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:

Yunnan Kawan 18.9MW Hydroelectric Project
Version 1
July 3, 2008

A.2. Description of the project activity:

Yunnan Kawan 18.9MW Hydroelectric Project (the Project developed by Changning County Jia Yuan Electric Power Development Co., Ltd., is located in the 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 4886h. 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 Corparation	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′ ～99° 46′ and north latitude of 25° 28′ ～26° 23′. Figure A-1, A-2 show the location of the Project.

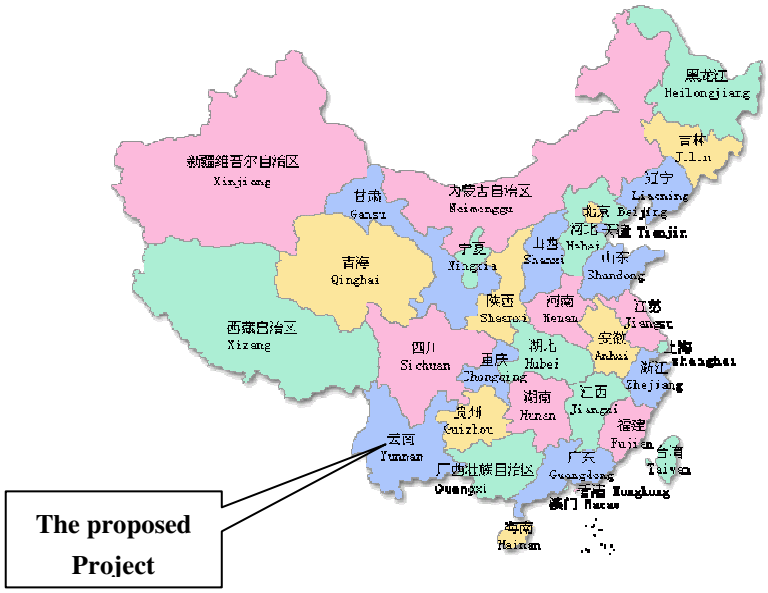


Figure A-1: Location of the Proposed Project in Country Map

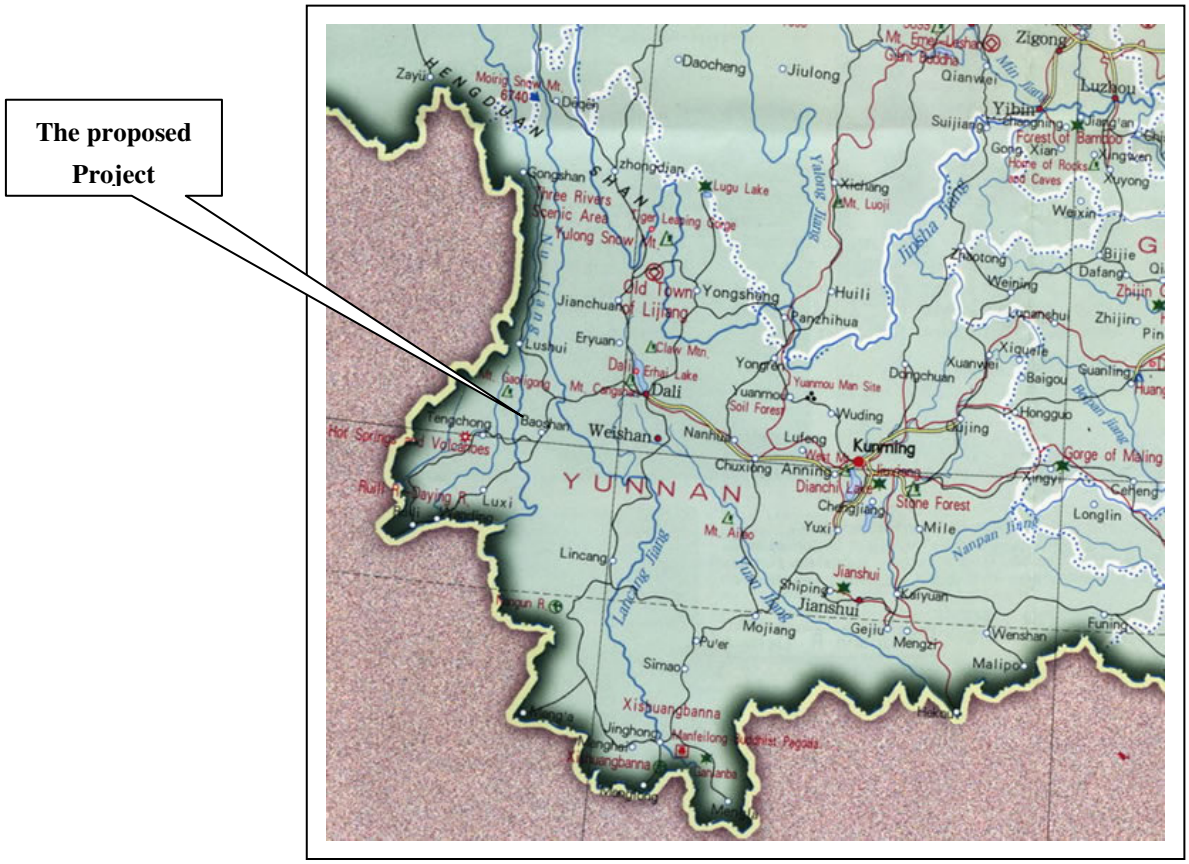


Figure A-2: Location of the Proposed Project in Province Map

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. And the main construction work consists of the dam, diversion tunnel system, power houses and step-up substation, etc. The installed capacity of the Project is 18.9MW.

The Project uses three units of HLA616-WJ-108 turbine and SFW6300-10/2150 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

Parameters	Specifications
Turbines	
Model	HLA616-WJ-108
Rated capacity	6300kW
Rated water head	68.8m
Rotation speed	600r/min
Rated water flow	10.6m3/s
Generators	
Model	SFW6300-10/2150
Rated capacity	6300kW
Rated voltage	6300V
Capacity factor	0.8
Frequency	50HZ

The technology employed for the Project, which has been used worldwide, is safe on environment. Proper mitigation methods are applied to prohibit the negative impacts that may occur.

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 532917 tCO_2e during the first crediting period of the project (2009-2015).

Year	Annual estimation of emission reductions (tCO2 e)
2009	76,131
2010	76,131
2011	76,131
2012	76,131
2013	76,131
2014	76,131
2015	76,131
Total estimated reductions(tCO2e)	532,917
Total number of crediting years	7
Annual average of estimated reductions over the crediting period	76,131

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 07）
Methodological Tool: "Tool for the demonstration and assessment of additionality (version 05)
Methodological Tool: "Tool to calculate the emission factor for an electricity system" (version 01)

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;
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 7) 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	According to ACM0002
		N_2O	No	According to ACM0002

The spatial scope of the project boundary covers the project site and all power plants physically connected into the South China Power Grid. According to the Chinese DNA guidance[1], the geographical extent of the South China Power Grid includes Guangdong, Guangxi, Yunnan and Guizhou Province.

