CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

Title: Yunnan Kegonghe 10MW Hydropower Project
Version number of the PDD: 01
Date: 11/08/2008

A.2. Description of the small-scale project activity:

The Yunnan Kegonghe 10MW Hydropower Project (hereafter referred to as "the Project"), developed by Xianggelila County Kangdong Limin Co., Ltd., is a small-scale run-of-river hydropower project in Yunnan Province in People's Republic of China. Total installed capacity of the Project is 10MW, annual operating hours of the Project is 5062h, expected annual output of the Project is 50,620MWh. A predicted power generation of 48,089 MWh is delivered to the South China Power Grid (SCPG) annually.

The purpose of the Project is to utilise the hydrological resources to generate electricity which would otherwise have been produced by fossil fuel-fired power plants in the SCPG. The Project is expected to reduce emissions of greenhouse gases by an estimated 42,323tCO_2e per year during the first crediting period.

The Project will help China fulfil its goals of promoting sustainable development. Specifically, the Project:

- Increases employment opportunities in the area where the Project is located
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from diesel and coal-supplied electricity generation
- Makes greater use of hydroelectric renewable energy generation resources for sustainable energy production
- Contributes to poverty alleviation through income and employment generation: the Project will employ people during the construction phase and throughout project operation.

A.3. Project participants:

Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
People's Republic of China (host)	Xianggelila County Kangdong Limin 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 small-scale project activity:

A.4.1.1. Host Party(ies):

P.R. China

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

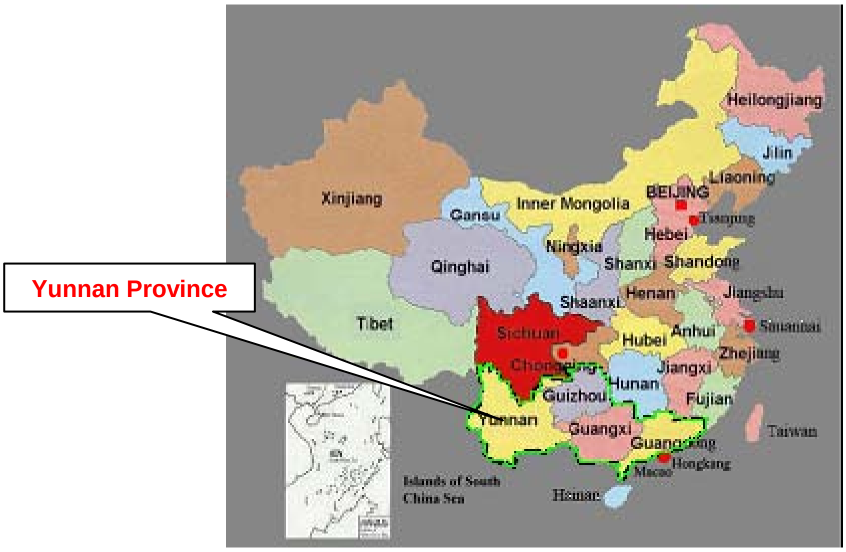
Diqing Zhou/Yunnan Province

A.4.1.3. City/Town/Community etc:

Tacheng Town/Wei Xi Li Su Zu Autonomous County

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity:

The project is located within the Tacheng Town of Wei Xi Li Su Zu Autonomous County, 52km from Wei Xi County, 103km from Xianggelila County, 724km from province capital Kunming. The geographical coordinates of the project site are east longitude 99°17′35″-99°19′24.3″and north latitude 27°32′18.8″-27°33′44.5″. The three maps below show location of the Project.



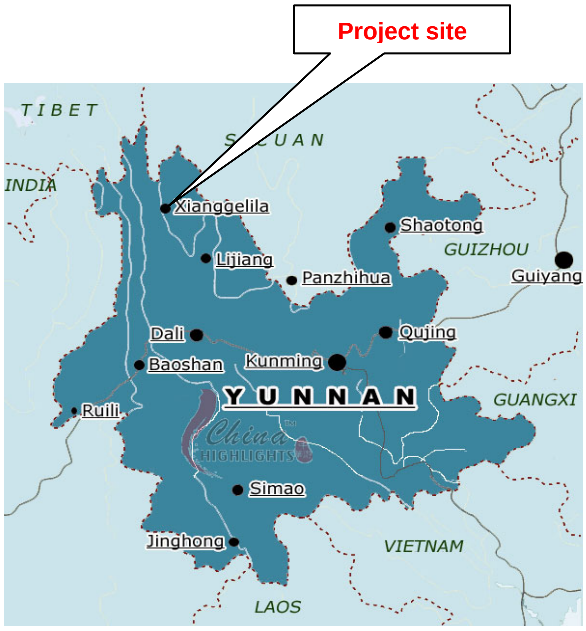


Fig.1 Location of Yunnan Province in China Map   Fig. 2 Location of project site in Yunnan Province

Figure 3 Location of project site in county map

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

According to Appendix B of the simplified procedures for small-scale activities, the type and category of the Project is as follows:

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 a total installed capacity of 10MW (5MW×2). Based on the Feasibility Study Report (FSR), the key components of the proposed project are as follows:

- Headwork mainly composed of one masonry gravity dams situated on Kegong River
- Intake water system including:
  - Intake water sluices incorporated in the gravity dams
  - The intake water channels consists of 1 channel with total length of 6,700 m
  - A pressure forebay, and
  - A penstock of 235.6 m long bifurcated into two branch pipes feeding the turbines downstream.
- Pivot structures mainly composed of a 10MW powerhouse, which consists of 2 sets of turbine-generator units with installed capacity of 5MW respectively, tail water tunnels, a substation, and county Road to facilitate the site transportation.

