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

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

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

Project: Nanzhahe Cascade Hydropower Project
Vision: 03
Date: 10/01/2008

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

Nanzhahe Cascade Hydropower Project (hereafter refers to as the Project) is located in Zhenkang County, Lincang City, Yunan Province, PR China. The total installed capacity of the Project is 10.4MW and it will provide 40GWh generated electricity to the grid every year. The Project includes 2 hydropower plants as follows:

- The 1st level hydropower plant is a diversion run-of-river hydropower station with installed capacity 6.4 MW(2*3.2MW), max dam height 12m, 24.22GWh generated electricity, via two 35KV outlet circuits, will be delivered to Zhenkang local grid and finally connected to China Southern Power Grid. The reservoir area of 1st plant is 600m^2, the power density is 10667W/m^2. Since this run-of-river plant results a very small reservoir, the power density is much high than 10W/m^2.

- The 2nd level hydropower plant is a diversion run-of-river hydropower station with installed capacity 4 MW(2*2MW), max dam height 8m, 15.78GWh generated electricity, via two 35KV outlet circuits, will be delivered to Zhenkang local grid and finally connected to China Southern Power Grid. The reservoir area of 2nd plant is 334m^2, the power density is 11976W/m^2. Since this run-of-river plant results a very small reservoir, the power density is much high than 10W/m^2.

The China Southern Power Grid gives priority to fossil fuel fired power plants, the proposed project will achieve greenhouse gas (GHG) emission reductions by avoiding CO_2 emissions from the business-as-usual scenario electricity generation of those fossil fuel-fired power plants connected into the China Southern Power Grid. The average annual emission reductions of the proposed project are estimated to be 33,734tCO_2e.

As a renewable energy project, the main propose of the Project is to generate electricity through hydro power, it will serve the economy development of Zhenkang County and West Development through providing electrical energy. The Project will contribute to local, host country and global sustainable development as following aspects:

- Providing clean electrical energy, mitigating the severe shortage of local electricity supply.
- Being consistent with China's national policy and the Western Development Strategy.

- Reducing greenhouse gas (GHG) and other pollutants emissions compared to business-as-usual scenario, protect the environment.
- Conducing to develop local tourism and mining, increase finance revenues, promote local economy development.
- Providing more than 60 job positions for the regions during the project operation period.

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)
P.R.China	Yongzhou Zhongxin Hydropower Development Co., Ltd.	No
Sweden	Standard Bank Plc.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

More detailed contact information of the Project Participants is provided in 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):

The People's Republic of China

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

Yunnan Province

A.4.1.3. City/Town/Community etc:

Zhenkang County, Lincang City

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

The Project is sited on the Nanzhahe River within Zhenkang County, Lincang City, Yunnan Province, PR China, the 1st level hydropower plant is sited on the midstream of Nanzhahe River

and the 2nd hydropower plant is sited on the downstream of Nanzhahe River. The Project geographic coordinate is 23° 47′ 58″ N and 99° 21′ 02″ E for 1st level, 23° 46′ 08″ N and 99° 22′ 08″ E for 2nd level, 3km between these two hydropower plants. The Project is 170km to Zhenkang County. Detailed physical location follows as Fig. 1.

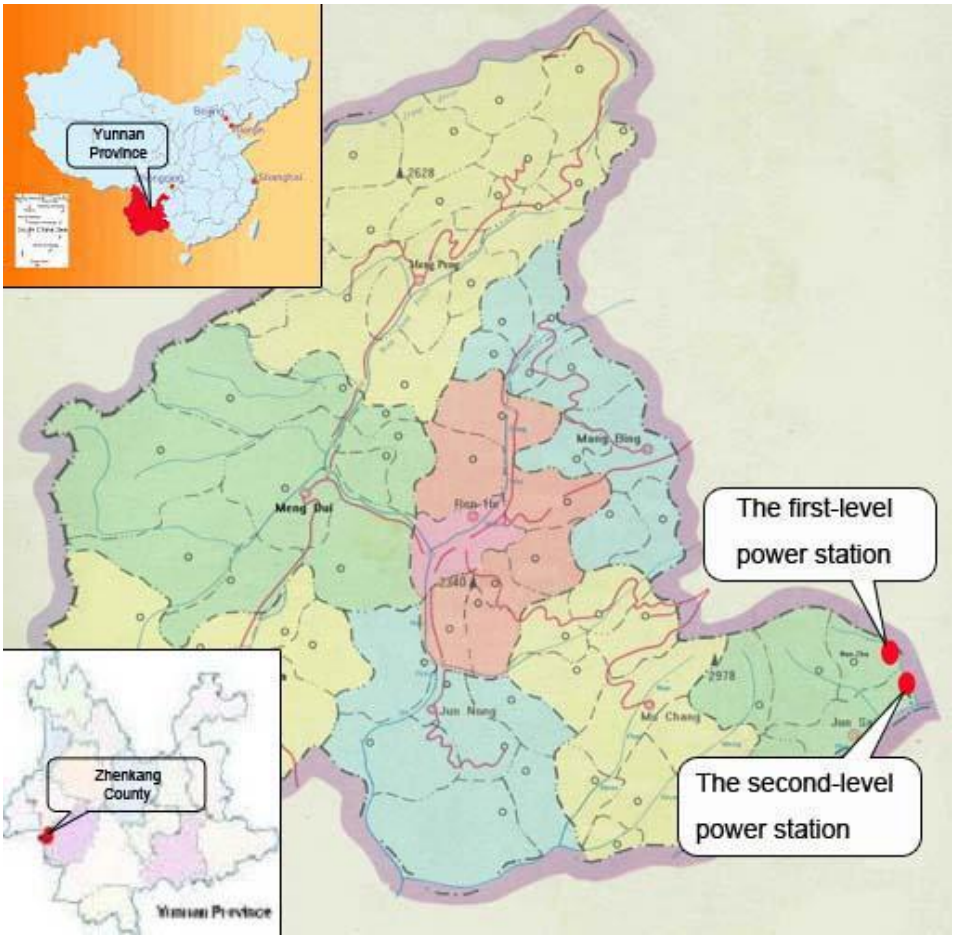

Fig. 1 Location of the Project

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

Using the categorization of Appendix B to the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*, the Project type and category are defined as follows:

Type I: Renewable energy projects
Category I.D.: Renewable Energy Generation for a Grid
Sub-category: Hydro

- The 1st level hydropower plant is a diversion run-of-river hydropower station, two sets of pelton turbine and associated 3.2MW generator will be installed in this plant.
- The 2nd level hydropower plant is a diversion run-of-river hydropower station, two sets of francis turbine and associated 2MW generator will be installed in this plant.