[1] *Notification on Determining Baseline Emission Factor of China's Grid* published by Chinese DNA on *09/08/2007* Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf

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.

According to analysis in B.5, alternative a) is financially unattractive and alternative b) is not in compliance with legal and regulatory requirements. 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. (c) is not a realistic alternative. Therefore alternative d) equivalent electricity service provided by the South China Power Grid is the only realistic and credible alternative to the Project and therefore the baseline scenario.

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 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 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.

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.

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 economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs). In the following, it is demonstrated that scenario c) (= no action is taken) is more economically attractive than a) (= implement the project without CERs) for the project owner through the investment analysis.

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

Sub-step 2a. Determine appropriate analysis method

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

The Project generates financial and economic benefits through the sales of electricity other than CDM income. Therefore the simple cost analysis (Option I) cannot be taken. And the investment comparison analysis (Option II) is only applicable to projects where alternatives should be similar investment projects, which is not the case for 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 projects*[3](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.

[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.cct.org.cn/cct/content.asp?ID=5576

[3] http://cdm.unfccc.int/UserManagement/FileStorage/ZF3WZC0QT66MDJRN1M0DJDQ8ZKNLBV

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	Data source
Annual grid-connected output	90272MWh	FSR
Annual operation hours	4886 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	8.15 EUR / tCO2e	Market price

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 7.91% 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

	Project IRR
Without CERs	7.91%
With CERs	14.32%

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, three parameters were selected as sensitive factors to assess the financial attractiveness:

1) Fixed asset investment
2) Annual O&M cost
3) Expected 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	8.94%	8.41%	7.91%	7.46%	7.03%
Annual O&M Cost	8.14%	8.03%	7.91%	7.80%	7.68%
Feed-in Tariff (excl. VAT)	6.92%	7.42%	7.91%	8.39%	8.86%
Annual electricity output	6.95%	7.44%	7.91%	8.37%	8.83%