According to the Feasibility Study Report (FSR), the project capacity design depends on the hydrological limit therefore the installed capacity will remain under the limits of small-scale project activity types (15MW), not scale-up during every year of the crediting period.

The Project uses two units of HLD46-WJ-84 turbine and SFW5000-6/1730 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.

In terms of the connection power system, after the transformer substation the 110KV pipelines are adopted to connect to Yunnan Power Grid which is a part of SCPG.

Table A.1 Technical parameters of the turbines and generators

No.	Parameters	Specifications
1	**Turbines**	
	Model	HLD46-WJ-84
	Quantity	2 sets
	Rated capacity	5000kW
	Rated water head	142m
	Rotation speed	750r/min
	Rated water flow	3.83m^3/s
	Manufacturer	Liu Zhou Hydraulic Turbine Plant(http://www.lzsljc.com)
2	**Generators**	
	Model	SFW5000-6/1730
	Rated capacity	5000kW

	Quantity	2 sets
	Rated voltage	6.3kV
	Manufacturer	Liu Zhou Hydraulic Turbine Plant(http://www.lzsljc.com)

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

The Project chooses 7*3 renewable crediting periods. During the first crediting period, the annual emission reduction is estimated to be 42,323 tCO_2e.

Year	Annual estimation of emission reductions in tonnes of CO_2e
01/01/2009~31/12/2009	42,323
01/01/2010~31/12/2010	42,323
01/01/2011~31/12/2011	42,323
01/01/2012~31/12/2012	42,323
01/01/2013~31/12/2013	42,323
01/01/2014~31/12/2014	42,323
01/01/2015~31/12/2015	42,323
Total estimated reductions (tCO_2e)	296,261
Number of years in the first crediting period(year)	7
Annual emission reductions in the crediting period (tCO_2e)	42,323

A.4.4. Public funding of the small-scale project activity:

There is no public funding from Annex 1 countries involved in this small-scale project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to the *Compendium of guidance on the debundling for SSC project activities*, the project participants confirm that the Project is not a debundled component of a larger project activity. There is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants,
- In the same project category and technology/measure,
- Registered within the previous two years, and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The project participants confirm that there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity with the same project participants and whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

According to Appendix C to the Simplified Modalities and Procedures for Small-scale CDM Project Activities, the project is not a debundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Approved methodology for small-scale CDM project- "AMS-I.D. grid connected renewable electricity generation" (version 13).
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html
Tool to calculate the emission factor for an electricity system (version 01.1)
http://cdm.unfccc.int/methodologies/Tools/EB35_repan12_Tool_grid_emission.pdf

B.2 Justification of the choice of the Project category

1. The Project is a new hydropower plant with a total installed capacity of 10MW.
2. The Project is connected with the SCPG, which is dominated by fossil fuel generation.

Therefore, the methodology AMS-I.D. (version 13) is applicable to the Project.

B.3. Description of the Project boundary

Based on the methodology AMS-I.D. (version 13), the project boundary encompasses the physical, geographical site of the renewable generation source. The Project is connected to SCPG, which will substitute equivalent amount of electricity by thermal power plants of SCPG. Therefore, the project boundary can be identified as SCPG and the Project site. The spatial scope of the project boundary covers the Project site and all power plants connected physically into SCPG. As a regional grid, SCPG consists of four provincial sub-grids: Yunnan Grid, Guangdong Grid, Guangxi Grid and Guizhou Grid[1].

In addition, to satisfy the growing demand for electricity supply, SCPG also imports electricity from the fossil-fuel dominated power mix of Central China Power Grid (CCPG). These amounts of imports have been considered for OM and BM calculation.

B.4. Description of baseline and its development:

The project developer identified the potential substituted scenarios as follows:

Alternative a) The project activity not undertaken as CDM project activity

This alternative is in compliance with applicable Chinese laws and regulations and is not prevented by

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[1] *Notification on Determining Baseline Emission Factors of China Power Grid* issued by China's DNA on Dec15th, 2006 on http://cdm.ccchina.gov.cn.

any technical barriers. However, as demonstrated in Section B.5 below, the Project is not financially attractive. Therefore alternative a) is not a credible and realistic alternative.

Alternative b) Construction of a coal-fired power plant with equivalent annual electricity generation connected to the grid

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 10MW. 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 a credible and realistic alternative.

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

Among all the possible technology options of grid-connected renewable energy power project, only wind power and biomass power plant are technically feasible. The Project is located in mountainous area, north of Yunnan Province where the wind resource is scarce for power generation. Biomass power generation needs plenty of biomass material, which is short in the mountainous area where the Project is located. Therefore, alternative c) is not a credible and realistic alternative.

Alternative d) Get equivalent electricity supply from the SCPG

This alternative is permitted by the national and local laws and regulations, and there is no economic or technical obstacle to realize this scenario. As a conclusion of the above assessment, the only credible and realistic alternative to the Project and hence the baseline scenario is: Alternative d) – Get equivalent electricity supply from the SCPG.

Based on the methodology AMS.I.D (version 13), the baseline is the on-grid electricity kWh produced by the project activity multiplied by an emission coefficient (measured in kg CO_2e/kWh). The calculation of grid emission factors is provided in B6.

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 small-scale CDM project activity:

According to the Attachment A to Appendix B of the simplified modalities and procedures of small scale project activities, the proposed project is additional due to the barriers analyzed as follows:

The project's Feasibility Study Report (FSR) was completed in May, 2005. Around that time, The decision to develop the project as a CDM project activity was taken in board meeting on March, 15, 2006.