The developer (project owner) is Yongzhou Zhongxin Hydropower Development Co., Ltd. The manufacturer is Yunan Yuxi Hydropower Equipment Works for 1st level station; Zhejiang Jinhua Turbine Works for 2nd level station. The constructor is just local builder.

All main equipments in the Project are domestically produced, The Project involves no technology and installations from abroad. The type and parameter of turbines and generators are listed in Table 1 as follows:

Table 1 Main Equipment type and parameter

Parameter	**Turbine（the 1st Level Plant）**	**Turbine（the 2nd Level Plant）**
Turbine Type	CJA237-W-105/2*10	HLD54-WJ-71
Quantity	2	2
Rated water head	360m	160m
Rated flow	1.14 m^3/s	1.6m^3/s
Rated efficiency	90%	92%
Generator Type	SFW3200-8/1730	SFW2000-6/1430
Quantity	2	2
Rated power	3.2MW	2MW
Rated voltage	6.3kV	6.3kV

The time schedule of the Project is presented as follows:

The 1st level station	**The 2nd level station**
Oct. 2005 – Construction start	Oct. 2004 – Construction start
May 2007 – Main equipment installation	Apr. 2006 – Main equipment installation
*Nov. 2007 – Test operation**	Aug. 2006 – Test operation
*Dec. 2007 – Operation**	Nov. 2006 – Operation

*Estimate time

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

The renewable crediting period will be applied in the Project, it is expected that the Project activity will achieve about 33,734**tCO_2e** emission reduction per year during the first 7-year crediting period from April 2008 to March 2015.

Years	Annual estimation of emission reductions in tonnes of CO_2e
01/04/2008-31/03/2009	33,734
01/04/2009-31/03/2010	33,734
01/04/2010-31/03/2011	33,734
01/04/2011-31/03/2012	33,734
01/04/2012-31/03/2013	33,734
01/04/2013-31/03/2014	33,734
01/04/2014-31/03/2015	33,734
Total estimated reductions (tonnes of CO_2e)	**236,138**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**33,734**

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

There is no public funding from Annex I parties for this Project.

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

According to *"the Simplified Modalities and Procedures for Small-scale CDM Project Activities, Attachment C*[1]*"*, the project participants confirm that no project with same type and technology, whose boundary is within 1 kilometer of the proposed small-scale activity at the closest point, has been registered or is applying to register CDM project by same project owner. So the Project is not a debundled component of a larger project activity.

[1] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

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:

AMS-I.D. ver 10 – *"Grid connected renewable electricity generation*. For more information, please refer to: *http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html*

ACM0002 ver 6 – *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"*. For more information, please refer to: *http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html*

B.2 Justification of the choice of the project category:

The methodology AMS-I.D. is applicable to renewable energy generation units that supply electricity to an electricity grid which is the case for the Project. Moreover, the size of the Project is 10.4 MW, which is not exceed the limit of 15 MW stipulated for the chosen methodology. Therefore, the methodology AMS-I.D. is applicable to the Project.

B.3. Description of the project boundary:

Based on the methodology AMS-I.D., the Project boundary covers physical, geographic site of this renewable generation source and those fossil fuel-fired power plants physically connected into the China Southern Power Grid.

According to the last *Notification on Determining Baseline Emission Factor of China's Grid* which is provided by Chinese DNA, the China Southern Power Grid is composed of Guangdong Power Grid, Guangxi Power Grid, Yunnan Power Grid and Guizhou Power Grid.

B.4. Description of baseline and its development:

The baseline of the Project is determined based on Appendix B the methodology AMS.I.D.: *the Simplified Modalities and Procedures for Small-scale CDM Project Activities*. The baseline scenario emission is power supply to the grid multiplied by the emission factor of the grid. The calculation of grid emission factor 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:

Since the Project faced investment barrier (analysed as following), the project owner, Yongzhou Zhongxin Hydropower Development Co., Ltd., considered CDM seriously before project start. The Board Resolution of CDM implementation has been made and signed by all board members at 16/09/2004[2]. The earliest construction date of 2nd level station is Oct. 2004.

Based on the requirement of Attachment A of Appendix B: the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*. Additionality of the Project is demonstrated by investment barrier analysis.

Investment analysis

(1) Benchmark analysis

According to the *Economic Evaluation Code for Small Hydropower Projects* (SL16-95), the financial benchmark rate of return adopted by the proposed is 10% for the Internal Rate of Return (IRR) of total investment. It is not considered the Project is financially attractive if the project IRR without additional revenue is lower than 10% (benchmark IRR).

(2) Calculation and Comparison of Financial Indicators

According to the *Feasibility Study*, the basic parameters for calculation of financial indicators of the Project are listed in Table 2 as follows:

Table 2 Financial parameters of the Project

Parameter	1st level plant	2nd level plant
Installed capacity	6.4MW	4MW
Estimated annual output	24.22GWh	15.78GWh
Project lifetime	26 years	26years
Total investment	25.64 million RMB(including electrical investment)	18.25 million RMB(including electrical investment)
Expected bus-bar tariff	0.2 RMB/kWh(including VAT)	0.2 RMB/kWh(including VAT)
Annual O&M cost	1.46 million RMB	0.97 million RMB
Value added tax rate	6%	6%

[2] The original decision paper has been offered to DOE for validation.