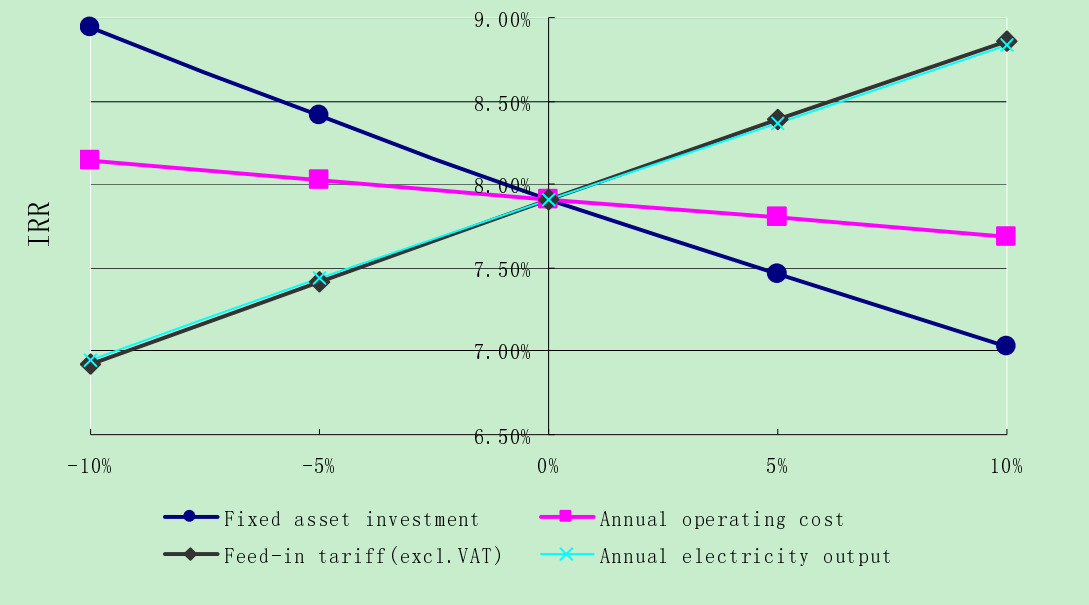


Figure B1 Sensitivity analysis of the Project

The project IRR of the proposed project varies to different degrees in accordance with the fluctuation of three parameters within the range of negative 10 percent to positive 10 percent. Table B3 and Figure B1 shows that the fixed asset investment and expected tariff are relatively sensitive factors while annual O&M cost is not. It could be seen that the project IRR is 8.94% when the fixed asset investment drops by 10 percent, which is still lower than the benchmark IRR 10%. In addition, when the expected tariff increases by 10 percent, the project IRR is 9.32%, also lower than the benchmark IRR. Therefore it can be concluded that without CERs revenues, the Project is not financially attractive.

Step 3. Barrier analysis

Skipped

Step 4. Common practice analysis

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

For the purpose of analyzing common practice, the Project is compared to other hydropower projects which have taken place in Yunnan Province.

Table B-4 shows the key indicators that can be compared for the similar projects in Yunnan

Province, whose installation is smaller than 50MW.

Table B-4 Hydropower projects in Yunnan Province (project installation <50MW)[4]

	Project Name	Installed Capacity (MW)	Project largest shareholder name	Type of company
1	Luoze River Hydropower Project	25	State Power Company	State Owned
2	Laohushan Hydropower Project	25	Dian Neng Group	State Power Company Staff Shareholders[5]
3	Yisa River Hydropower Project	26.6	Yunnan Jiang County Electricity Power Company	State Owned
4	Nanding River Hydropower Project	34	Wen Shan Power Company	State Owned
5	Supa River Sanjiangkou Hydropower Project	30	Yunnan Baoshan Power Company	State Owned
6	Jiren River Hydropower Project	30	State Investment Company	State Owned
7	Heier Hydropower Project	25	Shizong Heier Hydro Power Development Co. Ltd	Private Owner
8	Luoshuidong Hydropower Project	20	Wen Shan Power Company	State Owned
9	Xiaohegou Hydropower Project	21	Guangnan Power Company	State Owned
10	Chongjiang River Hydropower Project	22.3	China Guodian Operation	State Owned
11	Luoze River Hydropower Project	25	Yunnan Yiliang County Hydropower Company	State Owned

The only existing project, which is funded by private finance, is the 25MW Heier Hydropower Project. This project, as well as the proposed project, is in the process of finding carbon finance help.[6]

Projects with a similar scale which is under construction in Yunnan Province are listed as below: Yunnan Maguan Daliangzi hydropower project, Yunnan Yingjiangxian Mangyahe First Grade hydropower project, Yunnan Yingjiangxian Mangyahe Second Grade hydropower project, Yunnan Supahe Sanjiangkou hydropower expansion project, Yunnan Yingjiangxian Mangzhang Langwaihe hydropower project, Yunnan Baishuijiang Grade

[4] Source from *China Hydro Resources Yearbook 2005*

[5] It is owned by the Staff Shareholders of the State Power Company, but its funding was still from the State

[6] Source from http://cdm.unfccc.int/Projects/Validation/DB/T3BP5GZP970FWODQSZEWMY2LD9I27D/view.html

hydropower project, Yunnan Mengjiahe Kachang Muwen hydropower project. All these projects are in the process of finding carbon finance help[7].

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

The majority of projects listed above are developed by state-invested organizations which have operational capacity to allow them a better (more and easier) access to project finance. Privately developed projects however have weaker leverage with the grid operating company. State-invested organizations are therefore better placed to deal with project risks and cannot be considered similar to the Project activity which is developed by a private power production company.