Investment barrier:

[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

This step is to determine whether the proposed project is financially unattractive or not and face tremendous financial and commercial barriers without the additional revenue from CDM. The investment analysis is conducted based on financial internal return rate (FIRR) as the financial indicator. According to Economic Evaluation Code for Small Hydropower Projects issued by the Ministry of Water Resources (Document No. SL16-95), the benchmark FIRR of small hydropower project is 10%. If the financial internal return rate (FIRR) of the proposed project is lower than 10%, the project can be considered financially unattractive.

Calculation and comparison:

The key financial parameters used for investment analysis are primarily obtained from the Feasibility Study Report (FSR) of the Project.

Table B-1 Key financial parameters used for investment analysis

Parameter	Value	Data source
Installed capacity (MW)	10 MW	FSR
Annual Power Generation(MW.h)	50620MWh	FSR
Project lifetime (years)	30 years	FSR
Fixed asset investment	RMB 50.18 million YUAN	FSR
Annual O&M cost	RMB 1.72 million YUAN	FSR
Income tax	33%	FSR
VAT	6%	FSR
Urban construction tax	3%	FSR
Education premium	2%	FSR
Expected Feed-in tariff(incl VAT)	RMB 0.140 Yuan/kWh	FSR
Expected CERs price	EUR 8.2/tCO_2e	ERPA

As is shown in table below, the FIRR of the proposed project is 6.84%, which is obviously lower than the benchmark 10%. Thus the proposed project is not financially attractive.

However, the extra income from CDM will improve the economic competitiveness of the Project if it is registered as a CDM project activity. The IRR (including expected CDM revenue) will be increased to 14.11% which is higher than the benchmark, making the Project financially feasible.

	Without CDM revenue	Benchmark	With CDM revenue
IRR	6. 84%	10%	14.11%

Sensitivity Analysis:

This step is to exam whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions.

The following four parameters are selected as the critical sensitivity indicators to check the financial attractiveness of the proposed project:

- Fixed asset investment
- Annual O&M cost
- Feed-in tariff (excl. VAT)
- Annual electricity output

Table B.2 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 a reasonable range commonly used for sensitivity analysis of construction projects in China.

Table B.2 Sensitivity analysis of total investment project IRR

	-10%	-5%	0%	5%	10%
Fixed asset Investment	7.85%	7.32%	6.84%	6.39%	5.97%
Annual O&M Cost	7.13%	6.98%	6.84%	6.69%	6.53%
Feed-in Tariff (excl. VAT)	5.82%	6.33%	6.84%	7.33%	7.81%
Annual electricity output	5.83%	6.34%	6.84%	7.32%	7.80%

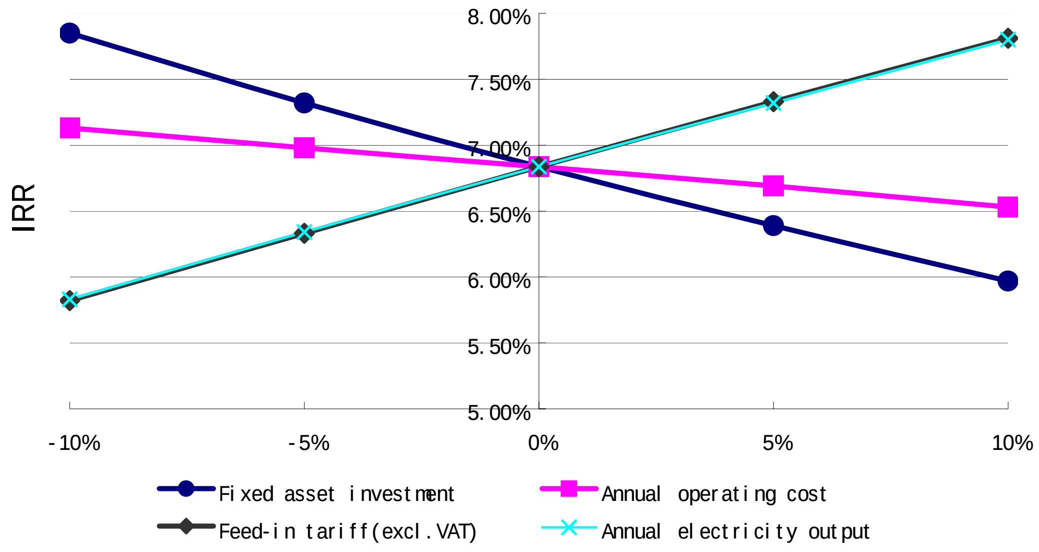

Figure B1 Sensitivity analysis of the Project

Figure B1 shows that even if the fixed asset investment declines by 10%, the IRR is only 7.85% which is still lower than the benchmark of 10%. If the annual O&M cost declines by 10%, the IRR is only 7.13%, still lower than the benchmark of 10%. Both assumptions are unrealistic as the price of equipments, raw materials and wage standard in China have been continued rising over the years. Therefore, the fixed asset investment and annual O&M cost would only increase rather than decrease.

If the feed-in tariff increases by 10%, the IRR is 7.81%. The Project is a small scale hydropower project and the project owner is a county-level small private company, it has very limited capacity to negotiate with the big power grid company for higher feed-in tariff. Large variation of annual electricity output is also impossible because it is calculated based on long-term hydrological parameters. Further, even if the feed-in tariff or annual electricity output rise by 10%, the IRR is still below the benchmark of 10%.

