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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Project Name: Jinping Ladeng River Hydropower Station
PDD Version: 3.1
Date: 23/07/2009

Version	Date	Comments
Version 1.0	23 August 2007	Complete version of the PDD, prepared for the host country approval process
Version 2.0	25 December 2007	Revised draft PDD; prepared for validation
Version 3.0	20 December 2008	Revised PDD after validation according to the draft validation report of DOE and new PDD guideline of Annex 12, EB41.
Version 3.1	23July 2009	Revised PDD based on the comments from DOE

A.2. Description of the project activity:

Summary:

Jinping Ladeng River Hydropower Station (hereafter referred as “the proposed project” or “the project”) involves the construction and operation of a diversion type hydropower station on Xinqiao River, Jinping Miao-Yao-Dai Autonomous County (hereafter referred as “Jinping County”), Honghe Hani-Yi Autonomous Prefecture (hereafter referred as “Honghe Prefecture”), Yunnan Province, China. It is constructed and operated by Yunnan Jinping Ladeng River Power Generation Co., Ltd. The total installed capacity of the project is 16MW and the project will construct two new small reservoirs, the total surface area of the reservoirs at full water level is 12,266.67m^2[1], thus the power density of the project is 1,304.35W/m^2. The estimated annual power generation will be 76,360MWh, and the annual power supplied to the grid will be 65,810.1MWh.[2]

The electricity generated by the project should have been supplied by the China Southern Power Grid prior to the implementation of the project activity, which is the same as the baseline scenario.

The project activity includes two dams, corresponding two water diversion systems and one powerhouse, and employs two units of CJA475-W-128/2×12.5 turbines matched with two units of SFW5000-10/2150 generators; two units of HLA575C-WJ-74 turbines matched with two units of SFW3000-6/1730 generators. The electricity generated by the project will be transmitted to the Yunnan Grid, and finally to the China Southern Power Grid.
The project will transmit renewable hydropower to the China Southern Power Grid, and substitute equivalent generation from fossil fuel fired power plant of the China Southern Power Grid (main emission CO_2), and then reduce Greenhouse Gas emissions amount to 55,501tCO_2e annually.

Contribution to sustainable development:

The project activity contributes significantly to the region’s sustainable development in the following ways:

[1]Evidence offered by Research & Design Institute of Sinohydro Engineering Bureau 14 presents the total submerged area of the project’s new reservoir is 18.4mu (1mu= 666.667m^2), among which, the submerged area of Ladeng reservoir is 15mu, and the submerged area of Ganwa reservoir is 3.4mu.

[2] Feasibility Study Report, Page 246 and FAR Page 5. The installed capacity is 16MW (5MW×2+3MW×2), the annual operation hour is 4,807h (PLF: 54.87%, which is calculated as 4,807h/8,760h) and 4,715h (PLF: 53.82%, which is calculated as 4,715h/8,760h) respectively, thus the power generation is 76,360MWh. The effective power rate is 0.90, with 0.25% of self-consumption rate and 4% of transmission line loss, thus the power supplied to the grid is: 76,360×0.90×(1-0.25%)×(1-4%)=65,810.1MWh.

- In recent years, China has witnessed a huge increase in power consumption. Both public and private parties are struggling to meet the demand for electricity.
The proposed hydropower project will contribute in a sustainable manner to bridging the gap between supply and demand of power on a regional and national level.
- In Southern China, 71.57% of total electricity production is derived from fossil fuel based power plants [3] of total electricity production is derived from fossil fuel based power plants. This project carries environmental benefits for the country's air, soil and water sources. The project activity will displace the generation of fossil fuel power plants, reducing CO_2, SO_x and NO_x emissions significantly, thus mitigating the air pollution and its adverse impacts on human health.
- The project activity promotes the growth of sustainable and renewable capacity in China and makes it less dependent on exhaustible and polluting fossil fuels.
- The project will definitely contribute to the province's economic development by improving the local energy generation infrastructure and providing employment opportunities during both the construction and the operation of the power plant.
- The proposed project is grid-connected electricity generation from renewable sources, which will be supplied to the China Southern Power Grid and will replace electricity generated by thermal power plants, which are predominant in the China Southern Power Grid. This will reduce anthropogenic emissions of greenhouse gases.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant（Yes/No）
People's Republic of China (host)	Yunnan Jinping Ladeng River Power Generation Co., Ltd. (as the project owner)	No
Italy	Edison Spa (as the CERs buyer)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

More detailed contact information on project participants are given in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party (ies):

People's Republic of China

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

[3] *China Electric Power Yearbook 2007, page 649.* In the year book, total power generated by the Southern China Grid in 2006 was 48,322,500 MWh, of which, 34,584,400MWh was generated by thermal power plants, which accounts for 71.57% of the total power generated by Southern China Grid in 2006.

Yunnan Province

A.4.1.3. City/Town/Community etc:

Ma'andi Town, Jinping County, Honghe Prefecture.

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

The project is located in Bozhuchong Nature Village, Ma'andi Town, Jinping County, Honghe Prefecture, Yunnan Province, China. The project consists of two dams, namely Ladeng Dam and Ganwa Dam respectively.

- The Ladeng Dam is located 100m downstream of the confluence of the Ladeng River and the Mawei River, and the central geographical coordinate is at longitude of 103º29′43″E and latitude of 22º48′10″N.
- The Ganwa Dam is located 80m downstream of the confluence of the Gan River and the Wayao River, and the central geographical coordinate is at longitude of 103º29′08″E and latitude of 22º49′10″N.
- The power plant is located on the left bank of the Xinqiao River, and the central geographical coordinate is at longitude of 103º29′43″E and latitude of 22º49′30″N.

The map indicating the location of the project site is provided in Fig A.1:

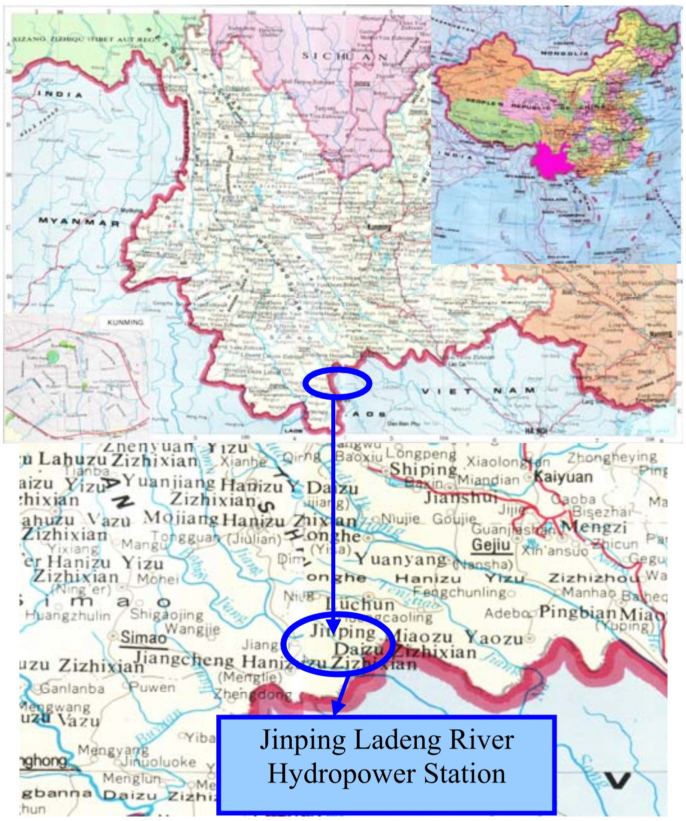

Fig A.1 the Location of Jinping Ladeng River Hydropower Station

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

The project activity falls under the category described under CDM as "Sectoral Scope Number 1: Energy Industries – Renewable Sources".

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

The scenario existing prior to the start of the implementation of the project activity (the same as baseline scenario):

The electricity should have been supplied by the China Southern Power Grid, prior to the start of the implementation of the project activity, which is the same as the baseline scenario. The China Southern Power Grid is dominated by electricity generated by fossil fuel fired plants, whose by-products are GHGs (main emission CO_2).

The project scenario:

The scope of activities [4] that are being implemented with the project activity is shown in Table A.1 and Table A.2.

Table A.1 Indicators sheet of the project (Ladeng Dam) with different installed capacity

Indicator	Unit	Options of Installed capacity		
Installed capacity	MW	8	9	10
Confirmed output	kW	2,231	2,231	2,231
Annual utilization hours (load factors)	Hours	5,348	5,062	4,807
Average annual power generation	10,000kWh	4,278	4,556	4,807
Confirmed flow rate	m^3/s	0.76	0.76	0.76
Utilized flow rate	m^3/s	2.7	3.1	3.4

Table A.2 Indicators sheet of the project (Ganwa Dam) with different installed capacity

Indicator	Unit	Options of Installed capacity		
Installed capacity	MW	6	7	9
Confirmed output	kW	1,214	1,214	1,214
Annual utilization hours (load factors)	Hours	4,715	4,343	4,021
Average annual power generation	10,000kWh	2,829	3,040	3,217
Confirmed flow rate	m^3/s	1.32	1.32	1.32
Utilized flow rate	m^3/s	6.5	7.6	8.7

In order to utilize the water resource sufficiently in rainy season, the installed capacity of 10MW and 6MW were chosen respectively.

The total installed capacity of the project is 16MW. The main structures of the project involve two dams, two water diversion systems and one powerhouse. The project employs four units of turbines and generators (5MW×2+3MW×2), all of which are installed in one power house. Two units of turbines and generators with each unit of 5MW utilize water from Ladeng dam, and the other two units of turbines and generators with each unit of 3MW utilize water from Ganwa dam.

[4] Indicator sheet refers to Page 91~92 in Feasibility Study Report (FSR) compiled by Research & Design Institute of Sinohydro Engineering Bureau 14 on Nov 2005.

The height of Ladeng Dam is 8.31m with the reservoir surface area of 10,000m^2 at full water level and the length of corresponding diversion tunnel is 1,416.32m; the height of Ganwa Dam is 4.10m with the reservoir surface area of 2,266.67m^2 at full water level and the length of corresponding diversion tunnel is 1,019.86m. The total surface area of the reservoirs at full water level is 12,266.67m^2, and the power density of the project is 1,304.35W/m^2.

The project is a diversion type hydropower station. It will use two units of CJA475-W-128/2×12.5 turbines matched with two units of SFW5000-10/2150 generators; two units of HLA575C-WJ-74 turbines matched with two units of SFW3000-6/1730 generators. The key technical parameters are shown in TableA.3:

Table A.3 Technical data of the turbine / generator units

The Main Technical Data		Value	
Turbines	Units	2	2
	Type	CJA475-W-128/2×12.5	HLA575C-WJ-74
	Manufacturer	Yunnan Yuxi Hydro Power Generation Equipment Co., Ltd.	Deyang Dongneng Electromechanical Equipment Engineering Co., Ltd.
	Rated Water Head	355.6m	115.4m
	Rated Rotational Speed	600r/min	1,000r/min
	Rated Efficiency	89%	95%
	Manufacture date	Jan. 2007	Jan. 2007
	Life time	25years	25years
Generators	Units	2	2
	Type	SFW5000-10/2150	SFW3000-6/1730
	Manufacturer	Yunnan Yuxi Hydro Power Generation Equipment Co., Ltd.	Deyang Dongneng Electromechanical Equipment Engineering Co., Ltd.
	Rated Power	5MW	3MW
	Rated Voltage	6.3kV	6.3kV
	Rated Current	573A	343.66A
	Rated Rotational Speed	600r/min	1,000r/min
	Rated efficiency	97%	95%
	Manufacture date	Jan. 2007	Jan. 2007
	Life time	25years	25years
Main Transformer	Designation	SF9-12500/110GY	SF9-8000/110
	Capacity	12,500kVA	8,000kVA

Note: the lifetime of the equipments is not shown in manufacturer's specifications and industry standards, so the estimated lifetime of the project is 25 years referring to the Feasibility Study Report.

There are 6 hydropower stations on Xinqiao river basin [5], and they are from upstream to downstream Wayao River, Sitaishan, Ladeng River (the project), Maguo River, Maocaoping and Maocaoping Weishui hydropower station. These stations are connected to each other, and there is one transmission line between each two stations.

The electricity produced by the proposed project together with the electricity generated by upstream Sitaishan hydropower station, were transmitted firstly to Maguo River Hydropower Station, then to

[5] The 6 hydropower stations are owned by different enterprises.

Maocaoping Hydropower Station, then to Xinqiao Transformer Substation, from there the electricity will be connected into the China Southern Power Grid. The project will employ a total of eight electric meters to finally monitor net electricity supply by the project. (See details in Section B.7.2).

With relevant to CDM monitoring, a monitoring officer will receive training on monitoring methodologies, procedures and archiving by Beijing Tianqing Power International CDM Consulting Co., Ltd. (hereinafter referred to as "Tianqing Power"). Then, the monitoring officer will train the project staff in charge for CDM monitoring.

The project will have a limited impact on the local environment as most of the impacts are temporary and the project will employ measures to minimize the impacts. More detailed information regarding the impact on the environment is provided in Section D.1 of this PDD.

There is no technology transfer due to all the technology employed is domestic.

The time schedule of project implementation is shown in Table B.2 in Section B.5.

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

The project activity uses the renewable crediting period (7 years×3), and the estimation of the emission reductions during the first crediting period (from October 2009 to September 2016) are presented in Table A.4. Estimated Emission Reductions throughout the first crediting period are 388,507tCO_2e.

Table A.4 the Estimation of the Emission Reductions in the Crediting Period

Years	Annual estimation of emission reductions in tCO_2e
01/10/2009-30/09/2010	55,501
01/10/2010-30/09/2011	55,501
01/10/2011-30/09/2012	55,501
01/10/2012-30/09/2013	55,501
01/10/2013-30/09/2014	55,501
01/10/2014-30/09/2015	55,501
01/10/2015-30/09/2016	55,501
Total estimated reductions (tCO_2e)	388,507
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tCO_2e)	55,501

A.4.5. Public funding of the project activity:

There is no public funding from Annex I parties available to the project.

SECTION B. Application of a baseline and monitoring methodology:

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

Baseline and monitoring methodology:
Approved consolidated baseline and monitoring methodology ACM0002 (Version 07): "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

The methodology draws upon the "Tool for the demonstration and assessment of additionality" (Version 5.2, approved at EB39), and the "Tool to calculate the emission factor for an electricity system" (Version 1.1, approved at EB35).
The methodologies and tools can be found from:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

This project satisfies ACM0002 methodology applicable conditions, that is:

1. The proposed project is a grid-connected renewable power generation project;
2. The proposed project electricity capacity addition is from new hydropower station, the project will build two new reservoirs with the total surface area of 12,266.67m^2 at the full water level, therefore the power density of the project is 1,304.35W/m^2, greater than 4W/m^2;
3. The geographic and system boundaries for the China Southern Power Grid can be clearly identified, and the information on the characteristics of the grid is available;
4. The proposed project activity does not involve fuel switching from fossil fuels.

Therefore, the baseline methodology is applicable to this project activity.

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

According to the definition of project boundary by ACM0002 (Ver. 07), the spatial extent of the project boundary includes the project power plant and all power plants connected to the electricity system that the project is connected to.

The electricity system is defined according to "Tool to calculate the emission factor for an electricity system" Version 1.1.

The power generated by the project is connected to the China Southern Power Grid via the local grid network. The China Southern Power Grid is a regional grid, which consists of four sub-grids: the Yunnan, Guangdong, Guangxi and Guizhou Grids[6]. As there is net import power from the Central China Power Grid (hereafter referred to as CCPG), the Central China Power Grid will be included into project boundary. According to the guidance above, it is justifiable to clarify the project site and the China Southern Power Grid and the Central China Power Grid as the right project boundary for this specific project activity.

Fig B.1 presents a flow diagram of the project boundary.