It can therefore be concluded that previously implemented projects did not face the same barriers as this private sector sponsored Project. As a result the Project cannot be considered common practice.

In conclusion the proposed Project shall be deemed to be additional according to ACM0002.

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). 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), the baseline GHG emissions should be calculated by following six steps:

Step 1. Identify the relevant electric power system

If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. Since Chinese DNA has published a delineation of the project electricity system and connected electricity systems[8], 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, 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

[7] Source from http://cdm.ccchina.gov.cn/

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

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[9] 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 2002-2006*, the share of the low-cost/must run resources in the South China Power Grid are 11.49%(2001), 11.86%(2002), 10.96%(2003), 9.77%(2004) and 11.94%(2005) 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 ($EF_{grid,OMsimple,y}$):

- Based on data on fuel consumption and net electricity generation of each power plant / unit[10] (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)

[9] 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.

[10] 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.

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

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

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 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 (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)[11]

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

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*. 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*

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

(2003~2005, published annually) and *China Energy Statistical Yearbook* (2004~2006). Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the South China Power Grid is calculated as 1.0119 tCO_2e/MWh (see Annex 3 for details).

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[12]:

(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[13].

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
($_{grid\,BM\,y}EF_{,,}$) 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 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:

[12] 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.

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

$EF_{grid,BM,y}$ = 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:

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

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

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

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 09/08/2007 for detailed calculation processes.
The value of $EF_{grid,BM,y}$, is 0.6748 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 (tCO2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO2/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 and for subsequent crediting periods.

1.2. Calculate the baseline emissions (BE_y)

Therefore, baseline emissions can be calculated as below:

$$BE_y = EG_y * EF_{grid,CM,y} \quad (9)$$

2. Project emissions (PE_y)

The emissions of the proposed project activity is zero, PE_y=0

3. Leakage (L_y)

According to the methodology, no leakage is considered in the project, L_y =0.

4. Emission reductions (ER_y)

The emission reduction (ER_y) by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage(L_y), as follows:

$$ER_y=BE_y-PE_y-L_y \quad (10)$$

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（2004~2006）
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（2006）
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 and procedures actually applied :	IPCC default values
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 (2004-2006)
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 (2004-2006)*
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 (2004-2006)*
Value applied:	See Annex 3 for details
Justification of the choice of data or description of	National values

measurement methods and procedures actually applied :	
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 *09/08/2007*
Value applied:	Coal: 35.82%; Oil: 47.67%; Gas: 47.67%. 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:	

B.6.3 Ex-ante calculation of emission reductions:

According to the ACM0002 methodology, PE_y=0, L_y=0

As per calculation formulae of baseline combined emission factor, the baseline emission factor of the project is 0.84335 tCO_2e /MWh

According to the feasibility study of the proposed project, the annual electricity delivered to the grid is approximately 90272MWh, i.e. EG_y=90272MWh

As per calculation formulae of baseline emission, the estimated anthropogenic emission of the first crediting period is as follows:

$BE_y = EG_y \times EF_y$ = 76131tCO_2e

With the emissions from the proposed project being zero, the emission reductions of the project activity are equivalent to the emissions of the baseline. The annual emission reduction of the first crediting period ER_y =76131tCO_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)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2009	0	76131	0	76131
2010	0	76131	0	76131
2011	0	76131	0	76131
2012	0	76131	0	76131
2013	0	76131	0	76131
2014	0	76131	0	76131

2015	0	76131	0	76131
Total(tCO2e)	0	532917	0	532917

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 delivered to grid: 90,272MWh
Description of measurement methods and procedures to be applied:	Hourly measured and monthly recorded
QA/QC procedures to be applied:	According to national standard, meters will be calibrated periodically. Data measured by meters will be cross checked by electricity sales receipt.
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 emission reductions in section B.5	Depend on the meters
Description of measurement methods and procedures to be applied:	Hourly measured and monthly recorded
QA/QC procedures to be applied:	According to national standard, meters will be calibrated periodically. Data measured by meters will be cross checked by electricity sales receipt.

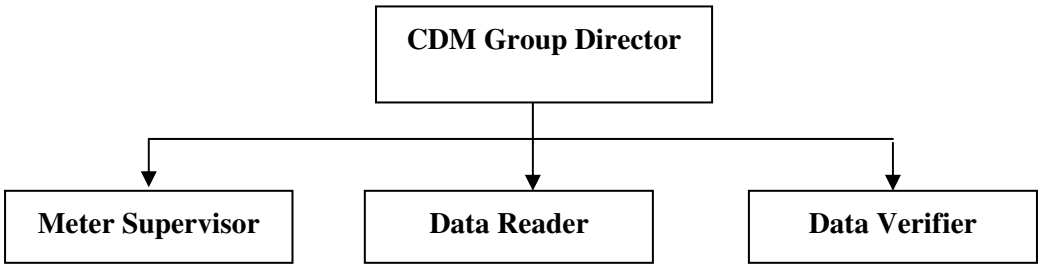
B.7.2 Description of the monitoring plan:

The approved monitoring methodology ACM0002 is used for developing the 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.