Therefore, it is robust to conclude that the project is financially unattractive without the CERs revenues. The project thus faces significant financial barriers without CDM support. On the other hand, the total investment project IRR would increase to 14.11% when CERs revenues are taken into account. It is evident that the benefits from the CDM help to reduce financial barriers, making the project attractive to investors.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the methodology, emission reductions (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:

$$ER_y = BE_y - PE_y - L_y \quad (1)$$

1. Calculation of baseline emissions (BE_y)

According to methodology AMS-I.D. (version 13), the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the ‘Tool to calculate the emission factor for an electricity system’(version 01.1).

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

For the Project, method (a) is adopted to calculate the combined margin emission factor.

The emission factors are determined according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system” (version 01.1) as following six steps:

Step 1. Identify the relevant electric power system

Using the boundary definitions of the Chinese DNA, the spatial extent of the project boundary for the displacement of electricity generation includes the Project site and all power plants physically connected to the SCPG. SCPG is defined as the Project electricity system, which consists of provincial electricity systems including Guangdong, Guangxi, Guizhou and Yunnan province that can be dispatched without significant transmission constraints.

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[3] constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. According to the data from *China Electric Power Yearbook* 2003-2007, the share of the low-cost/must run resources in the SCPG are 32.98%(2002), 30.59%(2003), 29.71%(2004), 30.94%(2005)and 27.01%(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 ($EF_{grid,OMsimple,y}$):

[3] 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[4] (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

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{co_2,i,y}}{EG_y} \qquad (2)$$

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 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)[5]

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

[4] 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.

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

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 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 *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

The Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the Project is calculated on the basis of the fuel consumption data for electricity generation of the SCPG during 2004-2006, 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 SCPG is calculated as the weighted average of OM factors during the three years, which is at 1.0634 tCO_2e/MWh. The detailed calculations and data are listed in Annex 3(the baseline emission factor OM refers to the *2008 Baseline Emission Factors for Regional Power Grids in China* published by Chinese DNA on *18/07/2008* (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf)

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[6]:

(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[7].

Since the set of power units described as (b) in SCPG comprises the larger annual generation than that of (a), the sample group (b) should be used for calculating the build margin of SCPG. 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 SCPG. 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***

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[6] 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.

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

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

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

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

However, a direct application of this approach is difficult in China, as data on either the five power plants that have been built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation are classified as business confidential and are not publicly available. As the data required cannot be obtained in China, the EB has provided guidance and allowed for deviation with respect of similar situations occurred in applying methodologies AMS-I.D and AM0005[8]. The same guidance and allowed deviations have been eventually applied by many CDM projects using methodology ACM0002/AMS-I.D. registered by the UNFCCC. The following deviation has been indicated by the EB:

a. Use of capacity addition during last several years as basis for determining the build margin, i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity.

b. Use of weights estimated using installed capacity in place of annual electricity generation

EB also suggests using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.

The calculations of build margin emission factor are derived from *2008 Baseline Emission Factors for Regional Power Grids in China* published by Chinese DNA on 18/07/2008.

First we calculated the newly–added installed capacity and the share of each power generation technology in the total capacity.

Second, the weights of newly-added installed capacity for each power generation technology have been calculated. Since the exact data are aggregated and is not possible to distinguish among the different

[8] http://cdm.unfccc.int/Projects/Deviations

thermal power generation technology capacities (e.g. coal, oil, gas, etc), the calculation applied the following method: calculation of shares of CO_2 emissions from solid fuel, liquid fuel and gas fuel in total emissions respectively by using the latest energy balance data available; the calculated shares are the weights. Shares of CO_2 emissions from solid fuel, liquid fuel and gas fuel in total emissions are calculated using the below formulas:

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

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

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

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 is solid, liquid and gas fuels respectively.

Third, the Emission Factor for thermal power generation is calculated by multiplying the emission factor for advanced efficient technology by the weights calculated above.

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

Where:

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

A coal-fired power plant with a total installed capacity of 600 MW is assumed to be the commercially available best technology in terms of efficiency. The estimated coal consumption of such a national sub-critical power station with a capacity of 600 MW is 329.94gce/kWh, which corresponds to an efficiency of 37.28% for electricity generation.

For gas and oil power plants, a 200MW combined cycle power plant with a specific fuel consumption of 252gce/kWh, which corresponds to an efficiency of 48.81% for electricity generation, is selected as commercially available best technology in terms of efficiency.

Fourth, the build margin emission factor of the power grid was calculated by multiplying the emission factor of the thermal power with the share of the thermal power in 20% of the newly-added capacity of the power grid.

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

Where ,

CAP_{Total} *is the* total capacity addition, and $CAP_{Thermal}$ is the total thermal power capacity addition.

Following the four steps above, the build margin emission factor $EF_{grid,BM,y}$ of the SCPG is calculated to be 0.6968 tCO_2/MWh. The detailed calculations and data are listed in the Annex 3.

Step6. Calculate the combined margin emission factor

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

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

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

$EF_{grid,OMsimple,y}$ = 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 and for subsequent crediting periods.

