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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Yunnan Diqing Jisha Hydropower Project

Document version: 3.5

Completion Date: 04/ 11/2009

Revision history of this document

Version number	Date	Descripition and reason of revision
1	15 June 2007	Initial adoption
2	30 August 2007	The NDRC requested to revise the PDD according to the latest emission factor provided by Chinese DNA
3	24 September 2007	The NDRC requested to revise the PDD to reinforce data references
3.1	21 May 2008	Revise the PDD according to the latest methodology version
3.2	20 September 2008	Revise the PDD according to the EB 42th meeting
3.3	10 December 2008	Revised the PDD according to the draft validation report
3.4	27 April 2009	Revised the PDD according to the comments from CB

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A.2. Description of the project activity:

Yunnan Jisha Hydropower Project (hereafter refers to the proposed project) is located in Diqing Tibetan autonomous prefecture, Yunnan province, P.R.China. The proposed project is a run-of-river hydropower plant on the Shuoduo River with total installed capacity of 120MW, and the power density is about 62.2w/m^2, of which the reservoir can store water for 24 operating hours with the adjustive volume of 10.909 million m^3.The objective of the proposed project is to utilize water resources of the Shuoduo river valley for electricity generation through the installation and operation of two 60MW hydro turbines.

The scenario existing prior to the start of the implementation of the project activity is South China Power Grid providing the same electricity supply as the proposed project. The proposed project is a grid-connected renewable energy project, from which the electricity generated will deliver about 571,600 MWh per year to the Yunnan Power Grid that is integral to and forms a part of the South China Power Grid. The electricity generated by the proposed project is expected to displace grid electricity generated from fossil fuels and reduces GHG emissions by an amount of approximatey 482,030 tCO2e (tons of

carbon dioxide equivalent) per year for the duration of the proposed project activity. A reduction of approximately 3,374,210 tCO_2e is forecast for the first 7-year crediting period.

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

Hydro power is a priority development area as a green energy supply technology in China. The proposed project can improve energy security and environmental quality, and contribute to sustainable development in various ways:

- It is accorded with the government's energy policy objective, which promotes the local economy and creates local employment during the installation and operation periods;
- It reduces greenhouse gas emissions resulting from the power generation industry in China, compared to a business-as-usual approach;
- The successful implementation of the proposed project will be serving as a demonstration for wider deployment of hydropower technology in local and national level.
- The proposed project provides the cheap electricity power to instead of wood utilization for the local residents, which avoid destroying a large numbers of the trees and protects the environmental balance of the river valley.

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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)
China (host)	Guodian Diqing Shangri La Electricity Generation Co., Ltd.	No
Austria	Kommunalkredit Public Consulting GmbH	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.		

Please see Annex 1 for detailed contact information

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A.4. Technical description of the project activity:

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A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

People's Republic of China
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A.4.1.2. Region/State/Province etc.:

Yunnan Province
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A.4.1.3. City/Town/Community etc:

Xiao Zhongdian County, Diqing Tibetan Autonomous Prefecture
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A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The proposed project is located in Diqing Tibetan autonomous prefecture, Yunnan province, P.R.China. It's on the Shuoduo River which is 1.5 kilometers far from Xiao Zhongdian County. The geographical co-ordinates are: longitude 99°39´00´´-100°07´00´´, and northern latitude 27°10´00´´-28°00´00´´. Figure 1 illustrates the location of the proposed project.

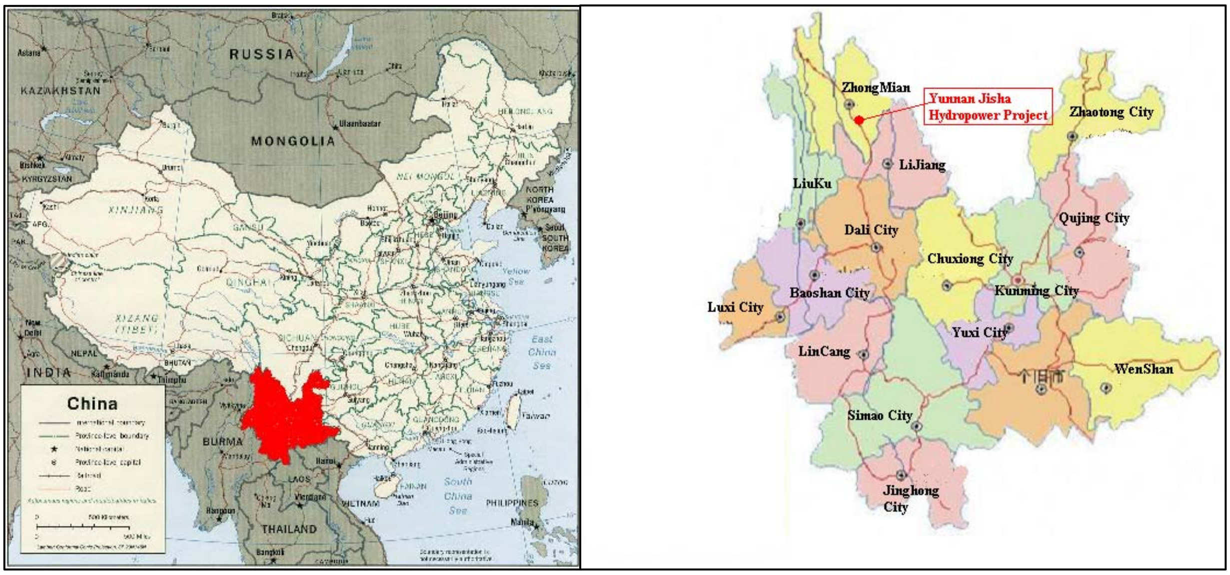

Figure 1 Location of Yunnan Jisha Hydropower Project

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

Category: Renewable Energy in grid connected applications

Sectoral Scope 1: energy industries

Project Activity: Grid-connected renewable power generation; electricity capacity addition from a hydropower project.

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

The proposed project is the installation of a new grid-connected renewable power generation activity. The purpose of the proposed project is to generate electricity using water resources in the project region and replace the same amount of power generation in the South China Power Grid. Prior to the implementation of the project activity, there were 68,963 MW of thermal power plants, 34,176 MW of hydropower plants, 183 MW of wind power plants and 3,780 MW of nuclear power plants in operation in the South China Power Grid[15].

The proposed project is a run-of-river hydropower plant with a total installed capacity of 120MW, consisting of two units of 60MW domestic turbine. The operating hours are 4763, leading to an estimated annual power generation of 571600MWh. The proposed project adopts a unit connection mode of one-turbine-one-transformer, and the electricity generated by the proposed project is delivered to Xiaozhongmian Transformer Station via the local 220 kV station, and then links to Yunnan Power Grid, which is an integral part of South China Power Grid. The turbines and transmission facility could be monitored and controlled either by onsite central control room or remotely through Internet. Moreover, the monitoring systems(electronic multifunctional electricity meters) are installed in the transformer substation to monitor the net electricity supplied by the proposed project, and by them the electricity delivered to the grid will be monitored continuously as the applied methodology required(detailed information in B7.2).

The plant load factor of the proposed project is 54.37% determined by a third party contracted by the project participant (e.g. BEIJING NATIONAL WATER CONSERVANCY & ELECTRIC POWER ENGINEERING CO.,LTD)

For the proposed project, the two most key techniques are the impingement turbines and the tunnel. The impingement turbines utilized in the proposed project activity are currently the biggest capacity units in china, which adopt absolutely domestic technology. Moreover, the tunnel with a distance of over 14000mfaced some unpredicted factors including worse geological conditions, increasing of the price of construction materials (steel, cement, etc). Therefore, the impingement turbines and the tunnel in the project activity resulted in a risk of construction and additional cost. Table 1 provides the technical characteristics of primary equipments for the proposed project. During the decision-making period, the owner and designers thought about the risks from unpredicted factors and increased the capital guarantee after receiving the approval letter of the FSR of the proposed project according to the geologic estimate advice for the proposed project on the channels by the local geological department. By the above

[15] China Electric Power Yearbook 2007

measures, the project owner has full confident in the implement of the proposed project. The development of the proposed project will contribute to accumulate the experiments of operation and maintenance of the domestic large-scale hydro turbines, and to promote widely the utilization of domestic turbines in China.

Table 1 Main technical data of the proposed project

serial number	Items	unit	amount
I	**Main constructions**		
	Area of the reservoir	m^2	192800(the reservoir can store water for 24 operating hours with the adjustive volume of 10.909 million m^3.)
	Dam heights	m	34
	Dam lengths	m	68
	Dam widths	m	8
	Hydraulic tunnel（L*D）	m	14805.992*3.3
	powerhouse (L*W*H)	m	58*21*35.5
II	**Main electric equipments**		
1	Turbine	CJ-L-219/6×18，G=180t	
	Worm gear diameter	m	2.19
	Nominal RPM	r/min	428.6
	Critical RPM	r/min	782
2	Generator		
	Nominal capacity	MW	60
	Nominal voltage	kV	10.5
	Power Factor		0.85
3	Transformer	SFP9-75000/220	
	Nominal capacity	kVA	75000
	Nominal voltage	kV	242/10.5

Data sources: the FSR of the proposed project, page 121, chater1, the characteristic table of the proposed project.

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

Emission reductions to be achieved by the project during the first crediting period are shown in the table below.

Years	**Annual estimation of emission reductions**

	in tonnes of CO_2e
2010	482,030
2011	482,030
2012	482,030
2013	482,030
2014	482,030
2015	482,030
2016	482,030
Total estimated reductions (tonnes of CO_2e)	3,374,210
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	482,030

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A.4.5. Public funding of the project activity:

There is no public funding for this proposed project.

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SECTION B. Application of a baseline and monitoring methodology:

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

Methodology:

- Version 07 of ACM0002:Consolidated methodology for grid-connected electricity generation from renewable sources

Tools referenced in this methodology:

- Version 05.2 of tool for the demonstration and assessment of additionality
- Version 02 of tool to calculate project or leakage CO2 emissions from fossil fuel combustion
- Version 01.1 of tool to calculate the emission factor for an electricity system

For more information regarding the methodology and the tools as well as their consideration by the Executive Board please refer to http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

The proposed project is a newly installed electricity capacity from run-of-river hydropower in the South China Power Grid. The approved consolidated methodology: ACM0002 (version 07) is applied here to

determine the baseline of the proposed project. The above methodologies are applicable to the project activities under the following conditions:

- The proposed project is a grid-connected renewable power generation project that involves electricity capacity additions from water resources;
- The proposed project is not an activity that involves switching from fossil fuels to renewable energy sources at the site of the project activity;
- The proposed project activity results in new reservoirs and the power density of the proposed project is about 62.2 W/m^2 that is greater than 10 W/m^2;
- The geographic and system boundaries for the relevant electricity grid (South China Power Grid) can be clearly identified and information on the characteristics of the grid is available.

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

The proposed project is the installation of a new grid-connected renewable power plant, and the baseline scenario is the following:

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

Spatial boundary:

The spatial extend of the project boundary includes the proposed project and all power plant connected to South China Power Grid and the emissions form electricity generation in fossil fuel fired power plants of imported electricity from Center China Power Grid. The South China Power Grid is the project electricity system, which is defined by the spatial extent of the power plants that can be dispatched without significant transmission constrains. Using the boundary definitions of the Chinese NDRC[16], the South China Power Grid consists of Guangdong, Guangxi, Yunnan, Guizhou power grids. In South China Power Grid, there were 68,963 MW of thermal power plants, 34,176 MW of hydropower plants, 183 MW of wind power plants and 3,780 MW of nuclear power plants in operation in the South China Power Grid[17]. The connected electricity system is Central China Power Grid, which is connected by transmission lines to the project electricity system. The South China Power Grid has net electricity imports from Central China Power Grid. The flow diagram of the project boundary is as in figure 2.

Emission sources:

For the baseline determination, emissions from electricity generation in fossil fuel fired power

[16] http://cdm.ccchina.gov.cn/web/index.asp .

[17] China Electric Power Yearbook 2007

plants in the South China Power Grid and emissions form electricity generation in fossil fuel fired power plants of imported electricity from Center China Power Grid.

