100	43,070	0.00
Diesel Oil	10^4t	48.88			1.83	**50.71**	20.2	100	42,652	1601975.28
Fuel Oil	10^4t	957.71				**957.71**	21.1	100	41,816	30983494.25
PLG	10^4t					**0**	17.2	100	50,179	0.00
Refinery Gas	10^4t	2.86				**2.86**	18.2	100	46,055	87899.34
Nature Gas	10^8m^3	0.48				**0.48**	15.3	100	38,931	104833.40
Other Petroleum Products	10^4t	1.66				**1.66**	20	100	38,369	46707.86
Other Coking Products	10^4t					**0**	25.8	100	28,435	0.00
Other Energy	10^4tce	79.42				**79.42**	0	100	0	0.00
									Subtotal	**265,175,481**

Data source: China Energy Statistical Yearbook 2005

[37] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[38] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Table A7. Fossil Fuel-fired Power Generation of CSPG in 2005

Regions	Electricity Generation (MWh)	Rate of Electricity Consumption (%)	Electricity Supply to Grid (MWh)
Guangdong	176,453,000	5.58	166,606,923
Guangxi	25,023,000	7.95	23,033,672
Guizhou	58,430,000	7.34	54,141,238
Yunnan	27,281,000	6.94	25,387,699
		Total	**269,169,531**

Data source: 1) China Electric Power Yearbook 2006; 2) Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th, 2007 (http://cdm.ccchina.gov.cn)

Table A8. Power Import of CSPG in 2005

Power Import from CCPG (MWh)	96,363,000
Emission Factor of CO_2 (tCO_2/MWh)	0.771225
Total Emission of CO_2 in CCPG (tCO_2)	359,887,488
Total Power Supply of CCPG (MWh)	466,644,030

Data source: Notification on Determining Baseline Emission Factor of China Power Grids published on the official web site of the Chinese DNA on August 9th, 2007 (http://cdm.ccchina.gov.cn)

Table A9. Calculate the Operating Margin Emission Factor of CSPG in 2005

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Total	Emission Factors[39] tc/TJ	Oxidation Factor[40] %	Average Low Calorific Value MJ/t,km^3	Emission of CO_2 tCO_2e
Raw Coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	20908	263442601.85
Cleaned Coal	10^4t				0.15	**0.15**	25.8	100	26344	3738.21
Other Washed Coal	10^4t			10.39	33.88	**44.27**	25.8	100	8363	350237.59
Coke	10^4t	4.79			8.05	**12.84**	25.8	100	28435	345389.71
Coke Oven Gas	10^8m^3				0.79	**0.79**	12.1	100	16726	58624.07
Other Gas	10^8m^3	1.87			15.96	**17.83**	12.1	100	5227	413485.84
Crude Oil	10^4t	10.91				**10.91**	20	100	41816	334555.88
Gasoline	10^4t	0.68				**0.68**	18.9	100	43070	20296.31
Diesel Oil	10^4t	31.96	2.02		1.81	**35.79**	20.2	100	42652	1130638.84
Fuel Oil	10^4t	887.21				**887.21**	21.1	100	41816	28702703.26
PLG	10^4t					**0**	17.2	100	50179	0.00
Refinery Gas	10^4t	4.92				**4.92**	18.2	100	46055	151211.46
Nature Gas	10^8m^3	0.93				**0.93**	15.3	100	38931	203114.71
Other Petroleum Products	10^4t	1.7				**1.7**	20	100	38369	47833.35
Other Coking Products	10^4t					**0**	25.8	100	28435	0.00
Other Energy	10^4tce	104.66	133.15		59.72	**297.53**	0	100	0	0.00
									Subtotal	**295204431.07**

Data source: China Energy Statistical Yearbook 2006

[39] 2006 IPCC Guidelines for National Greenhouse Gas Inventories
[40] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

2. Calculation of $EF_{BM,y}$

1) Calculation of $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$

According to the statistical analysis of newly-built fuel-fired power plants in the 10th Five-Year Plan (2000-2005) a by State Electricity Regulatory Commission of China, for the coal-fired power plant, the best technology commercially available in China was selected as 600MW. The fuel consumption is 343.33gce/kWh, while the corresponding efficiency of the power supply is 35.82%.