2. Project emissions (PE_y)

As a run-of-river hydropower project, the project emission is zero. Therefore, 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)

According to Equation(1) and results of baseline emissions, project emissions and leakage calculations above, the emission reductions of the Project are equal to the baseline emissions, that is:

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

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（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 SCPG 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 SCPG
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 SCPG 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:	*2008 Baseline Emission Factors for Regional Power Grids in China* published by Chinese DNA on 18/07/2008
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:	

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

$EF_y = EF_{OM,y} * w_{OM} + EF_{BM,y} * w_{BM} = EF_y = 1.0634*0.5+0.6968*0.5=0.8801$ (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 =48,089 MWh

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

$BE_y = EG_y \times EF_y$ = 48,089 MWh * 0.8801 tCO_2e/MWh = 42,323 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

$ER_y = BE_y - PE_y - L_y = BE_y$ =42,323 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)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
01/01/2009~31/12/2009	0	42,323	0	42,323
01/01/2010~31/12/2010	0	42,323	0	42,323
01/01/2011~31/12/2011	0	42,323	0	42,323
01/01/2012~31/12/2012	0	42,323	0	42,323
01/01/2013~31/12/2013	0	42,323	0	42,323
01/01/2014~31/12/2014	0	42,323	0	42,323
01/01/2015~31/12/2015	0	42,323	0	42,323
Total(tCO_2e)	0	296,261	0	296,261

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{grid-in, y}$
Data unit:	MWh
Description:	Electricity delivered to grid by the Project in year y
Source of data to be used:	Annual on-grid electricity supplied to SCPG by the proposed project.
Value of data:	48,089MWh
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 periodically. Data measured by meters will be cross checked by electricity sales receipts. The plant manager will hold the overall responsibility for it.
Any comment:	

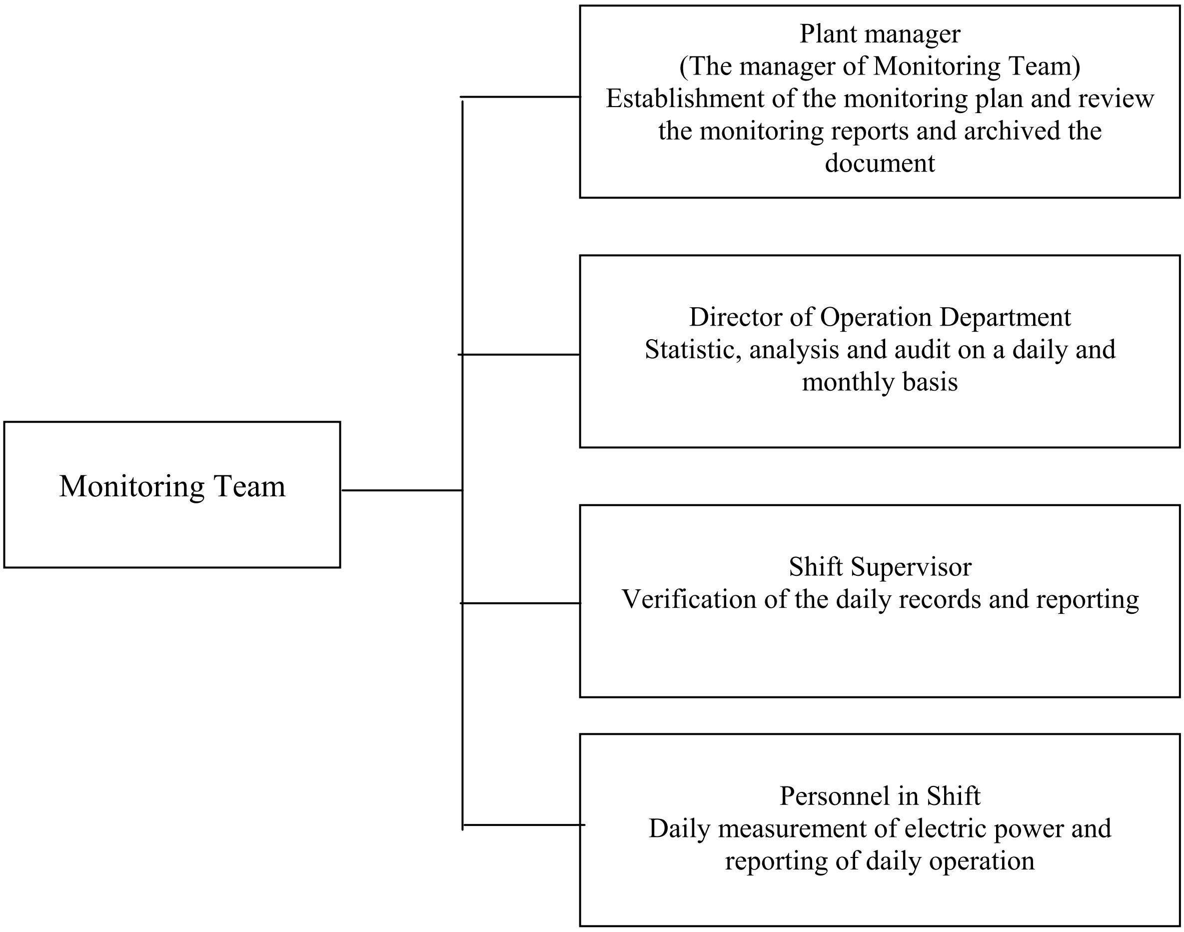
Data / Parameter:	$EG_{grid-out, y}$
Data unit:	MWh
Description:	Electricity purchased from the grid in year y for the consumption of the Project
Source of data to be used:	Annual on-grid electricity purchased from SCPG by the proposed project for the plant operation.
Value of data:	0
Description of 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 periodically. Data measured by meters will be cross checked by electricity sales receipts. The plant manager will hold the overall responsibility for it.
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.

OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING
The project owner has assigned a Monitoring Team to carry out the whole monitoring process as the diagram below.