Income tax rate[3]	33%	33%
Expense for city maintenance and construction	5%	5%
Education fee addition	3%	3%
CER price	EURO8/tCO_2e[4]	

Based on the data above, without CERs revenue, the IRR of total investment of the 1st level plant is 8.24%, the IRR of total investment of the 2nd level plant is 7.35%, which are lower than benchmark 10%. Therefore, the Project activity is not a financially attractive project.

(3) Sensitivity analysis

For the project, the following financial parameters were taken as uncertain factors for sensitivity analysis of financial attractiveness:

- Total investment
- Annual O&M cost
- Annual output

Assuming the above three indicators varied in the range of -10%-+10%, the IRR varieties of the 1st plant are shown in Table 3 and Figure 2.

Table 3. IRR of total investment sensitivity analysis of the 1st plant
(Without CERs revenues)

Range / Parameter	-10%	0	+10%
Total investment (%)	9.47	8.24	7.21
Annual O&M cost (%)	8.75	8.24	7.74
Annual output (%)	6.68	8.24	9.77

[3] The Project has been implemented *the State Administration of Taxation (2002) No.47 Document*. The income tax rate of the 1st and the 2nd years in operating duration are 0%, the 3rd to 5th years are 16.5%, other years are 33%.

[4] This Price is come from Emission Reduction Purchase Agreement which signed by project participants in A.3. The page of price has been delivered to DOE for validation.

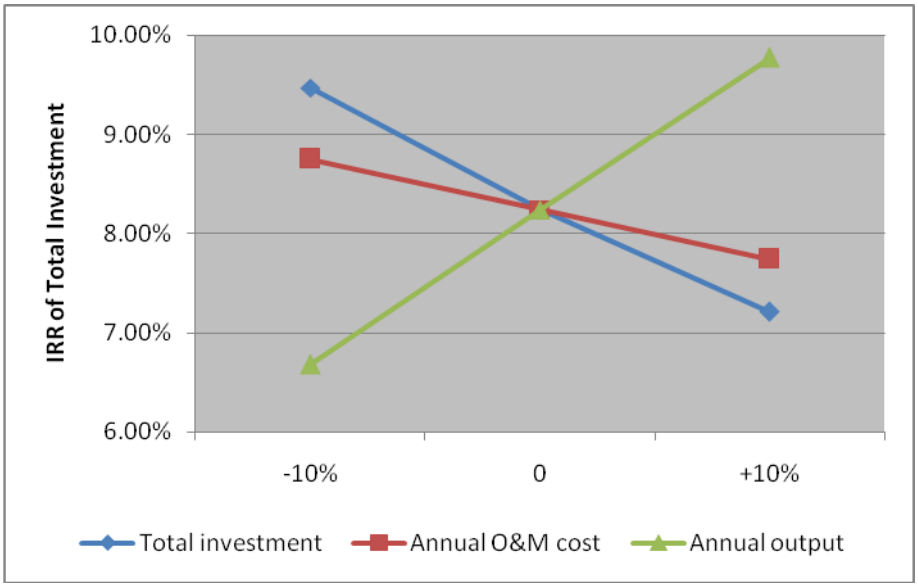

Figure 2. IRR of total investment sensitivity analysis of the 1st plant (Without CERs revenues)

The IRR varieties of the 2nd plant are shown in Table 4 and Figure 3.

Table 4. IRR of total investment sensitivity analysis of the 2nd plant (Without CERs revenues)

Range / Parameter	-10%	0	+10%
Total investment (%)	8.51	7.35	6.38
Annual O&M cost (%)	7.82	7.35	6.88
Annual output (%)	5.90	7.35	8.77

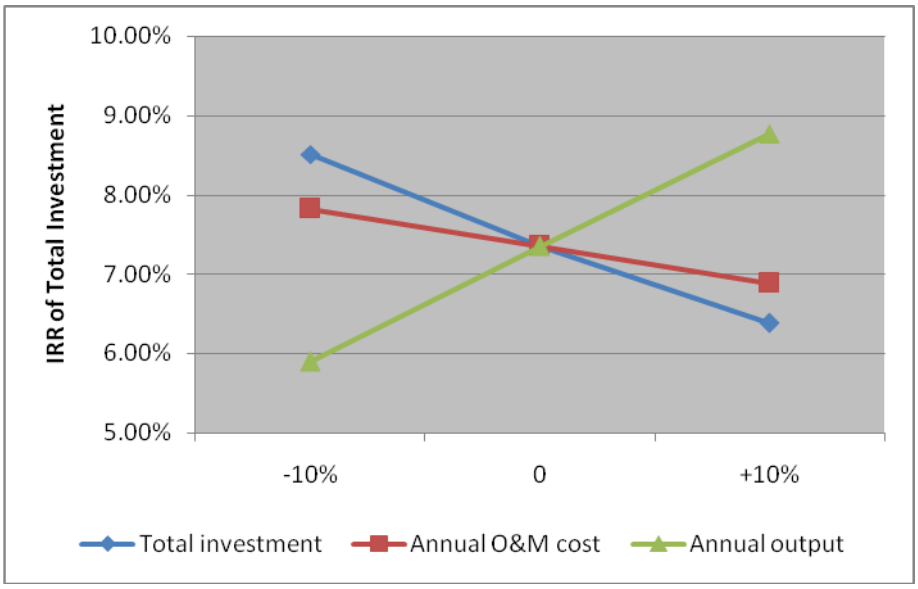

Figure 3. IRR of total investment sensitivity analysis of the 2nd plant (Without CERs revenues)

As shown in the sensitivity analysis, impacts of total investment and annual output on IRR of total investment are obvious. Even the variation range of the factor reaches 10%, the IRR of total investment of the Project could not reach the benchmark.

