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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Project title: Changning Kawan 18.9MW Hydroelectric Project
PDD Version: 05
Date: June 22nd, 2009

Revision History of the PDD

- Version 01 (completed on July 21th, 2008): submitted to DOE for validation for GSP on the website of UNFCCC (Initial adoption);
- Version 02 (completed on November 19th, 2008): revised according to the DOE's primary revision checklist
- Version 03 (completed on January 5th, 2009): revised according to the DOE's second revision checklist
- Version 04 (completed on May 5th, 2009): revised according to the DOE's request
- Version 05 (completed on June 22nd, 2009): revised according to the DOE's request

A.2. Description of the project activity:

Changning Kawan 18.9MW Hydroelectric Project (the Project developed by Changning County Jia Yuan Electric Power Development Co., Ltd.) is located on Kuke River of Changning County, Baoshan City of Yunnan Province. The purpose of the Project is to utilize the hydrological resource in run-of-river scheme to generate zero carbon emission electricity for the South China Power Grid. The project will generate certified emission reductions (CERs) by displacing electricity generation from grid connected fossil fuel-fired power plants that would otherwise be generating electricity needed.
The total installed capacity of the Project is 18.9MW. The average annual operating hours of the project is 4,886hrs. The annual power generation is about 92,345 MWh. It is estimated that an estimated annual power output of 90,272MWh that will be delivered to the South China Power Grid.

As a renewable energy project, the Project will produce positive environmental and economic benefits and contribute to the local sustainable development more than other fossil-fuel (mainly coal) power generation. The specific sustainable development benefits of the Project are shown as following:

1. Improve the local and regional economy development by providing electricity to meet its increasing demands;
2. Support the minority territory's economy development, and to alleviate poverty;
3. Make greater use of hydroelectric renewable energy generation resources for sustainable energy production;
4. Abate the local air pollution caused from fossil fuel-fire power plants by supplying zero-emission renewable energy to South China Power Grid; and
5. Contribute to community development and facilitate the development of ethnic cultures.

A.3. Project participants:

Name of Party involved (*)((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Changning County Jia Yuan Electric Power Development Co., Ltd.	No
Japan	Mitsubishi Corporation	No

For more information about project participants, please refer to Annex 1.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Baoshan City, Yunnan Province

A.4.1.3. City/Town/Community etc:

Changning County

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

The project is located 51km from Changning County. The geographical coordinates of the plants are: east longitude of 98° 52′ 6″ ～99° 46′ 48″ and north latitude of 25° 28′ 51″ ～26° 23′ 58″ . Figure A-1 and A-2 show the location of the Project.

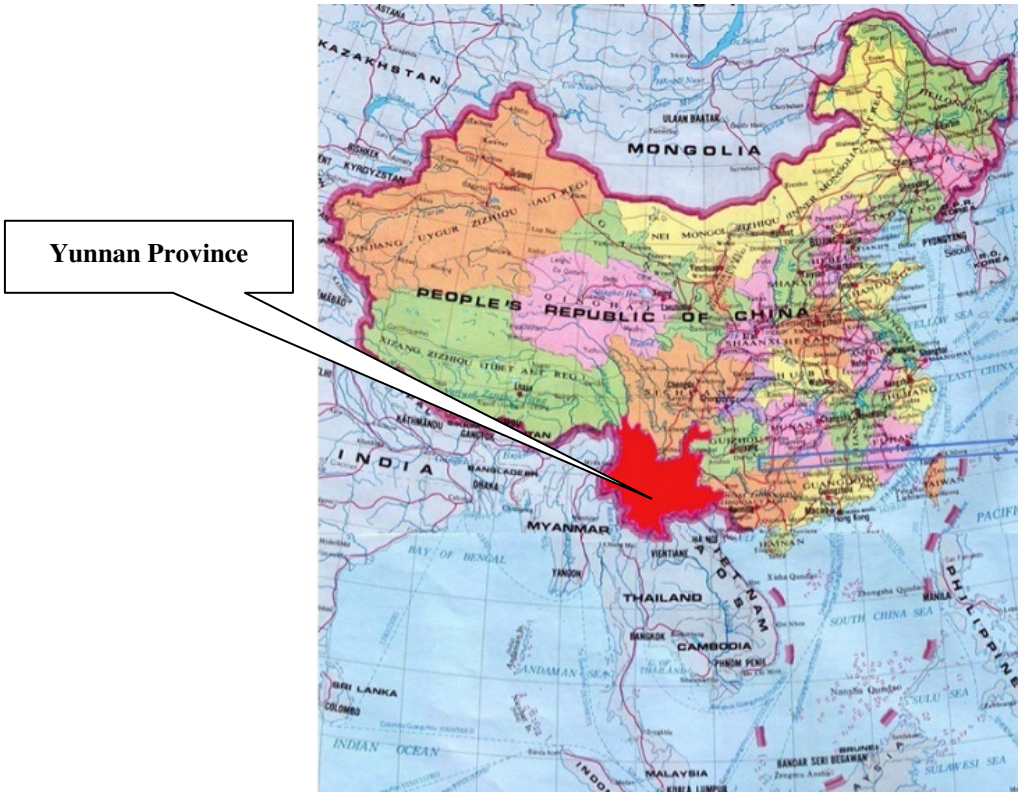


Figure A-1: Location of Yunnan Province in Country Map

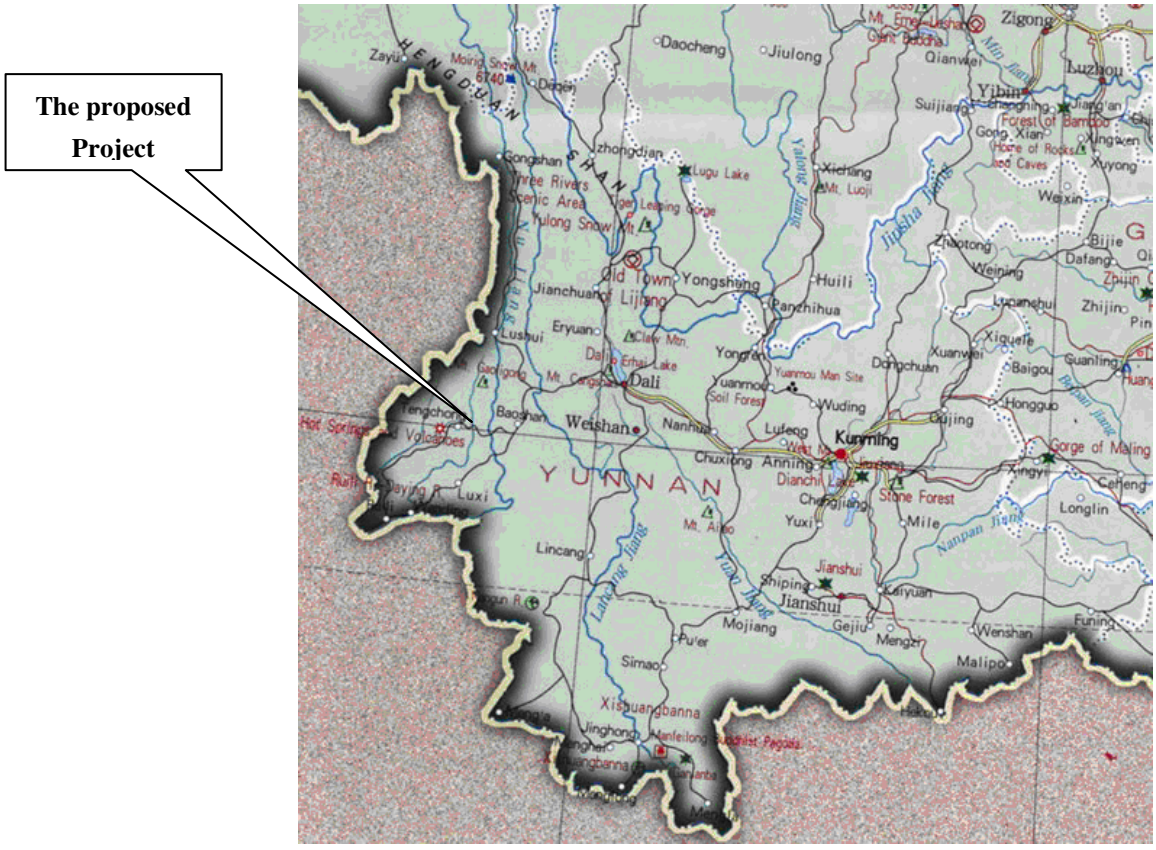


Figure A-2: Location of the Proposed Project in Province Map

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

Sectoral scope 1: energy industries (renewable sources)

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

The Project is a diversion type run-of-river hydropower station without immigrations. The installed capacity of the Project is 18.9MW.

Type I - *Renewable Energy Project*;
Category I.D. - *Grid Connected Renewable Electricity Generation.*
Sub-category: Hydro

Technology

The project is a run-of-river hydropower plant with total installed capacity of 18.9MW (6.3MW×3). Based on the Feasibility Study Report (FSR), the key components of the proposed project are as follows: the dam, diversion tunnel system, power houses, a substation, etc.

- Headwork mainly composed of one dam situated on river
- Intake water system including:
  - Intake water sluices incorporated in the gravity dams
  - Intake water channels consists of channel with total length of 8,110.527 m
  - A pressure forebay,
  - A penstock bifurcated into 3 branch pipes feeding the turbines downstream
- Pivot structures mainly composed of a 18.9MW powerhouse, which consists of 3 sets of turbine-generator units with installed capacity of 6.3MW respectively, tail water tunnels, a substation, and county road to facilitate the site transportation.

The Project uses three units of HLA616-LJ-110 turbine and SFW6300-10/2600 generator matched. These equipments are domestically manufactured. No technology transferred from other countries is involved. Detailed technical parameters of the Project are given in Table A.1 below.

Table A.1 Technical parameters of the turbines and generators

No.	Parameters	Specifications
1	**Turbines**	
	Model	HLA616-LJ-110
	Quantity	3 sets
	Rated capacity	6,300Kw
	Rated water head	68.8m
	Rotation speed	600r/min
	Rated water flow	10.54m^3/s
	Manufacturer	Hangzhou Chunjiang Power Equipments Co., Ltd. (http://www.hangzhoucf.com/)
2	**Generators**	
	Model	SFW6300-10/2600
	Rated capacity	6,300kW
	Quantity	3 sets
	Rated voltage	6.3kV
	Manufacturer	Hangzhou Chunjiang Power Equipments Co., Ltd. (http://www.hangzhoucf.com/)

In terms of the electricity connection system, the electricity voltage will be increased to 110kV and transmitted to the Substation through transmission lines, finally connected to China Southern Power Grid.