The plant manager will establish the monitoring plan, and hold the overall responsibility for the whole process. The first step is the measurement of daily electrical energy supplied to the grid and reporting of daily operation, which will be conducted by personnel in shift. Secondly, the shift supervisor will verify the daily measurement and operation report. Then, the data and report will be submitted to the director of operation department who will be responsible for statistic analysis and audit of the daily and monthly 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, equipment defects, and etc. Finally, the plant manager will review the monitoring reports.

Monitoring Plan

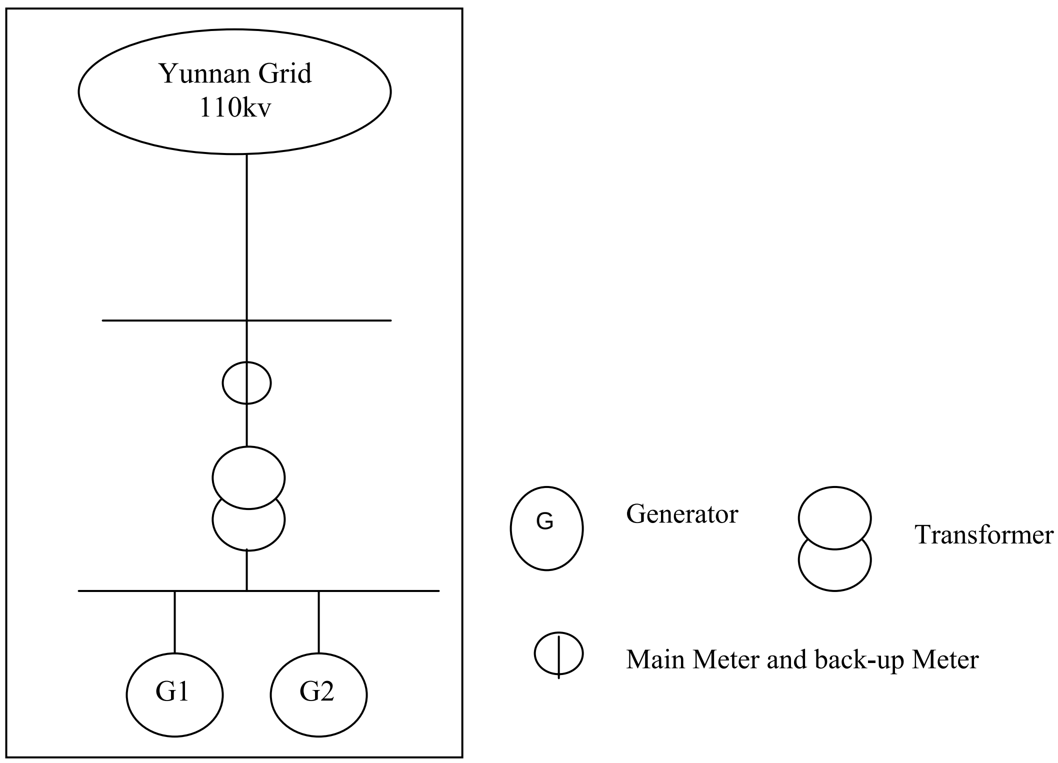
Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

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

2. Installation of meters

Output electricity connected into the grid ($EG_{grid\text{-}in}$) will be measured by both a main meter and a back-up meter installed at the outlet of the transformer substation of the hydropower station. 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. Another meter is installed on the side of the hydropower station to measure electricity imported from the grid ($EG_{grid\text{-}out}$). The net electricity delivered to the grid will be calculated as the difference of $EG_{grid\text{-}in}$ and $EG_{grid\text{-}out}$.

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.



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 a particular day of every month. Then, Grid company supplies reading cards 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 cards and copies of sales receipts to DOE for verification.

Should any previous months reading of the main meter be inaccurate by more than 0.5% of full-scale rating, or otherwise functioned improperly, the grid-connected electricity generated by the proposed project shall be determined 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

All 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. And all the meters shall be calibrated specified as follows:

- The metering equipments installed are calibrated annually
- All the meters installed shall be tested by a qualified 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.

Calibration is carried out by qualified parties with the records being supplied to the project owner, and these records will be preserved and maintained both by the project owner and the qualified parties. The metering equipment shall have sufficient accuracy so that any error resulting from such equipment shall not exceed 0.5% of full-scale rating.

Problem occurred in monitoring and measurement process will be recorded and the corrective resolution will be done as soon as possible and to avoid it occur again in future.

5. 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, 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.

6. Data management system

All data collected as part of monitoring will be archived electronically. All information will be stored by the plant manager and material will have a physical copy for backup every month. 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.

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 date of completing the baseline study and monitoring methodology is 11/08/2008.

Person responsible for the application of the baseline and monitoring methodology to the project is: Wang xiaoli, He xugang, Zhengli

E-mail: wxl61km@126.com, hxg69@163.com，zl79@live.cn , TEL: +086-871-3112542，

13577027272/13577025792/13608809660

They are not the project participants.

SECTION C. Duration of the Project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

08/05/2006

C.1.2. Expected operational lifetime of the small-scale project activity:

30 years

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

C.2.1. Renewable crediting period:

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

01/01/2009 or the date of registration by the UNFCCC whichever is later.