1. Responsibility

Overall responsibility for daily monitoring and reporting lies with the project owner. A CDM group will be established within Yunnan Changning County Jia Yuan Electric Power Development Co., Ltd. to carry out the monitoring work. Its staffs will be trained by the experts of the project consultancy.

The CDM group will be structured as in the below chart.



2. Installation of meters

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 grid company before operation.

Two meters are installed for the measurement of net electricity delivered to grid. The main meter will be owned, operated and maintained by the South China Power Grid, and the backup meter will be owned, operated and maintained by Yunnan Changning County Jia Yuan Electric Power Development Co., Ltd. When the main meter is out of order, the readings from the backup meter will be used for reference.

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 the last day of every month.
Project owner reads the backup meter and records data on the last day of every month
Grid company supplies readings to the project owner and provides invoice.
Project owner records the data of net electricity delivered to the grid
Project owner provides two meters' readings and photocopies of invoices to DOE for verification as the attachments to the monitoring report.

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.

4. 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 0.5% of full-scale rating. 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 third 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.

5. Data management system
Physical document such as paper-based maps, diagrams and environmental assessments will be collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the project, the project material and monitoring results will be indexed. All paper-based information will be stored by the technology department of the project owner and all the material will have a copy for backup. And all data including calibration records is kept until 2 years after the end of the total credit time of the CDM project.

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, Pu Weidong, He Xugang
Tel：0871－3161306，13577027272/13064291023/13577025792
wxl@ynst.net.cn, pweidong1968@hotmail.com, hxg69@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:

Oct. 15, 2006

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:

Jan. 1, 2009

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:

Based on China Environmental Assessment Law, the Environmental Impact Assessment (EIA) must be completed before the development and construction of the proposed project. Thus, the project owner authorized a third party to carry out the EIA report, which was later approved by Changning County Environmental Protection Bureau.

The EIA states that the project will contribute to the development of the local economy and society. The project will also enhance the investment environment for the local economy. Both the EIA and feasibility studies note that revenue generated from electricity sales will increase local residents' living standards, improve infrastructure and therefore make it a more attractive environment for investment.

Some major environmental impacts stated in the EIA are summarized in the following:

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.

Dust and Air Quality
Considering flying dust produced during construction period, the dust and soot will be strictly controlled by watering the transportation routes and construction site regularly. Measures of reducing smoke and dust should also be carried out. During the construction phase, the air quality will be monitored and the waste residue and refuse produced by the proposed project construction will be piled up in a certain place and earthed up. As the heating system of the project uses electricity, no exhausted gas or solid waste will likely to be generated.

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 to avoid breakage of ecological environment. And the waste soil produced during construction period will be used for backfilling, while solid wastes are collected regularly and transported into the designated dumping site. After the project completion, the land in the project management site and temporary construction site will be restored and rehabilitated with the trees and vegetation.

Ecological impacts
Terrestrial plants: there will be influence on the upper vegetation during the blast, excavation, road construction. Reforest and restore the green lands after the construction are required.
Terrestrial animals: most animals spread in the mountains far away from the project site. Therefore, the construction of the project would have little adverse impacts on them.
Aquatic creatures: no rare and endangered aquatic species are found, however, the number of existing aquatic creatures will decrease due to the project construction. The measures include some compensation to the fisher men and fries put in the river.

Socio-economic Environment
There will be no cultivated land flooded or resettlement involved in the project. Therefore, the impact of the project on socio-economic environment is minimal.

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
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URL:	
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Title:	Chairman
Salutation:	Legal Representative
Last Name:	Li
Middle Name:	
First Name:	Shiping
Department:	
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Direct FAX:	0875－7837099
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Represented by:	
Title:	Manager
Salutation:	Mr.
Last Name:	kobayashi
Middle Name:	
First Name:	yoshiaki
Department:	Emissions Reduction Business Unit
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the proposed project.

Annex 3

BASELINE INFORMATION

The baseline information for calculations of OM, BM and CM emission factors of South China Power Grid is shown in the Report on Determination of Baseline Grid Emission Factor by China DNA at http://cdm.ccchina.gov.cn. The concrete processes are shown in the following tables.