The technology adopted by the proposed project is domestic technology, so the technology transfer is not involved in the proposed project.

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

The project activity is expected to generate an estimated emission reduction of 550,515 tCO_2e during the first crediting period of the project (2010-2017).

Year	Annual estimation of emission reductions (tCO_2e)
01/2/2010~31/01/2011	78,645
01/2/2011~31/01/2012	78,645
01/2/2012~31/01/2013	78,645
01/2/2013~31/01/2014	78,645
01/2/2014~31/01/2015	78,645
01/2/2015~31/01/2016	78,645
01/2/2016~31/01/2017	78,645
Total estimated reductions(tCO_2e)	550,515
Total number of crediting years	7
Annual average of estimated reductions over the crediting period	78,645

A.4.5. Public funding of the project activity:

There is no public funding from Annex 1 countries involved in this Project.

SECTION B. Application of a baseline and monitoring methodology

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

Methodology ACM0002: "Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable sources" (version 08）
Methodological Tool: "Tool for the demonstration and assessment of additionality (version 05.2)
Methodological Tool: "Tool to calculate the emission factor for an electricity system" (version 01.1)

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

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

ACM0002 Methodology is chosen and applicable to the proposed project due to the following reasons:

1. The Project is a renewable electricity generation plant, in the form of run-of-river hydroelectric plant; the power density of the power plant is 1,125W/m^2 which is greater than 10 W/m^2 .
2. The Project is a grid-connected hydropower project which is connected with a regional power grid, South China Power Grid; South China Power Grid is clearly identified and information on the characteristics of this grid is publicly available;
3. The proposed project is not an activity that involves switching from fossil fuels to renewable energy at the site of the project activity.

On the basis of the above reasons, the applicability criteria of the Methodology stated in ACM0002 (Version 08) are met.

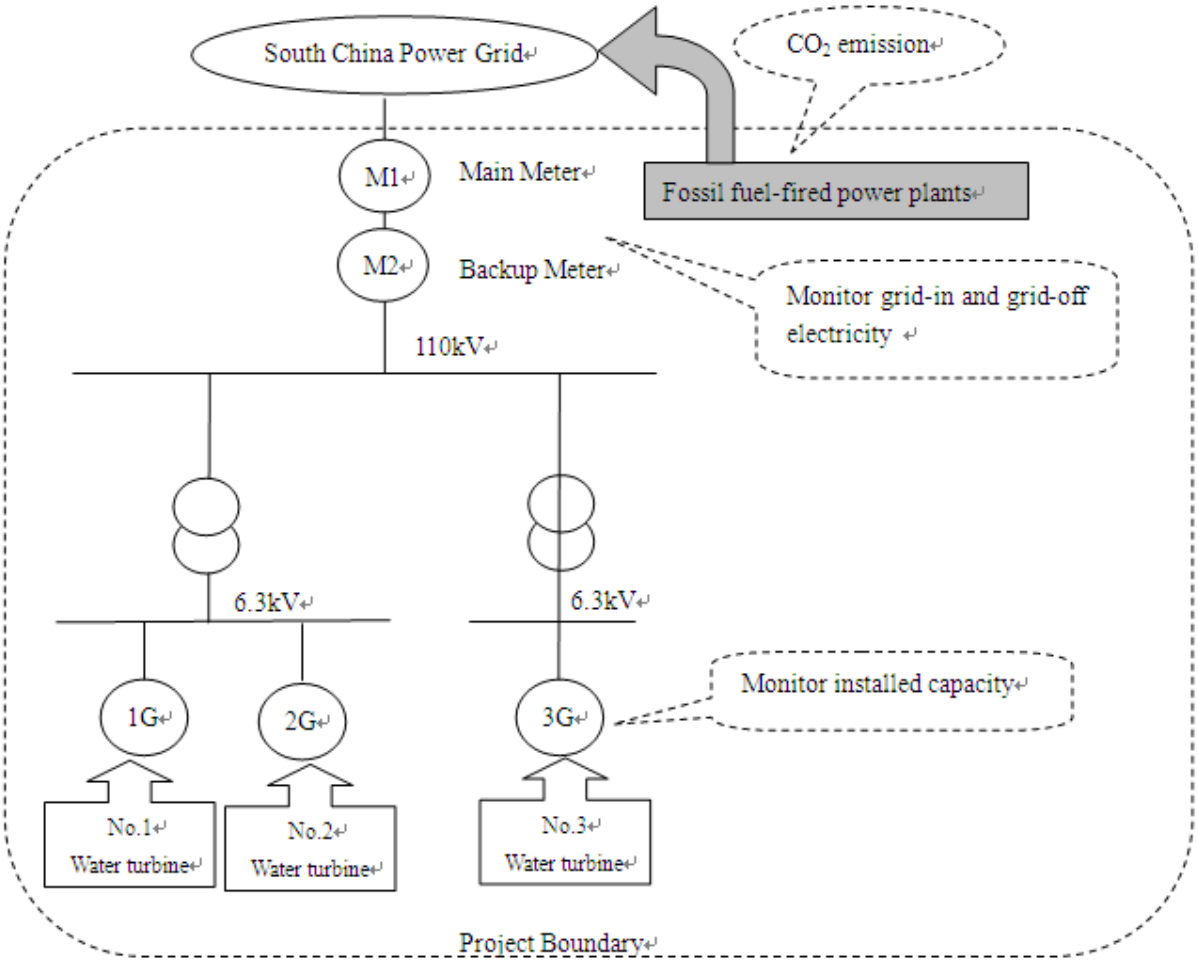
B.3. Description of the sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Grid electricity production	CO_2	Yes	Main emission source and the only gas identified in the baseline methodology
		CH_4	No	According to ACM0002
		N_2O	No	According to ACM0002
Project Activity	Proposed Project	CO_2	No	According to ACM0002
		CH_4	No	The power density of the proposed project is 1,125W/m^2 which is bigger than 10W/m^2, therefore not considered as project emission.
		N_2O	No	According to ACM0002

The electricity generated by the proposed project will be transmitted to Yunnan Power Grid which is part of China Southern Power Grid. According to the latest guidelines issued on 18/07/2008 (last update on 30/12/2008) by China's DNA, the geographical boundary of China Southern Power Grid covers Yunnan Province Power Gird, Guangxi Zhuang Autonomous Region Power Gird, Guizhou Province Power Gird and Guangdong Province Power Grid[1], Therefore, the spatial scope of the project boundary covers all power plants physically connected to China Southern Power Grid.

[1] *Notification on Determining Baseline Emission Factor of China's Grid* published by Chinese DNA on 18/07/2008 (last update on 31/12/2008) Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf


Russia
Kazakhstan
Mongolia
Heilongjiang
Neimenggu
Jilin
Kyrgyzstan
Xijiang
Liaoning
Gansu
Korea, Peoples Republic of
Tajikistan
Heber
Tianjin
Shanxi
Ningxia
China
Shandong
Korea, Republic of
Afghanistan
Qinghai
Shaanxi
Japan
Pakistan
Henan
Jiangsu
Japan
Xizang
Anhui
Shanghai
Hubei
Sichuan
Chongqing
Zhejiang
Nepal
Bhutan
Hunan
Jiangxi
Guizhou
Fujian
Yunnan
Bangladesh
Guangxi
Taiwan
India
Guangdong
Hongkong
Myanmar (Burma)
Laos
Hainan
Philippines
Thailand
South China Power Grid


South China Power Grid
CO_2 emission
M1
Main Meter
Fossil fuel-fired power plants
M2
Backup Meter
Monitor grid-in and grid-off electricity
110kV
6.3kV
6.3kV
Monitor installed capacity
1G
2G
3G
No.1 Water turbine
No.2 Water turbine
No.3 Water turbine
Project Boundary

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

The alternatives that provide outputs or services comparable with the Project include:
a) The proposed project not undertaken as a CDM project activity;

b) Construction of a coal-fired power plant with equivalent installed capacity or annual electricity generation;

c) Construction of a new power plant from other renewable sources with equivalent annual electricity generation connected to the grid

d) Equivalent electricity service provided by the South China Power Grid.

The scenario most likely to occur among the four alternatives is analyzed as follows:

As for alternative a) is financially unattractive.

As for alternative b) is not in compliance with legal and regulatory requirements.

As for alternative c) Due to the technology development status and the high cost for power generation, solar PV, geothermal and biomass of the similar installed capacity as the proposed project are alternatives far from being attractive investment in the grid in China. In addition, the site where the Project is located lacks economically feasible wind resources for constructing a wind farm with the same installed capacity as the Project.

As for alternative d) equivalent electricity service provided by the South China Power Grid is the only realistic and credible baseline scenario for the Project

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 following timeline and milestone provides background information that the incentive from the CDM was seriously considered in all relevant decisions for the project.

	Milestone	Date
1.	FSR completed	2006.9
2.	EIA completed	2006.12
3.	EIA approved by Baoshan City Environmental Protection Bureau	2006.12.28
4.	FSR approved by Baoshan City Development and Reform Commission	2007.1.22
5.	Board resolution to develop the Project as CDM project activity	2007.4.5
6.	Approval letter of loan	2007.4.27
7.	CDM consultation agreement signed	2007.10.8
8.	Project construction started	2007.11.6
9.	Purchase Agreement for Turbines and Generators	2007.11.20
10.	ERPA signed	2008.5.13
11.	Contract with DOE signed	2008.7.28
12.	LOA from China DNA	2008.9.22
13.	LOA from Japan DNA	2009.6.18

The incentive from the CDM was seriously considered in the decision to proceed with the project activity. The evidences will be presented to DOE.

The project uses the *Tool for the Demonstration and Assessment of Additionality*, version 05.2 to demonstrate its additionality. The tool includes the following steps:

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

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

The alternatives that provide outputs or services comparable with the Project include:

a) The proposed project by the project owner not undertaken as a CDM project activity;
b) Construction of a coal-fired power plant with equivalent installed capacity or annual electricity generation;

c) Construction of a new power plant from other renewable sources with equivalent annual electricity generation connected to the grid

d) Equivalent electricity service provided by the South China Power Grid.