[6] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

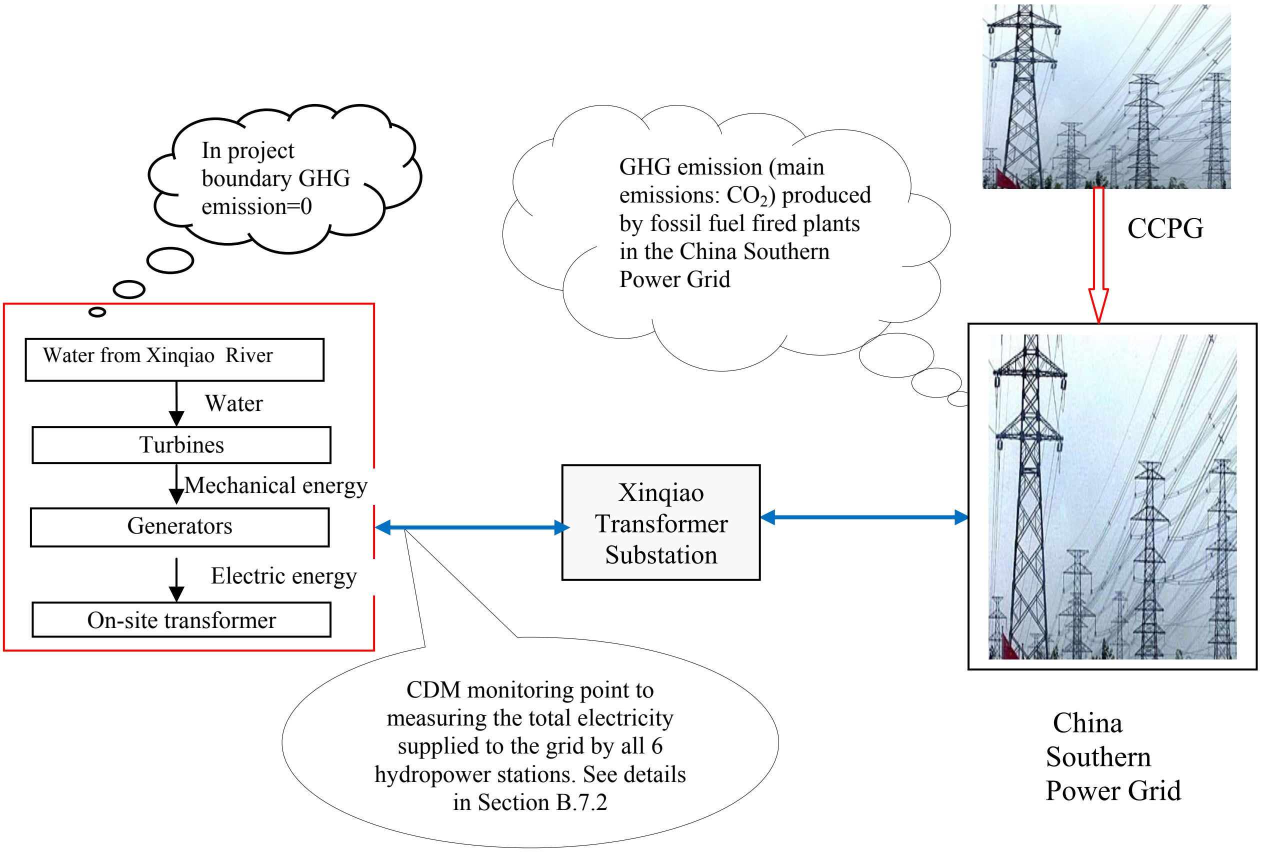

Fig B.1 the Flow Diagram of the Project Boundary

Table B.1 Emissions sources included in or excluded from the Project Boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source, not included for conservative purpose.
		N_2O	No	Minor emission source, not included for conservative purpose.
Project Activity	Emissions of CH_4 from the reservoir of the Project	CO_2	No	Minor emission source, according to ACM0002, CO_2 is excluded for simplification.
		CH_4	No	The power density of the project is 1,304.35W/m^2, which is greater than 10W/m^2, so according to methodology ACM0002, it is excluded for simplification.
		N_2O	No	Minor emission source, according to ACM0002, N_2O is excluded for simplification.

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

The baseline scenario of the proposed project activity is the continued operation of the existing power plants and the addition of new generation sources on the China Southern Power Grid to meet electricity demand. The project does not involve leakages and will not take project emissions into account as further explained in section B.6. Thus, the emission reductions are equal to the baseline emissions.

In accordance with the ACM0002 methodology, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. The baseline emission factor is equal to the combined margin: a weighted average of the operating margin emission factor and the build margin emission factor.

The basic parameters used for calculating baseline emissions of the proposed project are provided in table B.2:

Table B.2 Basic parameters used for calculating baseline emissions

Parameters	Value	Data sources
the operating margin emission factor ($EF_{grid,OM,y}$) of the China Southern Power Grid （tCO_2e/MWh）	1.0119	China DNA: Bulletin on Baseline Emission Factor of China Grid[7]
the build margin emission factor($EF_{grid,BM,y}$) of the China Southern Power Grid （tCO_2e/MWh）	0.6748	China DNA: Bulletin on Baseline Emission Factor of China Grid
Electricity supplied to grid （EG_y, MWh）	65,810.1	Feasibility Study Report

About calculation for baseline emissions and basic parameters used for calculating baseline emissions are provided in section B.6.

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

Below we provide a summarized implementation schedule of the project, illustrating the main events leading up to the start of operation. The starting date of the project activity was on March 14th, 2006. Before that, the project owner was very knowledgeable about the possibilities offered by CDM. An overview of key events is given in Table B.3.

Table B.3 Overview of key events in the development of the project

Date	Key Event
November, 2005	Feasibility Study Report (FSR) of the project was written by Research & Design Institute of Sinohydro Engineering Bureau 14
January, 2006	Financial Analysis Report (FAR) of the project was written by Research & Design Institute of Sinohydro Engineering Bureau 14
January 20, 2006	Directorate meeting decided to apply for CDM

[7] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=2193

February, 2006	EIA was compiled by Honghe Environmental Science Research Institute
February 15, 2006	Local government supported the project to apply for CDM
March 6, 2006	The EIA has been approved by Honghe Environment Protection Bureau
March 11, 2006	The project owner signed the CDM cooperation contract with Tianqing Power
March 14, 2006	The project owner signed construction contract (the earliest starting date of the project activity)
April, 2006	Tianqing Power introduced the project to ENEL
April 8, 2006	Approval of Starting Construction
April 17, 2006	Notification for delayed the construction project of Ladenghe Hydropower station
May 18, 2006	The FSR was approved by Local Development and Reform Commission
May 19, 2006	The project started to construction
June 15, 2006	The project owner signed Generator Units Purchasing Contract
July 14, 2006	The FAR has been approved by Local Development and Reform Commission
August, 2006	ENEL refused to sign LoI for the project, but promised to introduce other buyers for the project
August 22, 2006	Loan Contract was signed
October 23, 2006	Tianqing Power trained the staff of the project about CDM
December, 2006	ENEL introduced Tianqing Power to Edison
January 28, 2007	Land Compensation Agreement was signed
April 4, 2007	Tianqing Power recommended the project to Edison and signed the Agreement on development cooperation in respect of CDM projects
July 27, 2007	Stakeholder consulting meeting was held
October 25, 2007	The project owner signed the Letter of Intent (LoI) with the buyer
November 5, 2007	The project started operation (start-up)
January 3, 2008	The project was approved as a CDM project by Chinese DNA
February 28, 2008	The date of publication of the CDM-PDD for global stakeholder process (GSP) by the DOE

In November 2005, FSR of the project was written by Research & Design Institute of Sinohydro Engineering Bureau 14. In December 2005, the Honghe Prefecture Development and Plan Committee organized an expert team to assess the FSR. In the Assessment Opinion of FSR, the experts suggested reassessing the project budget and revising the financial analysis of FSR due to the huge diversion project, complex geological condition, and so on. According to these factors, the project owner entrusted the same institute to remake the investment budget and the financial analysis, [8] which is FAR. The FAR (Local Development and Reform Commission has approved FAR on July 14, 2006.) was completed in January 2006, it has a low IRR (7.87%). As per the CDM information and low IRR, the project owner held the directorate meeting immediately on January 20, 2006 and finally decided to apply for CDM to solve the economic and financial barriers. Almost at the same time, the project owner required local government to support the project apply for CDM, and local government gave the project owner the response in the following month that they supported the project to apply for CDM. Soon, the project owner consigned Tianqing Power to assist the CDM applying work on March 11, 2006. Only after all these were finished,

[8] FSR assessment opinion in December 2005 indicated that the project budgets need to be revised, the annual operation cost was not reasonable and need to be revised, and sensitivity analyse should be carried out regarding power generation, power price and total investment.

the project owner signed the construction contract on March 14, 2006, which is the earliest starting date of the project. Therefore, it can be concluded that the project owner was in an early stage aware about the potential of CDM to support its activities. CDM has been considered seriously in the decision to implement the project activity.

Then the project owner started supplying the relevant documents to Tianqing Power after the FAR was approved on July 14, 2006. During this period, Tianqing Power was positively looking for a buyer for the project. In April 2006, Tianqing Power recommended the project to ENEL, ENEL refused to sign the LoI for the project because ENEL had no further plan to cooperate on hydropower stations with Tianqing Power. But considering the project was a high quality CDM project, ENEL promised to introduce international buyers for the project in August 2006. Meanwhile, Tianqing Power was looking for other buyers and training the staff of the project about CDM. By October 2006, ENEL recommended Tianqing Power to Edison Spa (Edison). After two months, contact people from Edison and Tiangqing Power started negotiating Cooperation Framework Agreement, and the information of the project was offered to Edison. After few months' negotiation on Cooperation Framework Agreement, it was signed by Tianqing Power and Edison on April 4, 2007. After reviewing the draft PDD and 3-month document due diligence (started from July 2007), Edison organized a site-visit (project Due Diligence) from October 23 to 26, 2007, and signed Letter of Intent with the project owner on October 25, 2007. At the same time, the project was submitted to Chinese DNA in August 2007 and approved as a CDM project on October 16, 2007 (See the website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1538.pdf), and then Chinese LoA (paper-pattern) was acquired in January, 2008. Afterwards, the project was submitted for GSP in February 2008. From then on, the process of CDM application was going on smoothly.

Therefore, CDM was seriously considered and played a key role at the time the project owner decided to go ahead the project. And real and continues actions were taken to secure CDM status for the project activity in parallel with its implementation.

The additionality of the project activity is demonstrated using *the Tool for the Demonstration and Assessment of Additionality (version 5.2)* as developed by the EB.

Step 1: Identification of Alternatives to the Project Activity Consistent with Current Laws and Regulations

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

This methodological step requires a number of sub-steps, the first of which is the identification of realistic and credible alternatives to the project activity. There are only a few alternatives that are available and credible in the China Southern Power Grid:

1. The proposed project activity undertaken without being registered as a CDM project activity;
2. Thermal power plant with equivalent annual power generation;
3. Other renewable energy power plant with equivalent annual power generation;
4. The equivalent annual power is supplied by the China Southern Power Grid.

These are credible and realistic alternatives and these alternatives are in accordance with the description of the methodology (the additionality tool requires that the proposed project activity be included as an alternative, without the benefit from CDM).

There is neither potential for wave or tidal energy nor for geothermal energy in the project area. No biomass based power plant with a similar scale to the project has previously been built in the region. In

addition biomass power plants face some barriers, such as high investment [9], lacking of operating experience and low benefit [10], are necessary to apply for CDM for retaining normal operation. The region where the project is located is poor in terms of wind resources with very low wind energy potential [11]. Other renewable energy alternatives, such as solar energy, is considered to be too cost intensive [5] for generating the equivalent annual output. Thus there are no favorable conditions for the construction of power plants based on other renewable sources. Therefore the alternative 3 is not feasible.

Sub-Step 1b. Consistency with Mandatory Laws and Regulations

There are large differences between thermal power and hydropower in annual operating hours and the stability of operation, if taking the capacity that can generate the equivalent annual electricity generation with the proposed project, the alternative scenario for the proposed project should be a grid-connected fossil fuel fired power plant with installed capacity less than 16MW. However, according to Chinese regulations, thermal power plants of less than 135MW are prohibited for construction [12]. Therefore, the second scenario doesn't accord with Chinese relevant laws and regulations, it isn't a feasible scenario.

The first, third and fourth alternatives are in compliance with Chinese relevant laws and regulations.

From above analysis, the proposed project activity is not the only alternative consistent with Chinese current laws and regulations, so it satisfies the pre-requisite for additionality.

<u>Step 2 Investment Analysis</u>

Sub-step 2a. Determine appropriate analysis method

The analysis will be done through Option III of the additionality tool, i.e. Benchmark analysis. This method is applicable because:

- Option I: Simple cost analysis, does not apply as, the project will receive revenues not only from the sale of emission reductions (CDM) but also from the sales of electricity.
- Option II: Investment comparison analysis is not appropriate as, the only realistic alternative to the project not being implemented as a CDM project activity involves the delivery of power by the grid, which is not a specific investment project.
- Option III, benchmark analysis is appropriate. This method has also been used in other PDDs of grid connected renewable energy projects in China.

<u>Conclusion</u>: We conclude that only option III is appropriate for the analysis of the additionality of the project activity.

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

The project compares the project IRR against the 10% benchmark (project IRR post-tax) as per the "The Economic Evaluation Code for Small Hydropower Projects (SL16-95)", which is applicable to hydropower stations with an installed capacity below 50MW. This document is part of the "Professional

[9]http://ac.agri.gov.cn/ac/ViewContent.do?id=4affaa20110219f101116d279548047d&year=2007&month=3&right=!ENCODEtkc1vlOItllg1Oe
[10] http://www.86ne.com/Biomass/200712/Biomass_103227.html
[11] http://www.newenergy.org.cn/html/0062/2006217_7650.html
[12]Notice on Strictly Prohibiting the Installation of Fuel fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Decree No. [2002]6.
http://www.zjjmw.gov.cn/zcfg/gjfg/2002/10/10/9318.shtml

Standards of the People's Republic of China [13]" and was approved and published by the Ministry of Water Resources of the People's Republic of China in 1995.
Since then, no new documents prescribing benchmarks for hydropower with an installed capacity below 50MW have been released by the Government of China, nor has the validity of this benchmark been repudiated in any way. In fact, its applicability was confirmed by the Ministry of Water Resources of the People's Republic of China in 2002 in the "Bulletin of Valid Hydropower Technical Standards No 07 (2002)".[14] Additionally, this benchmark is still in effect in 2008.[15] The 10% benchmark is still ubiquitously applied by stakeholders of hydropower projects with an installed capacity less than 50MW (e.g. design institutes, investors, governments in charge of approving projects) to evaluate the feasibility of these projects. In addition, China DNA's approval of CDM project activities with an IRR below this benchmark indicates it is still valid.

The installed capacity of the project is 16MW, therefore, the benchmark of 10% in the document SL16-95 as mentioned above is applicable to the project.

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):

The basic parameters for calculation key financial indexes are provided in Table B.4:

Table B.4 the Basic Financial Parameter of the Project[16]

Parameter	Data	Source
Installed Capacity	16MW	Financial Analysis Report
Annual Power Supplied to Grid	65,810.1MWh[17]	
Static Total Investment	85,020,300 Yuan RMB	
Power Price (with VAT)	0.18 Yuan RMB/kWh	
VAT	6%	
Urban Construction and Maintenance Tax	1%	
Addition Tax of Education	3%	
Corporate Income Tax	15%	
Operation Period	25years	
Annual Operation Cost	2,550,100 Yuan RMB	

The post-tax project IRR of the proposed project is provided in Table B.5.

[13]http://www.cws.net.cn/guifan/bz/SL16-95/

[14]http://jsgl.mwr.gov.cn/index/detail_xx.aspx?DocID=176

[15]Searching System for Water Conservancy and Hydropower Technique Standard is updated first time in 2008.

[16] According to the No [1995]186 documents published by Water Resource Bureau of P.R.China, the IRR should be calculated based on fixed price.

[17] Feasibility Study Report, Page 246 and FAR Page 5. The installed capacity is 16MW (5MW×2+3MW×2), the annual operation hour is 4,807h and 4,715h respectively, thus the power generation is 76,360MWh. the effective power rate is 0.90(sourced from SL16-95, for grid connected run of river hydropower station, the coefficient of effective electricity generation is 0.70-0.90), with 0.25% of self-consumption rate (sourced from SL22-92, the average auxiliary power consumption is 0.5%) and 4% of transmission line loss (sourced from China Electric Power Yearbook 2006, the average line loss of Yunnan Province is 6.28%), the self-consumption rate of 0.25% and the line loss of 4% are conservative.thus the power supplied to the grid is: 76,360×0.90×(1-0.25%)×(1-4%)=65,810.1MWh.