The best technology commercially available in the combined cycle power plant (including gas power plant and oil power plant) is selected as 200MW level, (equals to the technology of 9E unit from GE). According to the data in 2004, the fuel consumption of the combined cycle power plant with the actual most efficiency level of the best technology commercially available is 258gce/kWh, while the corresponding efficiency of the power supply is 47.67%.

The emission factors of coal-fired power, oil-fired power and gas-fired power respectively with the most efficiency level of the best technology commercially available was described in Table A10.

2) Calculation of λ_{Coal} , λ_{Oil} and λ_{Gas}

Based on the data described in Table A9, the emission of CO_2 caused by power plant of the CSPG is equal to 295,204,431t CO_2, which includes：

The emission of CO_2 caused by coal-fired power plant was equal to 264,141,967tCO_2 (See the table below);

2005		Fuel Consumption (Fi,j,y)					EFCO2,i	NCVi	OXIDi	tCO2
Type of fuel	Unit	Yunnan	Guizhou	Guangxi	Guandong	Total	tC/TJ	Tj/A		
	A					B	C	D	E	F=B*C*D*E*44/12
Raw Coal	10^4 Tonne	1975.55	3212.31	1435	6696.47	13319.33	25.8	209.08	1	263442601.9
Clean coal	10^4 Tonne	0.15				0.15	25.8	263.44	1	3738.2136
Other washed	10^4 Tonne	33.88	10.39			44.27	25.8	83.63	1	350237.5895
Coke	10^4 Tonne	8.05			4.79	12.84	25.8	284.35	1	345389.7084
Subtotal										264141967.4

The emission of CO_2 caused by oil-fired power plant was equal to 30,236,028t CO_2 (See the table below);

2005		Fuel Consumption (Fi,j,y)					EFCO2,i	NCVi	OXIDi	tCO2
Type of fuel	Unit	Yunnan	Guizhou	Guangxi	Guandong	Total	tC/TJ	Tj/A		
	A					B	C	D	E	F=B*C*D*E*44/12
Crude oil	10^4 Tonne				10.91	10.91	20	418.16	1	334555.8773
Gasoline	10^4 Tonne				0.68	0.68	18.9	430.7	1	20296.3068
Diesel	10^4 Tonne	1.81		2.02	31.96	35.79	20.2	426.52	1	1130638.836
Fuel oil	10^4 Tonne				887.21	887.21	21.1	418.16	1	28702703.26
Other petroleu	10^4 Tonne				1.7	1.7	20	383.69	1	47833.35333
Subtotal										**30236027.63**

And the emission of CO_2 caused by gas-fired power plant was equal to 826,436t CO_2 (See the table below).

2005		Fuel Consumption (Fi,j,y)					EFCO2,i	NCVi	OXIDi	tCO2
Type of fuel	Unit	Yunnan	Guizhou	Guangxi	Guandong	Total	tC/TJ	Tj/A		
	A					B	C	D	E	F=B*C*D*E*44/12
Coke Oven ga	10^8 m3	0.79				0.79	12.1	1672.6	1	58624.07247
Other gas	10^8 m3	15.96			1.87	17.83	12.1	522.7	1	413485.8424
LPG	10^4 Tonne					0	17.2	501.79	1	0
Refinery gas	10^4 Tonne				4.92	4.92	18.2	460.55	1	151211.4604
Natural gas	10^8 m3				0.93	0.93	15.3	3893.1	1	203114.7063
Subtotal										**826436.0815**

So the λ_{coal} = 264,141,967tCO_2 /295,204,431t CO_2= 0.8948, similarly λ_{oil} = 0.1024, λ_{gas}= 0.0028.

3) Calculation of $EF_{Thermal}$

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9117.$$

4) Calculation of $EF_{BM,y}$

The Change in total installed capacity and the fuel installed capacity of CSPG in 2003~2005 was described in Table A11~A14, according to the data; the BM of the CSPG is equal to 0.9117×0.7401＝0.6748tCO_2/MWh.