Table A1 Thermal Power Generation of South China Power Grid in 2003

Province	Thermal Power Generation	Rate of self-consumption	Thermal Power generation connected to the grid
	（MWh)	（%）	（MWh)
Guangdong	143,351,000	5.5	135,466,695
Guangxi	17,079,000	8.43	15,639,240
Guizhou	43,295,000	7.4	40,091,170
Yunnan	19,055,000	8.01	17,528,695
Total			208,725,800

Data source: China Electric Power Yearbook 2004

Table A2 Thermal Power Generation of South China Power Grid 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 A3 Thermal Power Generation of South China Power Grid in 2005

Province	Thermal Power Generation	Rate of self-consumption	Thermal Power generation connected to the grid
	（MWh)	（%）	（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

Data source: China Electric Power Yearbook 2006

Table A4. Basic Fuel Data of South China Power Grid in 2003

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total
		A	B	C	D	E=A+B+C+D
Raw coal	Ten thousand ton	4491.79	831.84	2169.11	1405.27	8898.01
Washed coal	Ten thousand ton	0.05				0.05
Other washed coal	Ten thousand ton			36.38	20.37	56.75
Coke	Ten thousand ton				0.5	0.5
Coke oven gas	Hundred million M^3				0.04	0.04
Other gas	Hundred million M^3	3.21			11.27	14.48
Crude oil	Ten thousand ton	6.85				6.85
Gasoline	Ten thousand ton	0.02				0.02
Diesel	Ten thousand ton	31.9			0.76	32.66
Fuel oil	Ten thousand ton	627.22	0.3			627.52
LPG	Ten thousand ton					0
Refinery gas	Ten thousand ton	2.85				2.85
Natural gas	Hundred million M^3					0
Other petroleum products	Ten thousand ton	11.35				11.35
Other coking products	Ten thousand ton					0
Other energy	Ten thousand tce	93.21			22.35	115.56

Data source: China Energy Statistical Yearbook 2004

Table A5. Calculation of simple OM emission factor of South China Power Grid in 2003

Fuels	Units	Total	Emission factor (tCO2e/TJ)	OXID (%)	NCV (MJ/t,km^3)	Emission (tCO2e)
		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	Ten thousand ton	8898.01	25.8	100	20908	175993455.05
Washed coal	Ten thousand ton	0.05	25.8	100	26344	1246.07
Other washed coal	Ten thousand ton	56.75	25.8	100	8363	448971.84
Coke	Ten thousand ton	0.5	25.8	100	28435	13449.76
Coke oven gas	Hundred million M^3	0.04	12.1	100	16726	2968.31
Other gas	Hundred million M^3	14.48	12.1	100	5227	335797.81
Crude oil	Ten thousand ton	6.85	20	100	41816	210055.71
Gasoline	Ten thousand ton	0.02	18.9	100	43070	596.95
Diesel	Ten thousand ton	32.66	20.2	100	42652	1031759.27
Fuel oil	Ten thousand ton	627.52	21.1	100	41816	20301304.48
LPG	Ten thousand ton	0	17.2	100	50179	0.00
Refinery gas	Ten thousand ton	2.85	18.2	100	46055	87592.00
Natural gas	Hundred million M^3	0	15.3	100	38931	0.00
Other petroleum products	Ten thousand ton	11.35	20	100	38369	319357.98
Other coking products	Ten thousand ton	0	25.8	100	28435	0.00
Other energy	Ten thousand tce	115.56	0	100	0	0.00
Imported electricity from Central China Power Grid(MWh)		11,100				
Total CO_2 Emissions(tCO2e)		198,755,407				
Total thermal power generation connected		208,736,900				

to the grid(MWh)	
$EF_{simple,OM,2003}$ (tCO2e/MWh)	0.952181

Data source: China Energy Statistical Yearbook 2004

Table A6. Basic Fuel Data of South China Power Grid in 2004

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total
		A	B	C	D	E=A+B+C+D
Raw coal	Ten thousand ton	6017.7	1305	2643.9	1751.28	11717.88
Washed coal	Ten thousand ton	0.21				0.21
Other washed coal	Ten thousand ton					0
Coke	Ten thousand ton					0
Coke oven gas	Hundred million M^3					0
Other gas	Hundred million M^3	2.58				2.58
Crude oil	Ten thousand ton	16.89				16.89
Gasoline	Ten thousand ton					0
Diesel	Ten thousand ton	48.88			1.83	50.71
Fuel oil	Ten thousand ton	957.71				957.71
LPG	Ten thousand ton					0
Refinery gas	Ten thousand ton	2.86				2.86
Natural gas	Hundred million M^3	0.48				0.48
Other petroleum products	Ten thousand ton	1.66				1.66
Other coking products	Ten thousand ton					0
Other energy	Ten thousand tce	79.42				79.42

Data source: China Energy Statistical Yearbook 2005

Table A7. Calculation of simple OM emission factor of South China Power Grid in 2004