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

N/A

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Environmental impacts:

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the Project activity:

A complete Environmental Impact Assessment (EIA) for the Project was approved by the Diqing Environmental Protection Bureau on 15/06/2005. The findings of the environmental impacts and remedy measures required to be made are summarized as follows:

Land Use

Measures of monitoring and supervising are taken to protect the land from soil erosion problem during construction period. Considering the disturbance of grassland, construction area and transportation routes are strictly managed to avoid breakage of ecological environment. And the waste soil produced during construction period are used for backfilling, while solid wastes are collected regularly and transported into the designated dumping site. After the Project construction is completed, the land in the project management site and temporary construction site will be restored and rehabilitated with trees and vegetation. Land use will be conducted in compliance with the notice about the Standard of Hydropower compensation for the land removal by Diqing government[2003-23].

Noise

The noise pollution in construction is mainly resulted from machines and vehicles. As the nearest villages are 1km far from the Project site, the noise will have little impact to local inhabitants. Noise pollution mainly affects the construction workers. In order to keep the local residents and the working personnel from being disturbed, some noise mitigation methods will be conducted in compliance with Standard of Noise at boundary of industrial enterprises (GB12523-90) I such as select the turbines and the generators with low noise, install the machine inside etc.

Wastewater and Sewage

Waste water disposal facility has been built to reduce the negative impacts to the river. All the wastewater and sewage will be processed by using deposition system. The supernatant liquor will be drain to the river, and the deposition will transport to designated dumping site. This is in line with the requirement of Integrated Wastewater Discharge Standard of the People’s Republic Of China（GB8978- 1996）II.

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.

Dust and Air Quality

The air pollution during the construction mainly comes from flying dust produced by excavating land and transportation vehicles, and some exhaust discharge from using and moving construction machinery. In order to protect the atmosphere environment, some alleviation measures will be taken according to Ambient Air Quality Standard （GB16297－1996）II. The remedy measures include a) installing a showering system to dampen and control dust, b) setting the time limit for the project construction, c) increasing the humidity of the operation area and d) labour protection and other appropriate measures taken to reduce the negative impact on the dust and air quality.

Ecological environment

Based on the Law of the People's Republic of China on the Protection of Wildlife and Regulations of the People’s Republic of China on Wild Plants Protection, there are no rare, threatened and endangered plants, animals and fishes around the project site. The flooding area is very small and there is no relocation of inhabitants involved.

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 Diqing Environmental Protection Bureau, the impact on the environment is not significant.

SECTION E. Stakeholders' comments:

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

To take the opinions of local stakeholders into account, a survey was conducted in August, 2006. Representatives from several villages around the project site, including different age, gender, education level and occupation (details see table E.1) were selected to participate in the survey. 30 questionnaires were distributed by village cadres, upon the request of the project developer. After being well informed of the project situation, all the participants filled out the survey and returned them to village cadres.

Table E.1 Statistic information of the stakeholders participating in the survey

Item	Sub-item	Number	Percentage
Age	18-30	4	13.3%
	31-50	23	76.7%
	>51	3	10%
Gender	Male	28	93.3%
	Female	2	6.7%
Education level	Elementary school	10	33.3%
	Junior high school	4	13.3%
	Senior high school	7	23.3%
	Technical secondary school above	9	30%
Occupation	Farmers	17	56.7%
	Teachers	4	13.3%
	Cadres	9	30%

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?

E.2. Summary of the comments received:

The survey shows that the Project receives strong support from local people. 100% of the respondents believe that the overall influence for the construction and implementation of the Project is positive and 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, 20% of the respondents are concerned with noise pollution during the construction period. Other issues concerned are local ecological environmental degradation such as waste (10%) and soil erosion (10%). However, as the EIA 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. No other comments and suggestions were received.

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 pay close attention to the concerns 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:	Xianggelila County Kangdong Limin Co. Ltd.
Street/P.O.Box:	Gesang Yunhai Hotel Jingmin Road Xianggelila County
Building:	
City:	Weixi Town
State/Region:	Yunnan Province
Postfix/ZIP:	674600
Country:	P. R. China
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FAX:	0887-8224088
E-Mail:	
Represented by:	Wang dui
Title:	Chairman
Salutation:	Legal Representative
Last Name:	Wang
Middle Name:	
First Name:	Dui
Department:	
Mobile:	
Direct FAX:	0887-8224088
Direct Tel:	0887-8224088
Personal E-Mail:	

Buyer:

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State/Region:	Tokyo
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FAX:	+81-3-5405-7708
E-Mail:	kentaro.kato@mitsubishicorp.com
URL:	http://www.mitsubishicorp.com/en/
Represented by:	
Title:	Manager
Salutation:	Mr.
Last Name:	Kentato
Middle Name:	
First Name:	Kato
Department:	Emissions Reduction Business Unit
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I parties involved in the 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	188429000	5.27	178,498,792
Guangxi	27967000	4.45	26,722,469
Guizhou	76039000	6.06	71,431,037
Yunnan	39791000	4.12	38,151,611
Total			314,803,908