5) Calculation the baseline emission factor EF_y

The Combined Margin Emission Factor (EF_y) was calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), where the weights w_{OM} and w_{BM} are 50% (i.e., $w_{OM} = w_{BM} = 0.5$).

EF_y =0.5× ($EF_{OM,y}$ + $EF_{BM,y}$) =0.5× (1.0119+0.6748) =0.8434tCO_2e/MWh.

The Table A10-A14 is given as follows:

Table A10. The Emission Factor of Coal, oil, Gas-Fired Power Plant

	Variable	Efficiency of Power Supply A	Emission Factor of the Fuel(tc/TJ) B	Oxidation Factor C	Emission Factor (tCO_2/MWh) D=3.6/A/1000*B*C*44/12
Coal-fired power plant	$EF_{Coal,Adv}$	35.82%	25.80	1.00	0.9508
Gas-fired power plant	$EF_{Gas,Adv}$	47.67%	15.30	1.00	0.4237
Oil-fired power plant	$EF_{Oil,Adv}$	47.67%	21.10	1.00	0.5843

Table A11. The Installed Capacity of CSPG in 2005

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Fuel-fired power	MW	35,182.6	4,931.2	4,758.4	9,634.8	**54,507**
Hydropower	MW	9,035.7	6,085.3	7,993.1	7,233	**30,347.1**
Nucleus power	MW	3,780	0	0	0	**3,780**
Wind power	MW	83.4	0	0	0	**83.4**
Total	MW	**48,081.7**	**11,016.5**	**12,751.5**	**16,867.8**	**88,717.5**

Data source：China Electric Power Yearbook 2006

Table A12. The Installed Capacity of CSPG in 2004

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Total
Fuel-fired power	MW	30,172.9	4,378.1	4,306.9	7,801.8	**46,659.7**

Hydropower	MW	8,584.6	5,040.4	7,058.6	6,896.5	**27,580.1**
Nucleus power	MW	3,780	0	3,056	0	**3,780**
Wind power	MW	83.4	0	0	0	**83.4**
Total	MW	**42,621**	**9,418.5**	**11,365.5**	**14,698.3**	**78,103.3**

Data source：China Electric Power Yearbook 2005

Table A13. The Installed Capacity of CSPG in 2003

	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Fuel-fired power	MW	27,231.4	3,190.1	3,556.8	6,456.8	0	**40,444.1**
Hydropower	MW	8,107.2	4,525.2	6,543.2	3713.7	2,520	**25,409.3**
Nucleus power	MW	3,780	0	3,056	0	0	**3,780**
Wind power	MW	83.4	0	0	0	12	**83.4**
Total	MW	**39,202**	**7,715.3**	**10,100**	**10,179.5**	**2,520**	**69,716.8**

Data source：China Electric Power Yearbook 2004

Table A14. Change in Installed Capacity of CSPG in 2003-2005

Year	**2003** A	**2004** B	**2005** C	**Change in Installed Capacity from 2003 to 2005** D=C-A	**The Proportion of the Total Change Capacity**
Fuel-fired power(MW)	44,444.1	46,659.7	54,507	14,062.9	74.01%
Hydropower(MW)	25,409.3	27,580.1	30,347.1	4,937.8	25.99%
Nucleus power	3,780	3,780	3,780	0	0.00%
Other(MW)	83.4	83.4	83.4	0	0.00%
Total(MW)	**69,716.8**	**78,103.2**	**88,717.5**	**19,000.7**	100.00%

Appendix 5: Further background information on monitoring plan

No further information

Appendix 6: Summary of post registration changes

The revision of Monitoring Plan of PDD from version 5.0, dated 20/09/2009 to version 6.0, dated 22/08/2012, was conducted during the third verification. The reason of revision and the comparison before the changes and after changes are described below:

As the 1st Cascade Hydropower Station of Duduluo River put into operation, it has to use the same transmission line as the project used to delivery the electricity to the grid, that is the electricity generated by the 1st Cascade Hydropower Station of Duduluo River is delivered to the output side of transformer of the project first, and then delivered to the substation of the grid via the common transmission line. Therefore, only use the meter installed at the substation side of the common transmission line can not

measure the electricity supplied to the grid. Thus the Monitoring Plan of PDD version 5.0 has to be revised.