Table B.5 Post-tax project IRR of the proposed project

	Post-tax Project IRR
Without CDM revenue	7.87%
With CDM revenue	10.41%

According to the calculation, the post-tax project IRR is 7.87% without CDM revenue which is lower than the benchmark rate of 10%. Based on the benchmark revenue rate in the financial evaluation of the Chinese *Economic evaluation code for small hydropower projects*, the project IRR of a hydropower project's total investment should not be lower than the threshold of 10%. So the project faces obvious financial barriers without CDM revenue. But the post-tax project IRR will achieve 10.41% with CDM revenue (expected CERs price is €6.00/tCO_2e [18], €1=10Yuan RMB), which is higher than 10%. Therefore, the CDM revenue can improve the economical attraction of the project.

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

The sensitivity analysis is conducted to check whether, under reasonable variations in the critical assumptions, the results of the analysis remain unaltered. Following parameters are assumed to be critical assumptions:

1. Annual power generation
2. Power price
3. Static total investment
4. Annual operation cost

Variations of ±10%[19] have been considered in the critical assumptions. Table B.6 summarizes the results of the sensitivity analysis, while Figure B.2 provides a graphic depiction.

Table B.6 Impact of Variations in Critical Assumptions on Post-tax Project IRR

	-10%	-5%	0%	5%	10%
Annual power generation	6.53%	7.21%	7.87%	8.52%	9.15%
Power price	6.49%	7.19%	7.87%	8.54%	9.19%
Static Total Investment	9.08%	8.45%	7.87%	7.33%	6.83%
Annual Operation Cost	8.22%	8.04%	7.87%	7.69%	7.52%

[18] The project owner got the CER price of €6.00/tCO_2e from: http://www.pointcarbon.com/polopoly_fs/1.265567!240106.pdf

[19] Variation of ±10% is taken from Financial Analysis Report, and it is also consistent with the custom usage of financial analysis in China.

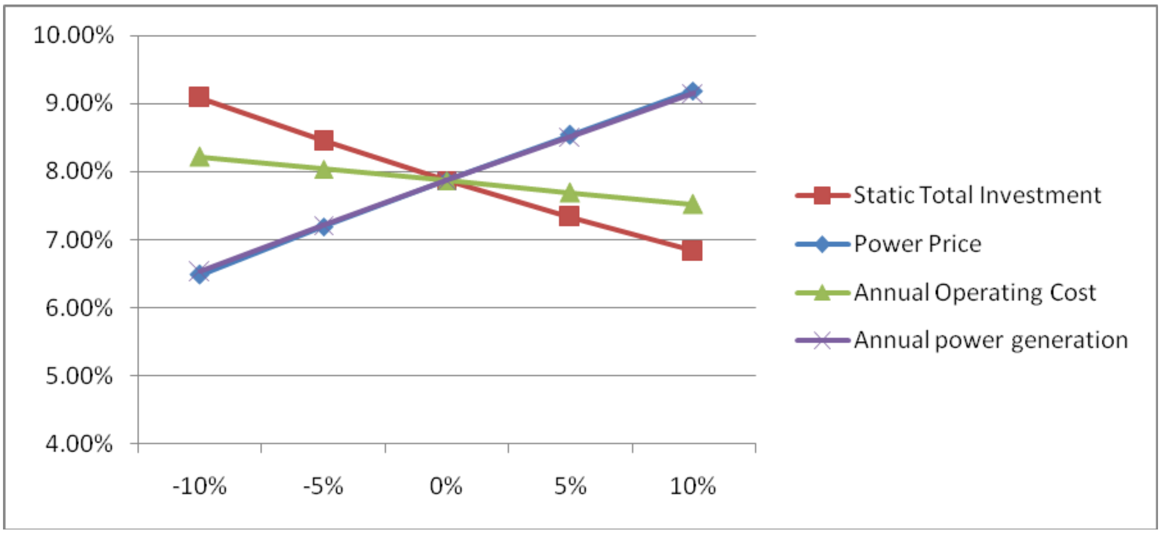

Fig B.2 the project IRR Sensitivity Analysis when Annual Power Generation, Power Price, Static Total Investment or Annual Operation Cost changed

The conclusion is evidenced (provided in Fig B.2) that: the project IRR is 7.87% without CDM revenue which is lower than the threshold of 10%.

Annual power generation:

With the increase of annual power generation by 10%, the project IRR is 9.15%, still less than the threshold of 10%. The annual power generation should be increased by 16.8% if the project IRR could reach 10%. In fact, the annual power generation are limited by natural water resources, and was estimated as average long-term natural river flow of 43-year [20] historical values. Therefore, dramatically increase of electricity generation of the project in the whole crediting period will rarely happen. Furthermore, the actual value of annual power supplied to the grid in year 2008 is 60,774.081MWh, which is lower than the expected value in FSR. Therefore, it is impossible to increase the IRR through increasing the annual power generation.

Power price:

With the increase of power price by 10%, the project IRR is 9.19%, still less than 10%. The power price should be increased by 16.35% if the project IRR could reach 10%. In fact, according to the Power Purchase Agreement 2008, the actual power price is 0.2037 Yuan RMB/kWh [21], which is only 13.17%

[20] The data (43 years, 1960~2002) is from FSR Page 35. Maybe in several years the amount of water flow is larger than usual, but the lack of water resources in some other years or disasters like floods have also to be taken into account. Therefore, in average, the water flow cannot change greatly, thus the power generation cannot increase a lot, too.

[21]It is calculated in weighted average as per different power prices in rainy, level period and dry season, and monthly electricity supplied to the grid (dispatched) in Power Purchase Agreement 2008. In the agreement, the normal season include May and Nov, the power supplied to the grid in normal season is 8,570MWh, and the power price in normal season is 0.215Yuan RMB/kWh (include VAT); the rainy season include Jun, Jul, Aug, Sep and Oct, the power supplied to the grid in rainy season is 44,750MWh, and the rainy season power price is 0.19 Yuan RMB/kWh (include VAT); the dry season include Jan, Feb, Mar, Apr and Dec, the power supplied to the grid in dry season is 16,580MWh, and the dry season power price is 0.24 Yuan RMB/kWh (include VAT). The average power price is:

higher than the power price expected in Financial Analysis Report.

In addition, in China, the power price is strictly regulated by China government and it is established on strict regulation rather than the market mechanism, so it is hard to forecast the future power price by the project owner. As the power price is related tightly to the national economy and livelihood of people, the government of China has to make the power price steady. Actually, the actual power prices signed in Power Purchase Agreement will not be adjusted for a long-term. In PPAs signed with local grid company, the signed power price of the project hasn't changed [22] since the project started operation. Therefore, it is impossible for the project to become commercially attractive through an adjustment of the power price.

Static Total Investment:

With the decrease of static total investment by 10%, the project IRR is 9.08%, still less than 10%. The static total investment should be decreased by 15.6% if the project IRR could reach 10%. This is impossible, because according to the financial report of the project, the total investment of the project is 90,925,374.49Yuan RMB [23], which is much more than the estimated one used in IRR calculation. Obviously, it is impossible to meet the IRR of 10% through decrease of static investment.

Annual Operation Cost:

With a decrease in the annual operation cost by 10%, the project IRR of the project is 8.22%, also less than 10%. The actual annual operation cost is 2,765,226Yuan RMB, which is higher than the estimated value of 2,550,140Yuan RMB in the Financial Analysis Report. In addition, the average annual operation cost for the project is 0.039Yuan/kWh, which is lower than the average annual operation cost of 0.04-0.09Yuan/kWh for hydropower stations in China[24]. Thus the annual operation cost is conservative. Obviously, it is impossible to meet the IRR of 10% through increase of annual operation cost.

In conclusion, without the consideration of the revenue from CERs, the conclusion of the project activities lacks of commercial attraction is evidenced, so the proposed project is in shortage of commercial attraction.

On the contrary, the CDM registration will create an additional income stream from the sale of CERs whose expected unit price is €6.00/tCO_2e, substantially increasing the economic attractiveness of the project. The additional income stream through CDM will lead the IRR of the project reach 10.41% which is higher than 10%. If the project could be approved by CDM project, the ability for repayment loan and interest will be increased, and the financial index and commercial attraction will be improved greatly, this project could be implemented and operated normally.

Step 3. Barrier Analysis

The Investment analysis can fully demonstrate and explain the additionality of the proposed project, so the Barriers analysis is not needed.

Step 4. Common Practice Analysis

$$\frac{8,570\times 0.215+44,750\times 0.19+16,580\times 0.24}{8,570+16,580+44,750}=0.2037 \text{ (With VAT).}$$

[22] Power Purchase Agreement 2007-2008.
[23] Financial Audit Report of Yunnan Jinping Ladeng River Power Generation Co., Ltd.
[24]Basic situation for Hydropower stations.

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

Yunnan Province with an area of 39.4 ten thousand km^2, is comparatively and considerably larger than many countries. According to the requirements of common practice, the projects with similar conditions, such as investment conditions and natural conditions (including geographical conditions, climate conditions, development conditions and so on), are necessary to be analyzed. Projects located in different provinces of the China Southern Power Grid have not the similar investment conditions [25] and natural conditions [26] [27] [28] [29]. In addition, Guangxi Zhuang Autonomous Region is an autonomous region, which has more different conditions [30] from normal provinces like Yunnan, Guangdong and Guizhou provinces, which located in the China Southern Power Grid. Therefore, the PDD selects geographical area, i.e. Yunnan Province, as a common practice region.

For the common practice, we have analyzed all hydropower projects in Yunnan Province with installed capacities lower than 50MW [31] that have started operations. According to the *Tool for the Demonstration and Assessment of Additionally*, projects are considered “similar” in case they are located in the “same county/region”, are of “similar scale”, and “take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc”. We have selected hydropower stations with a similar installed capacity and have taken a wide range of installed capacities (below 50MW).

Therefore, we have analyzed hydropower projects located in Yunnan Province, and installed capacities lower than 50MW in Table B.7.

Table B.7. Existing hydropower plants similar to the proposed activity

Name of hydropower plant	Installed Capacity (MW)	Start Operations	Location	Project owner/largest stockholder
Luoze River Hydropower Project	25	1987[32]	Zhaotong County	State owned
Supa River Sanjiangkou Hydropower Project	30	1993[33]	Baoshan City Tengchong	State owned
Yisa River Hydropower Project	26.6	1994[34]	Yuxi City Yuanjiang County	State owned
Laohushan II Hydropower Project	25	1998[35]	Chuxiong Perefeture	State owned
Hongshiyan	44	1999[36]	Yiliang County	State owned

[25] Yearbook of China Water Resources 2006
[26] http://www.checc.cn/zgsd/zgsd_zy.jsp
[27] http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=17
[28] http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=22
[29] http://www.checc.cn/shuigis/province/provincedetail.jsp?provinceID=21
[30] http://www.gov.cn/test/2005-07/29/content_18338.htm
[31] Almanac of China’s Water Power (2005), page 141. Hydropower stations were divided into three scales: big scale is for those stations with installed capacity larger than 300MW; medium scale is for stations with installed capacity between 50MW and 300 MW; small scale is for stations with installed capacity lower than 50MW.
[32] http://www.sp.com.cn/zgsd/tjzl/yunnan.htm
[33] http://cdm.unfccc.int/UserManagement/FileStorage/WW0ONO7SW2DC8LE537BK8TEFP3FS2N
[34] http://slx.zjwchc.com/sdz/sdz1/604.htm
[35] http://www.yn.gov.cn/yunnan,china/72626041549488128/20050415/25579.html

Hydropower Station				
Jiren River Hydropower Station	30	2001[37]	Diqing prefecture Shangri-La County	Diqing Electric Power Co., Ltd.
Nanting River Hydropower Station	34	2004[38]	Wenshan Prefecture Maguan County	Wenshan Electric Power Co., Ltd. [39] (State owned)
Mengdianhe II Hydropower	30	2004	Dehong Prefecture Yingjiang County	Yingjiang Mengdian River Second Level Power Station Co., Ltd.
Xiashilong Hydropower Station	25	2005	Wenshan Prefecture Guangnan County	Guangnan Xinangjiang Hydropower Development Co., Ltd.
Laodukou Hydropower Station	37.5	2005	Qujing City Luoping County	Yunan Luoping Laodukou Power Co., Ltd.
Wunihe Hydropower Station	30	2005	Baoshan City Longling County	Yunnan Baoshan Supahe Hydropower Development Co., Ltd.
Houqiao Hydropower Station	48	2005	Baoshan City Tengchong County	Yunnan Baoshan Binlangjiang Hydropower Development Co., Ltd.
Yanziya Hydropower Station	25	2005	Dali Prefecture Heqing County	Heqing Xinyuan Yanggongjiang Power Co., Ltd.
Maomaotiao Hydropower Station	40	2005	Wenshan Prefecture Malipo County	Maomaotiao Power Co., Ltd.
Xima Xingyun Aluminium Factory Hydropower Station	26	2005	Dehong Prefecture Yingjiang County	Yunnan Yingjiang Xingyun Co., Ltd.
Chongjianghe II Phase (Expansion) Hydropower Station	48	2006	Diqing Prefecture Yulong County	Guodian Diqing Shangri-la Generating Limited Liability Company
Guquan River Hydropower Station	22	2007[40]	Nujiang Lisu Autonomous Prefecture	Fugong Hongyuan HydropowerDevelopment Co., Ltd.

Source: *Yearbook of China Water Resources 2006*; *Yearbook of China Water Resources 2007.*

Of these projects, 6 projects, Luoze River Hydropower Project, Supahe Sanjiangkou Hydropower Project, Yisa River Hydropower Project, Laohushan II Hydropower Project, Hongshiyan Hydropower Station and Jiren River Hydropower Station started operated before 2002, they were developed by the state under a power system environment that is substantially different from the current power system environment, because, the first Power System Reform Blue Print has been published by State Council in February 2002, and the reform content mainly include: Power plants separating from the power grid, reforming enterprises for power plants and power grids; bidding to power grid, building a competitive and open power market initially; changing the current situation of all power purchased by the state owned grid enterprises.[41] So they are not similar with the proposed project. Furthermore, Xima Xingyun Aluminium Factory

[36] http://www.7c.gov.cn/color/DisplayPages/ContentDisplay_455.aspx?contentid=9204
[37] http://www.zhongguook.com/news/web/shangri-la/2004-03/1079363260.html
[38] http://www.cninfo.com.cn/finalpage/2004-12-07/14853004.html
[39] http://business.sohu.com/20051228/n241172999.shtml
[40]http://cdm.unfccc.int/UserManagement/FileStorage/O4K1F5IN0Q9X3G7DAWEBSUR8TLMZHV
[41] Power System Reform Blue Print, published by State Council, February 10, 2002.

Hydropower Station is the captive station of Yunnan Yingjiang Xingyun Co., Ltd [42], and Chongjianghe II Phase (Expansion) Hydropower Station is an expansion project in an existing power plant [43]. Therefore, the 2 projects are not similar with the project as the former station is not connected to the grid and the other is not a new project, and they are excluded.

In addition, other projects with a similar scale which were under construction or operation in Yunnan Province are applying for CDM project status [44].

Furthermore, Zilienghe 24MW Hydropower Station has been restarted GSP for CDM application on UNFCCC website:
http://cdm.unfccc.int/Projects/Validation/DB/0TP4ET3BJRL0O96SVPQBCQWOAK2MRJ/view.html.
Therefore, this project also can be excluded from the common practice and we only analyzed the left 9 projects.

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

From the above analysis, nine projects are similar with the proposed project.