Sub-step 1b. Enforcement of applicable laws and regulation

a) The proposed project by the project owner not undertaken as a CDM project activity

Alternative a) is in compliance with legal and regulatory requirements. However, according to the Investment Analysis in B.5, without the CERs sales revenue from CDM, the proposed project is not financially attractive. Thus, Alternative a) is not a credible baseline scenario.

b) Construction of a coal-fired power plant with equivalent installed capacity or annual electricity generation

As the annual operation hours of a coal-fired power plant and a hydropower station differs considerably, the annual electricity generation and associated supply reliability for the two, which has equivalent installed capacity, remain incomparable. Normally, a coal-fired power plant which provides equivalent annual electricity generation compared with the proposed hydropower project would only need an installed capacity which is lower than 18.9MW. According to China's power regulations, coal-fired power plants of less than 135MW, if without special permission, are prohibited for construction in the areas covered by large grids[2]. Alternative b) is not in compliance with legal and regulatory requirements, therefore not baseline scenario.

c) Construction of a new power plant from other renewable sources with equivalent annual electricity generation connected to the grid

Due to the technology development status and the high cost for power generation, solar PV, geothermal and biomass of the similar installed capacity as the proposed project are alternatives far from being attractive investment in the grid in China. In addition, the site where the Project is located lacks economically feasible wind resources for constructing a wind farm with the same installed capacity as the Project.

d) Equivalent electricity service provided by the South China Power Grid

Alternative d) is in compliance with legal and regulatory requirements. Equivalent electricity service provided by the South China Power Grid can be the baseline scenario.

Step 2. Investment Analysis

The purpose of investment analysis is to determine whether the proposed project activity is not economically or financially attractive without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, use the following sub-steps:

Sub-step 2a. Determine appropriate analysis method

[2] Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135MW or below Issued by State Council Office, decree no. 2002-6

http://www.gov.cn/gongbao/content/2002/content_61480.htm

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

The Project generates financial and economic benefits through the sales of electricity other than CDM income. Therefore the simple cost analysis (Option I) cannot be taken. And neither is the investment comparison analysis (Option II) because the alternative is "Provision of equivalent amount of annual power output by the grid (SCPG) with which the Project is connected" rather than a similar investment project alternative to the Project. Therefore, the benchmark analysis (Option III) shall be chosen.

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

According to *Economic Evaluation code for small hydropower project*s (SL16-95), the benchmark of internal rate of return (IRR) of total investment for Chinese small scale hydropower project is 10%, which is widely used for hydropower projects in China.

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

1) Parameters needed for calculation of key financial indicators

Table B-1 Parameters for calculation of key financial indicators

Installed capacity	18.9MW	FSR
Annual grid-connected output	90,272MWh	FSR
Annual operation hours	4,886 h	FSR
Fixed asset investment	RMB 92.04million Yuan	FSR
Annual O&M cost	RMB 2.57million Yuan	FSR
Expected tariff (excl. VAT)	RMB 0.146 Yuan/kWh	FSR
Income tax	33%	FSR
Value-added tax	6%	FSR
Urban construction tax	5%	FSR
Education premium	4%	FSR
Project lifetime	30 years	FSR
Expected CERs price	8.2 EUR / tCO_2e	ERPA

2) Comparison of IRR for the Project and the benchmark

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

Table B-2 shows the project IRR of the Project, with and without the sales of CERs. Without the sales of CERs the project IRR is 8.19% which is lower than the benchmark. However, taking into account the CDM revenues, the financial attractiveness of the Project will greatly improve.

Table B-2 Project IRR in two scenarios

	Without CERs	With CERs
Project IRR	8.19%	14.57%

Sub-step 2d. Sensitivity analysis

The sensitivity analysis shall show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. For the Project, four parameters were selected as sensitive factors to assess the financial attractiveness:

1) Fixed asset investment
2) Annual O&M cost
3) Feed-in Tariff (excl. VAT)
4) Annual electricity output

Table B-3 shows the impact on the total investment project IRR when the four parameters fluctuate in the range of -10% to +10%, which is consistent with FSR and is commonly used for sensitivity analysis of construction projects in China.

Table B-3 Sensitivity analysis of total investment project IRR

	-10%	-5%	0%	5%	10%
Fixed Asset Investment	9.24%	8.70%	8.19%	7.73%	7.30%
Annual O&M Cost	8.38%	8.29%	8.19%	8.10%	8.00%
Feed-in Tariff (excl. VAT)	7.19%	7.70%	8.19%	8.68%	9.14%
Annual electricity output	7.23%	7.72%	8.19%	8.66%	9.11%

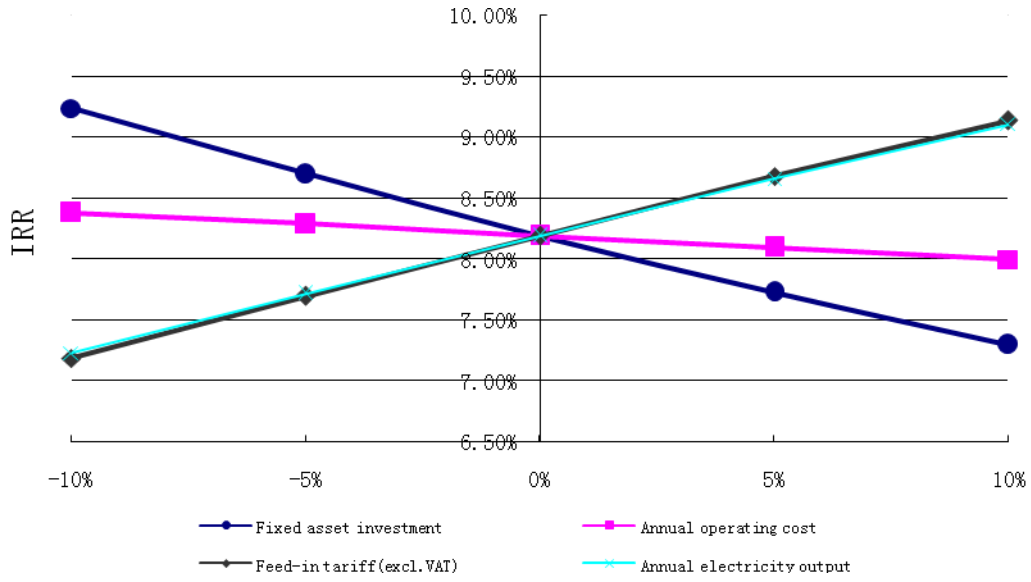


Figure B1 Sensitivity analysis of the Project

Table B3 and Figure B1 shows that without CERs revenue, when the four parameters fluctuate from -10% to +10%, the IRR of the proposed project can't reach the benchmark value 10%. The following will show why the IRR of the proposed project can't reach the benchmark when the four parameters fluctuate.

1) As for fixed asset investment

As showed in Table B3, when the fixed asset investment drops by 10% , the IRR of the proposed project will be 9.24%,which is still lower than the benchmark value. However with the rising of price level, the investment to purchase equipment and other materials will be increased rather than decreased comparing to the initial budget. Moreover, due to the difficulty of tunnel digging, the expected operation time the proposed project has been delayed one year from November 2008 to November 2009, which means the construction cost of the proposed project will be increased substantially than the budget.
Therefore it can be concluded that the investment of the proposed project can't be decreased, the IRR can't reach 10% and the project is financially unattractive.

2) As for annual O&M cost

The O&M cost mainly include staff wage, welfare fund, water charges, repair cost and other cost. It could be found that the staff wage is a main component of the O&M cost while other cost and fees are relatively fixed. And according to the information published by the Bureau of Labor and Social Security of Yunnan Province, the actual average increasing rate of enterprises' wage was 11%, 13% and 12% respectively from 2006 to 2008[3].It could be drawn that the salary of the enterprise staff has been on the rising tendency. Therefore the O&M cost is more likely to rise than the initial budget, which will make the project financially unattractive.

3) As for expected tariff

The expected tariff (RMB 0.146 Yuan/kWh excl. VAT) in the FSR and PDD was determined by the grid company and the project owner, so it is relatively fixed. Moreover the project owner is a country-level small private company, which has very limited capacity to negotiate with the big power grid company for a higher feed-in tariff. Table 3 shows when the tariff is fluctuating within the reasonable range (-10%~+10%), the IRR of the proposed project will not reach the benchmark and the project is financially unattractive.

4) As for annual electricity output

According to FSR the annual electricity output is estimated through 40 years hydrology data from the hydrometric station. So it is relatively stable. Table 3 shows when the annual electricity output is fluctuating within the reasonable range (-10%~+10%), the IRR of the proposed project will not reach the benchmark and the project is financially unattractive.

Therefore, when the key parameters fluctuate within reasonable range, the proposed project will never be financially attractive.

Step 3. Barrier analysis

Skipped

Step 4. Common practice analysis

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

According to the guidelines from EB (Tool for the demonstration and assessment of additionality Version 05.2), "Projects are considered similar if they are in the same country/region and/or rely on a

[3] The average enterprises' wage increasing rate of from 2006 to 2008 issued by the Bureau of Labor and Social Security of Yunnan Province

broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc."

Choose the similar scale

According to *Classification & design safety standard of hydropower projects (DL5180-2003*[4]*)*issued by State Economic and Trade Commission of People's Republic of China in 2003, hydropower plants are divided into five categories based on the project scale and their importance to economy. The installed capacity of the proposed project is 18.9 MW and it belongs to category IV. Since Category IV covers hydropower plants with the installed capacity between 10~50 MW, the installed capacity of activities similar to the proposed project should be between 10~50 MW.

Choose the same area

As the development policy and investment environment for each province for hydropower projects is so different, for example in China, the tariff in each province has some differences and the investment for hydropower projects differs from region to region. Each province in China was set as the area for common practice. As for the proposed Project, Yunnan province was chosen as the similar area.

Therefore the hydropower plants with the installed capacity between 10MW~50MW in Yunnan province are chosen as the similar projects to the proposed project. According the statistical data of Yearbook of China Water Resources 2006, there are eighteen hydropower projects with the installed capacity between 10MW~50MW in Yunnan province, which are Luoze River hydropower station, Laohushan hydropower station, Hongshiyan hydropower station, Yisa River hydropower station, Supahesanjiangkou hydropower station, Lamenga hydropower station, Jiren hydropower station, Laodukou hydropower station, Maomaotiao hydropower station, Nanting hydropower station, Xiashilong hydropower station, Yanziya hydropower station, Houqiao hydropower station, Wuni River hydropower station, Ximaxingyun hydropower station, Mengdian River hydropower station,Mengga River hydropower station, and Chongjianghe II Phase (Expansion) hydropower station.