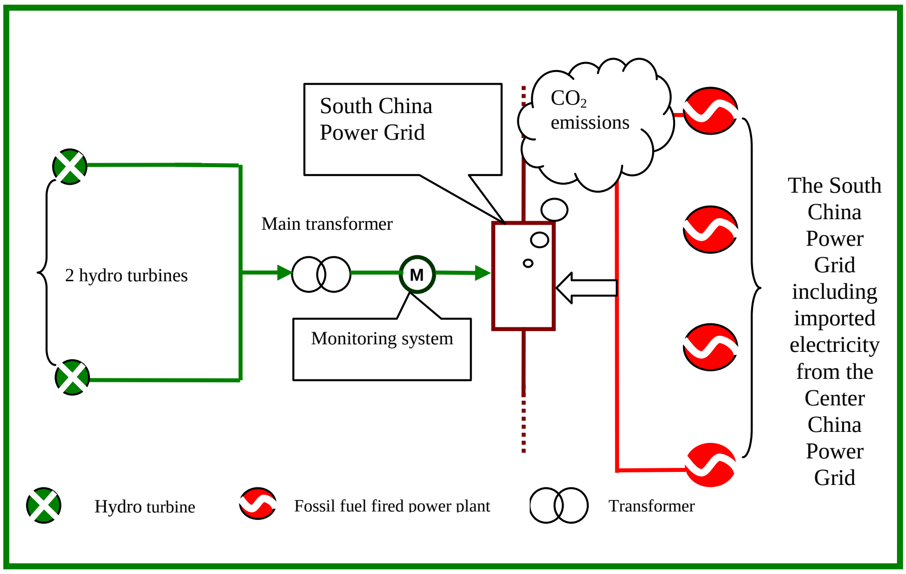

Figure 2: The diagram of the project activity boundary

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table:

	Source	Gas	Included?	Justification / Explanation
Baseline	The South China Power Grid including imported electricity from the Center China Power Grid	CO_2	Yes	Major emission sources
		CH_4	No	Minor emission source, and excluded by the methodology
		N_2O	No	Minor emission source, and excluded by the methodology
Project Activity	Hydro power	CO_2	No	Minor emission source, and excluded by the methodology
		CH_4	No	As the power density of the project activity is about 62.2 W/m² which is more than10 W/m², the methane emission is assumed to be zero.
		N_2O	No	Minor emission source, and excluded by the methodology

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

According to the description in the approved consolidated baseline and monitoring methodology ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

The proposed project is connected to the Yunnan Grid, an integrated part of the South China Power Grid. So South China Power Grid is considered as the "connected electricity system", which is defined as the "project boundary" of the proposed project. It includes the grids of Guangdong, Guangxi, Yunnan, Guizhou power grids. Therefore, being a project with the boundary of South China Power Grid that does not modify or retrofit an existing electricity generation facility, the baseline scenario of the proposed project can be identified as the following:

> Electricity delivered to the grid by the proposed project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources within the South China Power Grid, as reflected in the combined margin (CM) calculated described latter.

The analysis and description in B.5 and B.6 will support the baseline scenario shown above.

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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):

The implementation timeline of the proposed project activity:

No.	Date	Description
1	06/11/2003	The approval letter for the general outline of EIA of the proposed project by Environmental Protection Bureau of Yunnan Province
2	12/2003	The feasibility study report of the proposed project designed by Beijing Guodian Hydropower Engineering Co., Ltd.,
3	13/02/2004	The approval letter for the FSR of the proposed project by Development and Reform Commission of Yunnan province
4	06/2004	The EIA report of the proposed project by Beijing Guodian Hydropower Engineering Co., Ltd.,
5	06/07/2004	The approval letter for the proposed project by Environmental Protection Bureau of Yunnan Province
6	21/07/2004	The geologic estimate advice for the proposed project on the channels by land resource bureau of Diqing Tibetan Autonomous Prefecture
7	19/08/2004	The emendatory documentation of budgetary estimate of the proposed project by Beijing Guodian Hydropower Engineering Co., Ltd.,
8	27/08/2004	Directorate decision of the proposed Project For CDM project

		development
9	16/09/2004	The approval letter for the revised investment of the proposed project by Development and Reform Commission of Yunnan province
10	11/09/2004	The intent letter of CDM development between Guodian Diqing Shangri La Electricity Generation Co., Ltd and China Fulin Windpower Development Corporation
11	21/10/2004	The construction contracts of the project (as the starting date of the project, in line with the definition of the starting date in the CDM Glossary of terms)
12	27/10/2004	The project construction permission for the proposed Project
13	07/12/2004	Equipment purchasing agreements
14	11/2004 to 07/2005	Road construction and implement the geological reconnaissance for the channels again
15	30/03/2005	The project owner attended the "Circulation Mechanism Research on CDM in China by NDRC[18]" to study the apply process of CDM and the supports from CDM.
16	08/2005 to 11/2005	Revised the design of the proposed project according to the detail geologic reconnaissance for the channels.
17	21/12/2005	Directorate decision of the proposed Project to quicken the application of CDM project development
18	From 2006	The constructions for channels and powerhouse were implementing step by step
19	05/09/2006	The project owner attend the "CDM Training about renewable energy projects by Longyuan(Beijing) carbon asset management technology Co.,ltd" to prepare for the following work about CDM.
20	03/06/2007	CDM development contract between Guodian Diqing Shangri La Electricity Generation Co., Ltd and China Fulin Windpower Development Corporation
21	14/09/2007	The LoI signed by the project owner and the Kommunalkredit Public Consulting GmbH
22	11/2007	CDM Validation contract between Guodian Diqing Shangri La Electricity Generation Co., Ltd and TUV SUD China
23	02/2008	The LoA signed by the NDRC of the People's Republic of China
24	19/11/2008	The LoA signed by the Kommunalkredit Public Consulting GmbH
25	01/12/2008	Expected operational date of the project activity
26	01/07/2009	Expected registered date of the project activity as a CDM project

Note: In China, especially in 2004-2006, the CDM development was just beginning .Therefore, the activity about CDM implemented by the project owner for the CDM continuous consideration was mainly focus on attending the CDM training by consult company and the CDM meeting by NDRC, by which the project owner knew the information about CDM and prepared the following the application work during less two years from 2004-2006.

[18] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=223

It can be found from the above table that the CDM was essential for project owner to go ahead with the implementation of the proposed project.

The feasibility study report of the proposed project was approved by the Development and Reform Commission of Yunnan province on 13th Feb. 2004, in which the expected tariff was of 0.205 RMB/kWh (Including VAT) and the static investment was of 690.293million Yuan. After that, the project owner began to implement the works of shop drawing phase for the proposed project. During this period, the professional companies implemented the further designs for the proposed project than the feasibility designs in FSR period. The professional company combined with land resource bureau of Diqing Tibetan Autonomous Prefecture to reconnoiter the geological conditions for the channels and powerhouses, especially a distance of over 14000m channels through the mountains .However, the geological conditions and the constructed difficulty of the channels were only considered by the experiments and analogy references in the FSR period. According to the practical survey by the professional company combined with land resource bureau of Diqing Tibetan Autonomous Prefecture, the FSR underestimated the geological conditions and the constructed difficulty of the channels in the following pre-design phase. According to the above results, the local geological department asked the project owner and the design company to reconsider and account the total investment of the proposed project After receiving the advice letter of the geological condition on 21st July 2004, the project owner and the design company revised the documentation of total investment of the proposed project , in which the static investment of the proposed project was 854.96 million Yuan with the IRR of 6.5%(the benchmark of 8%). Based on the increasing of the investment and the decreasing of IRR, the project owner thought that the proposed project could not be considered as financially attractive. To implement the project with the IRR of 6.50 %, the project owner received the advices of the local DRC and the CDM office of Guodian Electric Power Groups to exploit the proposed project as a CDM project. With that, the project owner invited the CDM consulting company (China Fulin Windpower Development Corporation) to identify the proposed project and negotiated the intent letter with the CDM consulting company on 11st Sep. 2004. After the project owner obtained the supports from CDM consulting company, the project owner could overcome the investment obstacle of the proposed project and the proposed project was approved to perform the construction on *27th Oct.2004.*

The project activity is not the baseline scenario and possesses additionality, which is demonstrated below in a step-wise manner using the latest version (05.2) of “Tool for demonstration and assessment of additionality”.

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

Define realistic and credible alternatives to the project activity(s) through the following Sub-steps:

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

To provide the same output or services comparable with the proposed CDM project activity, these alternatives are to include:

a) The project not undertaken as a CDM project activity but as a commercial project;
b) The fossil fuel power plant with the same annual electricity output as the proposed project;
c) Other power plants using other sources of renewable energy with the same annual electricity output as the proposed project;
d) The South China Power Grid as the provider for the same capacity and electricity output as the proposed project.

In South China Power Grid, other renewable energies including wind power, solar PV, biomass and geothermal are the possible grid-connected technologies However, it is not feasible to develop wind power plants as resulted in the lack of wind resources in Diqing Tibetan autonomous prefecture. At the same time, based on the technology development status and the high cost for power generation, wind power, solar PV, biomass and geothermal of the same annual electricity output as the proposed project are alternatives far from being attractive investment in the grid in China[19,20]. Moreover, the proposed project owner is only dedicated to hydropower development in Yunnan Province, and has no experience and ability to develop other renewable energy power plants. So the scenario c) couldn't be considered as an alternative scenario.

Outcome of Step 1a: as a result of above sectoral issues, the alternatives available to the project would be a), b) and d).

Sub-step1b. Consistency of mandatory laws and regulations

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[19] http://jjckb.xinhuanet.com/cjxw/2007-11/27/content_75467.htm

http://finance.people.com.cn/GB/1038/59942/59949/6294546.html

[20] *Tentative Management Measures for Price and Sharing of Expenses for Electricity Generation from Renewable Energy*, Document No. NDRC Energy [2006]13

6 China Electric Power Yearbook2007, page626

7 *On Prohibition of 135MW and Smaller-scale Coal-fired Power Plants, General Office of State Council(*http://www.gov.cn/gongbao/content/2002/content_61480.htm*)*

As the annual operation hours of a fossil fuel power plant and a hydropower plant differs considerably, the annual electricity generation and associated supply reliability for the two, which has equivalent installed capacity, remain incomparable. Based on the latest national power statistic, the operational hour of a fossil fuel plant (5612 hours) is about 1.2 times more than that of the proposed project (4763 hours) with the same capacity[6]. Therefore, a fossil fuel power plant which provides equivalent annual electricity generation would require an installed capacity of 101.9MW. According to Chinese power regulations, fossil fuel power plants of less than 135MW are prohibited for construction in the areas covered by large grids[7].Alternative b) is not in compliance with Chinese regulations. Therefore, b) is not a realistic and credible alternative.

Outcome of Step 1b:
Mandatory legislation and regulations to each alternative are taken into account in sub-step 1b.Based on the above analysis, the proposed project activity is not the only alternative amongst the ones identified that is in compliance with legal and regulatory requirements. Therefore, the proposed CDM project activity may be additional.

Step2. Investment analysis
This step will determine whether the project is the economically or financially less attractive than other alternatives without the revenue from the sale of CERs.

Sub-step 2a. Determine appropriate analysis method

Tool for the Demonstration and Assessment of Additionality (version 5.2) provides three analysis methods to apply for the investment analysis: the simple cost analysis (option I), the investment comparison analysis (option II) and the benchmark analysis (option III).
For the proposed project, the simple cost analysis method is not applicable because the project activity will produce economic benefit (from electricity sale) other than CDM related income. The investment comparison analysis method is also not applicable because the baseline scenario is the South China Power Grid rather than a new investment project.
To conclude, the proposed project will use the benchmark analysis method based on total investment IRR to identify whether the financial indicators of the proposed project is better than relevant benchmark value.

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

In according with *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects* issued by State Power Corporation of China[8], a project benchmark after tax (not taking into account the financing structure of the project as benchmark in China's power generation industry is 8% considering economic assessments of hydropower projects, fossil fuel fired projects, transmission and substation projects, especially the interest rate of commercial loans over five years. Nowadays China's existing hydropower projects except the small-size hydropower projects have applied it as the benchmark IRR.

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

(1) Basic parameters for calculation of financial indicators

According to the feasibility study report of the proposed project, the parameters for calculation of financial indicators are shown in Table 2.