The monitoring activities before this revision are
Before, the 1st Cascade Hydropower Station of Duduluo River put into operation, the electricity supplied by the project can be measured by the meter installed at the substation side of common transmission line, i.e. $EG = EG_{M5}$, see Figure 5 below.

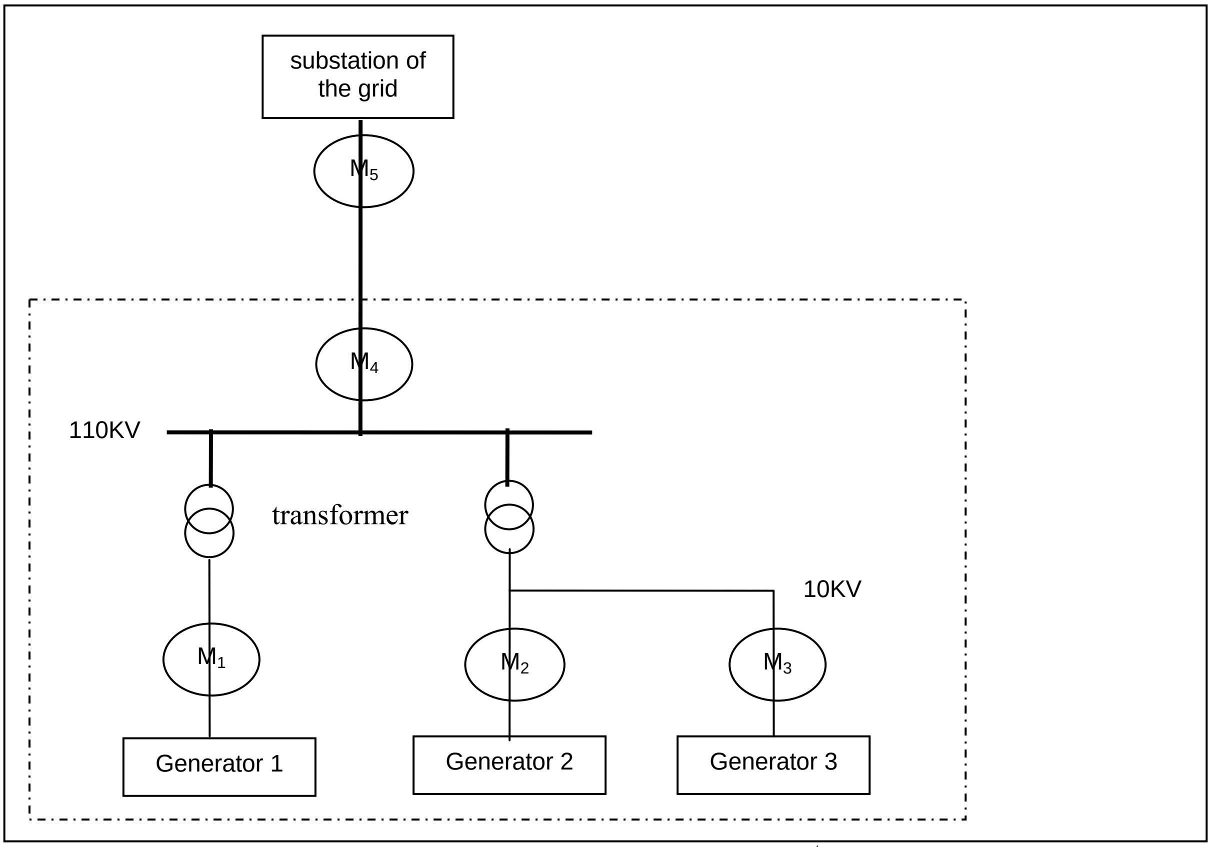

Figure 5 the installation of electricity energy meters before the 1st Cascade Hydropower Station of Duduluo River connected

The monitoring activities after this revision are:
After the 1st Cascade Hydropower Station of Duduluo River put into operation, the electricity supplied by the project can be calculated as the difference between the electricity delivered to the substation via the common transmission line (measured by M5) and the electricity input from the 1st Cascade Hydropower Station of Duduluo River (measured by M6), i.e. $EG = EG_{M5} - EG_{M6}$ see Figure 6 below.