- ✧ Nanting River Hydropower Station was developed by stated owned entity---Wenshan Electric Power Co., Ltd. (hereafter referred to as "Wenshan Company") was founded in 1997, whose main business is power generation and grid (the Wenshan Grid) and it has abundant experience in hydropower industry. The Wenshan Company made initial public offering in 2004 (Southern Power Grid Company is the biggest stakeholder of the Wenshan Company), and it was the first Electric Power Listed Companies of Yunan Province. [45]
- ✧ Wunihe Hydropower Station was developed by state holding entity---Yunnan Baoshan Supahe Hydropower Development Co., Ltd., whose all stakeholders of Baoshan State Asset Operation Co., Ltd., Yunnan Development Investment Co., Ltd. and Baoshan Electricity Co., Ltd. are all state company with powerful ability[46][47][48].
- ✧ Houqiao Hydropower Station was developed by stated entity---Yunnan Baoshan Binlangjiang Hydropower Development Co., Ltd., whose all stakeholders of Baoshan Electricity Co., Ltd., Kunming Reconnaissance and Design Institute and Yunnan Machinery Import & Export Co., Ltd. are all state company with powerful ability.[49] [50][51][52]
- ✧ Yanziya Hydropower Station was developed by state holding entity---Heqing Xinyuan Yanggongjiang Power Co., Ltd. whose stakeholder of Dianxi Electric Bureau (Dali Electric Power Supply Bureau) is similar as Wenshan Company, its' main business is power generation and grid (Dali Grid) and it has abundant experience in hydropower industry[53][54] [55].

---

[42] http://0871.und.cn/small/cpybase.do?companyid=D658A7E06D9B41318F44FBF1B0E6C0E7
[43] http://0871.und.cn/small/cpybase.do?companyid=D658A7E06D9B41318F44FBF1B0E6C0E7
[44] http://cdm.unfccc.int/Projects/Validation/index.html and
Chinese DNA web site: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1774.pdf
[45] http://www.wsdl.com.cn/introduce/
[46] http://mkt.und.cn/small/cpybase.do?companyid=6DF66BA0B8044174AEAC16B104ECD94C
[47] http://www.ynsph.com.cn/
[48] http://www.nut168.com/mrmq/mq/1559.html
[49] http://www.khidi.com:8083/ShowMess.asp?ArticleID=934
[50] http://www.nut168.com/mrmq/mq/1559.html
[51] http://www.khidi.com:8083/BMWeb/kmyjj/qygs.asp
[52] http://www.ymc.com.cn/EN/1.htm
[53] http://www.yn.xinhuanet.com/ynnews/2003-05/07/content_469089.htm
[54] http://www.chinapower.com.cn/companyproduct/enterprise1front.asp?target=brief&enterpriseid=ent1003264

- ✧ Wunihe Hydropower Station [56] and Houqiao Hydropower Station [57] mentioned are connected to the *West-East Electricity Transmission Projects*, which is a government sponsored project offering favourable conditions to electricity suppliers participating in the project with the aim to secure transmission of power from West China to East China.

Based on the factors, the above companies have better financing conditions; face fewer barriers than privately owned project entities.

Furthermore,

- ✧ Nanting River Hydropower Station with annual operation hours of 6,464h[58], Laodukou Hydropower Station with annual operation hours of 5,040h[59], Xiashilong Hydropower Station with annual operation hours of 5,533h[60], Yanziya Hydropower Station with annual operation hours of 6,000h[61], Wunihe Hydropower Station with annual operation hours of 5,750h[62], Guquan River Hydropower Station with annual operation hours of 5,351h[63], which are all higher than any sub-project of the proposed project (Ladeng Dam: 4,807h; Ganwa Dam: 4,715h);
- ✧ Nanting River Hydropower Station belong to the China Southern Power Grid Company (because China Southern Power Grid Company is the biggest stakeholder of the Wenshan Company, therefore the Nanting River Hydropower Station has a higher price), therefore, the difference of the electricity sale price and cost price is the power price of 0.178Yuan RMB/kWh (without VAT, 0.208Yuan RMB/kWh with VAT) for the Nanting River Hydropower Station [64]; Maomaotiao Hydropower Station with power price of 0.25Yuan RMB/kWh (with VAT) [65]; Xiashilong Hydropower Station with power price of 0.225Yuan RMB/kWh (with VAT) [66];Yanziya Hydropower Station with power price of 0.21Yuan RMB/kWh[67]; Wunihe Hydropower Station with power price of 0.205Yuan RMB/kWh[68]; Laodukou Hydropower Station with power price of 0.20Yuan RMB/kWh(with VAT)[69], which are all higher than the power price of 0.18Yuan RMB/kWh (with VAT) for the project.
- ✧ Maomaotiao Hydropower Station has a unit investment cost of 3,000Yuan RMB/kW[70]; Xiashilong Hydropower Station has a unit investment of 4,320Yuan RMB/kW[71]; Yanziya Hydropower Station has a unit investment cost of 4,800Yuan RMB/kW[72], Guquan River Hydropower Station has a unit

[55] http://www.smeyndl.gov.cn/readnews.asp?newsid=1798
[56] http://www.leica-geosystems.com.cn/newsdetail.asp?l3=0&nid=469
[57] http://www.baoshan.cn/4034/2005/10/25/707@277291.htm
[58] Yearbook of China Water Resources 2006, p577
[59] http://www.chinapower.com.cn/article/1096/art1096480.asp
[60] Feasibility Study Report for Xiashilong Hydropower Station
[61]http://www.heqing.gov.cn/DefaultStyle/DefaultStyle_NewPage.aspx?PageId=24495&TagControlID=24502&LibInfoID=25536
[62] http://www.ynsph.com.cn/
[63]http://cdm.unfccc.int/UserManagement/FileStorage/O4K1F5IN0Q9X3G7DAWEBSUR8TLMZHV
[64] Investment Strategy Report on Electric Power Industry 2005, http://www.gsstock.com/yfzx/041206dlbg.pdf
[65] http://www.788111.com/f10/600995/f10_newscontent/2/174050602171.html
[66] Feasibility Study Report for Xiashilong Hydropower Station
[67] http://www.bofcom.gov.cn/bofcom/432911834190708736/20070124/103037.html
[68] http://www.ynpower.com.cn/information/510.whtml
[69] http://www.topcj.com/html/2/KPGG/20070214/45241.shtml
[70] http://www.ynws.gov.cn/docdetail_new.asp?id1=20050321081428
[71]Feasibility Study Report for Xiashilong Hydropower Station
[72]http://www.heqing.gov.cn/DefaultStyle/DefaultStyle_NewPage.aspx?PageId=24495&TagControlID=24502&LibInfoID=25536

investment cost of 4,517 Yuan RMB/kWh[73], which are all lower than the unit investment of 5,564.51Yuan RMB/kW of the project.

- ✧ The IRR of the project is only 7.87% (lower than the benchmark of 10%), which is much lower than Mengdianhe II Hydropower Project, i.e. 14%[74] (higher than the benchmark of 10%).

Therefore, the above stations were more attractive than the project.

It is clear from the investment analysis that the proposed project, like other similar projects benefiting from or applying for CDM support, does not benefit from the same economic advantages as the projects listed in Table B.5. Therefore, the project is additional.

Conclusion:

In general, the project faces several barriers which would prevent the implementation of the project activity without CDM. CDM helps to overcome these barriers. If the project is not implemented, the power will be supplied by the China Southern Power Grid. Hence, the project activity isn't the baseline scenario, and it's additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Project emissions

For hydropower project activities that result in new reservoirs and hydropower project activities that result in the increase of existing reservoirs, project proponents shall account for project emissions.

The project is a diversion hydropower station, and will build a new reservoir, according to ACM0002 (Version 7), the power density of the project activity is calculated as follow:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ Equation (B.1)

Where,

Cap_{PJ} is installed capacity of the hydropower plant after the implementation of the project activity (W). The installed capacity of the project is 16,000,000W;

Cap_{BL} is installed capacity of the hydropower plant before the implementation of the project activity (W). The project is a new hydropower plant, thus this value is zero;

A_{PJ} is area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2). A_{PJ} of the project is 12,266.67m^2;

A_{BL} is area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). The reservoir of the project is a new reservoir, and zero is chose for this value for conservative.

The power density calculated of the project is 1,304.35W/m^2 greater than 10W/m^2. According to ACM0002, for hydropower project with power density larger than 10W/m^2, the project emission is zero, so PE_y =0.

Baseline emissions

[73] http://cdm.unfccc.int/UserManagement/FileStorage/O4K1F5IN0Q9X3G7DAWEBSUR8TLMZHV
[74] The FSR of Mengdianhe II Hydropower Project

According to ACM0002 (version 7), baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) \times EF_{grid,CM,y} \quad \text{Equation (B.2)}$$

Where:

BE_y is baseline emissions in year y (tCO_2e/yr);

EG_y is electricity supplied by the project activity to the grid (MWh);

$EG_{baseline}$ is baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). The project is a new power plant, according ACM0002, $EG_{baseline} = 0$;

$EF_{grid,CM,y}$ is combined margin CO_2 emission factor for the China Southern Power Grid in year *y*, and is calculated according to *"Tool to calculate the emission factor for an electricity system" Version 1.1*.

According to *"Tool to calculate the emission factor for an electricity system" (Version 1.1)*, the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system is determined by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM).

The tool provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO_2e/MWh	Combined margin CO_2 emission factor for grid connected power generation in year *y*
$EF_{grid,BM,y}$	tCO_2e/MWh	Build margin CO_2 emission factor for grid connected power generation in year *y*
$EF_{grid,OM,y}$	tCO_2e/MWh	Operating margin CO_2 emission factor for grid connected power generation in year *y*

$EF_{grid,OM,y}$, $EF_{grid,BM,y}$ $EF_{grid,CM,y}$ calculation for the China Southern Power Grid is calculated as follows:

Project participants shall apply the following six steps:

Step 1. Identify the relevant electric power system.
Step 2. Select an operating margin (OM) method.
Step 3. Calculate the operating margin emission factor according to the selected method.
Step 4. Identify the cohort of power units to be included in the build margin (BM).
Step 5. Calculate the build margin emission factor.
Step 6. Calculate the combined margin (CM) emission factor.

According to the *Bulletin on Baseline Emission Factors of China Grid* renewed by the Director Office of National Climate Change Coordination of NDRC (Chinese DNA) on 9 August 2007, the OM Emission Factor is 1.0119tCO_2e/MWh, and the BM Emission Factor of 0.6748tCO_2e/MWh. Therefore, the Combined Baseline Emission Factor of the China Southern Power Grid **c**orresponds to **0.84335**tCO_2e/MWh.

In addition, according to the *Bulletin on Baseline Emission Factors of China's Regional Grid* updated by Chinese DNA on 18 July 2008, the OM Emission Factor is 1.0608tCO_2e/MWh, and the BM Emission Factor of 0.6816tCO_2e/MWh. Therefore, the Combined Baseline Emission Factor of the China Southern

Power Grid **c**orresponds to **0.8712**tCO_2e/MWh. However, the OM and BM Emission Factor deviate on the original data published in the China Energy Statistical Yearbook and China Electric Power Yearbook.

We calculated the OM and BM Emission Factor on the basis of the correct data, which results in an OM Emission Factor of 1.06106tCO_2e/MWh, and the BM Emission Factor of 0.6816tCO_2e/MWh. Therefore, the Combined Baseline Emission Factor of the China Southern Power Grid **c**orresponds to **0.8712**tCO_2e/MWh.

Finally, we will use the lowest combined margin emission factor of **0.84335**tCO_2e/MWh for conservative purpose that can be calculated based on the published OM (1.0119) and BM (0.6748) by the Chinese DNA. The full process of the calculation of the emission factors and all underlying data are presented in Annex 3 to this PDD.

Step 1. Identify the relevant electric power system

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

In addition, there is net imported power to the China Southern Power Grid from the Central China Power Grid. Therefore, the Central China Power Grid is considered as part of the relevant electric power system.

To determine the CO_2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from the Central China Power Grid, the tool provides four options:

a) 0tCO_2e/MWh, or
b) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in step 3 (d) below; or
c) The simple operating margin emission rage of the exporting grid, determined as described in step 3(a), if the conditions for this method, as described in step 2 below, apply to the exporting grid; or
d) The simple adjusted operating margin emission rate of the exporting grid, determined as described in step 3 (b) below.

The PDD will choose option b) since it is not possible to identify the specific power plants exporting electricity from the Central China Power Grid to the China Southern Power Grid.

Step 2. Select an operating margin (OM) method

The tool offers four options for the calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$):

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

According to China Electric Power Yearbook (2002-2006), from 2001 to 2005, in the composition of gross annual power generation for China Southern Power Grid, the ratio of power generated by hydro-

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

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

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

The "ex-ante vintage" will be employed for OM calculation of the project.

Step 3. Calculate the operating margin emission factor according to the selected method

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

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

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

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,j} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} \qquad \text{Equation (B.3)}$$

Where

$EF_{grid,OMsimplei,y}$ is simple operating margin CO_2 emission factor in year *y* (tCO_2e/MWh);

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

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

$EF_{CO_2 i,y}$ is CO_2 emission factor of fossil fuel type *i* in year y (tCO_2e/GJ);

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

The Operating Margin emission factors for 2003, 2004 and 2005 are calculated. The three-year average is calculated as a 3-year generation-weighted average of the emission factors. The operating margin emission

factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period of the project activity.

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

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

a) The set of five power units that have been built most recently, or
b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently [75].

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

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

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

The PDD choose Option 1 to calculate $EF_{grid,BM,y}$ without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 5. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2e/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \text{Equation (B.4)}$$

Where

$EF_{grid,BM,y}$ is Build margin CO_2 emission factor in year y (tCO_2e/MWh);

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

$EF_{EL,m,y}$ is CO_2 emission factor of power unit m in year y (tCO_2e/MWh).

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

In China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts [76] the following deviation in methodology application:

1) Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1 - 3 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.
2) Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Since there is no way to separate the different generation technology capacities as coal, oil or gas etc from thermal power based on the present statistical data, the following calculating measures will be taken:
- First, according to the energy statistical data of most recent one year, determine the ratio of CO_2 emissions produced by solid, liquid, and gas fuels consumption for power generation;
- Second, multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency;
- Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

The calculation is conducted as follows:
Sub-step 1: Calculate the proportion of CO_2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO_2 emissions from the total fossil fuelled electricity generation (sum of CO_2 emissions from coal, oil and gas).

$$\lambda_{Coal} = \frac{\sum_{i \in COAL} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \qquad \text{Equation (B.5)}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \qquad \text{Equation (B.6)}$$

$$\lambda_{oil} = \frac{\sum_{i \in oil} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \qquad \text{Equation (B.7)}$$

Where,
$FC_{i,m,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power sources *m* in year(s) *y*;

[76] This is in accordance with the „Request for guidance: Application of AM0005 and AMS-I.D in China", a letter from DNV to the Executive Board, dated 07/10/2005, available online at:
http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM.
This approach has been applied by several registered CDM projects using methodology ACM0002 so far.

$NCV_{i,y}$ is the net calorific value (energy content) of fossil fuel type *i* in year y (GJ/mass or volume unit);
$EF_{CO_2 i,y}$ is CO_2 emission factor of fossil fuel type *i* in year y (tCO_2e/GJ);
Coal, Oil and *Gas* is solid, liquid and gas fuels respectively.

Sub-step 2: Calculate the operating margin emission factor of fuel-based generation:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \qquad \text{Equation (B.8)}$$

Where,
$EF_{Coal,Adv}, EF_{Oil,Adv}, EF_{Gas,Adv}$ are the emission factors for coal-fired, oil-fired and gas-fired generation technology according to commercially available best practice technology in terms of efficiency.

The estimated coal consumption of a coal-fired power plant, which is considered to be the commercially available best practice technology in terms of efficiency, is 343.33gce/kWh corresponding to an efficiency of 35.82% for electricity generation. For gas and oil power plants, the fuel consumption of commercially available best practice technology is 258gce/kWh, which corresponds to an efficiency of 47.67% for electricity generation[77].

Sub-step 3: Calculate the Building Margin emission factor

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \qquad \text{Equation (B.9)}$$

Where,

CAP_{Total} is the total capacity addition and $CAP_{Thermal}$ is the total thermal (coal, oil and gas) power capacity addition.

As mentioned above, the build margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period of the project activity.

The data resources for calculating OM and BM are:

- Installed capacity, power generation and the rate of internal electricity consumption of thermal power plants
  Source: *China Electric Power Yearbook* (2002-2006);
- Fuel consumption and the net caloric value of thermal power plants
  Source: *China Energy Statistical Yearbook* (2004-2006);
- Carbon emission factor of each fuel
  Source: *2006 IPCC Guidelines for National Greenhouse Gas Inventories:* Table 1.3 in the page of 1.23-1.24 in *Chapter Ⅰ, Volume Ⅱ*.