Data source: China Electric Power 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	6017.7	1305	2643.9	1751.28	**11717.88**
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	**11717.88**	25.8	100	20908	231767573.55
Washed coal	10^4t	**0.21**	25.8	100	26344	5233.50
Other washed coal	10^4t	**0**	25.8	100	8363	0.00
Coke	10^4t	**0**	29.2	100	28435	0.00
Coke oven gas	$10^8 M^3$	**0**	12.1	100	16726	0.00
Other gas	$10^8 M^3$	**2.58**	12.1	100	5227	59831.38
Crude oil	10^4t	**16.89**	20	100	41816	517932.98
Gasoline	10^4t	**0**	18.9	100	43070	0.00
Diesel	10^4t	**50.71**	20.2	100	42652	1601975.28
Fuel oil	10^4t	**957.71**	21.1	100	41816	30983494.25
LPG	10^4t	**0**	17.2	100	50179	0.00
Refinery gas	10^4t	**2.86**	15.7	100	46055	87899.34
Natural gas	$10^8 M^3$	**0.48**	15.3	100	38931	104833.40
Other petroleum products	10^4t	**1.66**	20	100	38369	46707.86
Other coking products	10^4t	**0**	25.8	100	28435	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	6696.47	1435	3212.31	1975.55	**13319.33**
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	**13319.33**	25.8	100	20908	263,442,602
Washed coal	10^4t	**0.15**	25.8	100	26344	3,738
Other washed coal	10^4t	**44.27**	25.8	100	8363	350,238
Coke	10^4t	**12.84**	29.2	100	28435	390,906
Coke oven gas	10^8 M^3	**0.79**	12.1	100	16726	58,624
Other gas	10^8 M^3	**17.83**	12.1	100	5227	413,486
Crude oil	10^4t	**10.91**	20	100	41816	334,556
Gasoline	10^4t	**0.68**	18.9	100	43070	20,296
Diesel	10^4t	**35.79**	20.2	100	42652	1,130,639
Fuel oil	10^4t	**887.21**	21.1	100	41816	28,702,703
LPG	10^4t	**0**	17.2	100	50179	0
Refinery gas	10^4t	**4.92**	15.7	100	46055	130,441
Natural gas	10^8 M^3	**0.93**	15.3	100	38931	203,115
Other petroleum products	10^4t	**1.7**	20	100	38369	47,833
Other coking products	10^4t	**0**	25.8	100	28435	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	7303.19	1490.01	4001.54	2735.88	**15530.62**
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					
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	**15530.62**	25.8	100	20908	307,179,636
Washed coal	10^4t	**0**	25.8	100	26344	0
Other washed coal	10^4t	**65.33**	25.8	100	8363	516,852
Coal briquette	10^4t	**133.75**	26.6	100	20908	2,727,466
Coke	10^4t	**1.31**	29.2	100	28435	39,882
Coke oven gas	10^8 M^3	**2.9**	12.1	100	16726	215,202
Other gas	10^8 M^3	**20.04**	12.1	100	5227	464,737
Crude oil	10^4t	**0.87**	20	100	41816	26,679
Gasoline	10^4t	**0**	18.9	100	43070	0
Diesel	10^4t	**34.18**	20.2	100	42652	1,079,777
Fuel oil	10^4t	**685.94**	21.1	100	41816	22,191,288
LPG	10^4t	**0**	17.2	100	50179	0
Refinery gas	10^4t	**0**	15.7	100	46055	0
Natural gas	10^8 M^3	**7.92**	15.3	100	38931	1,729,751
Other petroleum products	10^4t	**0.67**	20	100	38369	18,852
Other coking products	10^4t	**0**	25.8	100	28435	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	7303.19	1490.01	4001.54	2735.88	15530.62	20908	25.8	1	307,179,636
Washed coal	10^4t	0	0	0	0	0	26344	25.8	1	0
Other washed coal	10^4t	0	0	19.53	45.8	65.33	8363	25.8	1	516,852
Coal briquette	10^4t	133.75	0	0	0	133.75	20908	26.6	1	2,727,466
Coke	10^4t	0	0	0	1.31	1.31	28435	29.2	1	39,882
Total of solid fuels										**310,463,836**
Crude oil	10^4t	0.87	0	0	0	0.87	41816	20	1	26,679
Gasoline	10^4t	0	0	0	0	0	43070	18.9	1	0
Coal oil	10^4t	0	0	0	0	0	43070	19.6	1	0
Diesel	10^4t	29.92	1.26	0	3	34.18	42652	20.2	1	1,079,777
Fuel oil	10^4t	685.85	0.09	0	0	685.94	41816	21.1	1	22,191,288
Other petroleum products	10^4t	0.67	0	0	0	0.67	38369	20	1	18,852
Total of liquid fuels										**23,316,596**
Natural gas	10^7m^3	79.2	0	0	0	79.2	38931	15.3	1	1,729,751
Coke oven gas	10^7m^3	0	8.4	0	20.6	29	16726	12.1	1	215,202
Other gas	10^7m^3	8.9	0	0	191.5	200.4	5227	12.1	1	464,737
LPG	10^4t	0	0	0	0	0	50179	17.2	1	0
Refinery gas	10^4t	0	0	0	0	0	46055	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%， $\lambda_{Gas,y}$ =0.71%

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	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 A14. Installed capacity of SCPG 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 A15. Installed capacity of SCPG in 2006

	Units	Guangdong	Guangxi	Yunnan	Guizhou	Total
Thermal power	MW	40615	5434	8564	14350	68963
Hydropower	MW	9320	7624	9698	7534	34176
Nuclear power	MW	3780	0	0	0	3780
Wind power and others	MW	183	0	0	0	183
Total	MW	53898	13058	18262	21884	107102

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	46659.7	54507	68963	14456	78.63%
Hydropower	27580.1	30347.1	34176	3828.9	20.83%
Nuclear power	3780	3780	3780	0	0.00%
Wind power	83.4	83.4	183	99.6	0.54%
Total	78103.3	88717.5	107102	18384.5	**100.00%**
Share in 2006 installed capacity	72.92%	82.83%	100%		

Data source: China Electric Power Yearbook 2005-2007

$EF_{BM,y}$= 0.8862×78.63%=0.6968tCO_2e /MWh

EF_y = 0.5*1.0634+ 0.5*0.6968 = 0.8801 tCO_2e/MWh

Annex 4

See B.7.1 for details. No additional information.