Table 2 Main parameters for calculation of financial indicators

Items	Unit	Amount	Data source
Capacity	MW	120	FSR, Page 1 ,Chapter 14
Total Static Investment	Million RMB	854.96	The approval letter for the revised investment of the proposed project
Annually output	MWh/year	571,600	FSR ,Page1 ,Chapter 14
O&M costs	Million RMB	656.01	The emendatory documentation of budgetary estimate of the proposed project
Averaged Electricity Tariff (Excluding VAT)	RMB/kWh	0.1752	FSR ,Page12 ,Chapter 14
Value Added Tax (VAT)	%	17	FSR, Page 8 ,Chapter 14
Income tax	%	33	FSR, Page 9 ,Chapter 14
Expected CERs Price	EUR/tCO_2	9.0	Letter of intent
Project life time	Year	34(including 3 years construction period)	FSR, Page3 ,Chater 14
CERs crediting time	Year	7*3	Section C

[8] Stater*ojects*. Beijing: Ch Power Corporation of China. *Interim Rules on Economic Assessment of Electrical Engineering Retrofit P*ina Electric Power Press, 2003

(http://www.ceppbooks.com/productinfo.asp?id=155083.7330016000000)

(2) Comparison of IRR for the proposed project and the financial benchmark

In according with the benchmark analysis method, the proposed project will not be considered as financially attractive if its financial indicators (such as IRR) are lower than the benchmark rate.
Table 3 shows the IRR of the proposed project with and without CERs revenues. Without CERs revenues, the IRR on the total investment is 6.41%, lower than the benchmark rate 8%. Thus the proposed project is not considered as financially attractive. However, taking into account the CERs revenues, the IRR on the total investment is 10.70%that is significantly improved and higher than the financial benchmark rate. Therefore, the proposed project with CERs revenues can be considered as financially attractive to the investors.

Table 3 Comparison of financial indicators with and without CERs revenues

Scenario	IRR (the benchmark of 8%)
Project without CERs revenues	6.41
Project with CERs revenues	10.70

Sub-step 2d. Sensitivity analysis

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. Four factors are considered in following sensitivity analysis:

1) Total investment.
2) Annual operation and maintenance cost(O&M)
3) Tariff
4) Electricity Supplied to the grid

The four financial parameters were identified as the main variable factors for sensitive analysis of financial attractiveness. Their impacts on IRR of total investment were analyzed in the below tables (Table 4 –Table 7).

Table 4 Sensitivity of total investment IRR to **Total investment**

IRR / Rang / Parameters	-14.05%	-7.5%	-5.0%	-2.5%	**0%**	2.5%	5.0%	7.5%	10.0%
Total investment	8.00%	7.21%	6.93%	6.66%	**6.41%**	6.16%	5.92%	5.70%	5.48%

Table 5 Sensitivity of total investment IRR to **Tariff**

IRR / Rang / Parameters	-10%	-7.5%	-5.0%	-2.5%	**0%**	2.5%	5.0%	7.5%	15.25%
Tariff	5.31%	5.59%	5.87%	6.14%	**6.41%**	6.67%	6.94%	7.20%	8.00%

Table 6 Sensitivity of total investment IRR to **O&M cost**

IRR / Rang / Parameters	**-71.3%**	-7.5%	-5.0%	-2.5%	**0%**	2.5%	5.0%	7.5%	10.0%
O&M cost	**8.00%**	6.58%	6.52%	6.46%	**6.41%**	6.35%	6.29%	6.23%	6.18%

Table 7 Sensitivity of total investment IRR to Electricity Supplied to the grid

IRR / Rang / Parameters	-10%	-7.5%	-5.0%	-2.5%	**0%**	2.5%	5.0%	**7.5%**	15.25%
Electricity Supplied	5.31%	5.59%	5.87%	6.14%	**6.41%**	6.67%	6.94%	**7.20%**	8.00%

As shown in Table 4, in the case that total investment decreases by about 14.05%, the IRR of the proposed project begins to exceed the benchmark IRR (8%). Since 47.5% of the total investment of the proposed project is used to build the main Constructions (powerhouse and tunnels)[9].Moreover, the main materials including steels and cement and other construct materials are continually increasing[10]. Hence, it is impossible to lower the expected total investment of the project in the Feasibility Study. Within the reasonable range of total investment, the proposed project is always lack of financial attractiveness.

[9] The feasibility study report of the proposed project, page 429

[10] http://203.95.6.186/newver/Info4.asp

As shown in Table 5, in the case that the tariff increases by 15.25%, the IRR of the proposed project begins to exceed the benchmark IRR (8%). In the feasibility study report of the proposed project, the expected tariff is 0.205RMB/kW.h that is lower than the benchmark tariff (0.224 RMB/kW.h). Compared with the two tariffs, the approval tariff of the proposed project will not be higher the benchmark tariff in Yunnan province with the increasing percent of 9.27. Therefore it is impossible that the tariff of the proposed project could increase 15.25%, so the proposed project is always lack of financial attractiveness.

As shown in Table 6, the annual O&M cost has a little impact on the project IRR. The annual O&M cost therefore shall be regarded as an insensitive factor. The FIRR of the proposed project could reach the benchmark when the annual O&M cost decreases by 71.3%. However, according to the Feasibility Study Report of the proposed project, the detailed operation costs is mainly composed of four kinds of costs - maintenance costs, annual salaries for the employees, insurance premium of fixed assets and other costs. Moreover, the price of material and salaries of the employees are gradually increasing in China, which leads annual O&M cost gradually increasing[11]. Therefore, it is impossible that the annual O&M cost could decrease 71.3%, so the proposed project is always lack of financial attractiveness within the reasonable range of annual O&M cost.

As shown in Table 7, when the electricity-supplied-to-grid increases by 15.25%, the project IRR is larger than the benchmark IRR (8%). The electricity- supplied -to-grid is influenced by the water resource. According to the feasibility study report of the project; the annual runoff flux (Cv) tends gradually to be stable at 0.16-0.20over the past 43 years from 1959 to 2002, as shown in table 4-7 in the feasibility study report[12] ,therefore, the water resource of the relative runoff area tends gradually to be stable. Moreover, the proposed project utilizes the tail-water of the upper hydropower plant to generate electricity and the water discharged from the upper hydropower plant is stable for the electricity generation and irrigation. All these certainties will lead the electricity- supplied -to-grid stable to meet its design data. Therefore, the probability that the electricity- supplied -to-grid is 15.25% higher than the estimated value is impossible.

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[11] http://www.china.com.cn/chinese/EC-c/1246238.htm
http://www.chinadaily.com.cn/hqcj/2007-09/03/content_6075777.htm

[12] the feasibility study report of the proposed project

Outcome of Step 2: as illustrated above, under the reasonable variations in the critical assumptions, the conclusion regarding the financial additionality is robust and supported by sensitivity analysis. So *the proposed CDM project activity is unlikely to be financially attractive.*

Step 3. Barrier analysis

Investment analysis has argued that the project is the economically less attractive than other alternatives without the revenue from the sale of CERs. According to "*Tool for the Demonstration and Assessment of Additionality (version 5.2)*", this PDD skips the barrier analysis and argues the additionality .

Step 4. Common practice analysis

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

According to the above analyses and the definitions of other activities similar to the proposed project activity in "Tool for the Demonstration and Assessment of Additionality (version 5.2)",The common practice analysis is limited to the provincial level as the investment environment for each Province differs (e.g. with regards to taxes, loan policy and electricity tariffs). The selected geographical area for the project, i.e. Yunnan province, is relatively large. Yunnan province is considerably larger than several countries in Europe. The policies and regulations in Chinese provinces are different with each other.

A comparable size to the project activity is defined as the range from 50% to 150% of the rated capacity of the project plant mentioned in ACM0013[13]. According to the description for the comparable size to the project activity approved by EB, a similar scale to the proposed project is limited with the capacity of 60-180MW.

In April 2002, China implemented the policy "separate power plants from network and compete in price to enter network"[14]. After that, the original State Power Corporation of China which monopolized in electronic power industry was divided into two business section of electricity generation and power grid. The electricity generation capital was reorganized into five independent electricity generation companies. While power grid capital was reorganized into State Grid Corporation of China and China Southern Power Grid Co., Ltd. Among them, China State Grid Corp. includes five subsidiary regional power grid companies, which are North China Grid Company Ltd., East China Grid Company Ltd., Central China Grid Company Ltd., Northeast China Grid Company Ltd., and Northwest China Grid Company Ltd.

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13 http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_JD73SPVZEDDN6IY8M6WFC7WIOBMNRN

14 http://www.ndrc.gov.cn/xwfb/t20050708_28096.htm

Therefore, independent grid company existed only after 2002, and the tariff was determined by the market instead of the government. Furthermore, at the time of submitting this PDD, data of hydropower projects developed after 2005 is not available. Hence, we compare the proposed project with hydropower projects developed in Yunnan Province from 2002 to 2005.

Accoding to above analyses, the other activities similar to the proposed project activity are hydropower projects in the same region (Yunnan province), rely on a broadly similar technology (hydropower plants), are of a similar scale (60MW~180MW), and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing since 2002, as shown in Table 8.

Table 8 Grid-connected hydropower plants similar with the proposed project in Yunnan

	Project name	Installed capacity（MW）	Operation starting date (Year)	Average annual electricity output(kW.h)	Total investment (Million Yuan)	The investment in Million Yuan per MW of installed capacity	Note
1	Ajiutian Hydropower project [19]	105	1998	5950	492.8	4.69	
2	Gaoqiao Hydropower project[20]	90	2001	4500	442	4.91	
3	Malutang(I)Hydropower project[21]	100	2002	6891.1	423	4.23	
4	Luosiwan Hydropower project[22]	60	1999	3007.3	483	8.03	poverty alleviation projects
5	Lazhai Hydropower project[23]	120	2008	6070	656.0	5.47	Applied for being a CDM project
6	Amojiang Sanjianghou Hydropower Project[24]	99	2009	4017.9	721.859	7.29	Applied for being a CDM project
7	Jisha Hydropower Project	120	2008	5716	854.96	7.12	Applied for being a CDM project

[19] http://news.sina.com.cn/c/2002-08-08/1402664780.html

[20] http://news.sohu.com/2004/07/08/44/news220914462.shtml

[21] http://news.sina.com.cn/c/2002-12-24/1313851622.html

http://www.yn.gov.cn/yunnan,china/73469366967992320/20050310/22349.html

[22] http://unn.people.com.cn/GB/channel23/176/845/200011/24/11580.html

[23] http://www.cwic.com.cn/show.aspx?id=992

[24] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2083.pdf

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

As it is demonstrated in table 8, there are similar hydropower developments in Yunnan Province. Hydropower project –Ajiutian Hydropower project, Gaoqiao Hydropower project, Malutang(I) Hydropower project were developed smoothly because they either enjoyed a much lower investment in Million Yuan per MW of installed capacity and Luosiwan Hydropower project obtained the assistance from the local government due to poverty alleviation project for entering Provincial Power Grid. The investment in Million Yuan per MW of installed capacityof the proposed project is much higher than other similar projects because of the geological conditions and the constructed difficulty of the channels. In recent years, hydropower projects- Amojiang Sanjianghou Hydropower Project, Lazhai Hydropower project under similar condition as the proposed project has been developed with successfully applying as CDM project. As a matter of fact, there is no hydropower project with similar conditions of the proposed project without additional financial support has been built in Diqing area in the past four years due to the reason of low tariff and higher investment in Million Yuan per MW of installed capacity. Therefore, the proposed project will face more barriers comparing with other projects developed.

To conclusion, the proposed project is still exceptive and lack of common practices in Yunnan province. As described above, the proposed project activity passed all criteria of "Tool for the demonstration and assessment of additionality" (*version 05.2*). Therefore, the proposed project is additional.
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B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

The proposed project is the installation of a new grid-connected renewable power plant, and the baseline scenario is the following:

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

Baseline emissions

Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) \times EF_{grid,CM,y} \qquad (1)$$

Where:
BE_y = Baseline emissions in year *y* (tCO2/yr).

EG_y = Electricity supplied by the project activity to the grid (MWh).

$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.

$EF_{grid,CM,y}$ = Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (version 01.1).

The methodological tool "Tool to calculate the emission factor for an electricity system" (version 01.1) determines the CO2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity.