If the Project can be successfully registered as a CDM project, the CERs sales revenues will improve the financial factors of the Project. Considering of the CERs revenues (calculated with EURO8/tCO2e, 21yrs crediting period), the IRR of the total investment of the 1st plant will be increased to 13.33%, the IRR of the total investment of the 2nd plant will be increased to 11.60%, which fulfil the requirement of the benchmark as shown in Table 5:

Table 5. The IRR of the total investment of the Project

	Without CERs Revenues	**Benchmark**	**With CERs Revenues**
IRR of the total investment of 1st level plant(%)	8.24	10	13.33
IRR of the total investment of 2nd level plant(%)	7.35	10	11.60

Conclusively, the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Step 1. Calculate the baseline emissions

The small-scale CDM methodology AMS-I.D. (Version 10) is applied in the Project, the emission reduction (ER_y) is calculated as the method (a).

Method (a): A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. According to the methodology ACM0002, ex ante data are adopted in the Project to calculate baseline emission factors.

Firstly the operating margin ($EF_{OM,y}$) and build margin ($EF_{BM,y}$) are calculated based on the ex ante data of the China Southern Power Grid, these data include the total installed capacity, the electricity generated and the amount of various fuel consumed of all power plants connected physically to the China Southern Power Grid. And then the baseline emission factor (EF_y) is calculated as combined margin of $EF_{OM,y}$ and $EF_{BM,y}$.

Sub-step1a. Calculate the Operating Margin Emission Factor(s) ($EF_{OM,y}$)

The methodology ACM0002 provides four Operating Margin Emission Factor calculating methods: (a) Simple OM, or (b) Simple adjusted OM, or (c) Dispatch Data Analysis OM, or (d) Average OM. If the dispatch data is available the (c) Dispatch Data Analysis OM method should be the first methodological choice, in case of the Project, the (a) Simple OM method is adapted with two reasons as follows:

(1) In cases where China presently the power grid dispatch and load data are unavailable as business secrets, so (b) and (c) cannot apply in the Project for calculating the Operating Margin Emission Factor ($EF_{OM,y}$).
(2) During the most recent 5 years, from 2001 to 2005, the hydroelectricity, nuclear-electricity and other low-cost/must run resources annual proportion in China Southern Power Grid is: 32.3% in 2001, 31.6% in 2002, 31.1% in 2003, 28.0% in 2004, 30.0% in 2005[5], which are much less than 50%.

From the methodology ACM0002, the simple OM method formula of $EF_{OM,simple,y}$ calculation is:

$$EF_{OM,Simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j,y}}{\sum_j GEN_{j,y}} \quad (1)$$

where:

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

$COEF_{i,j,y}$ is the total amount the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels (coal, oil and gas) used by power j and the oxidation rate of the fuel in year(s) y, and

$GEN_{j,y}$ is the electricity output (MWh) supplied to the grid by power j.

The CO_2 emission coefficient $COEF_i$ is then obtained from equation (2) as

$$COEF_i = NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \quad (2)$$

where:

[5] China Energy Statistical Yearbook, 2001 to 2005

NCV_i is the net calorific value (energy content) per mass or volume unit of fuel i,

$OXID_i$ is the oxidation factor of the fuel i, and

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

When there exists net electricity imports ($COEF_{i,j,imports}$) from a connected electricity system within the same host country(ies):

(b) the emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known, or
(d) the emission factor of the exporting grid, if the specific plants are not clearly known.

The data on electricity generation and auxiliary electricity consumption are obtained from the *China Electric Power Yearbook* from 2001 to 2006 (published annually). The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2001 to 2006 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*.

With reference to the last version *Notification on Determining Baseline Emission Factor of China's Grid*, the Simple OM emission factor ($EF_{OM,y}$) of the China Southern Power Grid is 1.0119 tCO_2/MWh (see Annex 3 for details)

Sub-step 1b. Calculate the Build Margin Emission Factor ($EF_{BM,y}$)

According to the consolidated baseline methodology ACM0002, the following equation (3) is adopted to calculate $EF_{BM,y}$.

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m,y}}{\sum_m GEN_{m,y}} \qquad (3)$$

where:

$F_{i,m,y}$ is the amount of fuel i (tCe) consumed by relevant power source m in year(s) y,

$COEF_{i,m,y}$ 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 relevant power source m and the percent oxidation of the fuel in year(s) y, and

$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by source m.

The methodology provides two alternative measures to calculate $EF_{BM,y}$. The Project was selected the Option 1: calculate the Build Margin emission factor ($EF_{BM,y}$) ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission.

According to the consolidated baseline methodology ACM0002, the sample group m consists of either (1) the five power plants that have been built most recently, or (2) the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. It is suggested that the sample group that comprises the larger annual generation should be used.

Consider of data availability, CDM EB accepts the following deviation in application of methodology AM0005[6]:
1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
2) 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.

Since methodology AM0005 has been replaced by and incorporated into the consolidated methodology ACM0002, the deviation above is also applicable to the consolidated methodology ACM0002. Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor use the efficiency level of the best technology commercially available in China.