In China 2002 was a landmark year for the power industry. Because in this year the National Council of PRC issued the "Notice of National Council Issued about the Power System of Organization Reform Programme [2002 No.5]"[5] and had a reform on China power industry. The general objectives of this reform including: breaking up monopoly, introducing competition, increasing efficiency and decreasing costs in power system. In order to realize these objectives, the power generation and transmission was separated, and the China State Power Corporation was diversified into two grid companies (State Grid and Southern Grid) and five power generation companies (Huaneng, Guodian, Datang, Huadian, and China Power Investment).

[4] http://www.csres.com/detail/82107.html

[5] http://www.shp.com.cn/news/info/2007/8/6/141009991.html

The reform obviously changed the existing electricity tariff mechanism and the investment environment of power industry. After that the power plant developers had to face high financial risk.

Therefore only the projects which were developed after 2002 should be considered in the common practice analysis. Refer to the Yearbook of China Water Resources 2003 (Projects developed before 2002 are listed), the following projects with the installed capacity between 10MW~50MW listed in Yearbook of China Water Resources 2006 were developed before 2002, which are the 6 projects of Luoze River hydropower station, Laohushan hydropower station, Hongshiyan hydropower station, Yisa River hydropower station, Supahesanjiangkou hydropower station, and Jiren River hydropower station. So these projects should not be included in the common practice due to significantly different investment environment.

Besides, the projects of Mengdian hydropower station [6], Mengga hydropower station [7] and Lamenga hydropower station[8] are applying for CDM, they should not be included also.

And the project of Ximaxingyun hydropower station is a non-utility power station, the power generation from the station is used for the Aluminium factory of the project owner and it is not connected to the grid[9]. So the Ximaxingyun hydropower station is not similar project with the project and it should be excluded also. Chongjianghe II Phase (Expansion) Hydropower Station is an expansion project in an existing power plant[10]. Therefore these two projects are not comparable with the proposed project, they should be excluded as well.
Finally 7 projects developed after 2002 without applying CDM are considered as "activities similar to the proposed project activity" and discussed in sub-step 4b.

[6] http://cdm.unfccc.int/Projects/Validation/DB/IWCK411P7XMVZY0YN7TYK3TGAVIO3R/view.html

[7] http://cdm.ccchina.gov.cn/website/CDM/pdf/Item_new/Item_new948.pdf

[8] http://cdm.ccchina.gov.cn/website/cdm/pdf/Item/Item293.pdf

[9] http://mkt.und.cn/small/cpybase.do?companyid=D658A7E06D9B41318F44FBF1B0E6C0E7

[10] http://www.gdxds.com.cn/Colligate.asp?classid=17

Table B-4. Hydropower projects (after 2002) with installed capacity between 10MW~50MW in Yunnan Province[11]

Project Name	Installed capacity (MW)	Annual Electric Output (MWh)	Investment (10^4RMB)	Unit Investment (RMB/MWh)[12]	Start operation
The Proposed Project	**18.9**	**92,345**	**9,875**	**1,069**	**2010.02**
Laodukou hydropower station	37.5	160,000[13]	20,000[13]	1,250	2005.09[13]
Maomaotiao hydropower station	40	174,830[11]	12,000[14]	686	2004.12[14]
Nanting River hydropower station	34	219,760[11]	15,400[15]	701	2004.12[15]
Xiashilong hydropower station	25	120,050[16]	10,800[17]	900	2005.03[18]
Yanziya hydropower station	25	150,000[19]	12,000[19]	800	2005.08[19]
Houqiao hydropower station	48[20]	235,000[20]	27,275[20]	1,161	2005.10[21]
Wuni River hydropower station	30	160,000[22]	17,537[22]	1,096	2005.05[22]

[11] Almanac of China's Water Power 2006 edition

[12] The data is earned from Investment divided by Annual Electric Output

[13] http://www.qjetc.gov.cn/lpxjjj/UploadFiles/20061128164018389.doc

[14] http://ws.xxgk.yn.gov.cn/WS_Model/newsview.aspx?id=230735

[15] http://weixin.gov.cn/new/read.asp?id=2411&asubid=2&bsubid=23

[16] http://news.bjx.com.cn/html/20071210/38937.shtml

[17] http://ws.xxgk.yn.gov.cn/WS_Model/newsview.aspx?id=230735

[18] http://www.ydxw.com/showinfo.asp?id=32571

[19] http://www.cnaec.com.cn/Info/Show.asp?ID=78270&SortID=

[20] http://www.yn.xinhuanet.com/newscenter/2004-11/26/content_3291421.htm

[21] http://www.tcxw.com.cn/Show2007.asp?id=1324

[22] http://www.ynsph.com.cn/

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

- Due to favorable environment, the unit investment of Maomaotiao hydropower station, Nanting River hydropower station, Xiashilong hydropower station, and Yanziya hydropower station is significantly lower compared with the proposed project, which means these projects are more financially attractive than the proposed project.
- Moreover, the projects of Houqiao hydropower station [23] and Wuni River hydropower station [24] have joined the *West-East Electricity Transmission Project*, a government project aims to transmit electricity from west of China such as Guizhou province, Yunnan province, Sichuan province, etc. to east of China where is power shortage such as Shanghai, Guangdong province, Jiangsu province, etc. The project helps the involved projects get favourable economic conditions.
- As for Laodukou Hydropower Station, one of its shareholders is Luoping Zinc-electricity Co., Ltd. which is a listed company in Shenzhen Stock Market[25]. The listed company has higher credit rating in the bank, and this will help the project get finance easily.

In conclusion, the above Projects have essential distinctions from the proposed project in the aspects of unit investment and operation hours. Besides the proposed project owner has to face not only the lower annual operation hour but also lower tariff. More over the project owner is a local-level enterprise, which bears higher risks in financing such as pressure from principle repayment and payment of interest on loans, etc. Therefore the project is not common in Yunnan province and it is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission reductions from the proposed project can be calculated based on the *Tool to calculate the emission factor for an electricity system* (version 01.1). According to the Tool, it is required to estimate the Operating Margin (OM) and Build Margin (BM) emission factor ex-ante, and through weighted average of OM and BM, the Combined Margin (CM) baseline emission factor of the South China Power Grid can be obtained and then the emission reductions from the project activity can be estimated. The details are shown below:

1. Baseline emissions

To calculate the emission factor for an electricity system

According to the *Tool to calculate the emission factor for electricity system* (version 01.1), the baseline GHG emissions should be calculated by following six steps:

Step 1. Identify the relevant electric power system

[23] http://www.dnjt.com/documents/200312/382.shtml

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

[25] http://money.finance.sina.com.cn/corp/go.php/vCO_HoldingCompany/stockid/002114.phtml

If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. Since Chinese DNA has published a delineation of the project electricity system and connected electricity systems[26], these delineations should be applied for the proposed project. According to the delineations, the South China Power Grid is identified as the relevant electric power system of the proposed project, which includes the grids of Guangdong, Guangxi, Yunnan, and Guizhou Province. Hence, the Project belongs to the Yunnan Power Grid, which is part of the South China Power Grid.

Step 2. 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 (a) can only be used if low-cost/must run resources[27] constitute less than 50% of total grid generation in average of the five most recent years. According to the data from *China Electric Power Yearbook 2003-2007*, the share of the low-cost/must run resources in the South China Power Grid are 31.6% (2002), 33.5% (2003), 30.0% (2004), 30.9% (2005), 28.7% (2006) respectively. Therefore, it is reasonable to select the method (a) to calculate the OM emission factor.

The Simple OM can be calculated using either of the two following data vintages for year(s) y:

- ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emission 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.

Based on the most recent data available, ex ante option is chosen.

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

There are three options calculating the Simple OM emission factor ($EF_{grid,OMsimple,y}$):

[26] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf

[27] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal-fired power is obviously a must-run, it should also be included in this list, i.e. excluded from the set of plants.

- Based on data on fuel consumption and net electricity generation of each power plant / unit[28] (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. However, the data on fuel consumption and net electricity generation of each power plant / unit is not publicly available. Thus, Option A cannot be adopted for the Project. Similarly, the data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit are not available either. Thus, Option B cannot be adopted for the Project.
So Option C is applied to calculate the operating margin emission factor.

The formula of $EF_{grid,OMsimple,y}$ calculation is

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad (1)$$

Where:

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

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

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

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

EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)[29]

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

[28] Power units should be considered if some of the power units at the site of the power plant are low-cost / must-run units and some are not. Power plants can be considered if all power units at the site of the power plant belong to the group of low-cost / must-run units or if all power units at the site of the power plant do not belong to the group of low-cost / must-run units.

[29] Electricity imports to the grid should be included, and an import from a connected electricity system should be considered as one power source.

y = Either 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) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

If available, $NCV_{i,y}$ and $EF_{CO2,i,y}$ from the fuel supplier of the power plants in invoices may be used; or, regional or national average default values may be used. In this PDD, $NCV_{i,y}$ of different fuels are obtained from *China Energy Statistical Yearbook* （*2005~2007*）. With regard to the fuel types where $NCV_{i,y}$ fluctuate in a certain range, the floor values of the fluctuation range are used for conservatism. $EF_{CO2,i,y}$ of fossil fuel comes from IPCC default values.

The Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the proposed project is calculated on the basis of the fuel consumption data for electricity generation of the South China Power Grid, not including those of low-operating cost and must-run power plants, such as wind power, hydropower and nuclear etc. These data are obtained from the *China Electric Power Yearbook* (2005~2007, published annually) and *China Energy Statistical Yearbook* (2005~2007). Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the South China Power Grid is calculated as 1.0608 tCO_2e/MWh refers to the *2008 Baseline Emission Factors for Regional Power Grids in China* published by Chinese DNA on 18/07/2008 (last updated: 30/12/2008) (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081230102527637.pdf)

For the proposed project, the renewable crediting period, i.e. 7*3 years, is adopted.

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[30]:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[31].