Fuels	Units	Total	Emission factor（tCO2e/TJ）	OXID（%）	NCV（MJ/t,km^3）	Emission（tCO2e）
		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	Ten thousand ton	11717.88	25.8	100	20908	231767573.55
Washed coal	Ten thousand ton	0.21	25.8	100	26344	5233.50
Other washed coal	Ten thousand ton	0	25.8	100	8363	0.00
Coke	Ten thousand ton	0	25.8	100	28435	0.00
Coke oven gas	Hundred million M^3	0	12.1	100	16726	0.00
Other gas	Hundred million M^3	2.58	12.1	100	5227	59831.38
Crude oil	Ten thousand ton	16.89	20	100	41816	517932.98
Gasoline	Ten thousand ton	0	18.9	100	43070	0.00
Diesel	Ten thousand ton	50.71	20.2	100	42652	1601975.28
Fuel oil	Ten thousand ton	957.71	21.1	100	41816	30983494.25
LPG	Ten thousand ton	0	17.2	100	50179	0.00
Refinery gas	Ten thousand ton	2.86	18.2	100	46055	87899.34
Natural gas	Hundred million M^3	0.48	15.3	100	38931	104833.40
Other petroleum products	Ten thousand ton	1.66	20	100	38369	46707.86
Other coking products	Ten thousand ton	0	25.8	100	28435	0.00
Other energy	Ten thousand tce	79.42	0	100	0	0.00

Imported electricity from Central China Power Grid(MWh)	10,951,240
Total CO_2 Emissions(tCO2e）	274,226,117
Total thermal power generation connected to the grid(MWh)	258,317,469
$EF_{simple,OM,2004}$ (tCO2e/MWh)	1.061586

Data source: China Energy Statistical Yearbook 2005

Table A8. Basic Fuel Data of South China Power Grid in 2005

Fuels	Units	Guangdong	Guangxi	Guizhou	Yunnan	Total
		A	B	C	D	E=A+B+C+D
Raw coal	Ten thousand ton	6696.47	1435	3212.31	1975.55	13319.33
Washed coal	Ten thousand ton				0.15	0.15
Other washed coal	Ten thousand ton			10.39	33.88	44.27
Coke	Ten thousand ton	4.79			8.05	12.84
Coke oven gas	Hundred million M^3				0.79	0.79
Other gas	Hundred million M^3	1.87			15.96	17.83
Crude oil	Ten thousand ton	10.91				10.91
Gasoline	Ten thousand ton	0.68				0.68
Diesel	Ten thousand ton	31.96	2.02		1.81	35.79
Fuel oil	Ten thousand ton	887.21				887.21
LPG	Ten thousand ton					0
Refinery gas	Ten thousand ton	4.92				4.92
Natural gas	Hundred million M^3	0.93				0.93
Other petroleum products	Ten thousand ton	1.7				1.7
Other coking products	Ten thousand ton					0
Other energy	Ten thousand tce	104.66	133.15		59.72	297.53

Data source: China Energy Statistical Yearbook 2006

Table A9. Calculation of simple OM emission factor of South China Power Grid in 2005

Fuels	Units	Total	Emission factor（tCO2e/TJ）	OXID（%）	NCV（MJ/t,km^3）	Emission（tCO2e）
		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	Ten thousand ton	13319.33	25.8	100	20908	263442601.85
Washed coal	Ten thousand ton	0.15	25.8	100	26344	3738.21
Other washed coal	Ten thousand ton	44.27	25.8	100	8363	350237.59
Coke	Ten thousand ton	12.84	25.8	100	28435	345389.71
Coke oven gas	Hundred million M^3	0.79	12.1	100	16726	58624.07
Other gas	Hundred million M^3	17.83	12.1	100	5227	413485.84
Crude oil	Ten thousand ton	10.91	20	100	41816	334555.88
Gasoline	Ten thousand ton	0.68	18.9	100	43070	20296.31
Diesel	Ten thousand ton	35.79	20.2	100	42652	1130638.84
Fuel oil	Ten thousand ton	887.21	21.1	100	41816	28702703.26
LPG	Ten thousand ton	0	17.2	100	50179	0.00
Refinery gas	Ten thousand ton	4.92	18.2	100	46055	151211.46
Natural gas	Hundred million M^3	0.93	15.3	100	38931	203114.71

Other petroleum products	Ten thousand ton	1.7	20	100	38369	47833.35
Other coking products	Ten thousand ton	0	25.8	100	28435	0.00
Other energy	Ten thousand tce	297.53	0	100	0	0.00
Imported electricity from Central China Power Grid(MWh)		96,363,000				
Total CO_2 Emissions(tCO2e）		369,521,975				
Total thermal power generation connected to the grid(MWh)		365,532,531				
$EF_{simple,OM,2005}$ (tCO2e/MWh)		1.010914				

Data source: China Energy Statistical Yearbook 2006

Table A10. Most recent three-year average OM emission factor of South China Power Grid

Year	2003	2004	2005
Total CO_2 Emissions(tCO2e）	198,755,407	274,226,117	369,521,975
Total thermal power generation connected to the grid(MWh)	208,736,900	258,317,469	365,532,531
$EF_{OM,y}$（tCO_2e/MWh）	1.011911		