Since data of installed capacities can not be separated to coal based, oil based and gas based at present, BM is calculated with following steps and formula:

(1) Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year

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

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

6 Http://cdm.unfccc.int/Projects/Deviations.

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

where:

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

$COEF_{i,j,y}$ 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 power j and the percent oxidation of the fuel in year(s) y, and

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

(2) Calculate emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China

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

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

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

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

Where CAP_{Total} is total capacity additions while $CAP_{Thermal}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2001 to 2006 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook.*

Referring to the *Notification on Determining Baseline Emission Factor of China's Grid*, the weighted average fuel consumption for power generation of 14 sets of 600 MW sub-critical coal-fired power generators built in 2005 (343.33 gCe/kWh) and the 200 MW oil/gas based combined cycle power generators (258 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

With reference to the last version *Notification on Determining Baseline Emission Factor of*

China's Grid, the Simple BM emission factor ($EF_{BM,y}$) of the China Southern Power Grid is 0.6748 tCO_2/MWh (see Annex 3 for details)

Sub-step 1c. Calculate the baseline emission factor (EF_y)

Based on the consolidated baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated as the weighted average of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$), as

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (9)$$

According to the consolidated baseline methodology ACM0002, both the weight w_{OM} and the weight w_{BM} take 0.5 as default. Therefore the combined baseline emission factor

EF_y =0.5×1.0119+0.5×0.6748=0.84335 (tCO_2e/MWh).

Sub-step 1d. Baseline emissions

Baseline emissions are calculated with combined baseline emission factor and the electricity delivered to the grid by the project as follows:

$$BE_y = EG_y \cdot EF_y \quad (10)$$

Step 2. Calculate the project GHG emissions

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per ACM0002, i.e. $BE_y = 0$ tCO_2e.

Step 3. Calculate the project leakage GHG emissions

The Project can take no account of such leakages, $L_y = 0$ tCO_2e.

Step4. Calculate the emission reductions

The project activity will generate GHG emission reductions by avoiding CO_2 emissions from electricity generation by fossil fuel power plants. The emission reduction (ER_y) during a given year y is calculated as follows:

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

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

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2e/MWh
Description:	The operating margin of Southern China Power Grid
Source of data used:	See Annex 3
Value applied:	1.0119
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 requirement, use accurate and reliable local or national data where available.
Any comment:	Reasonable

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2e/MWh
Description:	The building margin of Southern China Power Grid
Source of data used:	See Annex 3
Value applied:	0.6748
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 requirement, use accurate and reliable local or national data where available.
Any comment:	Reasonable

Data / Parameter:	$EF_{CM,y}$
Data unit:	tCO_2e/MWh
Description:	The combined margin of Southern China Power Grid
Source of data used:	Calculated as $0.5*EF_{OM,y}+0.5*EF_{BM,y}$
Value applied:	0.84335
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 requirement, use accurate and reliable local or national data where available.
Any comment:	Reasonable

Data / Parameter:	$F_{i,j,y}$
Data unit:	Mass or volume
Description:	The fuel consumption of fuel i in power plant j during year y
Source of data used:	*China Energy Statistical Yearbook, 2006*
Value applied:	Values depend on specifically fuel, referring to Annex 3.
Justification of the choice of data or	According to the ACM0002 requirement, use accurate and reliable local or national data where available.

description of measurement methods and procedures actually applied :	
Any comment:	Reasonable

Data / Parameter:	NCV_i
Data unit:	TJ/t, TJ/km^3
Description:	Net calorific value (energy content) per mass or volume unit of a fuel *i*
Source of data used:	*China Energy Statistical Yearbook, 2006*
Value applied:	Values depend on specifically fuel, referring to Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 requirement, use accurate and reliable local or national data where available.
Any comment:	Reasonable

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tC/TJ (tCO_2e/TJ)
Description:	tCO_2e emission factor per energy unit of a fuel *i*
Source of data used:	*IPCC 2006 Revised Guidelines*
Value applied:	Values depend on specifically fuel, referring to Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 requirement, use IPCC default value.
Any comment:	Reasonable

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of the fuel *i*
Source of data used:	*IPCC 2006 Revised Guidelines*
Value applied:	Values depend on specifically fuel, referring to Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the ACM0002 requirement, use IPCC default value.
Any comment:	Reasonable

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh/a
Description:	The electricity generated by source *j* in year *y* of each province

	connected to CCPG.
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 :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	Internal use rate of power plant
Data unit:	%
Description:	The internal power consumption of power plants in year(s) *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 :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$CAP_{i, j, y}$
Data unit:	MW
Description:	Installed capacities of power plant category *i* of province *j* in years *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 :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$EG_{import,y}$
Data unit:	MWh
Description:	Southern China Power Grid imported electricity from other 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 :	Data used are from Chinese authorities.

Any comment:	Southern China Power Grid imported electricity from Central China Grid.

Data / Parameter:	$A_{P,j}$
Data unit:	m^2
Description:	Reservoir area of the Project
Source of data used:	*Feasibility Study*
Value applied:	i=1, the reservoir area of 1st plant is 600m^2; i=2, the reservoir area of 2nd plant is 334m^2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from independent third party design institute.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Step 1. Estimated the baseline emissions of greenhouse gases

Baseline emissions are calculated with combined baseline emission factor and the electricity delivered to the grid by the project. The electricity delivered to the grid by the Project in year y is calculated as subtract the electricity import from the grid in year y ($EG_{aux,y}$) from the electricity exported to the grid in year y (EG_y).

Assuming the $EG_{aux,y}$ = 0 in ex-ante calculation of emission reductions for the Project.

According to the *Feasibility Study* of the Project, the annual power generation is estimated to be 40GWh. The baseline emission factor for the Project is 0.84335tCO_2e/MWh and the annual baseline emission of the Project is:

$$BE_y = EG_y \cdot EF_y = 33{,}734 tCO_2e.$$

Step 2. Estimated project activity emissions

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0$ tCO_2e.

Step 3. Estimated project leakage emissions:

As above ACM0002, the leakage of the Project is not considered, i.e. L_y=0 tCO_2e.

Step 4. Estimated emission reductions

As per formula (11), the annual emission reductions of the Project are:

$ER_y = BE_y - PE_y - L_y$ = 33,734tCO$_2$e

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

It is expected that the proposed project activity will generate about 236,138 tCO$_2$e emission reductions over the first 7-year crediting period from April 2008 to March 2015.