Since the set of power units described as (b) in South China Power Grid comprises the larger annual generation than that of (a), the sample group (b) should be used for calculating the build margin of South China Power Grid. The power plant projects that have been registered as CDM project activities should be excluded from the sample group m.

In terms of vintage of data, project participants chooses Option 1 to calculate the BM emission factor ($EF_{grid,BM,y}$) of South China Power Grid. Option 1 is as follows:

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

[30] If this approach does not reasonably reflect the power plants that would likely be built in the absence of the project activity, project participants are encouraged to submit alternative proposals for consideration by the CDM Executive Board.

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

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.

Step 5. ***Calculate the build margin emission factor***

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

$$EF_{grid,\,BM,\,y} = \frac{\sum_{m} EG_{m,\,y} \times EF_{EL,\,m,\,y}}{\sum_{m} EG_{m,\,y}} \qquad (2)$$

Where:

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

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

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

m = Power units included in the build margin

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

Currently in China, the capacity margin data of sampling plants group m are publicly not available. Taking notice of this situation, CDM EB accepts the following deviation in application of methodology AMS-I.D in China:

-Use of capacity additions exceeds 20% of total generation for estimating the build margin emission factor for grid electricity.

-Use of weights estimated using installed capacity in place of annual electricity generation.
And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

For the Project: Firstly, calculate the share of different power generation technology in recent capacity additions. Secondly, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor using the efficiency level of the best technology commercially available in China. Due to the installed capacities of coal based, oil based and gas based can not be separated and determined directly at present, BM is calculated with following steps and formula:

Sub-step 5.1 Calculate the proportion of CO_2 emission caused by solid, liquid and gas fuels in the total emission respectively:

$$\lambda_{Coal} = \frac{\sum_{i \in COAL,\,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (3)$$

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

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

Where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by province j in year(s) y;

$COEF_{i,j}$ is the CO_2 emission coefficient of fuel i (tCO_2/tCe), taking into account the carbon content of the fuels (coal, oil and gas) used by province j and the percent oxidation of the fuel in year(s) y;

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

Step 5.2 Calculate the emission factor of thermal power generation

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (6)$$

Where:

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

Sub-step 5.3 Calculate BM of the grid

$$EF_{grid,\,BM,\,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (7)$$

Where ,

CAP_{Total} = the total amount of incremental installed capacity;

$CAP_{Thermal}$ = the increased installed capacity of thermal power generation.

Please refer to Report on Determination of Baseline Grid Emission Factor released by China DNA NDRC issued on 18/07/2008 (last updated: 30/12/2008) for detailed calculation processes. The value of $EF_{grid,BM,y}$, is 0. 6816 tCO_2/MWh. (See Annex 3 for details)

Step6. Calculate the combined margin emission factor

The combined margin emissions factor $EF_{grid,CM,y}$ is calculated as follows:

$$EF_{grid,\,CM,\,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM} \quad (8)$$

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

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

W_{OM} = Weighting of operating margin emissions factor (%)

W_{BM} = Weighting of build margin emissions factor (%)

The combined margin emissions factor $EF_{grid,CM,y}$ should be calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$), where w_{OM} = 0.5 and w_{BM} = 0.5 for hydropower project for the first crediting period.

2. Baseline emissions

According to ACM0002 (version 08), based on the above calculated $EF_{grid,cm,y}$ of South China Power Grid according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system" (EB35, version 01.1), the baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{baseline}) \times EF_{grid,CM,y} = EG_y \times EF_{grid,CM,y} \quad \textbf{(9)}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/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. The proposed project is a new plant, so $EG_{baseline}$ is zero.

$EF_{grdi,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (EB35, version 01.1).

So, the baseline emissions (BE_y in tCO_2e) are the product of the baseline emissions factor ($EF_{grid,CM,y}$ in tCO_2e/MWh) calculated in the above procedures, times the result of the electricity supplied by the project activity to the grid (EG_y in MWh).

In case of equipment shutdown or overhaul, the project is likely to import the electricity from the grid during this period. Thus, the amount of imported electricity ($EG_{Grid\ to\ PJ,\ y}$) will be deducted from the amount supplied to the grid ($EG_{PJ\ to\ Grid,\ y}$) and the net quantity of electricity supplied ($EG_y = EG_{PJ\ to\ Grid,\ y} - EG_{Grid\ to\ PJ,\ y}$) will be as the base for emission reductions calculation.

$EG_{Grid\ to\ PJ,\ y}$ is considered to be zero ex-ante and will be monitored in the project operation period by the project operator and verified by DOE periodically.

So the baseline emissions are calculated as:

$$BE_y = EG_y \times EF_{grid,CM,y} = (EG_{PJ\ to\ Grid,y} - EG_{Grid\ to\ PJ,y}) \times EF_{grid,CM,y} \quad \textbf{(10)}$$

Where:

$EG_{PJ\ to\ Grid,\ y}$ = the amount of the electricity supplied to the grid;

$EG_{Grid\ to\ PJ,\ y}$ = the amount of electricity imported from the grid;

3. Project emissions

In order to decide the project emissions for hydro power plants, firstly the power density must be calculated as follows according to ACM0002 (version 08):

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \qquad \textbf{(11)}$$

Where:

PD = Power density of the project activity, in W/m^2.

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero. The proposed project is a new hydro plant, so Cap_{BL} is zero.

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

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). The project is a new built reservoir, so A_{BL} is zero.
The installed capacity of the proposed project (Cap_{PJ}) is 18.9MW. The area of the new reservoir (A_{PJ}) is 16,800m^2 and A_{BL} is zero, so the power density is 1,125W/m^2, much higher than 10W/m^2.According to ACM0002 (version 08), the project proponents should not account for project emissions, so the emissions of the proposed project activity is zero, PE_y=0

4. Leakage

According to ACM0002 (version 08), the leakage emission wasn't considered and L_y is zero.

5. Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - L_y \qquad \textbf{(12)}$$

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

Data / Parameter:	$FC_{i,m,y}$
Data unit:	10^4t, 10^8m^3
Description:	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data used:	China Energy Statistical Yearbook（2005~2007）
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	MJ/t or MJ/Km^3
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	China Energy Statistical Yearbook（2007）
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	National values
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of the fuel *i*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	Details see Annex3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values
Any comment:	

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2e/TJ
Description:	CO_2 Emission Factor of fossil fuel type *i* in year *y*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods	IPCC default values

and procedures actually applied :	
Any comment:	

Data / Parameter:	$GEN_{m,y}$
Data unit:	MWh
Description:	Electricity generation by power plant/unit *m* in South China Power Grid in year *y*
Source of data used:	China Electric Power Yearbook *(2005~2007)*
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	National values
Any comment:	

Data / Parameter:	Electricity self-consumption ratio
Data unit:	%
Description:	The internal use rate of power source *j* in South China Power Grid
Source of data used:	*China Electric Power Yearbook (2005~2007)*
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	National values
Any comment:	

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	Installed capacity of power source *j* of South China Power Grid in year *y*
Source of data used:	*China Electric Power Yearbook (2005~2007)*
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	National values
Any comment:	

Data / Parameter:	$\eta_{best,i}$
Data unit:	%
Description:	Power supply efficiency of optimum commercialized coal-fired, oil-fired, and gas-fired power plants.

Source of data used:	*Notification on Determining Baseline Emission Factor of China's Grid* published by Chinese DNA on *30/12/2008*
Value applied:	Coal: 37.28%; Oil: 48.81%; Gas: 48.81%. See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities
Any comment:	

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant/unit in year y
Source of data used:	*China Electric Power Yearbook(2005~2007)*
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the "Tool to calculate the emission factor for an electricity system", values from government records or official publications can be used; Once 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)
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

As per calculation formulae of baseline combined emission factor, the baseline emission factor of the first crediting period is

$EF_y = EF_{OM,y} * w_{OM} + EF_{BM,y} * w_{BM} = EF_y = 1.0608*0.5+0.6816*0.5=0.8712(tCO_2e/MWh)$

According to the feasibility study of the Project, the annual electricity delivered to the grid is approximately 48,089 MWh

EG_y =90,272 MWh

As per calculation formulae of baseline emission, baseline emission of the first crediting period is
$BE_y = EG_y \times EF_y$ = 90,272 MWh * 0.8712 tCO_2e/MWh = 78,645 tCO_2e

As mentioned above, project emission $PE_y = 0$ and leakage $L_y = 0$

Therefore, the annual emission reduction of the first crediting period is

$ER_y = BE_y - PE_y - L_y = BE_y$ =78,645 tCO_2e

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

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)
01/2/2010~31/01/2011	0	78,645
01/2/2011~31/01/2012	0	78,645
01/2/2012~31/01/2013	0	78,645
01/2/2013~31/01/2014	0	78,645
01/2/2014~31/01/2015	0	78,645
01/2/2015~31/01/2016	0	78,645
01/2/2016~31/01/2017	0	78,645
Total(tCO_2e)	0	550,515

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

B.7.1 Data and parameters monitored:	
Data / Parameter:	$EG_{grid\text{-}in,\ y}$
Data unit:	MWh
Description:	Electricity delivered to grid in year y
Source of data to be used:	Measured by meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimation of annual electricity generation of this 18.9MW project delivered to grid: 90,272MWh
Description of measurement methods and procedures to be applied:	Electricity will be hourly measured and monthly recorded. The data will be archived both in electronic and paper format. Data monitored are to be kept for two years after the last issuance of CERs for the Project.
QA/QC procedures to be applied:	According to national standard, meters will be calibrated annually. Data measured by meters will be cross checked by electricity sales receipts. The plant manager will supervise the project operation related to data monitoring to ensure a smooth and orderly monitoring process
Any comment:	

Data / Parameter:	$EG_{grid\text{-}out,\ y}$
Data unit:	MWh
Description:	Electricity purchased from the grid in year y for the consumption of the project
Source of data to be used:	Measured by meters
Value of data applied for the purpose of calculating expected	Depend on the meters

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Electricity will be hourly measured and monthly recorded. The data will be archived both in electronic and paper format. Data monitored are to be kept for two years after the last issuance of CERs for the Project.
QA/QC procedures to be applied:	According to national standard, meters will be calibrated annually. Data measured by meters will be cross checked by electricity sales receipts. The plant manager will supervise the project operation related to data monitoring to ensure a smooth and orderly monitoring process

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	Project site.
Measurement procedures (if any)	Measured from topographical surveys and maps in accordance with ACM0002-Version 08
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	MW（18.9MW）
Description:	Installed capacity of the proposed project.
Source of data	Project site.
Measurement procedures (if any)	Determined in accordance with the nameplates supplied by the manufacturer.
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

The project owner is the user of this monitoring plan and will be responsible for it. The project owner must maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to maintain the information required for an audit of an emission reduction project. These records and monitoring systems are needed to allow the selected DOE to verify project performance as part of the verification and certification process. This process also reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs).