STEP 6 Calculate the combined margin emission factor

---

[77]the "*Bulletin on the Baseline Emission Factors of the China's Regional Grids",* which has been renewed by the Chinese DNA (Director Office of National Coordination Committee on Climate Change of NDRC) on Aug. 9, 2007.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y}$$ Equation (B.10)

Where:

$EF_{Grid,BM,y}$ is build margin CO_2 emission factor in year y (tCO_2e/MWh);

$EF_{Grid,OM,y}$ is operating margin CO_2 emission factor in year y (tCO_2e/MWh);

W_{OM} is weighting of operating margin emissions factor (%);

W_{BM} is weighting of build margin emissions factor (%).

According to the *Bulletin on the Baseline Emission Factors of the China's Grid* renewed by Director Office of National Climate Change Coordination of NDRC(Chinese DNA) on Aug. 9, 2007, the Operating Margin Emission Factor ($EF_{grid,OM,y}$) of the China Southern Power Grid is 1.0119tCO_2e/MWh and the Build Margin Emission Factor ($EF_{grid,BM,y}$) is 0.6748tCO_2e/MWh. The defaults weights value[78] during the first crediting period for hydropower projects are used as specified in the "Tool to calculate the emission factor for an electricity system" (Version 1.1) ($w_{OM} = 0.5$; $w_{BM} = 0.5$)

Using above mentioned values the Combined Baseline Emission Factor of the China Southern Power Grid corresponds to 0.84335tCO_2e/MWh.

Emission Reduction ER_y

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year *y* is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (LE_y), as follows:

$$ER_y = BE_y - PE_y - LE_y$$ (Equation B.11)

where the baseline emissions (BE_y in tCO_2e) are the product of the baseline emissions factor ($EF_{grid,CM,y}$ in tCO_2e/MWh) calculated in Step 3, times the net electricity supplied by the project activity to the grid (EG_y in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities ($EG_{baseline}$ in MWh), as follows:

$$BE_y = (EG_y - EG_{baseline}) \times EF_{grid,CM,y}$$ (Equation B.12)

There is no modified or retrofit facilities, so $EG_{baseline}$ =0.

As discussed above, $PE_y = 0$.

Based on ACM0002 (Version 7), project participant does not need to consider leakage in applying

[78] $w_{OM} = 0.5$ *and* $w_{BM} = 0.5$ *for the first crediting period, and* $w_{OM} = 0.25$ *and* $w_{BM} = 0.75$ *for the second and third crediting period.*

ACM0002 methodology, i.e. $LE_y = 0$. Therefore,

$$ER_y = BE_y = EG_y \times EF_{grid,CM,y} \quad \text{(Equation B.13)}$$

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

Data / Parameter:	$EGP_{y,j}$
Data unit:	MWh
Description:	The Generation of Power Sources *j* in different provinces in (years) *y* (2001-2005, including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Electric Power Yearbook 2002-2006*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate the power delivered to the grid

Data / Parameter:	$GEN_{import,y}$
Data unit:	MWh
Description:	The Power Transmitted from the Central China Grid to the China Southern Power Grid in (years) *y* (2003-2005)
Source of data used:	*State Power Information Network: http://www.sp.com.cn*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate the OM

Data / Parameter:	PR_y
Data unit:	%
Description:	The rate of electricity consumption of thermal power plants in different provinces in (years) *y* (2003-2005 including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate the power delivered to the grid

Data / Parameter:	$FC_{i,y}$
Data unit:	10^4t/10^8m^3
Description:	The Amount of Fossil Fuel Type *i* Consumed by Power System in different

	provinces in year *y* (2003-2005, including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Energy Statistical Yearbook 2004-2006*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate OM and BM

Data / Parameter:	$NCV_{i,y}$
Data unit:	TJ/ fuel in a mass or volume unit
Description:	The net calorific value of Fuel *i* in a mass or volume unit in year *y*
Source of data used:	*China Energy Statistical Yearbook 2006*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate OM and BM

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tC/TJ
Description:	The Emission Factor of Fuel *i* in a mass or volume unit in year *y*
Source of data used:	*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC Default Value
Any comment:	To calculate OM and BM

Data / Parameter:	$\eta_{best,coal}$
Data unit:	%
Description:	The optimum commercial, coal-fired power supply efficiency
Source of data used:	*Chinese DNA: Bulletin on Baseline Emission Factor of China Grid-the calculation of baseline Build Margin emission factor for China Grid*
Value applied:	35.82%
Justification of the choice of data or description of measurement methods and procedures actually applied :	National Fixed Value
Any comment:	To calculate BM

Data / Parameter:	$\eta_{best,oil/gas}$
Data unit:	%
Description:	The optimum commercial, oil and gas power supply efficiency

Source of data used:	*Chinese DNA: Bulletin on Baseline Emission Factor of China Grid-the calculation of baseline Build Margin emission factor for China Grid*
Value applied:	47.67%
Justification of the choice of data or description of measurement methods and procedures actually applied :	National Fixed Value
Any comment:	To calculate BM

Data / Parameter:	$CAP_{y,i}$
Data unit:	MW
Description:	The Install Capacity of Power Sources *j* in different provinces in year *y* (2003-2005, including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Electric Power Yearbook 2004-2006*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate BM

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Install Capacity of the hydro power plant before the implementation of the project activity.
Source of data:	-
Value applied:	For the project is a new hydropower plant, this value is zero.
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2).
Source of data:	-
Value applied:	For the project is a new hydropower plant and the reservoir is new constructed, zero is chose as the value for conservative.
Measurement procedures (if any):	Conservative Value.
Any comment:	-

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

According to section B.6.1, the baseline emission factor of the project is 0.84335tCO_2e/MWh in the first crediting period. And the net annual power supplied to the grid by the project is 65,810.1MWh.

Therefore, BE_y during the first crediting period is to be calculated as follows:

$ER_y = BE_y = EG_y \times EF_{grid,CM,y}$ =65,810.1×0.84335=55,501 tCO_2e

Hence the emission reductions due to the project are equal to the baseline emissions, and annual emission reductions are 55,501tCO_2e during the first crediting period.

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

The total emission reductions of the project are 388,507tCO_2e during the first 7 years crediting period.

Table B.8 Estimate of Emission Reductions Due to the Project

Years	Estimation of project activity emissions (tCO_2e)	Estimation of baseline Emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
01/10/2009-30/09/2010	0	55,501	0	55,501
01/10/2010-30/09/2011	0	55,501	0	55,501
01/10/2011-30/09/2012	0	55,501	0	55,501
01/10/2012-30/09/2013	0	55,501	0	55,501
01/10/2013-30/09/2014	0	55,501	0	55,501
01/10/2014-30/09/2015	0	55,501	0	55,501
01/10/2015-30/09/2016	0	55,501	0	55,501
Total(tCO_2e)	0	388,507	0	388,507

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

B.7.1. Data and parameters monitored:

There are 6 hydropower stations on Xinqiao river basin, and they are Wayao River (8MW), Sitaishan(12.6MW), Ladeng River (the proposed project), Maguo River (10MW), Maocaoping (10MW) and Maocaoping Weishui Hydropower Station (3MW) from upstream to downstream. These stations are connected to each other, and there is one transmission line between each two stations, and all six stations were finally connected to the grid via the Maocaoping Hydropower Station (See Fig.B.3).

In order to calculate emission of baseline, we need to monitor the following data:

1. The electricity supplied to the grid by Sitaishan Station ($EG_{M7,y}$) and the total electricity supplied by the proposed project and the Sitaishan Station ($EG_{M6,y}$) , and according to the difference of $EG_{M7,y}$ and $EG_{M6,y}$ to get the gross electricity supplied to the grid by the proposed project ($EG_{M6,y}$ - $EG_{M7,y}$);
2. The total electricity supplied to the grid by the proposed project and Sitaishan hydropower station ($EG_{M5,y}$, not include the transmission line loss of La-Ma line) will be monitored to calculate the transmission line loss of La-Ma line ($EG_{M6,y}$ - $EG_{M5,y}$), and the shares of transmission line loss of La-Ma line will be determined based on power generation of the two stations;
3. $EG_{M3,y}$ and $EG_{M4,y}$ will be monitored to get the line loss of Ma-Mao line, and the lineloss of Ma-Mao line is shared by Wayao River (8MW), Sitaishan (12.6MW), Maguo River (10MW) hydropower stations and the project based on power generation of each project;

4. The total power imported from the gird by all six stations ($PR_{M1,y}$) will be monitored to calculate the electricity imported from the gird by the project ($PR_{g,y}$).For conservative reason, $PR_{M1,y}$ will be taken as the power imported from the grid ($PR_{g,y}$) by the proposed project.

Additionally, in order to calculate the power density, we need to monitor the installed capacity (Cap_{PJ}) and the surface area of the reservoir at full water level (A_{PJ}) to calculate the power density.

Data / Parameter:	$EG_{M5,y}$
Data unit:	MWh
Description:	Total power supplied to the grid by Sitaishan Station and the proposed project (not include the transmission line loss of La-Ma line) in *y* year
Source of data to be used:	Directly measured and verified against electricity bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	Estimated to be 119,226.94MWh [79].
Description of measurement methods and procedures to be applied	Measured continuously through national standard electricity metering instruments. Hourly measurement and monthly recording.
QA/QC procedures:	The meters will be periodically checked according to the relevant national electric industry standards and regulations; Electricity supplied to the grid will be double checked by electricity bills.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	$EG_{M6,y}$
Data unit:	MWh
Description:	Total power supplied to the grid by Sitaishan Station and the proposed project (include the transmission line loss of La-Ma line) in *y* year
Source of data to be used:	Directly measured and verified against electricity bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	Estimated to be 119,226.94MWh [80].
Description of measurement methods and procedures to be applied	Measured continuously through national standard electricity metering instruments. Hourly measurement and monthly recording.
QA/QC procedures:	The meters will be periodically checked according to the relevant national electric industry standards and regulations; Electricity supplied to the grid

[79] Generation and relevant data of Sitaishan hydropower station refer to page 247 of its FSR, of which power generation is 61,980MWh, effective power factor is 0.9, power consumption rate by the plant is 0.25%; Generation and relevant data of Ladeng River hydropower station refer to page 246 of its FSR, of which power generation is 76,360MWh, effective power factor is 0.9, power consumption rate by the plant is 0.25%. Therefore, $EG_{M5,y}$=55,642.55×(1-4%) +68,552.19×(1-4%)=119,226.94MWh.

[80] In order to simplify the calculation of electricity supplied to the grid to each hydropower station, the line loss of La-Ma line are assumed to 0MWh. In other words, the readings of M5 and M6 are same. But, in fact, the line loss of La-Ma line will be calculated and recorded as per the readings of M5 and M6.

	will be double checked by electricity bills.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	$EG_{M7,y}$
Data unit:	MWh
Description:	Power supplied to the grid by Sitaishan Station (not include the line loss from Sitaishan Station to the project) in *y* year
Source of data to be used:	Directly measured and verified against electricity bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	Estimated to be 53,416.84MWh[81].
Description of measurement methods and procedures to be applied	Measured continuously through national standard electricity metering instruments. Hourly measurement and monthly recording.
QA/QC procedures:	The meters will be periodically checked according to the relevant national electric industry standards and regulations; Electricity supplied to the grid will be double checked by electricity bills.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	$EG_{M4,y}$
Data unit:	MWh
Description:	Power supplied to the grid by Wayao River, Sitaishan, Ladeng River, Maguo River hydropower station (include the transmission line loss of Ma-Mao line) in the years y
Source of data to be used:	Directly measured and verified against electricity bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	Estimated to be 193,765.53MWh[82]
Description of measurement	Measured continuously through national standard electricity metering

[81] Generation and relevant data of Sitaishan hydropower station refer to page 247 of its FSR, of which power generation is 61,980MWh, effective power factor is 0.9, power consumption rate by the plant is 0.25%, and the line loss rate is 4%. Therefore, the electricity supplied to the grid of Sitaishan hydropower station is:
61,980×0.9×(1-0.25%)×(1-4%) = 53,416.84MWh.

[82] Generation and relevant data of Sitaishan hydropower station refer to page 247 of its FSR, of which power generation is 61,980MWh, effective power factor is 0.9, power consumption rate by the plant is 0.25%, and the line loss rate is 4%. Therefore, the electricity supplied to the grid of Sitaishan hydropower station is 53,416.84MWh;
Generation and relevant data of Ladeng River hydropower station refer to page 246 of its FSR, of which power generation is 76,360MWh, effective power factor is 0.9, power consumption rate by the plant is 0.25%, and lineloss rate is 4%. Therefore, the electricity supplied to the grid of Ladeng River hydropower station is 65,810.10MWh;
Generation of Wayao River hydropower station (36,310MWh) refers to approval of adjustment of its installed capacity (Adjusted from 7.4MW to 8MW). Effective power factor (0.9), power consumption rate by the plant (0.5%) refers to page 95 in FSR (7.4MW) of Wayao River hydropower station, and lineloss rate is 4%. Therefore, the electricity supplied to the grid of Wayao River hydropower station is 31,214.98MWh;
Generation and relevant data of Maguo River refer to page158 of its FSR, of which power generation is 45,310MWh, power consumption rate by the plant is 0.4%, and lineloss rate is 4%. Therefore, the electricity supplied to the grid of the project is 43,323.61MWh;
Therefore, the reading of M4 would be $EG_{M4,y}$=53,416.84+65,810.10+31,214.98+43,323.61=193,765.53MWh.

methods and procedures to be applied	instruments. Hourly measurement and monthly recording.
QA/QC procedures:	The meters will be periodically checked according to the relevant national electric industry standards and regulations; Electricity supplied to the grid will be double checked by electricity bills.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	$EG_{M3,y}$
Data unit	MWh
Description:	Power supplied to the grid by Wayao River, Sitaishan, Ladeng River, Maguo River hydropower station (not include the transmission line loss of Ma-Mao line) in the years y
Source of data to be used:	Directly measured and verified against electricity bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	The electricity supplied to the grid by the four stations is expected to be 193,765.53MWh[83]
Description of measurement methods and procedures to be applied	Measured continuously through national standard electricity metering instruments. Hourly measurement and monthly recording.
QA/QC procedures to be applied:	The meters will be periodically checked according to the relevant national electric industry standards and regulations; Power supplied to the grid and double checked according to electricity bills.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	$PR_{M1,y}$
Data unit	MWh
Description:	Total power imported from the grid by all six stations (Wayao River, Sitaishan, Ladeng River, Maguo River, Maocaoping and Maocaoping Weishui hydropower stations) in the years y
Source of data to be used:	Directly measured at the transformer substation and verified against electricity bills.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	The electricity imported from the grid by the six stations is 0 MWh
Description of measurement methods and procedures to be applied	Measured continuously through national standard electricity metering instruments. Hourly measurement and monthly recording.
QA/QC procedures to be applied:	The meters will be periodically checked according to the relevant national electric industry standards and regulations; Power supplied to the grid and double checked according to electricity bills.
Any comment:	Refer to B.7.2. Description of the monitoring plan

[83] In order to simplify the calculation of electricity supplied to the grid to each hydropower station, the line loss of Ma-Mao line are assumed to 0MWh. In other words, the readings of M3 and M4 are same. But, in fact, the line loss of Ma-Mao line will be calculated and recorded as per readings of M3 and M4.

Data / Parameter:	EG_y
Data unit	MWh
Description:	Net electricity supplied to the grid by the proposed project
Source of data to be used:	Calculated according to the data of $PR_{M1,y}$, $EG_{M3,y}$, $EG_{M4,y}$, $EG_{M5,y}$, $EG_{M6,y}$ and $EG_{M7,y}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	The net electricity supplied to the grid by the proposed project is 65,810.1MWh
Description of measurement methods and procedures to be applied	Calculated as: ($EG_{M6,y}$ - $EG_{M7,y}$) - $\frac{EG_{M6,y} - EG_{M7,y}}{EG_{M6,y}}(EG_{M6,y} - EG_{M5,y})$ - $\frac{EG_{M6,y} - EG_{M7,y}}{EG_{M4,y}}(EG_{M4,y} - EG_{M3,y})$ - $PR_{M1,y}$, please see the details in the following context.
QA/QC procedures to be applied:	Net electricity supplied to the grid will be double checked according to electricity bills to project owner and sale invoices to Grid Company.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	The installed capacity of the project after the implementation of the project activity.
Source of data to be used:	Feasibility Study Report and the mark of the generation units
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	Estimated to be 16,000,000W
Description of measurement methods and procedures to be applied	Verified on site
QA/QC procedures:	-
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	Estimated to be 12,266.67m^2
Description of measurement methods and procedures to be applied	The surface area will be calculated using the design schematics. Photographs of the reservoir at several key locations will be taken when the project becomes operational to check whether the actual reservoir deviate

	substantially for the design.
QA/QC procedures:	-
Any comment:	Refer to B.7.2. Description of the monitoring plan

B.7.2. Description of the monitoring plan:

The objective of the monitoring plan is to assure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The project owner is responsible for the implementation of the monitoring plan, and the Grid Company cooperates with the project entity.