Table A11. Calculation of the weight of CO2 emissions from solid fuels, liquid fuels and gas fuels among total emissions in South China Power Grid

		Guangdong	Guangxi	Guizhou	Yunnan	Total	NCV	Emission factor(tc/TJ)	OXID	Co2 emissions(tCO2e)
Fuels	Units	A	B	C	D	E=A+…+D	F	G	H	I=E*F*G*H*44/12/100
Raw coal	Ten thousand ton	6696.47	1435	3212.31	1975.55	13319.33	20908 kJ/kg	25.80	1	263,442,602
Washed coal	Ten thousand ton	0	0	0	0.15	0.15	26344 kJ/kg	25.80	1	3,738
Other washed coal	Ten thousand ton	0	0	10.39	33.88	44.27	8363 kJ/kg	25.80	1	350,238
Coke	Ten thousand ton	4.79	0	0	8.05	12.84	28435 kJ/kg	25.80	1	345,390
Total of solid fuels										264,141,967
Crude oil	Ten thousand ton	10.91	0	0	0	10.91	41816 kJ/kg	20.00	1	334,556
Gasoline	Ten thousand ton	0.68	0	0	0	0.68	43070 kJ/kg	18.90	1	20,296
Coal oil	Ten thousand ton	0	0	0	0	0	43070 kJ/kg	19.60	1	0
Diesel	Ten thousand ton	31.96	2.02	0	1.81	35.79	42652 kJ/kg	20.20	1	1,130,639
Fuel oil	Ten thousand	887.21	0	0	0	887.21	41816 kJ/kg	21.10	1	28,702,703

	ton									
Other petroleum products	Ten thousand ton	1.7	0	0	0	1.7	38369 kJ/kg	20.00	1	47,833
Total of liquid fuels										30,236,028
Natural gas	Ten million M3	9.3	0	0	0	9.3	38931 kJ/m^3	15.30	1	203,115
Coke oven gas	Ten million M3	0	0	0	7.9	7.9	16726 kJ/m^3	12.10	1	58,624
Other gas	Ten million M3	18.7	0	0	159.6	178.3	5227 kJ/m^3	12.10	1	413,486
LPG	Ten thousand ton	0	0	0	0	0	50179 kJ/kg	17.20	1	0
Refinery gas	Ten thousand ton	4.92	0	0	0	4.92	46055 kJ/kg	18.20	1	151,211
Total of gas fuels										826,436
Total of solid, liquid and gas fuels										295,204,431

Data source: China Energy Statistical Yearbook 2006

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

Table A12. Emission factor of fuel-fired power plants

	Variable	Efficiency of electricity	Emission factor of the fuels	OXID	Emission factor(tCO_2e/MWh)

		supply (%)	(tc/TJ)		=3.6/J/1000*F*G*44/12
Coal-fired power plant	$EF_{Coal,Adv}$	35.82	25.8	1	0.9508
Gas-fired power plant	$EF_{Gas,Adv}$	47.67	15.3	1	0.4237
Oil-fired power plant	$EF_{Oil,Adv}$	47.67	21.1	1	0.584

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

Table A13. Installed capacity of South China Power Grid in 2003

	Units	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	27231.4	3190.1	3556.8	6465.8	40444.1
Hydropower	MW	8107.2	4525.2	6543.2	3713.7	25409.3
Nuclear power	MW	3780	0	0	0	3780
Wind power and others	MW	83.4	0	0	0	83.4
Total	MW	39202	7715.3	10100	10179.5	69716.8

Data source: China Electric Power Yearbook 2004

Table A14. Installed capacity of South China Power Grid in 2004

	Units	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	30172.9	4378.1	4306.9	7801.8	46659.7

Hydropower	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

Data source: China Electric Power Yearbook 2005

Table A15. Installed capacity of South China Power Grid in 2005

	Units	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	35182.6	4931.2	4758.4	9634.8	54507
Hydropower	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

Data source: China Electric Power Yearbook 2006

Table A16. Calculation of BM emission factor of South China Power Grid

	Installed capacity in 2003	Installed capacity in 2004	Installed capacity in 2005	Newly added installed capacity between 2003 and 2005	Share in newly added installed capacity
	A	B	C	D=C-A	
Thermal power	40444.1	46659.7	54507	14062.9	74.01%
Hydropower	25409.3	27580.1	30347.1	4937.8	25.99%
Nuclear power	3780	3780	3780	0	0.00%
Wind power	83.4	83.4	83.4	0	0.00%
Total	69716.8	78103.3	88717.5	19000.7	100.00%
Share in 2005 installed capacity	79.07%	89.26%	100%		

Data source: China Electric Power Yearbook 2004-2006

$EF_{BM,y}$=0.9117×74.01%=0.6748 tCO2e /MWh

EF_y = 0.5*1.0119+ 0.5*0.6748 = 0.84335 tCO2e/MWh

Annex 4

MONITORING INFORMATION

No additional information.