Year	Emission of the Project(tCO$_2$e)	Baseline Emission (tCO$_2$e)	Leakage Emission of the Project(tCO$_2$e)	Emission Reduction(tCO$_2$e)
01/04/2008-31/03/2009	0	33,734	0	33,734
01/04/2009-31/03/2010	0	33,734	0	33,734
01/04/2010-31/03/2011	0	33,734	0	33,734
01/04/2011-31/03/2012	0	33,734	0	33,734
01/04/2012-31/03/2013	0	33,734	0	33,734
01/04/2013-31/03/2014	0	33,734	0	33,734
01/04/2014-31/03/2015	0	33,734	0	33,734
Total(tCO$_2$e)	**0**	**236,138**	**0**	**236,138**

The emission reductions of the 1st Level Plant and the 2nd Level Plant are listed respectively in following table (tCO$_2$e):

	01/04/2008-31/03/2009	01/04/2009-31/03/2010	01/04/2010-31/03/2011	01/04/2011-31/03/2012	01/04/2012-31/03/2013	01/04/2013-31/03/2014	01/04/2014-31/03/2015	**Total**
1st Level Plant	20,426	20,426	20,426	20,426	20,426	20,426	20,426	**142,982**
2nd Level	13,308	13,308	13,308	13,308	13,308	13,308	13,308	**93,156**

Plant								
Total	**33,734**	**33,734**	**33,734**	**33,734**	**33,734**	**33,734**	**33,734**	**236,138**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity delivered to the grid by the Project in year y
Source of data to be used:	Accurate value from meters.
Value of data	40000
Description of measurement methods and procedures to be applied:	Continuously measured by ammeters and automatically recorded by computer. Recorded per month by appointed staff as backup
QA/QC procedures to be applied:	Sales receipts/records to the grid are used to ensure the consistency
Any comment:	--

Data / Parameter:	$EG_{aux,y}$
Data unit:	MWh
Description:	Electricity imported from the grid in year y
Source of data to be used:	Assuming 0 in PDD, accurate value from meters.
Value of data	0
Description of measurement methods and procedures to be applied:	Continuously measured by ammeters and recorded monthly by appointed staff.
QA/QC procedures to be applied:	Duty meter and margin meter are used to ensure the consistency.
Any comment:	--

B.7.2 Description of the monitoring plan:

1. Purpose

Baseline emission factor of the Project is determined ex ante. Therefore the electricity delivered by the Project to the China Southern Power Grid is defined as the key data to be monitored. The monitoring plan is drafted to focus on monitoring the electricity delivered by the Project to the China Southern Power Grid.

2. Monitoring Structure

The Project owner assigns the person in charge of CDM operation with assistance of the technological departments and financial department. The structure shows as the following Figure 4.