Emission reductions will be achieved through avoided power generation of fossil fuel plant due to the power generated by the proposed project. The grid-connected output is therefore defined as the key data to monitor.

1. **Responsibility**

Overall responsibility for daily monitoring and reporting lies with the project owner. A monitoring team mentioned above will be established by the project owner to carry out the monitoring work.

2. **Operational and management structure for monitoring**

Monitoring Plan

Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

The project owner has assigned a Monitoring Team to carry out the whole monitoring process as the diagram below.

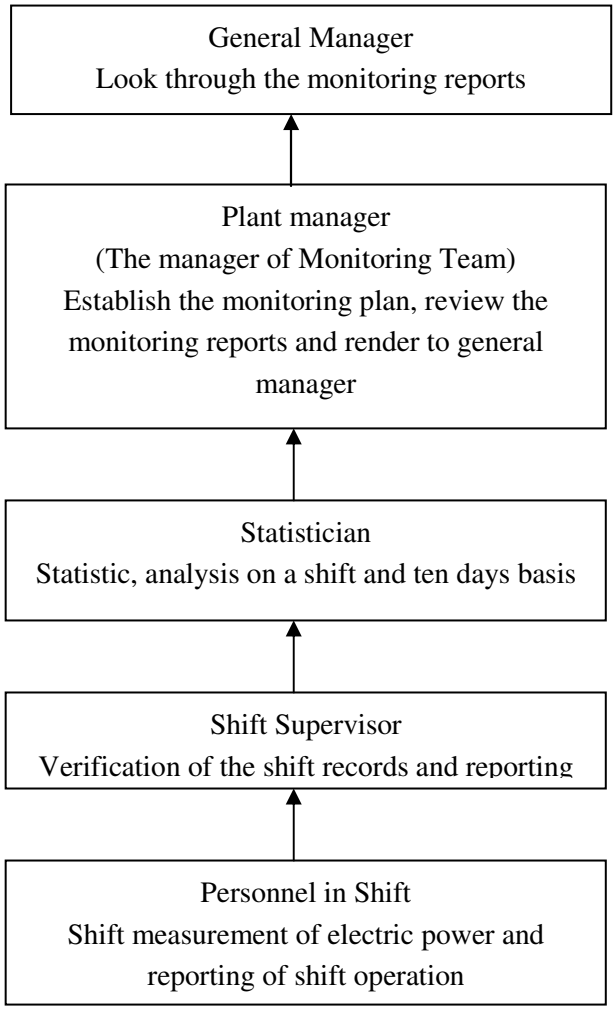


Figure B-2 Monitoring and Management Structure

The plant manager will establish the monitoring plan and make procedural manual of maintenance of monitoring equipment and installations including the procedure of daily data recording toward the operation, and hold the overall responsibility for the whole process.

1. The first step is the measurement of shift electrical energy supplied to the grid and reporting of shift operation, which will be conducted by personnel in shift.
2. Secondly, the shift supervisor will verify the shift measurement and operation report. Then, the data and report will be submitted to the statistician who will be responsible for statistic analysis of the shift and ten days measurement, collection of sales receipts provided to the Grid, and prepare monitoring report of the project activity including operating periods, power generation, power delivered to the gird.
3. Finally, the plant manager will review the monitoring reports and carry out internal audit, which will finally be rendered to general manager. All of the files will be kept with the administrator.

3. Reporting

The specific steps for data collection and reporting are listed below:

- Grid Company, together with the project owner reads the main meter and records data on a particular day of every month.
- Project owner reads the backup meter and records data on the same day of every month. Then, the grid company supplies reading records to the project owner and the project owner crosschecks the readings and then provides sales receipts to the Grid company.
- Project owner provides reports, reading records and copies of sales receipts to DOE for verification.

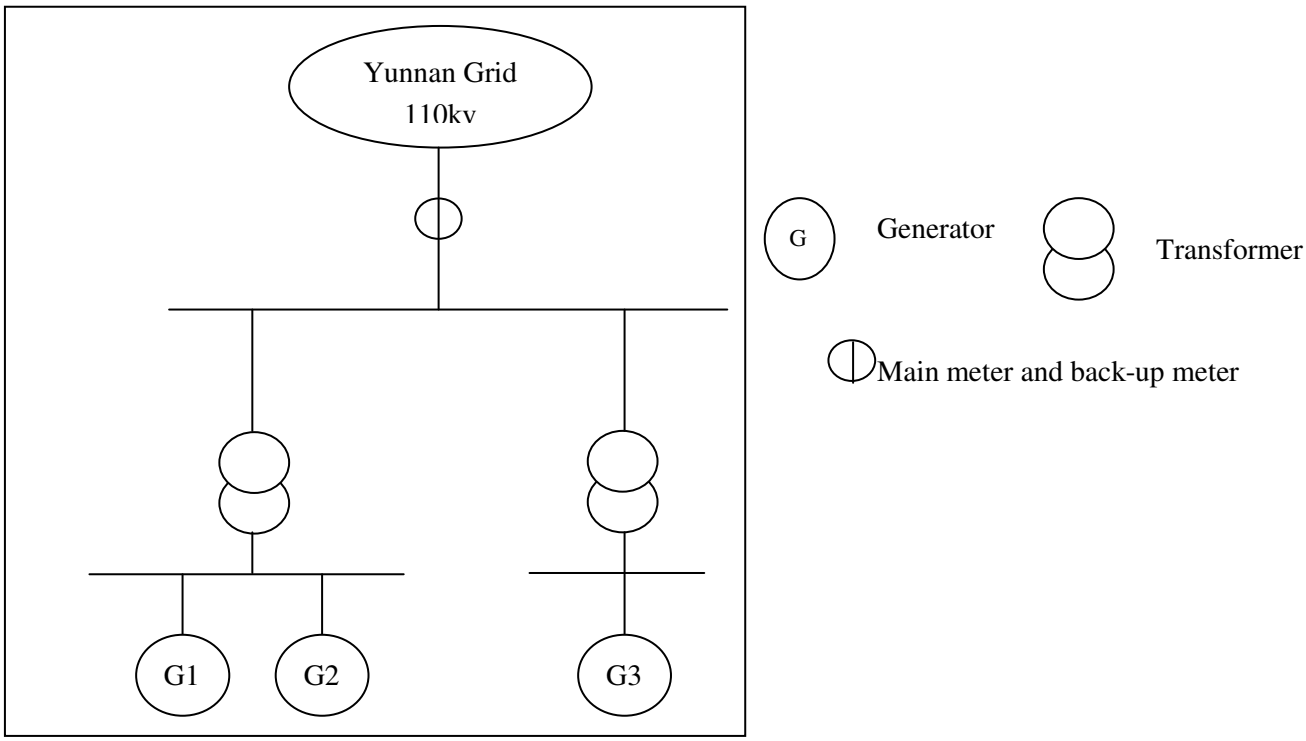
4. Data management system

All data collected as part of monitoring will be archived electronically every ten days. All information will be stored by the plant manager and material will have hard copy for backup every ten days. In order to facilitate auditors' reference of relevant literature relating to the project, the project materials and monitoring results will be indexed. And all data including calibration records are kept until 2 years after the end of the total credit time of the CDM project.

5. Installation of meters

Output electricity connected into the grid ($EG_{grid\text{-}in}$) will be measured by both a main meter with an accuracy of 0.5% and a back-up meter with an accuracy of 0.5% installed at the outlet of the transformer substation of the hydropower station owned by the project owner. Both of the meters will fulfill the requirement of the national standards. When the main meter is out of order, the readings from the back-up meter will be used for reference. When both the main and back-up meter are out of order, readings from the meter installed at the inlet of the transformer substation of the grid company will be used.

The metering equipment will be properly configured and checked annually according to the requirement from Technical Administrative Code of Electric Energy Metering (DL/T448－2000). The metering equipment will be checked by the project owner and the grid company before operation.



Should any previous months reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the grid-connected electricity generated by the proposed project shall be determined by:
First, by reading the backup meter, unless a test by either party reveals it is inaccurate; If the backup system is not with acceptable limits of accuracy or is otherwise performing improperly the proposed project owner and grid company shall jointly prepare an estimate of the correct reading; and
If the proposed project owner and the grid company fail to agree the estimate of the correct reading, then the matter will be referred for arbitration according to agreed procedures.

6. Calibration
The Power Interchange Agreement between the Project owner and the grid company defines the metering arrangements and the required quality control procedures to ensure accuracy.

The metering equipment are calibrated and checked annually for accuracy. The metering equipment shall have sufficient accuracy so that any error resulting from such equipment shall not exceed allowed accuracy. Calibration is carried out by the grid company with the records being supplied to the project owner, and these records will be maintained by the project owner and the appointed qualified party. Both 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.

All the meters installed shall be tested by a third party within 10 days after:
(a) Detection of a difference larger than the allowable error in the readings of both meters;
(b) The repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications.

7. Quality Assurance and Internal Audit

The quality assurance and internal audit procedures for recording, maintaining and archiving data shall be implemented as part of this CDM project activity according to EB rules and real practice in terms of the need for verification of the emission reductions on monthly basis. The Plant manager will review the monitoring reports and organize internal audit and finally render to General Manager.

8. Monitoring training

In order to popularize the general knowledge of hydropower and further enhance the smooth, safely and efficient operation of the Project, the project owner carried out a technical training, Both an internal training and an internship in another power plant were involved in the training program mainly focusing on environment protection of hydropower project, safety regulation for power industry, operation of turbine-generator units and etc. Through the training, all the trained staffs got profound understanding of hydropower theories and the practical experience on safe and environmentally-friendly operation of hydropower plants.

This project will provide sustainable development benefits to local environment, economy, and society. The project owner will concern the sustainable too.