1. Monitoring Data

The main monitoring data are electricity delivered to the grid and the power imported by the project from gird thus gets the net electricity delivery because the baseline emission factor is fixed by Ex-ante calculation.
Additionally, installed capacity of the project and the area of the reservoir at full water level will be monitored to calculate the power density.

2. Monitoring Organization

A monitoring officer will be appointed by the project owner, who supervise and verify metering and recording, collect data (the data on the ammeter), calculate emission reductions and prepare monitoring report.

The principal of the station
Measuring the generation

↓

The monitoring personnel
- Verifying the measurement;
- Collecting the data;
- Calculating the emission reductions;
- Preparing the monitoring report; etc.

↓

The manager of the station
Auditing and discussing

3. Monitoring Equipment and program

According to *Technical Administrative Code of Electric Energy Metering* (DL/T448-2000), the electric energy metering will be properly configured, and the metering equipment will be checked by both the project owner and the grid company before operation.

There are 6 hydropower stations on Xinqiao river basin, and they are from upstream to downstream Wayao River, Sitaishan, the project (Ladeng River), Maguo River, Maocaoping and Maocaoping Weishui hydropower station. These stations are connected to each other, and there is one transmission line between

each two stations. There is only one transmission line from each station to another station or transformer substation without any backup line. In case the Ma-Mao line or Mao-Xin line were broken down, all stations supplying electricity through the line have to pause generation and Grid Company will maintain the line. In case the La-Ma line was breakdown, the proposed project and Sitaishan will stop generation. The electricity connection of the 6 projects is in Fig B.3.

There should be more meters in reality than in the figure, but except the shown meters others are not related to calculation of emission reduction of the project. Therefore, their locations and functions will not be considered in below context.

Regarding to the project, only M5, M6, M7, M4, M3, M1, M13 and M14 will be monitored and their readings would be used to calculate the net electricity supplied to the grid. The information of the metering equipments is shown in Table B.9.

Table B.9 Information of Electric Meters

Meter	Recording	Calibration	Accuracy	Measuring	Remarks
M7	Monthly	Qualified Body (Annually)	Class 0.5s	Electricity delivered to the grid by the Sitaishan Station (not include the transmission line loss of Si-La line)	Main meter
M6	Monthly	Qualified Body (Annually)	Class 0.5s	Electricity delivered to the grid by the Sitaishan Station and the proposed project (include the transmission line loss of La-Ma line)	Main meter
M5	Monthly	Qualified Body (Annually	Class 0.5s	Electricity delivered to the grid by the Sitaishan Station and the proposed project (not include the transmission line loss of La-Ma line)	Main meter
M4	Monthly	Qualified Body (Annually)	Class 0.5s	Total electricity delivered to the grid by the Wayao River, Sitaishan, Ladeng River and Maguo River Station (include the transmission line loss of Ma-Mao line)	Main meter
M3	Monthly	Qualified Body (Annually)	Class 0.5s	Total electricity delivered to the grid by the Wayao River, Sitaishan, Ladeng River and Maguo River Station (not include the transmission line loss of Ma-Mao line)	Main meter
M1	Monthly	Qualified Body (Annually)	Class 0.5s	Total power imported from the grid by all six stations	Main meter
M14 and M15	Monthly	Qualified Body (Annually)	Class 1.0	Power generation by the proposed project	Backup meters

For the electric meters in Table B.9:
M7 measures the electricity supplied to the grid by Sitaishan Station ($EG_{M7,y}$); M6 measures the total electricity supplied by the proposed project and the Sitaishan Station ($EG_{M6,y}$, include the transmission line loss of La-Ma line). According to the difference of $EG_{M7,y}$ and $EG_{M6,y}$, the gross electricity supplied to the grid by the proposed project can be calculated as ($EG_{M6,y}$ - $EG_{M7,y}$);

M5 measures the total electricity supplied to the grid by the proposed project and the Sitaishan Station ($EG_{M5,y}$, not include the transmission line loss of La-Ma line). According to the difference

of $EG_{M5,y}$ and $EG_{M6,y}$, the transmission line loss of La-Ma line will be calculated as ($EG_{M6,y}$ - $EG_{M5,y}$), and the transmission line loss of La-Ma line will be shared the Sitaishan Station and the proposed project based on the power generation of the two stations . Therefore, the line loss of the proposed project activity is calculated as:

$$\frac{EG_{M6,y}-EG_{M7,y}}{EG_{M6,y}}(EG_{M6,y}-EG_{M5,y});$$

M4 measures the total power supplied to the grid by Wayao River (8MW), Sitaishan (12.6MW), Maguo River (10MW) hydropower stations and the project ($EG_{M4,y}$, include the transmission line loss of Ma-Mao line); M3 also measures the total power supplied to the grid by the four stations ($EG_{M3,y}$, not include the transmission line loss of Ma-Mao line) . According to difference of $EG_{M3,y}$ and $EG_{M4,y}$, the line loss of Ma-Mao line can be calculated by ($EG_{M4,y}$ - $EG_{M3,y}$) , and the line loss of Ma-Mao line is shared by Wayao River (8MW), Sitaishan (12.6MW), Ladeng River (16MW) and Maguo River hydropower stations based on the power generation. Hence the line loss of the project on La-Ma line is calculated as:

$$\frac{EG_{M6,y}-EG_{M7,y}}{EG_{M4,y}}(EG_{M4,y}-EG_{M3,y});$$

M1 measures the total power imported from the gird by all six stations ($PR_{M1,y}$); the imported electricity of each plant from the grid will be calculated based on each power generation., However taking conservative into account, each power generation of the hydropower station will subtract all the imported electricity respectively, thus the electricity imported from the gird by the proposed project ($PR_{g,y}$) will be calculated as:

$$PR_{g,y} = PR_{M1,y}$$

Thus, the net power supplied to the grid (EG_y) by the proposed project will be calculated by:

EGy = ($EG_{M6,y}$ - $EG_{M7,y}$) - $\frac{EG_{M6,y}-EG_{M7,y}}{EG_{M6,y}}(EG_{M6,y}-EG_{M5,y})$ - $\frac{EG_{M6,y}-EG_{M7,y}}{EG_{M4,y}}(EG_{M4,y}-EG_{M3,y})$ - $PR_{M1,y}$ [84]

---

[84] According to Guidelines of Energy Losses Calculation for Small-Scale Hydropower Grid (SL173-96) published in August 17th, 1996, and it has been in effect since October 1st, 1996. (http://www.bjwater.gov.cn/Portals/flfg/files/S017-1.pdf), the line loss is calculated:

$$\Delta A = 3I^2_{jf}RT\times10^{-3}, \quad I_{jf}=\sqrt{\frac{\sum_{t=1}^{24}I_t^2}{24}}$$

ΔA=daily electric quantity loss, kWh;

T=operational hours, h;

I_{jf} = root mean square current, A;

R= line resistance, Ω;

In case the main meter (M1, M3, M4, M5, M6 or M7) were in trouble, the project owner should employ the data monitored by M14 and M15 for calculation of the power supply, and the net power supplied to the grid will be calculated by (M14+M15)−(maximum historical electricity imports of the proposed project from grid) − (maximum historical transmission line loss of the proposed project).

Additionally, the installed capacity of the proposed project (Cap_{PJ}) and the surface area of the reservoir at full water level (A_{PJ}) of the project will be monitored to calculate the power density.

I_t = load current passes component on schedule, A.

As the above equation shows that the share of line loss for the project is only impacted by the transmission line. Among the above parameters, line resistance is addressed by the material, the length and the surface area of section, and the load current is addressed by transmission voltage and capacity. Thus, for the one part of transmission line (between two stations), the material, the length, the surface area of section and transmission voltage are the same, however only the capacities of stations and operational hours (resulting in electricity transmitted and supplied to the grid) are different.

Moreover, although the way of lineloss calculation for each station is complicated, it is applied by the project owners of all stations to share the lineloss fairly. The calculation sheets are also agreed by the grid company before it delivers the electricity bills every month. The calculation sheets have been validated by the DOE.

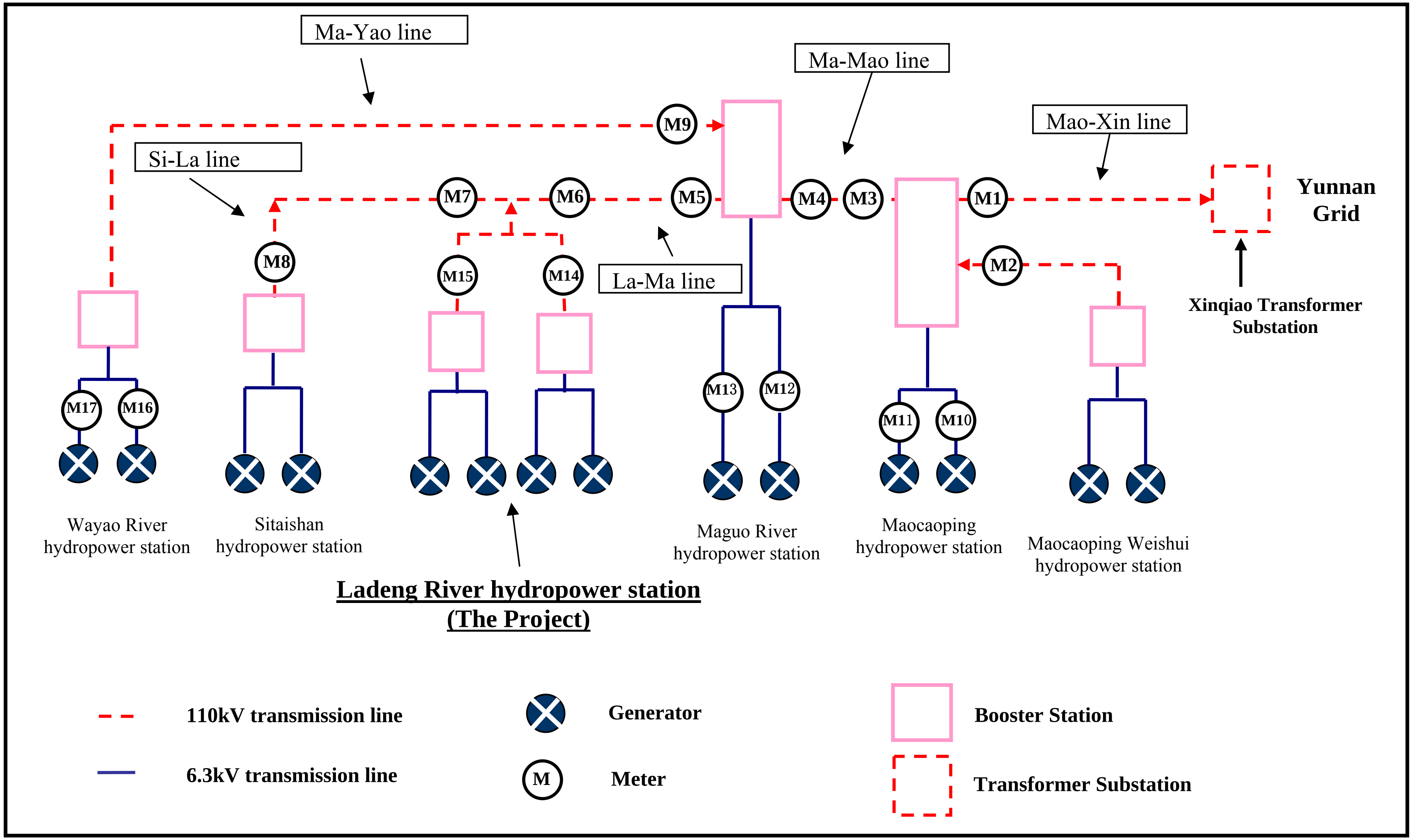

Fig B.3 The Wire Connection Diagram of the project

4. Data Collection and Meter Calibration

4.1 Electricity Generation Data

The Grid Company will assist the project owner for monitoring the backup meter and the main meter, and guarantee the measuring equipments are in good operation and completely sealed.

The electricity recorded by the main meters alone will suffice for the purpose of billing and emission reduction verification as long as the main meters fault is within the permissible tolerance. The main monitoring process is as follows:

- i The project owner and Grid Company read and check the backup meters and the main meters and record the data at one appointed day of every month;
- ii The grid company delivers the record of electricity delivered to the grid to the project owner;
- iii The project owner provides an electricity sales invoice to the Grid Company. A copy of the invoice is stored by the project owner, together with a record of the payment by the grid company.
- iv The Grid Company provides an electricity sales invoice to the project owner, and the invoice is stored by the project owner.
- v The project owner records the electricity supplied to the grid;
- vi The project owner keeps and safeguards the records of data reading of the main meter and backup meters for verification by the DOE.

If any previous months reading of the main meter is inaccurate by more than the allowable error or otherwise functioned improperly, or any other unexpected problems, the grid-connected electricity generated by the proposed project shall be determined by:

- First, by reading backup meters for calculation of the power supply, unless a test by either party reveals it inaccurate;
- If the backup meters are not with acceptable limits of accuracy or is otherwise performing improperly the proposed project owner and the Grid Company shall jointly prepare a conservative estimate of the correct reading, and shall afford enough evidences to explain that the method is logical for DOE; and
- If the proposed project owner and the Grid Company fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to agreed procedures.

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

4.2 Data of Installed capacity and Area of the reservoir measured in the surface of water when the reservoir is full

The installed capacity will be checked according to the mark on the generator units annually.
The area of the reservoir measured in the surface of water when the reservoir is full will be calculated according to the design schematics. Photographs of the reservoir at several key locations will be taken when the project becomes operational to check whether the actual reservoir deviate substantially for the design.

5. Calibration

The verification of electric energy meter should be periodically carried out according to relevant national electric industry standards or regulations. After verification, meters should be sealed. Both meters shall be jointly inspected and sealed on behalf of the project owner and Grid Company and shall not be accessible by either party except in the presence of the other party or its accredited representatives.
All the meters installed shall be tested by the qualified metrical organization co-authorized by the project owner and the Grid Company within 10 days after:

i The detection of a difference larger than the allowable tolerance in the readings of the main meter and the backup meter;
ii Repair to the faulty meter caused by improper operation.

6. Data Management

Data will be archived at the end of each month using electronic spreadsheets. The electronic files will be stored on hard disk and CD-ROM. In addition, a hard copy printout will be archived. Physical documentation such as, paper-based maps, diagrams and environmental assessment, will be collected in a central place, together with the monitoring plan. In order to facilitate the auditor's reference, monitoring results will be indexed. All paper-based information will be stored by the project owner.
All data records will be kept for a period of 2 years following the end of the crediting period.

7. Monitoring Report

The project owner will in addition collect sales receipts for the power delivered to the grid as a cross-check. At the end of each crediting year, a monitoring report will be compiled detailing the metering results and evidence (i.e. sales invoices).

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

Date of completion: 23/07/2009
Name of persons determining the baseline:

Alex Yang, General Manager, Beijing Tianqing Power International CDM Consulting Co., Ltd.
Tel: +86-10-62199416; 62199417
Fax: +86-10-62166196; 62164780
Email: aiminyang820@yahoo.com.cn
(Not Project Participant)

Tony Li, Beijing Tianqing Power International CDM Consulting Co., Ltd.
Tel: +86-10-62199416; 62199417
Fax: +86-10-62166196; 62164780
Email: lixiaofeng44@yahoo.com.cn
(Not Project Participant)

Christine Wang, Beijing Tianqing Power International CDM Consulting Co., Ltd.
Tel: +86-10-62199416; 62199417
Fax: +86-10-62166196; 62164780
Email: wang_wangting@yahoo.com.cn
(Not Project Participant)

Tracy Yuan, Beijing Tianqing Power International CDM Consulting Co., Ltd.
Tel: +86-10-62199416; 62199417
Fax: +86-10-62166196; 62164780
Email: abeautytracy@yahoo.com.cn
(Not Project Participant)

SECTION C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

14/03/2006 (the signature date of construction contract, which is the earliest starting date of the project activity earlier than the CDM-PDD for GSP), it can be determined by Table B.2.