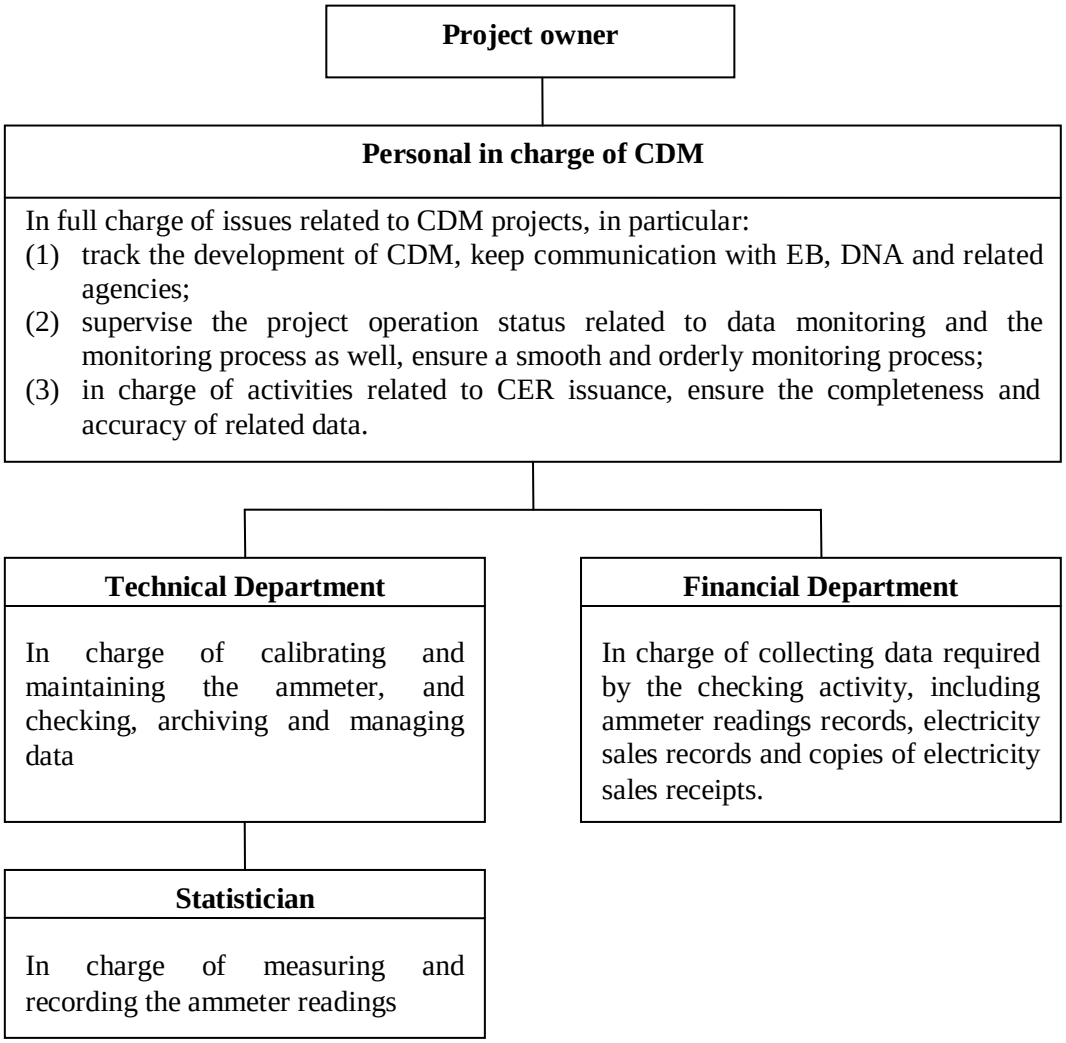


Figure 4. Management Structure of Monitoring Plan

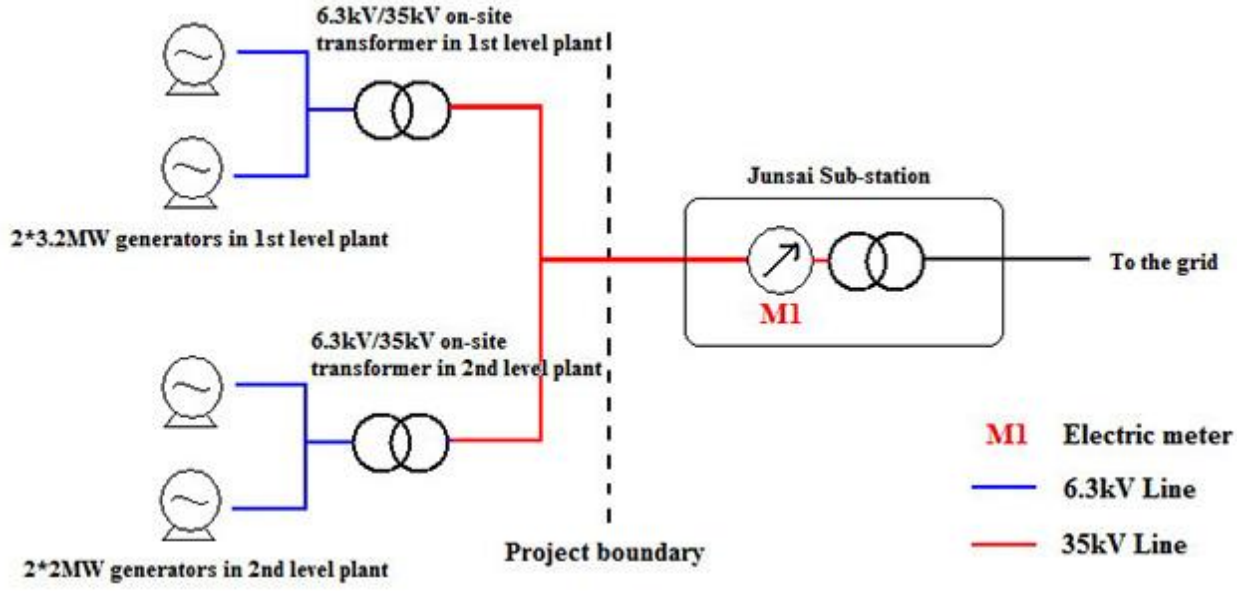
3. Equipment and Installation of Monitoring

Distribution and calibration of electric meter should be implemented according to the technical requirements of < Technical administrative code of electric energy metering > (DL/T448-2000).

The grid access point of the Project is Junsai Sub-station which is 10km away from the plant. One of 3-phase & 3-line digital multi-function electric meter with accuracy 0.5S is installed in Junsai Sub-station. The technical information and installation diagram are presented as follow:

Access point	Measuring	Measuring	PT rate	CT rate	Measuring

	point	method			rate
Junsai Sub-station	Junsai Sub-station	35KV measuring	35000/100	100/5	7000



The grid company takes full responsibility for the operation & maintenance of the meter.

4. Data Collection

If the duty meters error falls within the permissible range, the monitoring process is listed as below:

(1) The data on the meter is recorded by project owner and grid company at 8:00am on every 20th of each month.
(2) The project owner offers relevant electricity sales receipt to grid company and keeps the photocopy of receipt; at the same time, the project owner keeps the purchase receipt which offered by grid company for showing the electricity imported.

If the meter's error oversteps the permissible range or other accidental situation occurred, the monitoring process is listed as below:

(1) During the data unavailable period, from meter failed to re-calibration, in order to keep conservativeness, the electricity supplied would be assumed as zero .
(2) If the project owner and grid company cannot achieve agreement in measuring method and then the arbitration should be carried out according to the process of contract.

5. Calibration

In order to maintain high precision for meters, the calibration should be implemented according to state and/or sector standards and rules and certificated after calibration.

The meters should be calibrated every year normally.

Within 10 days on the date of :

(1) The error of duty meters and checking meters oversteps the permissible range;

(2) Repairs due to meters failure

all the installed meters should be tested by relevant qualified institution which designated by both project owner and grid company.

6. Data Management

The monitoring data should be saved at the end of each month, the regular summary should be made and reported to technology department by statistician periodic, all the data should be saved up to 2 years after the end of the crediting period.

7. Relevant Documents

Table 6 below outlines the key documents relevant to monitoring and verification of the emission reductions from the Project.

Table 6. List of the key documents relevant to monitoring and verification

I.D. No.	Document Title	Main Content	Source
A	PDD, including the electronic spreadsheets and supporting documentation (assumptions, estimations, measurement, etc)	Calculation procedure of emission reduction and monitoring items	the project owner, or directly download from UNFCCC website
B	Monitoring Quality Control and Quality Assurance Report	Equipments and national and industry standards	the project owner the grid company
C	The report on qualifications of the persons responsible for the monitoring and calculation	Major, the title of a technical post, working experience and etc.	the project owner the grid company
D	The report on monitoring and checking of the electricity delivered by the Project to the grid	Record based on monthly meter reading and electricity sales receipts/records	the project owner the grid company

E	Record on maintenance and calibration of metering equipment	Reasons for maintenance and calibration and the precision after maintenance and calibration	the project owner the grid company
F	Monitoring report	CO_2 emission reduction calculation	the project owner
G	Letter of confirmation on B to F	Confirmation of monitoring and calculation data and procedure from B to F	The person in charge of CDM
H	Project Management Record (including data collection and management system)	Comprehensive and true reflection of the management and the operation of the Project	the project owner

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

The application of the baseline study and monitoring methodology of the Project was completed on 18/07/2007 by:

Mr. Jin Song

Email: songj@pdd-agetc.com.