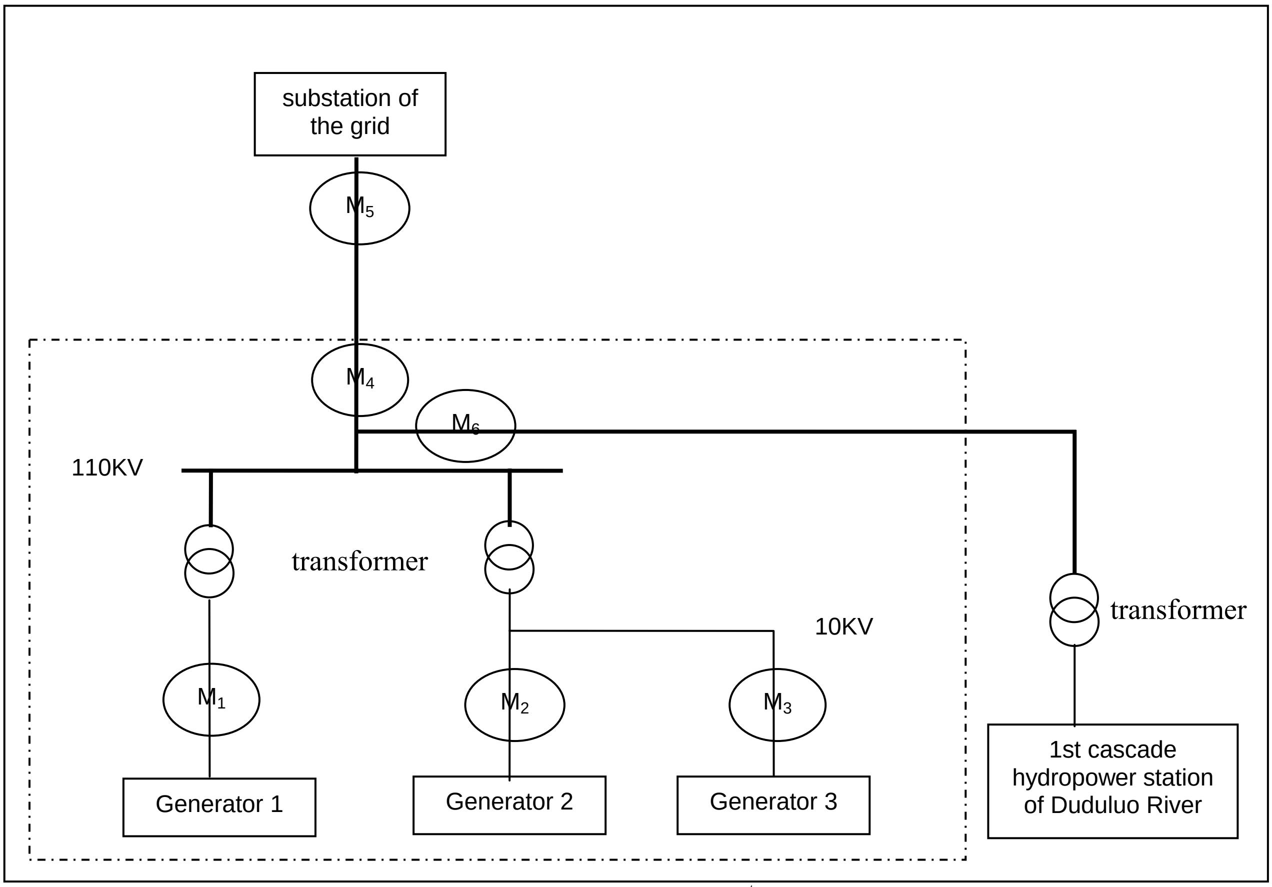

Figure 6 the installation of electricity energy meters after the 1st Cascade Hydropower Station of Duduluo River connected

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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.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		