The methodological tool "Tool to calculate the emission factor for an electricity system" (version 01.1) provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO2/MWh	Combined margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,BM,y}$	tCO2/MWh	Build margin CO_2 emission factor for grid connected power generation in year y
$EF_{grid,OM,y}$	tCO2/MWh	Operating margin CO_2 emission factor for grid connected power generation in year y

The following six steps are applied to calculate the emission factor for an electricity system:

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) emissions factor.

Step1: Identify the relevant electric power system.

Using the boundary definitions of the Chinese NDRC[25], the spatial extent of the project boundary includes Yunnan Amojiang Sanjiangkou Hydropower Project and all power plants connected physically to the China Southern Power Grid that the CDM project power plant is connected to. China Southern Power Grid is defined as the **project electricity system**, which consists of independent province-level electricity systems including Guangdong, Guangxi, Yunnan and Guizhou province grid that can be dispatched without significant transmission constraints. The **connected electricity system** is Central China Power Grid, which is connected by transmission lines to the project electricity system.

[25] http://cdm.ccchina.gov.cn/web/index.asp

Electricity transfers from connected electricity systems to the project electricity system are defined as **electricity imports** and electricity transfers to connected electricity systems are defined as **electricity exports**. China Southern Power Grid has the electricity imports from the Central China Power Grid.

For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system (China Southern Power Grid), since the electricity imports from Central China Power Grid account for a very small percentage and recent or likely future additions to transmission capacity will not enable significant increases in imported electricity.

For the purpose of determining the operating margin emission factor, use one of the following options to determine the CO2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from a connected electricity system within the same host country:

(a) 0 tCO2/MWh, or
(b) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in step 3 below; or
(c) The simple operating margin emission rate of the exporting grid, determined as described in step 3 below; or
(d) The simple adjusted operating margin emission rate of the exporting grid, determined as described in step 3 below.

For the project activity, option (b) is used to determine the CO2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from Central China Power Grid.

Step2: Select an operating margin (OM) method

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

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

The simple OM method (option a) can only be used if low-cost/must-run resources[26] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

For the simple OM, the simple adjusted OM and the average OM, the emissions 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

[26] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

time of submission of the CDM-PDD to the DOE 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 emissions 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*, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

For the dispatch data analysis OM, use the year in which the project activity displaces grid electricity and update the emission factor annually during monitoring.

The data vintage chosen should be documented in the CDM-PDD and not be changed during the crediting periods.

Power plants registered as CDM project activities should be included in the sample group that is used to calculate the operating margin if the criteria for including the power source in the sample group apply.

The justifications of the choice of method to calculate OM emission factor are as follows.

Method (c): The dispatch data analysis OM emission factor is determined based on the power units that are actually dispatched at the margin during each hour *h* where the project is displacing electricity. This method requires the dispatch order of each power plant and the dispatched electricity generation of all the power plants in the power grid during each hour. Since the dispatch data, power plants operation data are considered as confidential materials and only for internal usage and are not available publicly. Thus, method (c) is not applicable for the proposed project.

Method (b): Method (b) requires the annual load duration curve of the power grid and the load data of every hour data during the whole year on the basis of the time order. As mentioned above, the dispatch data and detailed load curve data are not available publicly. Therefore, method (b) is not applicable for the proposed project as well.

In terms of Method (d) and Method (a): The average OM emission factor (option d) is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) above for the simple OM, but including in all equations also low-cost/must-run power plants. The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants. Considering the low-cost/ must run resources only constitute 22-40% of total generation of South China Power Grid from the year 2001 to 2005 (China Electric Power Yearbooks 2002-2006). Therefore, method (a) is chosen to calculate OM emission factor for the proposed project.

In conclusion, the Ex ante option of the data vintages is chosen to calculate the emission factor of the China Southern Power Grid by using the simple OM method (option a) for the proposed 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 (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / 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. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost / must-run power sources and if the quantity of electricity supplied to the grid by these sources is known.

For the proposed project, the data on fuel consumption, net electricity generation and the average efficiency of each power unit are unavailable, thus option A and option B cannot be used. Nevertheless, the 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 are available, and, nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known, therefore, Option C can be used.

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

$$EF_{grid,OMsimple,y} = \frac{\sum FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad (2)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year y (tCO2/MWh)

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

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

$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)

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

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

y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

For this approach (simple OM) to calculate the operating margin, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and including electricity imports to the grid[27]. Electricity imports should be treated as one power plant source.

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. The Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2007. Emission factors ($EF_{CO2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

As chosen in step 2, the simple OM emission factor is calculated by using Ex-ante option of data vintages, i.e. a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

The data of installed capacity, electricity generation and fuel consumptions are all from China Energy Statistical Yearbooks 2004-2006 and China Electric Power Yearbooks 2004-2006.

The electricity imports to South China Power Grid is from Central China Power Grid, which is 11100 MWh in 2003, 10951240 MWh in 2004 and 96363000 MWh in 2005 respectively [28]. The average operating margin emission rate of Central China Power Grid is calculated as the emission factor of the electricity imports from CCPG (see Annex 3 for detailed information).

Given the above, the simple operating margin CO2 emission factor ($EF_{grid,OMsimple,y}$) of China Southern Power Grid is **1.0119tCO2/MWh.** The detailed calculations and data are listed in the annex 3 (The baseline emission factor OM is same as that provided by ChineseNDRC, the website is http://cdm.ccchina.gov.cn/web/index.asp).

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

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[27] An import from a connected electricity system should be considered as one power source.

[28] China Electric Power Yearbook 2004-2006

(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[29].

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

A power unit is considered to have been built at the date when it started to supply electricity to the grid.

Power plant registered as CDM project activities should be excluded from the sample group *m*. However, if group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power unit(s) that is (are) built more than 10 years ago then:

(i) Exclude power unit(s) that is (are) built more than 10 years ago from the group; and

(ii) Include grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

In terms of vintage of data, one of the following two options can be chosen:

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

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

For the proposed project, option 1 is chosen to calculate Build Margin emission factor.

Step 5: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

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

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

Where:

$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year y (tCO2/MWh)

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

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year y (tCO2/MWh)

m = Power units included in the build margin

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

No matter which options for calculating BM factor mentioned in step 4 was adopted for the proposed project; the same issue on data availability must be addressed. Currently, it is very difficult to get the capacity margin data of power plants in China, since these data as well as net quantity of electricity generated and delivered to the grid and fuel consumption data in power unit *m* are regarded as commercial secrets or only for internal usage. According to the guidance from the CDM Executive Board for a deviation of the baseline methodology of AM0005, which had combined into the baseline methodology of ACM0002, the following deviation was adopted to calculate the Build Margin emission factor (http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ):

1） Use of capacity additions for estimating the build margin emission factor for grid electricity.
2） Use of weights estimated using installed capacity in place of annual electricity generation.
3） Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

Then the following steps were adopted to calculate the Build Margin emission factor:

1. The breakdown data by power plants are not while the aggregate data by different types of fuels are available. Considering this situation, the *m* sample group will consist of capacity addition by power sources with same fuel instead of by power plants. For the proposed project the *m* sample group will consist of fossil fuel fired capacity addition, hydropower capacity addition and other capacity addition;

2. Assuming that all the power plants with same fuel type have equal annual operation hours, and identify the starting year t_0 which the power capacity additions from t_0 to t (i.e. the recent year of

which the latest data is available) in the electricity system that comprise 20% of the system generation (in MWh).

The capacity addition belonging to *m* sample group thus could be identified. For the proposed project, the most recent year of which data is available is 2005, while t_0=2003, the total capacity addition during 2003 to 2005 consisting of 27062.1MW of fossil fuel fired capacity, 195.6MW of the low-cost/ must run resources capacity, which accounts for 23.78% of total installed capacity in 2005[30] (See Annex 3 for detailed calculation)

3. To be conservative, zero emission factors were selected for hydropower capacity and other capacity. Moreover, since specific data on coal fired capacity, oil fired capacity, and gas fired capacity could not be separated from current statistical data on fossil fuel fired capacity, the following approach was adopted for calculating the emission factor of fossil fuel fired capacity addition:

(1) With the energy balance sheet in China Energy Statistical Yearbook for the most recent year, calculating the respective percentages of CO2 emissions from coal fired power generation, oil fired power generation, and gas fired power generation against total CO2 emissions from fossil fuel fired power generation:

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (4)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (5)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS, j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}}{\sum_{i,j} FC_{i,j,y} \times NCV_{i,y} \times EF_{CO2,i,j,y}} \quad (6)$$

Where:

$FC_{i,j,y}$ = The amount of fuel i (in a mass or volume unit) consumed by province j in year y ;

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

$EF_{CO_2,i,j,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ).

$COAL, OIL, and\ GAS$ = The aggregation of various kinds of coal, oil, and gas as fossil fuels.

(2) Calculating the corresponding emission factor for fossil fuel fired power generation:

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30 China Electric Power Yearbook 2004-2006

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

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are the emission factors for the best commercially available technology of coal fired power generation, oil fired power generation, and gas fired power generation, respectively (See Annex 3 for detailed calculation).

4. Using the share of different type of capacity in total capacity addition as weight, the weighted average of emission factors of different type capacity is calculated as the Build Margin emission factor $EF_{grid,BM,y}$ of China Southern Power Grid (See Annex 3 for detailed calculation):

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

Where:

CAP_{Total} = The total capacity addition
$CAP_{Thermal}$ =The fossil fuel fired capacity addition

Following the four steps above, the build margin emission factor $EF_{grid,BM,y}$ of the China Southern Power Grid is calculated to be **0.6748tCO2/MWh.** The detailed calculations and data are listed in the annex 3 (The build margin emission factor BM is same as that provided by Chinese DNA, the website is http://cdm.ccchina.gov.cn/web/index.asp).

Step 6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

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

Where:
$EF_{grid,BM,y}$ =Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$ =Operating margin CO2 emission factor in year y (tCO2/MWh)
w_{OM} =Weighting of operating margin emissions factor (%)
w_{BM} =Weighting of build margin emissions factor (%)

For hydropower project activities: w_{OM} = 0.50 and w_{BM} = 0.50 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period.

The default weights are adopted for the proposed project, the baseline emission factor for the first crediting period is:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$ = **0.8433 tCO2/MWh**

Project emissions

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad (10)$$

Where:
PD =Power density of the project activity, in W/m^2.
Cap_{PJ} =Installed capacity of the hydropower plant after the implementation of the project activity (W).
Cap_{BL} = Installed capacity of the hydropower plant before the implementation of the project activity (W). For new hydropower plants, this value is zero.
A_{PJ} =Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir if full (m^2).
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir if full (m^2). For new reservoirs, this value is zero.

For the proposed project, Cap_{PJ} is 120 MW and A_{PJ} is 192800m^2, so PD would be 62.2W/m^2, as per the methodology: $PE_y = 0$

Leakage

For hydropower project activities, LE_y = 0

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (11)$$

Where:

ER_y = Emission reductions in year y (t CO2e/yr).
BE_y = Baseline emissions in year y (t CO2e/yr).
PE_y = Project emissions in year y (t CO2/yr).
LE_y = Leakage emissions in year y (t CO2/yr).

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

Data / Parameter:	$FC_{i,y}$, $FC_{i,j}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type i (in a mass or volume unit) consumed by power plant/unit (or in the project electricity system in case of $FC_{i,y}$) in year y , or the amount of fuel type i (in a mass or volume unit) consumed by province j
Source of data used:	China Energy Statistical Yearbook 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Simple OM: For each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option). BM: For the first crediting period, following the EB guidance. For the second and third crediting period, only once ex-ante at the start of the second crediting period.
Any comment:	

Data / Parameter:	$EG_{m,y}$, EG_y
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant / unit *m* (or in the project electricity system in case of EG_y) in year y
Source of data used:	China Electric Power Yearbook 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Simple OM: For each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option) BM: For the first crediting period, following the EB guidance. For the second and third crediting period, only once ex-ante at the start of the second crediting period.
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/ mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type i in year y
Source of data used:	China Energy Statistical Yearbook 2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Simple OM: For each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option) BM: For the first crediting period, following the EB guidance. For the second and third crediting period, only once ex-ante at the start of the second crediting period.