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

The expected operational lifetime of the project activity is 25 years.

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

C.2.1. Renewable crediting period

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

01/10/2009 (The crediting period will not commence prior to the date of registration)

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

Not applicable

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Environmental impacts

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

According to the relevant environmental law and regulations, an environmental impact assessment had been carried out, and the environmental impact assessment report had been approved by Honghe Environmental Protection Bureau on March 6, 2006. The main assessment conclusions are provided below:

1、 Impact on the Air environment quality

The main air pollutants are dusts; powders etc produced from blasting, stone crushing and transport vehicles during the construction periods. For the workers who contact the powder in the long time, they should wear respirators to protect and the time in turn system should be carried out for them. Some operations will be done in wet conditions. The tank car which will sprinkle the construction road everyday will be employed during the construction periods. In the summer, the sprinkling times will be increased. There isn't any resident inhabit here separately, and the influence scale is comparatively mall. The impacts will finished when the project has been finished.

2、 Impact on the water environment

The impacts on the water quality are mainly in industrial wastewater and domestic sewage. The industrial wastewater which roots in aggregate flushing and concrete stirring, pouring, maintaining etc. will be collected to treat in the precipitating tank to reach the standard before discharging. Four sewage integrated disposal equipments will be set up in the four construction living areas to treat the domestic sewage to achieve the standard before discharging.

3、 Noise impact on the environment

The noise will be generated mainly by construction machinery, engineering excavation, transport vehicles, the aggregate processing and blasting etc. The builders who work in the big noise condition must wear the personal protection appliances as earplugs, and the time in turn system should be carried out for them.

4、 Impact of solid waste on the environment

The solid waste includes discarded slag and domestic refuses. Three slag sites, two of which are permanent, will be built to deal with the discarded slag. The protecting measures will be taken to avoid the water and soil loss. The domestic refuses will be treated with sanitary landfill method to avoid the environmental pollution.

5、 Impact on water and soil loss

The project operation impacts on water and soil loss is mainly happened in the construction periods. The impacts appear mostly in digging, discarded slag and road building which destroy the vegetation and the slop stability. The project owner will strengthen the project management, carry out the corresponding project defending measures to prevent and cure, reclaim the temporary occupation of land by construction, and green the permanent occupied land by adjusting measures to local conditions with trees or grass, which could renew the vegetation and beautify the environment.

6、 Impact on the ecological environment

The project causes little impacts on local animal and plant. In the dry seasons, the ecological water of $0.25m^3/s$ and $0.45m^3/s$ will be guaranteed at the two dams respectively to reduce the impacts to the aquatic life, fishes and the vegetation at both sides of the river. When the construction has been finished, the vegetations will be renewed as soon as possible.

7. Impact on Land Requisition, Land Utilization and Immigration

The total occupied land amounts to 24.39hm^2, and the permanently occupied land to 17.51hm^2. Since the working plant for this project is centralized, the occupied tilled land is limited. The project owner will compensate for land occupation and the influence on local citizens will be comparatively small.

8. Impact on Immigration

This project does not involve moving the local residents.

9. Transboundary Environmental Impact

Xinqiao River and its branches are not transboundary Rivers, so there is no transboundary environmental impact involved with the project activity.

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

All of project participants and host party involved think there is little negative environmental impact of this proposed project.

SECTION E. Stakeholders' comments

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

In order to comprehend the opinions and advices of this project from all stakeholders, also the residues of the areas which probably be affected, the project owner had distributed questionnaires for local residents to investigate the suggestion of them on the construction of Jinping Ladeng River Hydropower Station, including the impact on society, economy and Manufacture.

After that, a special stakeholder consultation meeting of the project was organized at the boardroom of Lvshui River Power Plant, Yunnan Province at PM 14:30～18:00 on Jul. 27, 2007, to investigate opinions of all the potential stakeholders, such as local residents and so on, aiming at collecting advice on the influence imposed on the local society, economy, daily life etc for the project broadly. In order to make the potential stakeholders to receive information of the meeting, Yunnan Jinping Ladeng River Power Generation Co., Ltd. published a bulletin for the meeting of stakeholders on the newspaper of *Honghe Daily* and via the website of www.tqcdmchina.com/cn/html/NewsView.asp?ID=59 on Jul. 25, 2007. In the bulletin, the companies noticed that all the potential stakeholders could know the detailed information on the project. On the meeting, the project owner and the consultant invited the participants in the meeting to express their comments and concerns about the project and CDM. The representatives asked some following questions focusing on CDM and the project, and then they got satisfied answers from experts. The following is the questions that the questionnaires and the stakeholder consultation meeting referred:

1. Is there any situation of electricity shortage?
2. What are the local residents live on?
3. Which negative impact on local will have caused by the construction? Such as electric consumption or migrating?
4. Will the construction of the station influence noise and drinking water pollution? How far is it from the nearest local residents?
5. What kinds of resources are used for daily life? What is the main income for local citizens? After the construction of the station, is there any increase for the income for local citizens? If yes, how to increase the income?
6. Before the construction of the project, what is the site used for? Whether the local residents have some following questions, such as tilled land reduction and so on? If there are such kinds of questions, have they been resolved? Whether the standard of compensation has been complied with the national policy?
7. Will the project bring any negative impacts on local ecological environment? Such as, local animals, fish, vegetable and so on.
8. Whether the construction of the reservoir will impact the local ecological environment? If any, are there any measures to solve the problems?
9. What's the attitude of citizens and government for the CDM project? Support or oppose?
10. Do you agree with the construction of the project?

E.2. Summary of the comments received:

Additionally, some residents were investigated who may be impacted by the proposed project and twenty investigation questionnaires came back, of which, 20% are female, 100% are graduated from junior high school or inferior, 100% are elder than twenty years old, and the investigation results are following:

- 100% of the investigated residents think the lack of electricity exist in local area, and 40% of the investigated residents think the lack of electricity seriously exist in local area.

- 100% of the investigated residents think the hydropower station will bring benefit to their lives, such as providing more employment opportunity, increasing their income and solving the problems of lack of electricity.
- 100% of the investigated residents think the hydropower station will cause little negative impacts on local residents.
- 100% of the investigated residents think the hydropower station doesn't cause negative impact on environment.
- 100% of the investigated residents agree with the construction of the project.

There were 19 residents and government staff presented at the stakeholders meeting. The project owner made a meeting minute.

From the questionnaires and stakeholder consultation meeting, we can find that all the local government and residents agree with the construction of the project. All stakeholders think that: the construction will not bring negative influence on ecological environment. The project will make best use of local water resource, mitigate the electricity supplying shortage. Meanwhile, the project will facilitate the consumption of electricity for local residents, carry out the electricity substitute firewood, and the environment could be protected. At the same time, the construction of the project will bring more employment opportunity that increase the income of local residents and improve the living standard. In summary, there is little negative impact from the project.

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

Given the generally positive (or neutral) nature of the comments received, no action will been taken to solve the comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Owner

Organization:	Yunnan Jinping Ladeng River Power Generation Co., Ltd.
Street/P.O.Box:	Room 022, Security Mansion 4th floor, Chuncheng Road No. 62, Kunming City, Yunnan Province
Building:	Room 022, Security Mansion 4th floor
City:	Kunming City
State/Region:	Yunnan Province
Postcode/ZIP:	650011
Country:	People's Republic of China
Telephone:	+86-871-3011034
FAX:	+86-871-3011034
E-Mail:	zhaochenchen126@126.com
URL:	/
Represented by:	Tianchao Zhu
Title:	Board Chairman
Salutation:	Mr.
Last Name:	Zhu
Middle Name:	/
First Name:	Tianchao
Department:	Management Department
Mobile:	+86-13888228870
Direct FAX:	+86-871-3011034
Direct tel:	+86-871-3011034
Personal E-Mail:	zhaochenchen126@126.com

The Buyer

Organization:	Edison Spa
Street/P.O.Box:	Foro Buonaparte, 31
Building:	/
City:	/
State/Region:	Milan
Postfix/ZIP:	20121
Country:	Italy
Telephone:	+39-02-62227572
FAX:	+39-02-62227218
E-Mail:	nicola.desanctis@edison.it
URL:	www.edison.it
Represented by:	Nicola De Sanctis
Title:	Renewable Sources & CO_2 Director
Salutation:	Mr.
Last Name:	Sanctis
Middle Name:	/
First Name:	Nicola
Department:	/
Mobile:	/
Direct FAX:	+39-02-62227218
Direct tel:	+39-02-62227572
Personal E-Mail:	nicola.desanctis@edison.it

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no official public funding from Annex I parties used in the project activity.

Annex 3

BASELINE INFORMATION

Table 1–The ratio of hydropower and other low cost/must run power of total grid generation for the China Southern Power Grid, 2001-2005

	2001	2002	2003	2004	2005
Electricity Generation of Thermal power plant (MWh)	162,910,000	185,168,000	222,780,000	263,574,000	287,187,000
Electricity Generation of Hydro power plant (MWh)	79,971,000	83,093,000	83,271,000	84,072,000	94,919,000
Other Power (MWh)	15,135,000	21,012,000	29,089,000	28,530,000	30,632,000
Total Electricity Generation of the North-west Grid (MWh)	258,016,000	289,273,000	335,140,000	376,277,000	412,738,000
The ratio of power generated by Hydro power, and other low cost/must run power of total grid generation（%）	36.86%	35.99%	33.53%	29.95%	30.42%

Data Source: China Electric Power Yearbook 2002-2006.

Table 2–Power Supply data for the China Southern Power Grid, 2003

	Guangdong	Guangxi	Guizhou	Yunnan
Thermal Power Generation (MWh)	143,351,000	17,079,000	43,295,000	19,055,000
Rate of Electricity Consumption of the Power Plant (%)	5.50	8.43	7.40	8.01
Power Supplied to the Grid(MWh)	135,466,695.00	15,639,240.00	40,091,170.00	17,528,695.00
Total Supplied to Grid of the Thermal Power (MWh)	208,725,800.00			
Net import Power from the Central China Power Grid (MWh)	11,100.00			
The total Power for the China Southern Power Grid (MWh)	208,736,900.00			

Data Source: China Electric Power Yearbook 2004, State Power Information Network (http://www.sp.com.cn/zgdl/spw/04_12y/04_12_dljh.htm).

Table 3–Power Supply data for the China Southern Power Grid, 2004

	Guangdong	Guangxi	Guizhou	Yunnan
Thermal Power Generation (MWh)	169,389,000	20,143,000	49,720,000	24,322,000
Rate of Electricity Consumption of the Power Plant (%)	5.42	8.33	7.06	7.56
Power Supplied to the Grid(MWh)	160,208,116.20	18,465,088.10	46,209,768.00	22,483,256.80
Total Supplied to Grid of the Thermal Power (MWh)		247,366,229.10		
Net import Power from the Central China Power Grid(MWh)		10,951,240.00		
The total Power for the South China Power Grid (MWh)		258,317,469.10		

Data Source: China Electric Power Yearbook 2005, State Power Information Network (http://www.sp.com.cn/zgdl/spw/04_12y/04_12_dljh.htm).

Table 4–Power Supply data for the China Southern Power Grid, 2005

	Guangdong	Guangxi	Guizhou	Yunnan
Thermal Power Generation (MWh)	176,453,000	25,023,000	58,430,000	27,281,000
Rate of Electricity Consumption of the Power Plant (%)	5.58	7.95	7.34	6.94
Power Supplied to the Grid(MWh)	166,606,922.60	23,033,671.50	54,141,238.00	25,387,698.60
Total Supplied to Grid of the Thermal Power (MWh)		269169530.70		
Net Import Power from the Central China Power (MWh)		96,363,000.00		
The Total Power for the South China Grid (MWh)		365,532,530.70		

Data Source: China Electric Power Yearbook 2006, State Power Information Network (http://www.sp.com.cn/zgdl/spw/05_12y/05_12_sdl.htm).

Table 5– Calculation of average emission factor for the Central China Power Grid in 2003- 2005

	2003	2004	2005
Total CO_2 emission of the Central China Power Grid (tCO_2e)	276,404,544.15	345,671,697.30	359,887,487.74
The total power supplied to the Central China Power Grid (MWh)	346,613,868.40	418,261,666.30	466,644,030.00
Average emission factor (tCO_2e/ MWh)	0.7974423	0.8264484	0.7712249

Table 6– Energy Consumption Statistics of Power Generation of the China Southern Power Grid in 2003

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total E=A+B+C+D
Raw coal	Ten thousand Tons	4,491.79	831.84	2,169.11	1,405.27	8,898.01
Clean coal	Ten thousand Tons	0.05	0.00	0.00	0.00	0.05
Other washed coal	Ten thousand Tons	0.00	0.00	36.38	20.37	56.75
Coke	Ten thousand Tons	0.00	0.00	0.00	0.50	0.50
Coke oven gas	10^8 Cubic meter	0.00	0.00	0.00	0.04	0.04
Other gas	10^8 Cubic meter	3.21	0.00	0.00	11.27	14.48
Crude oil	Ten thousand Tons	6.85	0.00	0.00	0.00	6.85
Gasoline	Ten thousand Tons	0.02	0.00	0.00	0.00	0.02
Diesel oil	Ten thousand Tons	31.90	0.00	0.00	0.76	32.66
Fuel oil	Ten thousand Tons	627.22	0.30	0.00	0.00	627.52
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Refinery gas	Ten thousand Tons	2.85	0.00	0.00	0.00	2.85
Natural gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	0.00
Other petroleum products	Ten thousand Tons	11.35	0.00	0.00	0.00	11.35
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other Energy	Ten thousand Tce	93.21	0.00	0.00	22.35	115.56

Data Source: China Energy Statistical Yearbook 2004.

Table 7–The Operation Margin Emission Factor Calculation of the China Southern Power Grid in 2003

Fuel	Unit	Fuel Consumption of the Central China Grid in 2002 G	Emission Factor H（tc/TJ）	Average NCV I ($MJ/t,km^3$)	CO_2 Emission(tCO_2e) K=G*H*I* 44/12/100 (for quality unit) K=G*H*I* 44/12/10 (for volume unit)
Raw coal	Ten thousand Tons	8,898.01	25.80	20,908	175,993,455.05
Clean coal	Ten thousand Tons	0.05	25.80	26,344	1,246.07
Other washed coal	Ten thousand Tons	56.75	25.80	8,363	448,971.84
Coke	Ten thousand Tons	0.50	25.80	28,435	13,449.76
Coke oven gas	10^8 Cubic meter	0.04	12.10	16,726	2,968.31
Other gas	10^8 Cubic meter	14.48	12.10	5,227	335,797.81
Crude oil	Ten thousand Tons	6.85	20.00	41,816	210,055.71
Gasoline	Ten thousand Tons	0.02	18.90	43,070	596.95
Diesel oil	Ten thousand Tons	32.66	20.20	42,652	1,031,759.27
Fuel oil	Ten thousand Tons	627.52	21.10	41,816	20,301,304.48
LPG	Ten thousand Tons	0.00	17.20	50,179	0.00
Refinery gas	Ten thousand Tons	2.85	18.20	46,055	87,592.00
Natural gas	10^8 Cubic meter	0.00	15.30	38,931	0.00
Other petroleum products	Ten thousand Tons	11.35	20.00	38,369	319,357.98
Other coking products	Ten thousand Tons	0.00	25.80	28,435	0.00
Other Energy	Ten thousand Tce	115.56	0.00	0.00	0.00
Emission of electricity from the Central China Power Grid		0.7974423×11,100= 8,851.61tCO_2e			
Total Emission (Q)		198,755,406.84tCO_2e			
Thermal Power supplied to the Central China Power Grid (P)		208,736,900.00MWh			
OM Emission Factor in 2003 [＝Q/P]		0.952181tCO_2e/MWh			

Data sources: China Energy Statistical Yearbook 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories，Table 1.3 of page 1.21-1.22 in Chapter 1, Volume II

Table 8–Energy Consumption Statistics of Power Generation of the China Southern Power Grid in 2004

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total E=A+B+C+D
Raw coal	Ten thousand Tons	6,017.70	1,305.00	2,643.90	1,751.28	11,717.88
Clean coal	Ten thousand Tons	0.21	0.00	0.00	0.00	0.21
Other washed coal	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Coke	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Coke oven gas	10^8 Cubic meter	0.00	0.00	0.00	0.00	0.00
Other gas	10^8 Cubic meter	2.58	0.00	0.00	0.00	2.58
Crude oil	Ten thousand Tons	16.89	0.00	0.00	0.00	16.89
Gasoline	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Diesel oil	Ten thousand Tons	48.88	0.00	0.00	1.83	50.71
Fuel oil	Ten thousand Tons	957.71	0.00	0.00	0.00	957.71
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Refinery gas	Ten thousand Tons	2.86	0.00	0.00	0.00	2.86
Natural gas	10^8 Cubic meter	0.48	0.00	0.00	0.00	0.48
Other petroleum products	Ten thousand Tons	1.66	0.00	0.00	0.00	1.66
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other Energy	Ten thousand Tce	79.42	0.00	0.00	0.00	79.42

Data Source: China Energy Statistical Yearbook 2005.