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)

The baseline and monitoring study was prepared by Yunnan CDM Center on 03/07/2008.
The persons involved in the study are listed as follows:

Wang Xiaoli, He Xugang, Zhengli, Xiao Hongwei
Tel：+86 -0871-3112542 / +86 -13577027272 / +86 -13577025792 / +86 -13608809660/ +86 -13987195507
wxl61km@126.com, hxg69@163.com，zl79@live.cn, xhw66@163.com
The above mentioned organization and individuals are not project participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

November. 6, 2007

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

30 years

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

C.2.1. Renewable crediting period

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

01/02/2010 (or the date of registration which is later)

C.2.1.2. Length of the first crediting period:

7 years

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

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

A complete Environmental Impact Assessment (EIA) for the Project was approved by the Changning County Environmental Protection Bureau on 28/12/2006. The findings of the environmental impacts and remedy measures required to be made are summarized as follows:

Impact on Ecosystem
There are only sparse trees, shrubberies and herbals in the project site. No national or provincial protected rare and endangered vegetation, ancient trees and wild animals were identified. And some afforestation projects and green projects will be carried out to reserve the ecosystem. Thus, the impact is little.

Dust and Air Quality
During the construction period, the dust rising from foundation excavation, sand-rock procession, concrete mixing, the machine and vehicles as well as the exhaust gases from the vehicles are the major air pollution. In order to protect the atmosphere environment, some alleviation measures will be taken Ambient air quality standard （GB 3095－1996）I, including adapt the wet-type construction method, watering, protect the working staff with mask, dustproof glasses and dustproof caps, equip the vehicles with exhaust gases purify devices, etc.

Noise
The noise pollution is mainly caused from the machines and vehicles in construction phase, but since there is no resident nearby, the noise will have no impact to local residents, therefore, the noise will mainly impact the construction workers on site. The vibration reduction, sound insulation and other measures will be carried out to protect the construction workers.

Wastewater and Sewage
Waste water disposal facility will be built at the time that project is constructed to reduce the negative impacts to the river. Wastewater from tunnel construction, sand and rock processing, materials and machines flushing, and daily living sewage will be retained in the sedimentation pond before discharged into the river or put into pool for irrigating plants. Wastewater is impossible to be fed into river directly. Consequently, the water quality of the river will not be impacted.

Land Use
Measures of monitoring and supervising will be taken to protect the land from soil erosion problem during construction period. Considering the disturbance of grassland, construction area and transportation routes should be strictly managed. And the waste soil produced during construction period will be collected regularly and transported into the designated dumping site.

Solid waste
The source of the solid waste mainly comes from construction wastes and living wastes. The construction wastes are treated in strict accordance with the requirements of the Soil and Water

Conservation Report to avoid water and soil erosion problems. The living wastes will be timely collected and delivered to nearby county for disposing.

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:

According to the results of EIA and the reply from the Environmental Protection Bureau, the impacts on the environment are not significant.

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,* a survey on the local villagers and residents has been conducted. The local government and stakeholders were invited to submit comments on the project activity.

The main questions in the questionnaire are:

- Will the Project bring improvements to their livelihoods?
- Will the Project have negative impacts on their livelihoods?
- What would the overall influence be for the construction and implementation of the Project?
- Do they support the construction of the Project?
- What other comments and suggestions do the respondents have for the company regarding the Project?

30 questionnaires were sent to the stakeholders by the project developer and 30 were returned. The filled forms are available for DOE's validation.

E.2. Summary of the comments received:

The survey shows that the proposed project receives strong support from local people. 100% of the respondents support the development of the project. The consensus is that the project can bring many positive impacts to the local economy and livelihoods of local people with increased job opportunities, more stable power supply and stimulated economy. Among the likely negative impacts, the main issues concerned are noise during construction and waste. However, as the environmental impact assessment demonstrates, these impacts mainly occur during construction period, and accompanied by mitigating measures stated in the EIA report, the impacts will be minimized after the construction.

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

There has been no need to modify the project due to comments received. Meanwhile, the project owner will concern much on the suggestions from stakeholders and put all of the measures listed in the EIA into effect during construction and operation, so as to achieve environmental, social and economic benefits.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Owner

Organization:	Changning County Jia Yuan Electric Power Development Co., Ltd.
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State/Region:	Yunnan Province
Postfix/ZIP:	
Country:	P.R.China
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E-Mail:	cnxjydlkfyxgs@sina.com
URL:	
Represented by:	Li Shi Ping
Title:	Chairman
Salutation:	Legal Representative
Last Name:	Li
Middle Name:	
First Name:	Shiping
Department:	
Mobile:	
Direct FAX:	+86 875-7837099
Direct tel:	+86 875-7837099
Personal E-Mail:	

BUYER

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State/Region:	
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Country:	Japan
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FAX:	+81-3-3210-7708
E-Mail:	ml.en-x@mitsubishicorp.com
URL:	http://www.mitsubishicorp.com/en/
Represented by:	Tsuyoshi Nakamura
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Salutation:	Mr.
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Middle Name:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the proposed project.

Annex 3

BASELINE INFORMATION

Table A1 Thermal Power Generation of SCPG in 2004

Province	Thermal Power Generation	Rate of self-consumption	Thermal Power generation connected to the grid
	（MWh）	（%）	（MWh）
Guangdong	169,389,000	5.42	160,208,116
Guangxi	20,143,000	8.33	18,465,088
Guizhou	49,720,000	7.06	46,209,768
Yunnan	24,322,000	7.56	22,483,257
Total			247,366,229

Data source: China Electric Power Yearbook 2005

Table A2 Thermal Power Generation of SCPG in 2005

Province	Thermal Power Generation	Rate of self-consumption	Thermal Power generation connected to the grid
	（MWh)	（%）	（MWh）
Guangdong	176,453,000	5.58	166,606,923
Guangxi	25,023,000	7.95	23,033,672
Guizhou	58,430,000	7.34	54,141,238
Yunnan	27,281,000	6.94	25,387,699
Total			269,169,531

Data source: China Electric Power Yearbook 2006

Table A3 Thermal Power Generation of SCPG in 2006

Province	Thermal Power Generation	Rate of self-consumption	Thermal Power generation connected to the grid
	（MWh)	（%）	（MWh）
Guangdong	188,429,000	5.27	178,498,792
Guangxi	27,967,000	4.45	26,722,469
Guizhou	76,039,000	6.06	71,431,037
Yunnan	39,791,000	4.12	38,151,611
Total			314,803,908

Data source: China Electric Power Yearbook 2007
China Energy Statistical Yearbook 2007

Table A4. Basic Fuel Data of SCPG in 2004

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total
		A	B	C	D	E=A+B+C+D
Raw coal	10^4t	6,017.7	1,305	2,643.9	1,751.28	**11,717.88**
Washed coal	10^4t	0.21				**0.21**
Other washed coal	10^4t					**0**
Coke	10^4t					**0**
Coke oven gas	10^8 M^3					**0**
Other gas	10^8 M^3	2.58				**2.58**
Crude oil	10^4t	16.89				**16.89**
Gasoline	10^4t					**0**
Diesel	10^4t	48.88			1.83	**50.71**
Fuel oil	10^4t	957.71				**957.71**
LPG	10^4t					**0**
Refinery gas	10^4t	2.86				**2.86**
Natural gas	10^8 M^3	0.48				**0.48**
Other petroleum products	10^4t	1.66				**1.66**
Other coking products	10^4t					**0**
Other energy	10^4t	79.42				**79.42**

Data source: China Energy Statistical Yearbook 2005

Table A5. Calculation of simple OM emission factor of SCPG in 2004

Fuels	Units	Total	Emission factor (tCO_2e/TJ)	OXID (%)	NCV ($MJ/t,km^3$)	Emission (tCO_2e)
		E	F	G	H	I=G*H*F*E*44/12/10000(for mass unit) I=G*H*F*E*44/12/1000 (for volume unit)
Raw coal	10^4t	**11,717.88**	25.8	100	20,908	231,767,573.55
Washed coal	10^4t	**0.21**	25.8	100	26,344	5,233.50
Other washed coal	10^4t	**0**	25.8	100	8,363	0.00
Coke	10^4t	**0**	29.2	100	28,435	0.00
Coke oven gas	10^8 M^3	**0**	12.1	100	16,726	0.00
Other gas	10^8 M^3	**2.58**	12.1	100	5,227	59,831.38
Crude oil	10^4t	**16.89**	20	100	41,816	517,932.98
Gasoline	10^4t	**0**	18.9	100	43,070	0.00
Diesel	10^4t	**50.71**	20.2	100	42,652	1,601,975.28
Fuel oil	10^4t	**957.71**	21.1	100	41,816	30,983,494.25
LPG	10^4t	**0**	17.2	100	50,179	0.00
Refinery gas	10^4t	**2.86**	15.7	100	46,055	75,825
Natural gas	10^8 M^3	**0.48**	15.3	100	38,931	104,833.40
Other petroleum products	10^4t	**1.66**	20	100	38,369	46,707.86
Other coking products	10^4t	**0**	25.8	100	28,435	0.00
Other energy	10^4t	**79.42**	0	100	0	0.00
Imported electricity from Central China Power Grid(MWh)		10,951,240				
Total CO_2 Emissions(tCO_2e)		**274,223,576**				
Total thermal power generation connected to the grid(MWh)		**258,317,469**				
$EF_{simple,OM,2004}$ (tCO_2e/MWh)		**1.061586**				

Data source: China Energy Statistical Yearbook 2005

Table A6. Basic Fuel Data of SCPG in 2005

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total
		A	B	C	D	E=A+B+C+D
Raw coal	10^4t	6,696.47	1,435	3,212.31	1,975.55	**13,319.33**
Washed coal	10^4t				0.15	**0.15**
Other washed coal	10^4t			10.39	33.88	**44.27**
Coke	10^4t	4.79			8.05	**12.84**
Coke oven gas	10^8 M^3				0.79	**0.79**
Other gas	10^8 M^3	1.87			15.96	**17.83**
Crude oil	10^4t	10.91				**10.91**
Gasoline	10^4t	0.68				**0.68**
Diesel	10^4t	31.96	2.02		1.81	**35.79**
Fuel oil	10^4t	887.21				**887.21**
LPG	10^4t					**0**
Refinery gas	10^4t	4.92				**4.92**
Natural gas	10^8 M^3	0.93				**0.93**
Other petroleum products	10^4t	1.7				**1.7**
Other coking products	10^4t					**0**
Other energy	10^4t	104.66	133.15		59.72	**297.53**