Any comment:	

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of fossil fuel type i in year y
Source of data used:	2006 IPCC default values
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	2006 IPCC values have been used for fuel types since no country specific CO2 emission factors are available Simple OM: For each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option) BM: For the first crediting period, following the EB guidance. For the second and third crediting period, only once ex-ante at the start of the second crediting period.
Any comment:	

Data / Parameter:	$\eta_{coal,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for coal fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	35.82
Justification of the choice of data or description of measurement methods and procedures actually applied :	Following the EB guidance, the statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan" period can be used.
Any comment:	

Data / Parameter:	$\eta_{oil,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for oil fired plant
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	47.67
Justification of the choice of data or description of measurement methods and procedures actually applied :	Following the EB guidance, the statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan" period can be used.
Any comment:	

Data / Parameter:	$\eta_{gas,adv}$
Data unit:	%
Description:	Best electricity supply efficiency for gas fired plant

Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	47.67
Justification of the choice of data or description of measurement methods and procedures actually applied :	Following the EB guidance, the statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan" period can be used.
Any comment:	

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO2/MWh
Description:	Operating Margin Emission Factor
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	1.0119(Chinese NDRC)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to calculate the emission factor for an electricity system" (version01.1)
Any comment:	

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO2/MWh
Description:	Bulid Margin Emission Factor
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	0.6748(Chinese NDRC)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to calculate the emission factor for an electricity system" (version01.1)
Any comment:	

Data / Parameter:	*OXIDi*
Data unit:	%
Description:	Oxidation factor of the fuel *i*
Source of data used:	2006 IPCC default value
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The country specific values of oxidation factors in China are not available. As such IPCC default values are used instead.
Any comment:	

Data / Parameter:	$EF_{grid,CM,y}$

Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data used:	http://cdm.ccchina.gov.cn/web/index.asp
Value applied:	0.8433(Chinese NDRC)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to calculate the emission factor for an electricity system" (version01.1)
Any comment:	

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For the proposed project, this value is zero.
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Determine the installed capacity based on recognized standards
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 if full. For the proposed project, this value is zero.
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	

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

According to the calculation results in B6.1, the emission reductions of the proposed project are calculated as follows:

Baseline emissions

Operating Margin emission factor （$EF_{OM,y}$）（tCO_2/MWh）：1.0119
Build Margin emission factor （$EF_{BM,y}$） （tCO_2/MWh）：0.6748
Baseline Emission factor （EF_y） （tCO_2/MWh）：0.8433

Project emissions

According to the baseline methodology ACM0002, the GHG emission of the proposed project within the project boundary is zero,i.e.

$$PE_y = 0$$

Leakage

According to the baseline methodology ACM0002, the leakage of the proposed project is not considered,

$$L_y = 0$$

Project Emission Reductions

According to the Feasibility Study Report of the proposed project, the estimated annual electricity generation delivered to the power grid will be:

EG_y =571,600 **MWh.**

The annual emissions of the baseline scenario will be:

$BE_y = EG_y \times EF_{grid,CM,y}$ = 482030 **tCO_2**

The annual emission reductions of the proposed project will be:

$ER_y = BE_y - PE_y - LE_y =$ 482030**tCO_2**

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2010	0	482,030	0	482,030
2011	0	482,030	0	482,030
2012	0	482,030	0	482,030
2013	0	482,030	0	482,030
2014	0	482,030	0	482,030
2015	0	482,030	0	482,030

2016	0	482,030	0	482,030
Total (tonnes of CO_2e)	0	3,373,210	0	3,373,210

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

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B.7.1. Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity supplied by the project activity to the grid during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	571,600
Description of measurement methods and procedures to be applied:	Calculated based on the recording measured by metering systems installed at the project site. The recording frequency will be hourly measured and monthly recorded. The proportion of data to be monitored is 100% and the data will be archived electronically and kept during the crediting period and 2 years after. Double check by invoices of electricity purchase. The metering devices are calibrated as stated in B.7.2.
QA/QC procedures to be applied:	The metering equipments at the substation are calibrated and checked periodically by qualified third party for accuracy according to Chinese electric industry regulation DL/T448-2000. Electricity exported to the grid will be double checked by the invoices of sales s or relevant commercial data.
Any comment:	

Data / Parameter:	TEG_y
Data unit:	MWh
Description:	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	571,600
Description of measurement methods and procedures to be applied:	measured by metering systems installed at the project site. The recording frequency will be hourly measured and monthly recorded. The proportion of data to be monitored is 100% and the data will be archived electronically and kept during the crediting period and 2 years after. Double check by invoices of electricity purchase. The metering devices are calibrated as stated in B.7.2.
QA/QC procedures to be	The metering equipments at the substation are calibrated and checked

applied:	periodically by qualified third party for accuracy according to Chinese electric industry regulation DL/T448-2000. Electricity exported to the grid will be double checked by the invoices of sales s or relevant commercial data.
Any comment:	

Data / Parameter:	$EG_{self\text{-}use}$
Data unit:	MWh
Description:	Electricity utilized by the project
Source of data to be used:	Measured and verified against sales data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	measured by metering systems installed at the project site. The recording frequency will be hourly measured and monthly recorded. The proportion of data to be monitored is 100% and the data will be archived electronically and kept during the crediting period and 2 years after. Double check by invoices of electricity purchase. The metering devices are calibrated as stated in B.7.2.
QA/QC procedures to be applied:	The metering equipments at the substation are calibrated and checked periodically by qualified third party for accuracy according to Chinese electric industry regulation DL/T448-2000. Electricity exported to the grid will be double checked by the invoices of sales s or relevant commercial data.
Any comment:	

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	120000000
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards. The recording frequency will be yearly measured and recorded.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	*Area of the reservoir measured in the surface of the water,after the implementation of the project activity,when the reservoir is full.*
Source of data to be used:	Feasibility report

Value of data applied for the purpose of calculating expected emission reductions in section B.5	192,800
Description of measurement methods and procedures to be applied:	*The area will be monitored based on topographical data and the height of the dam.* The recording frequency will be yearly measured and recorded.
QA/QC procedures to be applied:	
Any comment:	

>>

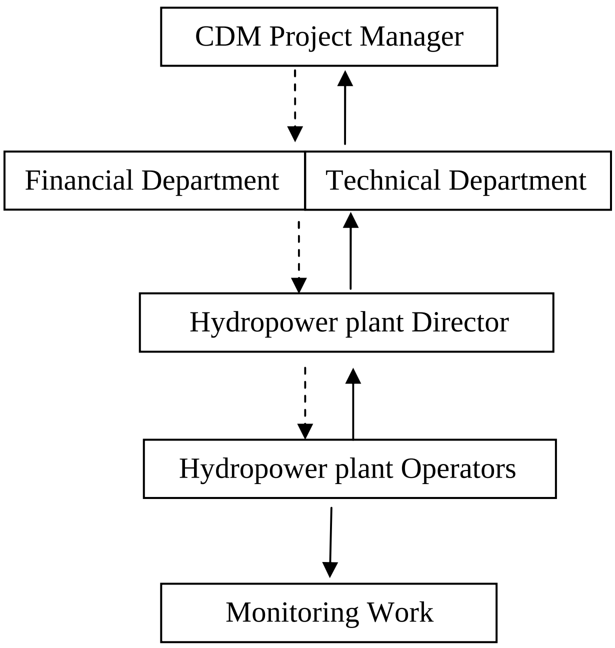
B.7.2. Description of the monitoring plan:

1. Introduction

The project adopts the approved consolidated baseline and monitoring methodology ACM0002 " Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 07) to determine the emission reductions from the wind farm. This plan describes the process in more detail.

2. Responsibility

This monitoring plan will be implemented by professional staff authorized by the owner of the proposed project, i.e. Guodian Diqing Shangrila Electricity Generation Co., Ltd. The management structure is illustrated as follows:



The Management Group has all received sufficient training in terms of monitoring and verification. They have received general training on wind power project operation organized the project owner, including

reading and calibration of the meter, recording of the readings, adjustment of readings, and reporting of readings.

	person in charge	working responsibility	contact way(moblie)
CDM Project Manager	Mr Gou Yiming	In control of the management of CDM works including validation and verification	13988770105
Technical Department	Mr Li Jun	In control of the management of the monitoring technologies and equipments, including reading and calibration of the meter, recording of the readings, adjustment of readings, reporting of reading and supervising the implements of monitoring plan	13988782929
Financial Department	Ms He Zhiyun	In control of the data Management System including the invoices of sales and purchases and others relevant commercial references of CDM ,and cross check the recording from Hydropower plant Director.	13988782936
Hydropower plant Director	Mr Wu Deyun	In control of the whole implements of monitoring and recording and supervision for CDM in the proposed project	13988770031
Hydropower plant Operators	Leader of operators group r	Implements of the monitoring plan according to the PDD of the project activity.	13508876999-8109

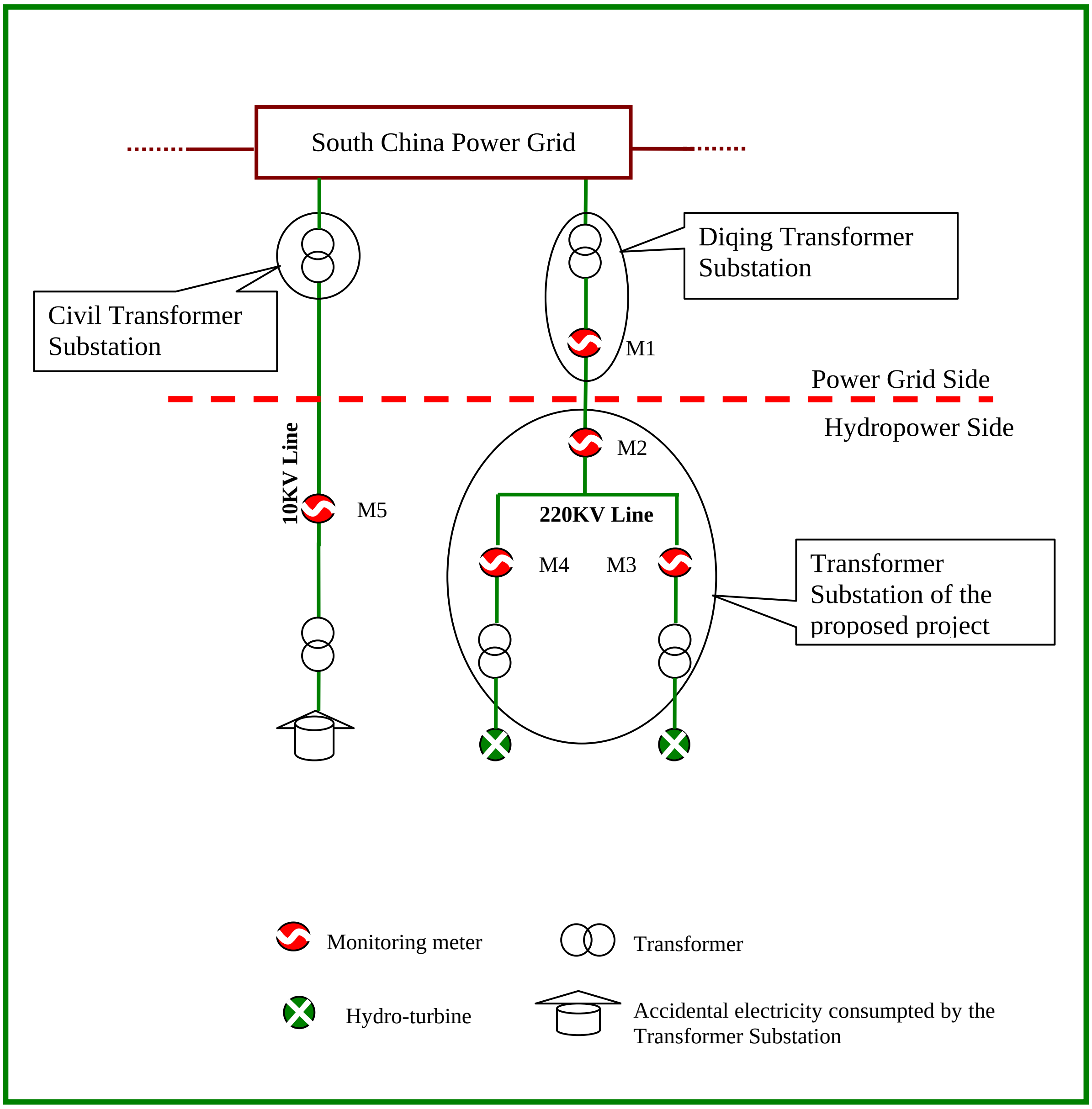
3. Training

Guodian Diqing Shangrila Electricity Generation Co., Ltd will assign and train the dedicated people on carrying out the monitoring work. The monitoring personnel training by professional CDM consulting company will be completed before the registration, further training work will be completed before initial verification. When necessary, the CDM Manager is responsible for organizing or attending trainings on Monitoring and Verification.