Table 9– The Operation Margin Emission Factor Calculation of the China Southern Power Grid in 2004

Fuel	Unit	Fuel Consumption of the Central China Grid in 2002 G	Emission Factor H（tc/TJ）	Average NCV I (MJ/t,km^3)	CO_2 Emission(tCO_2e) K=G*H*I* 44/12/100 (for quality unit) K=G*H*I* 44/12/10 (for volume unit)
Raw coal	Ten thousand Tons	11,717.88	25.80	20,908	231767573.55
Clean coal	Ten thousand Tons	0.21	25.80	26,344	5233.50
Other washed coal	Ten thousand Tons	0.00	25.80	8,363	0.00
Coke	Ten thousand Tons	0.00	25.80	28,435	0.00
Coke oven gas	10^8 Cubic meter	0.00	12.10	16,726	0.00
Other gas	10^8 Cubic meter	2.58	12.10	5,227	59831.38
Crude oil	Ten thousand Tons	16.89	20.00	41,816	517932.98
Gasoline	Ten thousand Tons	0.00	18.90	43,070	0.00
Diesel oil	Ten thousand Tons	50.71	20.20	42,652	1601975.28
Fuel oil	Ten thousand Tons	957.71	21.10	41,816	30983494.25
LPG	Ten thousand Tons	0.00	17.20	50,179	0.00
Refinery gas	Ten thousand Tons	2.86	18.20	46,055	87899.34
Natural gas	10^8 Cubic meter	0.48	15.30	38,931	104833.40
Other petroleum products	Ten thousand Tons	1.66	20.00	38,369	46707.86
Other coking products	Ten thousand Tons	0.00	25.80	28,435	0.00
Other Energy	Ten thousand Tce	79.42	0.00	0.00	0.00
Emission of electricity from the Central China Power Grid		0.8264484×10,951,240=9,050,630.39tCO_2e			
Total Emission (Q)		274,226,116.64tCO_2e			
Thermal Power supplied to the Central China Power Grid (P)		258,317,469.10MWh			
OM Emission Factor in 2004[＝Q/P]		1.061586tCO_2e/MWh			

Data sources: China Energy Statistical Yearbook 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories，Table 1.3 of page 1.21-1.22 in Chapter 1, Volume Ⅱ

Table 10– Energy Consumption Statistics of Power Generation of the China Southern Power Grid in 2005

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total E=A+B+C+D
Raw coal	Ten thousand Tons	6,696.47	1,435	3,212.31	1,975.55	13,319.33
Clean coal	Ten thousand Tons	0.00	0.00	0.00	0.15	0.15
Other washed coal	Ten thousand Tons	0.00	0.00	10.39	33.88	44.27
Coke	Ten thousand Tons	4.79	0.00	0.00	8.05	12.84
Coke oven gas	10^8 Cubic meter	0.00	0.00	0.00	0.79	0.79
Other gas	10^8 Cubic meter	1.87	0.00	0.00	15.96	17.83
Crude oil	Ten thousand Tons	10.91	0.00	0.00	0.00	10.91
Gasline	Ten thousand Tons	0.68	0.00	0.00	0.00	0.68
Diesel oil	Ten thousand Tons	31.96	2.02	0.00	1.81	35.79
Fuel oil	Ten thousand Tons	887.21	0.00	0.00	0.00	887.21
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Refinery gas	Ten thousand Tons	4.92	0.00	0.00	0.00	4.92
Natural gas	10^8 Cubic meter	0.93	0.00	0.00	0.00	0.93
Other petroleum products	Ten thousand Tons	1.70	0.00	0.00	0.00	1.7
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other Energy	Ten thousand Tce	104.66	133.15	0.00	59.72	297.53

Data Source: China Energy Statistical Yearbook 2006

Table 11– The Operation Margin Emission Factor Calculation of the China Southern Power Grid in 2005

Fuel	Unit	Fuel Consumption of the Central China Grid in 2002 G	Emission Factor H（tc/TJ）	Average NCV I (MJ/t,km^3)	CO_2 Emission(tCO_2e) K=G*H*I* 44/12/100 (for quality unit) K=G*H*I* 44/12/10 (for volume unit)
Raw coal	Ten thousand Tons	13,319.33	25.80	20,908	263,442,601.85
Clean coal	Ten thousand Tons	0.15	25.80	26,344	3,738.21
Other washed coal	Ten thousand Tons	44.27	25.80	8,363	350,237.59
Coke	Ten thousand Tons	12.84	25.80	28,435	345,389.71
Coke oven gas	10^8 Cubic meter	0.79	12.10	16,726	58,624.07
Other gas	10^8 Cubic meter	17.83	12.10	5,227	413,485.84
Crude oil	Ten thousand Tons	10.91	20.00	41,816	334,555.88
Gasline	Ten thousand Tons	0.68	18.90	43,070	20,296.31
Diesel oil	Ten thousand Tons	35.79	20.20	42,652	1,130,638.84
Fuel oil	Ten thousand Tons	887.21	21.10	41,816	28,702,703.26
LPG	Ten thousand Tons	0.00	17.20	50,179	0.00
Refinery gas	Ten thousand Tons	4.92	18.20	46,055	151,211.46
Natural gas	10^8 Cubic meter	0.93	15.30	38,931	203,114.71
Other petroleum products	Ten thousand Tons	1.70	20.00	38,369	47,833.35
Other coking products	Ten thousand Tons	0.00	25.80	28,435	0.00
Other Energy	Ten thousand Tce	297.53	0	0	0.00
Emission of electricity from the Central China Power Grid		0.7712249×96,363,000=74,317,554.67tCO_2e			
Total Emission (Q)		369,521,974.54tCO_2e			
Thermal Power supplied to the Central China Power Grid (P)		365,532,530.70MWh			
OM Emission Factor in 2005 [＝Q/P]		1.010914tCO_2e/MWh			

Data sources: China Energy Statistical Yearbook 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories，Table 1.3 of page 1.21-1.22 in Chapter 1, Volume Ⅱ.

Table 12– Calculation of average emission factor for the China Southern Power Grid in recent 3 years

	2003	2004	2005
Total CO_2 emission of the South China Power Grid (tCO_2e)	198,755,406.84	274,226,116.64	369,521,974.54
The total power supplied to the South China Power Grid (MWh)	208,736,900.00	258,317,469.10	365,532,530.70
Average emission factor (tCO_2e/ MWh)	= (198,755,406.84+274,226,116.64+369,521,974.54) / (208,736,900.00 +258,317,469.10 +365,532,530.70) = 1.0119tCO_2e/MWh		

Table 13– Calculation of CO_2 Emission of Solid, Liquid and Gas Fuel for Power Generation

Fuel		Unit	Guang dong	Guangxi	Guizhou	Yunnan	Total	NCV kJ/kg kJ/m^3 H	Emission Factor I	CO_2 emission (tCO_2e)	**ratio**
Solid	Raw coal	10^4 Tons	6,696.47	1,435.00	3,212.31	1,975.55	13,319.33	20,908.00	25.80	263,442,602	-
	Clean coal	10^4 Tons	0.00	0.00	0.00	0.15	0.15	26,344.00	25.80	3,738	-
	Other washed coal	10^4 Tons	0.00	0.00	10.39	33.88	44.27	8,363.00	25.80	350,238	-
	Coke	10^4 Tons	4.79	0.00	0.00	8.05	12.84	28,435.00	25.80	345,390	-
	Subtotal	-	-	-	-	-	-	-	-	**264,141,967**	89.48%
Liquid	Crude oil	10^4 Tons	10.91	0.00	0.00	0.00	10.91	41,816.00	20.00	334,556	-
	Gasoline	10^4 Tons	0.68	0.00	0.00	0.00	0.68	43,070.00	18.90	20,296	-
	Coal oil	10^4 Tons	0.00	0.00	0.00	0.00	0.00	43,070.00	19.60	0.00	-
	Diesel oil	10^4 Tons	31.96	2.02	0.00	1.81	35.79	42,652.00	20.20	1,130,639	-
	Fuel oil	10^4 Tons	887.21	0.00	0.00	0.00	887.21	41,816.00	21.10	28,702,703	-
	Other petroleum products	10^7 m^3	1.70	0.00	0.00	0.00	1.70	38,369.00	20.00	47,833	-
	Subtotal	-	-	-	-	-	-	-	-	**30,236,028**	10.24%
Gas	Natural gas	10^7 m^3	9.30	0.00	0.00	0.00	9.30	38,931.00	15.30	203,115	-
	Coke oven gas	10^7 m^3	0.00	0.00	0.00	7.90	7.90	16,726.00	12.10	58,624	-
	Other gas	10^4 Tons	18.70	0.00	0.00	159.60	178.30	5,227.00	12.10	413,486	-
	LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	50,179.00	17.20	0.00	-
	Refinery gas	10^4 Tons	4.92	0.00	0.00	0.00	4.92	46,055.00	18.20	151,211	-
	Subtotal	-	-	-	-	-	-	-	-	**826,436**	0.28%
Total					-	-	-	-	-	**295,204,431**	100%

Table 14– Calculating of Emission Factor for Various Power Plant

	Variable	Power Supply Efficiency L	Emission Factor for Fuels (tc/TJ) I	Emission Factor (tCO_2e/MWh) O=3.6/L/1000*I *J*44/12
Coal-fired Power Plant	$EF_{Coal,Adv}$	35.82%	25.80	0.9508
Gas-fired Power Plant	$EF_{Gas,Adv}$	47.67%	15.30	0.4237
Oil-fired Power Plant	$EF_{Oil,Adv}$	47.67%	21.10	0.5843

Therefore, the emission factor of thermal power is:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9117 tCO_2e/MWh$$

Table 15–Installed Capacity of the China Southern Power Grid in 2003

Installed Capacity	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Thermal Power(MW)	27,231.40	3,190.10	3,556.80	6,465.80	0.00	40,444.10
Hydro Power(MW)	8,107.20	4,525.20	6,543.20	3,713.70	2,520.00	25,409.30
Nuclear Power(MW)	3,780.00	0.00	0.00	0.00	0.00	3,780.00
Wind Power and others(MW)	83.40	0.00	0.00	0.00	0.00	83.40
Total(MW)	39,202.00	7,715.30	10,100.00	10,179.50	2,520.00	69,716.80

Data Source: 2004 China Electric Power Yearbook

Table 16– Installed Capacity of the China Southern Power Grid in 2004

Installed Capacity	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao
Thermal Power(MW)	30,172.90	4,378.10	4,306.90	7,801.80	46,659.70
Hydro Power(MW)	8,584.60	5,040.40	7,058.60	6,896.50	27,580.10
Nuclear Power(MW)	3,780.00	0.00	0.00	0.00	3,780.00
Wind Power and others(MW)	83.40	0.00	0.00	0.00	83.40
Total(MW)	42,620.90	9,418.50	11,365.50	14,698.30	78,103.30

Data Source: 2005 China Electric Power Yearbook

Table 17– Installed Capacity of the China Southern Power Grid in 2005

Installed Capacity	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal Power(MW)	35,182.60	4,931.20	4,758.40	9,634.80	54,507.00
Hydro Power(MW)	9,035.70	6,085.30	7,993.10	7,233.00	30,347.10
Nuclear Power(MW)	3,780.00	0.00	0.00	0.00	3,780.00
Wind Power and others （MW）	83.40	0.00	0.00	0.00	83.40
Total(MW)	48,081.70	11,016.50	12,751.50	16,867.80	88,717.50

Data Source: 2006 China Electric Power Yearbook, Tianshengqiao power station is included in Guizhou

Table 18– The BM Calculation of the China Southern Power Grid

	2003	2004	2005	Capacity Addition Of 2003-2005	Ratio of Capacity Addition
Thermal Power(MW)	40,444.10	46,659.70	54,507.00	14,062.9	74.01%
Hydro Power(MW)	25,409.30	27,580.10	30,347.10	4,937.8	25.99%
Nuclear Power （MW）	3,780.00	3,780.00	3,780.00	0.00	0.00%
Wind Power(MW)	83.40	83.40	83.40	0.00	0.00%
Total（MW）	69,716.80	78,103.30	88,717.50	19,000.70	100.00%
Percent of Installed Capacity in 2004	78.58%	88.04%	100.00%	-	-

$EF_{BM,y}$ = 0.9117×74.01% = 0.6748tCO_2e/MWh.

The OM is calculated as 1.0119tCO_2e/MWh, the BM is calculated as 0.6748tCO_2e/MWh. And the baseline emission factor equal to the combined margin with equally weighted average of the operating margin emission factor and the build margin emission factor.

According to “tool to calculate the emission factor for an electricity system (version 1.1)”, the default weight of hydropower is:

$w_{OM} = 0.5 \qquad w_{BM} = 0.5$

So the Baseline Emissions Factor (EF_y in tCO_2e/MWh) is 0.84335tCO_2e/MWh.

Annex 4

MONITORING INFORMATION

Selection procedure:
The monitoring officer will be appointed by the general manager of Yunnan Jinping Ladeng River Power Generation Co., Ltd. The monitoring officer will be selected among the senior technical or managerial staff. Before he/she commences monitoring duties, he/she will receive training on monitoring requirements and procedures by Beijing Tianqing Power International CDM Consulting Co., Ltd.

Tasks and responsibilities:
The monitoring officer will be responsible for carrying out the following tasks

- **Supervise and verify metering and recording:** The monitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.
- **Collection of additional data, sales / purchasing invoices:** The monitoring officer will monitor the M1, M3, M4, M5, M6 and M7 to get the net electricity supplied to the grid:

  $$EGy = (EG_{M6,y} - EG_{M7,y}) - \frac{EG_{M6,y} - EG_{M7,y}}{EG_{M6,y}}(EG_{M6,y} - EG_{M5,y}) - \frac{EG_{M6,y} - EG_{M7,y}}{EG_{M4,y}}(EG_{M4,y} - EG_{M3,y}) - PR_{M1,y}$$

  In case M1, M3, M4, M5, M6 or M7 were in trouble, M14 and M15 will be employed to calculate the electricity supplied to the grid.

  Additionally, the monitoring officer will also monitor the installed capacity of the project and the surface area of the reservoirs at full water level for power density calculation.
- **Calibration:** The monitoring officer will coordinate with staff of the project entity to ensure that calibration of the metering instruments is carried out periodically in accordance with regulations of the grid company.
- **Calculation of emission reductions:** The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.
- **Preparation of monitoring report:** The monitoring officer will annually prepare a monitoring report which will include among others a summary of daily monthly operations, metering values of power supplied to and received from the grid, copies of sales/purchasing invoices, a report on calibration and a calculation of emission reductions.

Support:
The monitoring officer will receive support from Beijing Tianqing Power International CDM Consulting Co., Ltd. in his/her responsibilities through the following actions:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving
- Provide the monitoring officer with a calculation template in electronic form for calculation of annual emission reductions
- Continuous advice to the monitoring officer on a need basis
- Review of monitoring reports