Data source: China Energy Statistical Yearbook 2006

Table A7. Calculation of simple OM emission factor of SCPG in 2005

Fuels	Units	Total	Emission factor (tCO_2e/TJ)	OXID (%)	NCV ($MJ/t,km^3$)	Emission (tCO_2e)
		E	F	G	H	I=G*H*F*E*44/12/10000(for mass unit) I=G*H*F*E*44/12/1000 (for volume unit)
Raw coal	10^4t	**13,319.33**	25.8	100	20,908	263,442,602
Washed coal	10^4t	**0.15**	25.8	100	26,344	3,738
Other washed coal	10^4t	**44.27**	25.8	100	8,363	350,238
Coke	10^4t	**12.84**	29.2	100	28,435	390,906
Coke oven gas	$10^8 M^3$	**0.79**	12.1	100	16,726	58,624
Other gas	$10^8 M^3$	**17.83**	12.1	100	5227	413,486
Crude oil	10^4t	**10.91**	20	100	41,816	334,556
Gasoline	10^4t	**0.68**	18.9	100	43,070	20,296
Diesel	10^4t	**35.79**	20.2	100	42,652	1,130,639
Fuel oil	10^4t	**887.21**	21.1	100	41,816	28,702,703
LPG	10^4t	**0**	17.2	100	50,179	0
Refinery gas	10^4t	**4.92**	15.7	100	46,055	130,441
Natural gas	$10^8 M^3$	**0.93**	15.3	100	38,931	203,115
Other petroleum products	10^4t	**1.7**	20	100	38,369	47,833
Other coking products	10^4t	**0**	25.8	100	28,435	0
Other energy	10^4t	**297.53**	0	100	0	0
Imported electricity from Central China Power Grid(MWh)		20,264,000				
Total CO_2 Emissions(tCO_2e)		**310,876,215**				
Total thermal power generation connected to the grid(MWh)		**289,433,531**				
$EF_{simple,OM,2005}$ (tCO_2e/MWh)		**1.07409**				

Data source: China Energy Statistical Yearbook 2006

Table A8. Basic Fuel Data of SCPG in 2006

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total
		A	B	C	D	E=A+B+C+D
Raw coal	10^4t	7,303.19	1,490.01	4,001.54	2,735.88	**15,530.62**
Washed coal	10^4t					**0**
Other washed coal	10^4t			19.53	45.8	**65.33**
Coal briquette	10^4t	133.75				**133.75**
Coke	10^4t				1.31	**1.31**
Coke oven gas	10^8 M^3		0.84		2.06	**2.9**
Other gas	10^8 M^3	0.89			19.15	**20.04**
Crude oil	10^4t	0.87				**0.87**
Gasoline	10^4t					**0**
Diesel	10^4t	29.92	1.26		3	**34.18**
Fuel oil	10^4t	685.85	0.09			**685.94**
LPG	10^4t					**0**
Refinery gas	10^4t					**0**
Natural gas	10^8 M^3	7.92				**7.92**
Other petroleum products	10^4t	0.67				**0.67**
Other coking products	10^4t					**0**
Other energy	10^4t	93.54	189.68		20.29	**303.51**

Data source: China Energy Statistical Yearbook 2007

Table A9. Calculation of simple OM emission factor of SCPG in 2006

Fuels	Units	Total	Emission factor (tCO_2e/TJ)	OXID (%)	NCV ($MJ/t,km^3$)	Emission (tCO_2e)
		E	F	G	H	I=G*H*F*E*44/12/10000(for mass unit) I=G*H*F*E*44/12/1000 (for volume unit)
Raw coal	10^4t	**15,530.62**	25.8	100	20,908	307,179,636
Washed coal	10^4t	**0**	25.8	100	26,344	0
Other washed coal	10^4t	**65.33**	25.8	100	8,363	516,852
Coal briquette	10^4t	**133.75**	26.6	100	20,908	2,727,466
Coke	10^4t	**1.31**	29.2	100	28,435	39,882
Coke oven gas	$10^8 M^3$	**2.9**	12.1	100	16,726	215,202
Other gas	$10^8 M^3$	**20.04**	12.1	100	5,227	464,737
Crude oil	10^4t	**0.87**	20.0	100	41,816	26,679
Gasoline	10^4t	**0**	18.9	100	43,070	0
Diesel	10^4t	**34.18**	20.2	100	42,652	1,079,777
Fuel oil	10^4t	**685.94**	21.1	100	41,816	22,191,288
LPG	10^4t	**0**	17.2	100	50,179	0
Refinery gas	10^4t	**0**	15.7	100	46,055	0
Natural gas	$10^8 M^3$	**7.92**	15.3	100	38,931	1,729,751
Other petroleum products	10^4t	**0.67**	20.0	100	38,369	18,852
Other coking products	10^4t	**0**	25.8	100	28,435	0
Other energy	10^4t	**303.51**	0	100	0	0
Imported electricity from Central China Power Grid(MWh)		21,730,840				
Total CO_2 Emissions(tCO_2e)		**352,951,910**				
Total thermal power generation connected to the grid(MWh)		**336,534,748**				
$EF_{simple,OM,2006}$ (tCO_2e/MWh)		**1.04878**				

Data source: China Energy Statistical Yearbook 2007

Table A10. Most recent three-year average OM emission factor of SCPG

Year	2004	2005	2006
Total CO_2 Emissions(tCO_2e）	**274,223,576**	**310,876,215**	**352,951,910**
Total thermal power generation connected to the grid(MWh)	**258,317,469**	**289,433,531**	**336,534,748**
$EF_{OM,y}$（tCO_2e/MWh）	**1.06080**		

Table A11. **Calculation of the weight of CO_2 emissions from solid fuels, liquid fuels and gas fuels among total emissions in SCPG**

		Guangdong	Guangxi	Guizhou	Yunnan	Total	NCV	Emission factor(tc/TJ)	OXID	CO_2 emissions(tCO_2e)
Fuels	Units	A	B	C	D	E=A+…+D	F	G	H	I=E*F*G*H*44/12/100
Raw coal	10^4t	7,303.19	1,490.01	4,001.54	2,735.88	15,530.62	20,908	25.8	1	307,179,636
Washed coal	10^4t	0	0	0	0	0	26,344	25.8	1	0
Other washed coal	10^4t	0	0	19.53	45.8	65.33	8,363	25.8	1	516,852
Coal briquette	10^4t	133.75	0	0	0	133.75	20,908	26.6	1	2,727,466
Coke	10^4t	0	0	0	1.31	1.31	28,435	29.2	1	39,882
Total of solid fuels										**310,463,836**
Crude oil	10^4t	0.87	0	0	0	0.87	41,816	20	1	26,679
Gasoline	10^4t	0	0	0	0	0	43,070	18.9	1	0
Coal oil	10^4t	0	0	0	0	0	43,070	19.6	1	0
Diesel	10^4t	29.92	1.26	0	3	34.18	42,652	20.2	1	1,079,777
Fuel oil	10^4t	685.85	0.09	0	0	685.94	41,816	21.1	1	22,191,288
Other petroleum products	10^4t	0.67	0	0	0	0.67	38,369	20	1	18,852
Total of liquid fuels										**23,316,596**
Natural gas	10^7m^3	79.2	0	0	0	79.2	38,931	15.3	1	1,729,751
Coke oven gas	10^7m^3	0	8.4	0	20.6	29.0	16,726	12.1	1	215,202
Other gas	10^7m^3	8.9	0	0	191.5	200.4	5,227	12.1	1	464,737
LPG	10^4t	0	0	0	0	0	50,179	17.2	1	0
Refinery gas	10^4t	0	0	0	0	0	46,055	15.7	1	0
Total of gas fuels										**2,409,690**
Total of solid, liquid and gas fuels										**336,190,122**

Data source: China Energy Statistical Yearbook 2007

$\lambda_{Coal,y}$=92.35%， $\lambda_{Oil,y}$=6.94%， $\lambda_{Gas,y}$=0.72%

Table A12. Emission factor of fuel-fired power plants

	Variable	Efficiency of electricity supply (%)	Emission factor of the fuels (tc/TJ)	OXID	Emission factor(tCO_2e/MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coal-fired power plant	$EF_{Coal,Adv}$	37.28%	25.8	1	0.9135
Gas-fired power plant	$EF_{Gas,Adv}$	48.81%	15.3	1	0.4138
Oil-fired power plant	$EF_{Oil,Adv}$	48.81%	21.1	1	0.5706

$EF_{Thermal} = \lambda_{Coal,y} \times EF_{Coal,Adv} + \lambda_{Oil,y} \times EF_{Oil,Adv} + \lambda_{Gas,y} \times EF_{Gas,Adv}$ =0.8862 tCO_2e/MWh

Table A13. Installed capacity of SCPG in 2004

	Units	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	30,172.9	4,378.1	4,306.9	7,801.8	46,659.7
Hydropower	MW	8,584.6	5,040.4	7,058.6	6,896.5	27,580.1
Nuclear power	MW	3780	0	0	0	3,780
Wind power and others	MW	83.4	0	0	0	83.4
Total	MW	42621	9,418.5	11,365.5	14,698.3	78,103.3

Data source: China Electric Power Yearbook 2005

Table A14. Installed capacity of SCPG in 2005

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

Data source: China Electric Power Yearbook 2006

Table A15. Installed capacity of SCPG in 2006

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

Data source: China Electric Power Yearbook 2007

Table A16. Calculation of BM emission factor of SCPG

	Installed capacity in 2004	Installed capacity in 2005	Installed capacity in 2006	Newly added installed capacity between 2004 and 2006	Share in newly added installed capacity
	A	B	C	D=C-A	
Thermal power	46,659.7	54,507	68,963	22,303.3	76.91%
Hydropower	27,580.1	30,347.1	34,176	6,595.9	22.75%
Nuclear power	3,780	3,780	3,780	0	0.00%
Wind power	83.4	83.4	183	99.6	0.34%
Total	78,103.3	88,717.5	107,102	28,998.7	**100.00%**
Share in 2006 installed capacity	72.92%	82.83%	100%		

Data source: China Electric Power Yearbook 2005-2007

$EF_{BM,y}$= 0.8862×76.91%=0.6816tCO_2e /MWh

EF_y = 0.5*1.0608+ 0.5*0.6816 = 0.8712 tCO_2e/MWh

Annex 4

See B.7.1 for details. No additional information.