4. Meters system

In order to monitor the electricity supplied to the Grid by each project and the total electricity supplied to the Grid, five multifunctional electronic meters were installed. As shown in diagram of monitoring meters, main meter M1 was installed at the 220kv side of Diqng Transformer Substation by the local electric power company. The check meter M2 was installed at the 220kv output side of the Transformer Substation of the proposed project by project owner. The separate meters of each hydro-turbine in the proposed project M3 and M4 were installed at the 220kv side of each transformer by the project owner. The electricity of the proposed project imported from the Grid under accidental condition is monitored by M5. M5 was installed at the 10kv side of the self-use transformer by the project owner. The draft diagram of monitoring meters and the detail information about the five meters are described as follows:

Metering diagram



Meter	Management	Calibration frequency	Accuracy degree	Monitoring style	Monitor data	Doubly check procedures
M1	South China Power Grid	Annually	Not less than 0.5	bidirectional	Main Meter, Monitor the total electricity supplied to the Grid by the proposed project (EG_{total});	M1 checked doubly by M2 and the invoice of sales
M2	Project Owner	Annually	Not less than 0.5	bidirectional	Total electricity produced by the project activity	M2 checked doubly by M3 and M4
M3 and M4	Project Owner	Annually	Not less than 0.5	bidirectional	Monitor electricity generated by each hydro-turbine in the proposed project	M3 and M4 checked doubly by the operatiaonal data of hydro-turbines in the proposed project
M5	Project Owner	Annually	Not less than 0.5	Monomial	Monitor the electricity imported from the Grid by both projects under accidental condition	M5 checked doubly by the invoice of purchases

5. Calibration

The metering equipments at the transformer substations are calibrated and tested yearly by a qualified third party appointed by the South China Power Grid for accuracy according to *the requirement from Technical administrative code of electric energy metering (DL/T448 —2000).* For the proposed project, all the meters installed shall be tested by a qualified institute which is authorized by the South China Power Grid - within 10 days after: the detection of meter reading beyond allowable error level; the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. The meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

6. Monitoring data

According to the meters system mentioned above, the net electricity supplied by the proposed project activity is calculated based on the recording measured by metering systems installed at Diqing Transformer Substation and the project side , recording exports to the grid (supply) and imports from the grid (consumption). Net electricity supplied is calculated by exports minus imports. The recording frequency will be hourly measured and monthly recorded.

The net electricity supplied to the grid by the project is calculated using following equations:

$$EG_y = EG_{total} - EG_{accident}$$

Where:

EG_y is the net calculated electricity supplied to the grid by the proposed project;

EG_{total} is the total electricity supplied to the Grid by the proposed project， metered by M1;

$EG_{accident}$ is the electricity imported from the civil Transformer Substation under accidental condition, metered by M5;

The information of main monitoring data is shown in the below Table:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1.EG_{total}	the total electricity supplied to the Grid by the proposed project	M1	MWh	*m*	hourly measured and monthly recorded	100%	Paper	During the crediting period and two years after	checked with meter recordings of M2
2.$EG_{accident}$	the electricity imported from the civil Transformer Substation under accidental condition	M5	MWh	*m*	hourly measured and monthly recorded	100%	Paper	During the crediting period and two years after	Checked with the invoice of electricity purchase
3. EG_y	the net calculated electricity supplied by the proposed project	Calculation	MWh	*c*	monthly recorded	100%	Paper	During the crediting period and two years after	Checked with the invoice of electricity sales
4． TEG_y	Total electricity produced by the project activity	M2	MWh	*m*	hourly measured and monthly recorded	100%	Electronic and paper	During the crediting period and two years after	Checked with the recordings of M3 and M4

7. Quality assurance and Quality control

Guodian Diqing Shangrila Electricity Generation Co., Ltd specially issued *the regulations of monitoring and management for CDM project* to monitor and verify the emission reductions from the proposed project. Moreover, the management procedures and regulations like operation, meter recordings, maintenance and emergency management are established, which guides the technicians to operate and guarantee the quality assurance and quality control procedures for recording, maintaining and archiving data in detail. This is an on-going process that will be ensured through the CDM in terms of the need for verification of the emissions on an annual basis according to methodology ACM0002.

Several processes required to meet the requirements for emissions reduction monitoring include:
The local Electric Power Company reads the main meter (M1) monthly, the project owner reads the check meter (M2) and other relevant separate meters (M3, M4 and M5) monthly and supplies the recordings to Yunnan Electric Power Company. If needed, the project owner carries out an internal audit and reports the meter readings to the DOE before the verification.
If either party finds any reading of the Meters more than the allowable error or the monitoring equipment functions improperly, it should inform the other party immediately. The project owner and Yunnan Power Grid Corporation should retain a qualified measure institute together to check the meters or equipment, solve the problems and get everything into normal condition. Finally, the electricity delivered to the grid by the project shall be determined by:

- If the main meter (M1) is not within the acceptable limits of accuracy, the net electricity supplied to the grid generated by the proposed project is calculated according to the below steps:

(a) The net electricity supplied to the grid by the proposed project is calculated as the monitoring data of the check meter (M2), which is verified by the project owner and the Northeast Electric Power Company, deducting the transmission line loss electricity[31], unless a test by either party reveals it is inaccurate;

[31] Transmission line loss electricity is calculated according to the maximal Line-loss rate (R=（TEG_y - EG_{total}）/ TEG_y）

(b) If the check meter (M2) is not within acceptable limits of accuracy or performed improperly, the project owner and South China Power Grid shall jointly prepare an reasonable and conservative estimate of the correct reading, and provide sufficient evidence that this estimation is reasonable and conservative according to the item 80 of *Regulations and Rules of Power Supply*[32] issued by State Electricity Regulatory Commission of China: using the reading of M2 without any errors as the benchmark, the revised reading is deducted the value resulted by any errors. The net calculated electricity supplied to the grid generated by the proposed project will base on the revised reading of M1 or M2.

- When M3 or M4 is not within the acceptable limits of accuracy, the monitoring data of M3and M4 are calculated based on the operational data of each hydro-turbine in the proposed project.
- When any errors of all meters are detected beyond the allowable value, the correlative proprietor should repair or recalibrate or replace the meter and give the other party sufficient notice to allow a representative to attend during any corrective activity.
- For the handling of disputes between the proposed project owner and the grid, measures will be adopted according to relevant articles of *Interim Measures for Settlement of Electricity Charges between the Power Generating Enterprises and the Grid Enterprises* (No. 24, Dianjianjiacai (2008))[33] issued by State Electricity Regulatory Commission of China.

8. Data Management System

Overall responsibility for monitoring greenhouse gas emissions reductions will rest with the CDM monitoring staff of the proposed project. The CDM manual sets out the procedures for tracking information from the primary source to data calculations in paper format. Moreover, the credibility and reliability of those data and information must be confirmed. Physical documentation such as paper-based maps, diagrams and environmental assessment will be collated in a central place, together with this monitoring plan. In order to facilitate auditor's reference, monitoring results will be indexed. All paper-based information will be stored by Guodian Diqing Shangrila Electricity Generation Co., Ltd and kept at least one copy, and all data including calibration records is kept until 2 years after the end of the total crediting period of the CDM project.

The following table below outlines the key documents relevant to monitoring and verification of the emission reductions from the proposed project.

[32] http://www.serc.gov.cn/flfg/bmgz/200802/t20080220_5931.htm

[33] http://www.chinapower.com.cn/article/1130/art1130580.asp

Table List of the key documents relevant to monitoring and verification

ID No.	Document Title	Main Content	Source
F-1	PDD, including the electronic spreadsheets and supporting documentation(assumptions, estimations, measurement, etc)	Calculation procedure of emission reduction and monitoring items	Proposed project owner or UNFCC website
F-2	Report on monitoring and checking of electricity supplied to the grid	Record based on monthly meter reading and electricity sale receipts	Proposed project owner
F-3	Report on maintenance and calibration of metering equipment	Reasons for maintenance and calibration and the precision after maintenance and calibration	Proposed project owner
F-4	Report on the qualifications of the operators	Technical post ,working experience etc.	Proposed project owner
F-5	the project management record (including date collection and management system)	Comprehensively and truly reflect the management and the operation of the proposed project	Proposed project owner

8 Verification

A DOE will be selected and engaged for the verification. The owner will make the arrangements for the verification to the best of its abilities. The owner will facilitate the verification by providing the DOE all required necessary information before, during and after the verification.
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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 of baseline study: 04/11/2009

Names of person/entity determining the baseline are listed as follows:

(Not the project participants listed in Annex 1)

- Mr. Li Gang,
  Entity: China Fulin Windpower Development Corporation.
  Address: Floor 7th, Tower C, International Investment Building, No.6-9, North Ave.Fuchengmen, Xicheng District, 100034, Beijing,P.R.C.
  Telephone/Fax: +8610-66091326 / 66091396
  E-mail: Ligang@clypg.com.cn

- Ms. FENG Tianfeng
  Entity: China Fulin Windpower Development Corporation.
  Address: Floor 7th, Tower C, International Investment Building, No.6-9, North Ave.Fuchengmen, Xicheng District, 100034, Beijing,P.R.C.

Telephone: +8610-66091327

Email: tffeng@163.com

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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:

21/10/2004(the construction contracts of the proposed project)

The date of construction contracts of the proposed project is the earliest date of the real actions (including construction and equipment purchase) of the project activity during the starting period. The correlative timelines were shown in B5.

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

34 years (including 3 years construction period))

>>

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

>>

C.2.1. Renewable crediting period

>>

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

01/01/2010

>>

C.2.1.2. Length of the first crediting period:

7 years

>>

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

Not applicable

>>

C.2.2.2. Length:

Not applicable

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SECTION D. Environmental impacts

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

In accordance with relevant environmental law and regulations, the Environmental Assessment Report of the proposed project has been approved by the Environmental Protection Administration of Yunnan Province in 6th July 2004, referred as "Yunnan Environment Construction (Table) [2004] No.422".A summary of the report is illustrated as follows:

- **Impacts on Air Environment**

Hydropower plants are known to contribute to zero atmospheric pollution as no fuel combustion is involved during any stage of the operation. However, the sources of air pollution are mainly due to the construction activities including the transportation of construction material, road construction and improvement and cadre construction etc. The impacts on air environment are temporarily that the impact will be ended when the construction is completed. It is suggested that several measures shall be taken into account, such as the construction under strong wind weather is prohibited, reducing as much as possible the area of construction, spraying water when undertaking construction, and reducing the speed of vehicles in the field. Hence, air pollution caused by the proposed project is not significant to the surrounding environment.

- **Impacts on Noise Environment**

The noise of the proposed project in construction phase is from vehicles and machines on-site. According to the monitoring data from the construction site, the noise is at a level between 91-102 dB. Based on the formula of declining of sound emitted from a non-directional source, it is estimated that the maximum noise effective distance of the project is 100m in daytime and 500m at night. Moreover, the magnitude of the impacts during construction phase exists for a temporary period of time till the end of construction phase. At the same time, the closest residential area to the site of the proposed project is over 5km away. Therefore, the noise of the project will not have impact on nearby residents.

- **Impacts from Wastewater and Solid Waste**

The possible negative impacts are the household wastewater and solid waste produced by builders and staff, and the waste earth from digging of the foundation in the construction phase. Under normal conditions with highly automated monitoring and control system, the household wastewater will be first treated to reach the standard, and then be disinfected to discharge for circumjacent virescence. Moreover, the amount of household solid waste will be very little, which will not have impact on the environment. Besides, the solid waste will be collected and moved to the landfill site of the nearest city. The waste earth from the digging should be firstly used for refilling. The rest of the waste earth should be placed in the low area of the site and replanted with grass. Following the suggestion, the water and solid waste should have no significant impact on the environment.

- **Impacts on Ecosystem Environment**

The project proponent has adopt a serial of protective measures, such as engineering measures and virescence measures, to dispose the adverse impacts from the occupation of the riverway and lands by the project activity. The minor quantity of solid / liquid discharge, likely to be generated during the construction phase has no noticeable impact on the region ecological environment. Although a serious potential concern for hydropower plant is its impact on vegetation, aquicolous animals and migrating birds. However, there are no migratory birds / endangered species in the region of project activity. Therefore, the activities to be carried out will not generate noticeable negative impact on the ecological environment.

- **Socio-Economic Impacts**

The preliminary appraisal assumed a larger installed capacity and higher coal displacement in the project. The project is estimated to supply 571600 MWh of power to the Yunnan Power Grid, which will save the fossil fuels. So the project generates eco-friendly, GHG free power that contributes to sustainable development of the region. Moreover, the project activity not only helps the uplift of skilled and unskilled manpower in the region, but also improves employment rate and livelihood of local populace in the vicinity of the project.

- **Compensation for submerged land**

For the proposed project, the types of the occupied land include bottomland, shrubbery, woodland and small part of farm or garden land. Therefore, the project owner will coordinate with local government and residents in paying reasonable compensation for the land occupation. Moreover, to mitigate the impact on the occupied land by the proposed project, the project owner will try to plant vegetation in the permanent occupied land and recovery the vegetation in the temporary occupied land when the proposed project is completed.

- **Summary of migration allocation**

According to the FSR of the proposed project, only 27 migrants were involved in the proposed project activity. Aimed to reasonable compensation and settlement of the migrants, the FSR and EIA of the proposed project both took fully consideration in the migration allocation. Moreover, the measures for migration allocation had been identified by the experts and government. Thereafter, according to the national provisions on the migration allocation, the project owner appointed the third party with competency to evaluate the implement of measures for the migration allocation. On December 3 2007, the local government approval the evaluate report for the migration allocation in the proposed project .According to the approval report, provides the reasonable compensation according to the relative regulation. Moreover, the project owner associates with local government to do their possible to create the

job opportunities and guarantee the migrants' living conditions. In addition, the stakeholders interviewed by the audit were all satisfied with the implement of migration allocation during the validation period. In conclusion, the migration allocation was successfully implemented and improved the live level of migrants.

- **Impacts on person health and environmental security**

During the construction period, the project proponent purchases and equips a number of iatrical medicaments and simple facility to dispose the exigency. Otherwise, the worker will be arranged to have a health check once a year. At the same time, the project proponent strengthens the managements of environmental sanitation to guarantee the water quality and health of the worker and inhabitants.
>>

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:

The construction and operation of the proposed project have no significant environmental impacts, and the project is definitely an environmentally more friendly way of providing power than others power plants,

>>

SECTION E. Stakeholders' comments

>>

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

According to the requirement by the *Measures for Operation and Management of Clean Development Mechanism Projects in China* and PDD, the staff of Guodian Diqing Shangrila Electricity Generation Co., Ltd. held an open public survey and a stakeholders conference on the local villagers and residents during June and July period in 2007. In the public survey and conference, the stakeholder representatives were respectively from the local government and the nearby village where the project is located.

- Public survey: during June and July period in 2007, one-page questionnaire was used to carry out a survey on the local stakeholders .
- Stakeholder conference: the meeting w was held on 8th July 2007 to explain CDM， better understand the stakeholders' interests and obtain their comments.

The public survey and the stakeholders conference was designed to comment as following sections:

1) The stakeholders' opinions to the proposed project including the society, economy and environment?
2) The impacts of the proposed project on the local sustainable development?
3) The stakeholders' attitude to the migration allocation and compensatory approach for your land occupied?
4) The stakeholders' attitude to the implement of the measures of environmental protection?

5) The stakeholders' suggestions to the company regarding the proposed project?

6) Whether or not agree with the construction of the proposed project?

>>

E.2. Summary of the comments received:

The summary of the comments received is listed in the following sections:

- Summary of the stakeholder interviewed

The survey of the proposed project involved 39 representatives (30 questionnaires and 9representatives), mainly from the local Development and Reform Bureau, the local Environmental Protection Bureau, the local Power Supply Corporation, and the nearby village. Among the stakeholder interviewed, there are 57% of males and 43% of females, education level of the stakeholder: primary level or below (23%); middle level or above (77%).

- Summary of the stakeholder comments received

Table 7 Statistic of the comments in the survey

No.	Discussional items	Options	Percentage （%）
1	Know of the proposed project	*Yeah*	84
		No	16
2	Satisfied with the local ecological and social environment	*Yeah*	94
		No	6
3	Do you think the proposed project will improve the local economy and increase the job opportunity	*Yesh*	64
		No impacts	30
		No	6
4	The major negative impact brought by the proposed project	*Society*	10
		Economy	67
		environment	17
		others	0
5	The impact of the project on the local environment (multi-options)	*Ecological environment*	73
		Noise pollution	20
		Water pollution	27
		Solid pollution	40
		Air pollution	23
		Soil erosion	97
6	The impacts of the project on the local water environment and marine lives	*No effect*	38
		low	56
		serious	6
7	Do you agree to accept compensatory approach for your land occupied?	*Yeah*	100
		No	0
8	Do the immigrants agree to accept compensatory approach	*Yeah*	100
		No	0
9	Attitude to the implement of the measures of environmental	*Satisfaction*	90

	protection	*Dissatisfaction*	10
10	Attitude towards the proposed project	*Support*	100
		Against	0

- Summary of the survey results

1) There are no adverse comments on the project activity, and mostly stakeholders interviewed were supportive of the proposed project.

2) The successful implementation of the proposed project will diversify local power mix, mitigate electricity shortage, and promote the development of local tourism and other tertiary industries.

3) The local villagers are satisfied with compensation by the project owner for occupation on part of land occupation.

4) Many of stakeholders interviewed suggested the project entity pay special attention to and make efforts to vegetation recovery, soil and water conservation and related facility construction.

>>

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

No negative comments have received on the proposed project. Moreover, the local stakeholders have strong positive comments on the effects that the proposed project will bring the local economy and society. However, to reduce the impacts on the local environment produced from the construction of the proposed project, the project owner should adopt relative measures as follow:

1) The project owner should guarantee and suitably add the investment of environmental protection.
2) The construction processes should be strictly implemented according to the national environment criterions.
3) The measures of environmental protection should been carried out to mitigate the environmental impacts according to the EIA report.

>>

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I countries is involved in the proposed project.
>>

Annex 3

BASELINE INFORMATION

Key parameters for the emission factors calculation

The key parameters in OM and BM calculation include the net caloric values (NCVs), oxidation factors (OXIDs), and CO_2 emission factor per unit of energy (EF_{co2}s) of various types of fuels, and power supply efficiency of various power generation technologies.

Table A-1 NCVs, OXIDs, and EF_{co2}s of various types of fuels

Fuel	NCV	EF_{co2} (tc/TJ)	OXID
Coal	20908 kJ/kg	25.80	1
Washed coal	26344 kJ/kg	25.80	1
Other Washed Coal[7]	8363 kJ/kg	25.80	1
Coke	28435 kJ/kg	25.80	1
Crude oil	41816 kJ/kg	20.00	1
Gasoline	43070 kJ/kg	18.90	1
Kerosene	43070 kJ/kg	19.60	1
Diesel	42652 kJ/kg	20.20	1
Fuel oil	41816 kJ/kg	21.10	1
Other petroleum products[8]	38369 kJ/kg	20.00	1
Natural gas	38931 kJ/m^3	15.30	1
Coke oven gas[9]	16726 kJ/m^3	12.10	1
Other gas[10]	5227 kJ/m^3	12.10	1
LPG	50179 kJ/kg	17.20	1
Refinery gas	46055 kJ/kg	18.20	1

Data sources:

NCVs are from China Energy Statistical Yearbook 2006, P287.

EF_{co2} and OXID are from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume2 Energy, Chapter 1, P1.21-1.24, Table 1.3 and Table 1.4 .

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7 Other washed coal includes middlings and slimes. The NCV value of middlings is adopted here, which is conservative because the NCV value of slimes is higher than that of middlings

8 The NCV value of other petroleum products are not provided in China Energy Statistical Yearbooks. This Annex calculates it as 38369 kJ/kg, i.e., 1.3108 tce/t, on the basis of Energy Balance Sheets (physical quantity) and conversion factor against SCE

9 The NCV value here adopts the lower limit of the NCV value range, i.e., 16726-17981 kJ/m^3, for coke oven gas provided in China Energy Statistical Yearbook 2006, P 287.

10 The NCV value here adopts the lowest NCV value among those for gas by furnace, gas by heavy oil catalytic cracking, gas by heavy oil catalytic thermal cracking, gas by pressure gasification, and water coal gas, which are provided in China Energy Statistical Yearbook 2006, P 287.

Table A-2.Caculation of emission factor of advanced electricity generation technology

	variable	efficiency of electricity transmission	Emission Factor of fuel	Carbon oxidation rate	Emission Factor of power plant
		A	B	C	D=3.6/A/100*B*C*44/12
coal-fired power plant	EFcoal,adv	35.82%	25.8	1	0.9508
gas-fired power plant	EFgas,adv	47.67%	15.3	1	0.4237
oil-fired power plant	EFoil,adv	47.67%	21.1	1	0.5843

Step1 .Calculation of the Operating Margin Emission Factor ($EF_{OM,y}$)

According to the ACM0002 methodology, the Simple method OM was used to calculate the OM emission factors of the years 2003, 2004 and 2005, and then weighted average emission coefficient was calculated and selected as the $EF_{OM,y}$ for primary fuel input for thermal power supply to the South China grid.

The power data and processes for the calculation of the $EF_{OM,y}$ in the South China Grid were shown in tables A-3～A-12 . The detailed calculation formulas are described in the section B6.

Table A-3 the calculation data and average emission of the South China Power Grid in 2003

Fuel type	unit	Guangdong	Guangxi	Guizhou	Yunnan	subtotal	Carbon content	OXID	NCV	CO_2 emissions
							（tc/TJ）	（%）	（MJ/t,km3）	(tCO_2e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/1000
Raw coal	**Mt**	44.9179	8.3184	21.6911	14.0527	**88.9801**	25.8	100	20908	175993455.05
Clean coal	**Mt**	0.0005				**0.0005**	25.8	100	26344	1246.07
Other washed coal	**Mt**			0.3638	0.2037	**0.5675**	25.8	100	8363	448971.84
Coke oven gas	**Billion m^3**				0.05	**0.05**	25.8	100	28435	13449.76
Other gas	**Billion m^3**				0.004	**0.004**	12.1	100	16726	2968.31
Crude oil	**Mt**	0.0321			0.1127	**0.1448**	12.1	100	5227	335797.81
Diesel	**Mt**	0.0685				**0.0685**	20	100	41816	210055.71
Fuel oil	**Mt**	0.0002				**0.0002**	18.9	100	43070	596.95
LPG	**Mt**	0.319			0.0076	**0.3266**	20.2	100	42652	1031759.27
Refinery gas	**Mt**	6.2722	0.003			**6.2752**	21.1	100	41816	20301304.48
Natural gas	**Billion m^3**					**0**	17.2	100	50179	0.00
Other energy	**Mtce**	0.0285				**0.0285**	18.2	100	46055	87592.00
Raw coal	**Mt**					**0**	15.3	100	38931	0.00
Clean coal	**Mt**	0.1135				**0.1135**	20	100	38369	319357.98
Other washed coal	**Mt**					**0**	25.8	100	28435	0.00
Coke oven gas	**Billion m^3**	9.321			2.235	**11.556**	0	100	0	0.00
										198746555.23

China Energy Statistical Yearbook 2004

Table A-4 Thermal power generation of the South China Power Grid in 2003

Province	Power generation	Power generation	Self-consumption rates	electricity supply
	（10^8 kWh)	（MWh)	（%）	（MWh)
Guangdong	1433.51	143351000	5.5	135,466,695
Guangxi	170.79	17079000	8.43	15,639,240
Guizhou	432.95	43295000	7.4	40,091,170
Yunnan	190.55	19055000	8.01	17,528,695
Total				208,725,800

China Power Yearbook 2004

Table A-5 the calculation of the OM emission factor of the South China Power Grid in 2003

Net import from Central China Power Grid（MWh）	A_i	11100
Emission factor of Central China Power Grid （ tCO_2/MWh）	B_i	0.797442
Fossil-fired electricity in the South China Power Grid（MWh）	C_i	208,725,800
Total power supply of the South China Power Grid（MWh）	$D_i= C_i+ A_i$	208,736,900
CO_2 emissions in the South China Power Grid （tCO_2e）	E_i	198746555.23
Total CO_2 emissions （tCO_2e）	$F_i= E_i+ A_i \times B_i$	198,755,407
$EF_{OM,y}$ （tCO_2/MWh）	$G_i = F_i/E_i$	0.952181

Table A-6 the calculation data and average emission of the South China Power Grid in 2004

Fuel type	unit	Guangdong	Guangxi	Guizhou	Yunnan	subtotal	Carbon content	OXID	NCV	CO_2 emissions
							（tc/TJ）	（%）	（MJ/t,km3）	(tCO_2e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/1000
Raw coal	Mt	60.177	13.05	26.439	17.5128	**117.1788**	25.8	100	20908	231767573.55
Clean coal	Mt	0.0021				**0.0021**	25.8	100	26344	5233.50
Other washed coal	Mt					**0**	25.8	100	8363	0.00
Coke oven gas	Billion m^3					**0**	25.8	100	28435	0.00
Other gas	Billion m^3					**0**	12.1	100	16726	0.00
Crude oil	Mt	0.0258				**0.0258**	12.1	100	5227	59831.38
Diesel	Mt	0.1689				**0.1689**	20	100	41816	517932.98
Fuel oil	Mt					**0**	18.9	100	43070	0.00
LPG	Mt	0.4888			0.0183	**0.5071**	20.2	100	42652	1601975.28
Refinery gas	Mt	9.5771				**9.5771**	21.1	100	41816	30983494.25
Natural gas	Billion m^3					**0**	17.2	100	50179	0.00
Other energy	Mtce	0.0286				**0.0286**	18.2	100	46055	87899.34
Raw coal	Mt	0.0048				**0.0048**	15.3	100	38931	104833.40
Clean coal	Mt	0.0166				**0.0166**	20	100	38369	46707.86
Other washed coal	Mt					**0**	25.8	100	28435	0.00
Coke oven gas	Billion m^3	7.942				**7.942**	0	100	0	0.00
										265175481.54

China Energy Statistical Yearbook 2005

Table A-7 Thermal power generation of the South China Power Grid in 2004

Province	Power generation	Power generation	Self-consumption rates	electricity supply
	(10^8 kWh)	(MWh)	(%)	(MWh)
Guangdong	1693.89	169389000	5.42	160208116
Guangxi	201.43	20143000	8.33	18465088
Guizhou	497.2	49720000	7.06	46209768
Yunnan	243.22	24322000	7.56	22483257
Total				247366229

China Electricity Power Yearbook 2005

Table A-8 the calculation of the OM emission factor of the South China Power Grid in 2004

Net import from Central China Power Grid (MWh)	A_i	10,951,240
Emission factor of Central China Power Grid (tCO_2/MWh)	B_i	0.826448
Fossil-fired electricity in the South China Power Grid (MWh)	C_i	247,366,229
Total power supply of the South China Power Grid (MWh)	$D_i = C_i + A_i$	258,317,469
CO_2 emissions in the South China Power Grid (tCO_2e)	E_i	265175481.54
Total CO_2 emissions (tCO_2e)	$F_i = E_i + A_i \times B_i$	274,226,117
$EF_{OM,y}$ (tCO_2/MWh)	$G_i = F_i/E_i$	1.061586

Table A-9 the calculation data and average emission of the South China Power Grid in 2005

Fuel type	unit	Guangdong	Guangxi	Guizhou	Yunnan	subtotal	Carbon content	OXID	NCV	CO_2 emissions
							（tc/TJ）	（%）	（MJ/t,km3）	(tCO_2e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/1000
Raw coal	Mt	66.9647	14.35	32.1231	19.7555	**133.1933**	25.8	100	20908	263442601.85
Clean coal	Mt				0.0015	**0.0015**	25.8	100	26344	3738.21
Other washed coal	Mt			0.1039	0.3388	**0.4427**	25.8	100	8363	350237.59
Coke oven gas	Billion m^3	0.479			0.805	**1.284**	25.8	100	28435	345389.71
Other gas	Billion m^3				0.079	**0.079**	12.1	100	16726	58624.07
Crude oil	Mt	0.0187			0.1596	**0.1783**	12.1	100	5227	413485.84
Diesel	Mt	0.1091				**0.1091**	20	100	41816	334555.88
Fuel oil	Mt	0.0068				**0.0068**	18.9	100	43070	20296.31
LPG	Mt	0.3196	0.0202		0.0181	**0.3579**	20.2	100	42652	1130638.84
Refinery gas	Mt	8.8721				**8.8721**	21.1	100	41816	28702703.26
Natural gas	Billion m^3					**0**	17.2	100	50179	0.00
Other energy	Mtce	0.0492				**0.0492**	18.2	100	46055	151211.46
Raw coal	Mt	0.0093				**0.0093**	15.3	100	38931	203114.71
Clean coal	Mt	0.017				**0.017**	20	100	38369	47833.35
Other washed coal	Mt					**0**	25.8	100	28435	0.00
Coke oven gas	Billion m^3	10.466	13.315		5.972	**29.753**	0	100	0	0.00
										295204431.07

China Energy Statistical Yearbook 2006

Table A-10 Thermal power generation of the South China Power Grid in 2005

Province	Power generation (MWh)	Power generation (%)	Self-consumption rates (MWh)
Guangdong	176453000	5.58	166,606,923
Guangxi	25023000	7.95	23,033,672
Guizhou	58430000	7.34	54,141,238
Yunnan	27281000	6.94	25,387,699
Total			269,169,531

China Electricity Power Yearbook 2006

Table A-11 the calculation of the OM emission factor of the South China Power Grid in 2005

Net import from Central China Power Grid （MWh）	A_i	96,363,000
Emission factor of Central China Power Grid （ tCO_2/MWh）	B_i	0.771225
Fossil-fired electricity in the South China Power Grid（MWh）	C_i	269,169,531
Total power supply of the South China Power Grid（MWh）	$D_i= C_i+ A_i$	365,532,531
CO_2 emissions in the South China Power Grid （tCO_2e）	E_i	295204431.07
Total CO_2 emissions （tCO_2e）	$F_i= E_i+ A_i \times B_i$	369,521,975
$EF_{OM,y}$ （tCO_2/MWh）	$G_i=F_i/E_i$	1.010914

Table A-12 Operating Margin Emission Factor of South China Power Grid

Year	2003	2004	2005
$EF_{OM,y}$ （tCO_2/MWh）	0.952181	1.061586	1.010914
$EF_{OM,}$ of South China Power Grid(*Weight Average*)（tCO_2/MWh）	1.011911		

Step 2. Calculation of the Build Margin Emission Factor （$EF_{BM,y}$）

According to the ACM0002 methodology, the Build Margin emission factor $EF_{BM,y}$ *ex-ante* was selected to identify sample group for calculating Build Margin emission factor. Based on the description of formulas in section B6, the power data and processes for the calculation of the $EF_{BM,y}$ in the South China grid were shown in tables A-13～A-16 .

Sub-step 2a: calculation of weights of CO_2 emissions of coal, oil and gas fuel in total emissions for fossil fuel fired power generation

Table A-13 **Calculation of emission weight of solid fuel, liquid fuel and gas fuel in all fuel emission in the South China Power Grid**

		Guangdong	Guangxi	Guizhou	yunnan	Total	**NCV**	**Emission Factor （Tc/TJ）**	**Carbon oxidation rate （%）**	**CO2 emissions（tCO2e） (Volume unit)**
Fuel type	**Unit**	A	B	C	D	E=A+…+D	F	G	H	I=E*F*G*H*44/12/1000
Raw coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	20908	263442601.85
Clean coal	10^4t				0.15	**0.15**	25.8	100	26344	3738.21
Other washed coal	10^4t			10.39	33.88	**44.27**	25.8	100	8363	350237.59
coke	10^4t	4.79			8.05	**12.84**	25.8	100	28435	345389.71
Total										**264,141,967**
Crude oil	10^4t	10.91				**10.91**	20	100	41816	334555.88
Gasoline	10^4t	0.68				**0.68**	18.9	100	43070	20296.31
coal oil	10^4t	0	0	0	0	0	19.6	100	43070	0
Diesel	10^4t	31.96	2.02		1.81	**35.79**	20.2	100	42652	1130638.84
Fuel oil	10^4t	887.21				**887.21**	21.1	100	41816	28702703.26
other petroleum product	10^4t	1.7				**1.7**	20	100	38369	47833.35
Total										**30,236,028**
Coke oven gas	10^7 m^3	0	0	0	7.9	7.9	12.1	100	16726	58,624
Other gas	10^7 m^3	18.7	0	0	159.6	178.3	12.1	100	5227	413,486
LPG	10^4t	0	0	0	0	0	17.2	100	50179	0
Refinery gas	10^4t	4.92				**4.92**	18.2	100	46055	151,211.46
Natural gas	10^7 m^3	9.3	0	0	0	9.3	15.3	100	38931	203,115
Total										**826,436**
Sum Total										**295,204,431**

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From above table and formulae (5), (6) and (7) in section B6, the weights are as follows: λ_{Coal} =89.48%，λ_{Oil} =10.24%，λ_{Gas} =0.28%。

Sub-step 2b: calculating the corresponding emission factor for fossil fuel fired power generation

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

Sub-step 2c: calculating the $EF_{BM,y}$ of local grid

Table A-14 Installed capacity in the South China Power Grid in 2005

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

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Table A-15 Installed capacity in the South China Power Grid in 2004

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

China Power Yearbook 2005

Table A-16 Installed capacity in the South China Power Grid in 2003

Installed capacity	Unit	Guangdong	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total
Thermal Power	MW	27231.4	3190.1	3556.8	6465.8	0	40444.1
Hydro power	MW	8107.2	4525.2	6543.2	3713.7	2520	25409.3
Nuclear power	MW	3780	0	0	0	0	3780
Wind power and others	MW	83.4	0	0	0	0	83.4
Total	MW	39202	7715.3	10100	10179.5	2520	69716.8

China Power Yearbook 2004

Table A-17 Installed capacity in the South China Power Grid in 2002

Installed	Unit	Guangdon	Guangxi	Yunnan	Guizhou	Tianshengqiao	Total

capacity		g					
Thermal Power	MW	25237.8	3156.2	2932.7	4642.5	0	35969.2
Hydro power	MW	7775.3	4363.3	5836.3	2426.1	2520	22921
Nuclear power	MW	2790	0	0	0	0	2790
Wind power and others	MW	76.8	0	0	0	0	76.8
Total	MW	35879.9	7519.5	8769.1	7068.6	2520	61757.1

China Power Yearbook 2003

Table A-18 Calculation of BM of the South China Power Grid

	Installation in year 2003	Installation in year 2004	Installation in year 2005	New additions from 2003 to 2005	Addition share（%）
	A	B	C	D=C-A	
Thermal power （MW）	40444.1	46659. 7	54507	14062. 9	74. 01%
Hydro power（MW）	25409.3	27580. 1	30347. 1	4937. 8	25. 99%
Nuclear power （MW）	3780	3780	3780	0	0. 00%
Wind power i（MW）	83.4	83. 4	83. 4	0	0. 00%
Total （MW）	69716.8	78103. 3	88717. 5	19000. 7	100. 00%
Share of 2004 installed capacity	78.58%	88. 04%	100%		

Based on above data and formulae (5), (6) and (7) in section B6:

$EF_{BM,y}$=0.9117×74.01%=0.6748tCO_2/MWh

Step 3. Calculation of the Baseline Emissions Factor（EF_y）

According to the baseline methodology (ACM0002), the baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), as shown in table A-19:

Table A-19 Baseline Emission factor (EF_y) of the South China Power Grid

Calculation of the Key factors:
Operating Margin emission factor ($EF_{OM,y}$)（tCO_2/MWh）： 1.0119
Build Margin emission factor ($EF_{BM,y}$)（tCO_2/MWh）： 0.6748
Baseline Emission factor (EF_y)（tCO_2/MWh）： **1.0119×0.50+0.6748×0.50=0.8433**

Note: the latest version of ACM0002 (version 6) provides the following default weights for hydropower projects: Operating Margin, W_{OM} = 0.5; Build Margin, W_{BM} = 0.5

>>Annex 4

MONITORING PLAN

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