Tel/Fax: +86(0) 10 59712655

Entity: Accord Global Environment Technology (Beijing) Co., Ltd.

The person/entity is not project participant listed in Annex 1.

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:

01/10/2004

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

26y-0m

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

C.2.1. Renewable crediting period

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

01/04/2008 or on the date of registration of the CDM project activity, whichever is later.

C.2.1.2. Length of the first crediting period:

7y-0m.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

The *Environmental Impact Assessment Report* has been approved by Lincang Environment Protection Bureau of Yunnan Province in Aug. 2005.

According to the *Environmental Impact Assessment Report*, the environment impacts possibly caused by the Project and the corresponding measures adopted by the Project are analyzed as followings:

Land use

ince the Project is run-of-river hydropower station, only a small number of lands will be submerged. 2.26 hectares land will be occupied by the Project and 1.73 hectares land will be temporarily occupied during the Project construction period. There are no building removing and settlement of migrants. The compensation for local residents is unnecessary.

Air pollution

The major air pollutants generated by machine fuel burning, sand and bone crushing and vehicle transporting during the Project construction period. The measures arranging the point of sand machining and concrete milling far away from the dweller points and retraining dusts will be adopted by the construction unit to reduce the dusts pollution. Operators adopt labour insurance and post shifting system to reduce the impact of the air pollution. Air pollution only impact in a certain small area and the impacts will eliminate when the Project construction finish.

Noise

Noise mainly generated by vehicles transportation, construction, excavation and explosion. The operators near the facilities are main noise receivers and labour insurances are adopted by the operators to reduce the noise impacts. There are no residential areas within 2km around the construction site, no dweller will be impacted by the air pollution and noise. Noise only impact in a certain small area and the impacts will eliminate when the Project construction finish.

Waste water

Production waste water and domestic sewage will generate during the Project construction and operation. Production waste water characteristic pollution factors are mineral SS and oiliness waste water. SS deal with physical deposition and the deposited water return to production system or farm land irrigation. The oiliness waste water via oil water separation technology, the upper oil is collected and disposed in other

place and the underlayer water can be used as virescence water. Domestic sewage mainly consisting of wash water from refectory and excrement, will use as farm manure via cesspool disposed.

Solid waste

Solid waste composes of engineering discarded solid generated during the construction and residential garbage. Engineering discarded solid will be transported to four disposal sits and the residential garbage will be collected and regularly sent to garbage disposal station by particular staff in charge.

Ecological impact

There is no rare animals and vegetation in the Project area. Reservoir submerging and construction activities do not bring the reduction of biological diversities, little impacts to animals and disadvantage impacts is mainly the loss of submerging but little. Enhancing environmental management, applying advanced construction process, using water and land protection measure will be adopted to reduce the ecological impacts brought by the Project.

In summary, the Project will not bring significant impacts on the environment.

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:

Environmental impacts of the Project are not considered significantly.

SECTION E. Stakeholders' comments

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

The stakeholders identified for the Project are the residents near the Project and local government. In the investigation 60 questionnaires are distributed and 57 questionnaires are returned , 43 male clients and 14 female clients, with 95% response rate. The questionnaire includes:

- The stakeholder's attitude to the implementation of the Project;
- The positive effects cause of construction and operation of the Project;
- The negative effects cause of construction and operation of the Project;
- Any suggestion for mitigating the identified negative effects.

E.2. Summary of the comments received:

Based on the 57 returned questionnaires, the summary of the comments shows:

(1) 70.18% of the respondents support the Project construction, no respondent is against the Project;
(2) More than 50% of the respondents believe that the Project will promote the electricity supply, 40.35% of the respondents believe the Project will increase local income, 8.77% of the respondents believe the Project will offer more employment opportunities;
(3) 57 informant whose land occupied or the Project impact their using water are all obtain satisfied compensation;
(4) Based on the questionnaires, the main negative effects are land occupied and using water reduced, the informants suggest the Project owner should improve the efficiency of water utilization.

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

The Project owner take account the problems provided in the questionnaires as following:

(1) The Project provides compensation strictly according to the relevant laws and regulations;
(2) According the *Water Resource Report of Nanzhahe 1st Level Hydro Power* and *Water Resource Report of Nanzhahe 2nd Level Hydro Power*, the relative water resource construction will be built for improving the efficiency of water utilization.
(3) The Project constructs strictly according C*onstruction Design* and insures construction safety.

The Project owner will enhance the communication with the residents and local government, reduce negative impacts brought by the Project and promote local economy development.

In conclusion, the Project obtained support from local residents and government thus modification and adjustment on design, construction and operation of the Project are unnecessary.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

Annex 3

BASELINE INFORMATION

Data recommended in the *Notification on Determining Baseline Emission Factor of China's Grid* for the China Southern Power Grid are adopted for the Project.

The emission factors of OM and BM are calculated based on the approved methodology ACM0002. The information provided by the tables includes data, data sources and the underlying calculations.

Table 3.1 Electricity generation of the China Southern Power Grid in 2003

Province	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Guangdong	143351000	5.5	135,466,695
Guangxi	17079000	8.43	15,639,240
Guizhou	43295000	7.4	40,091,170
Yunnan	19055000	8.01	17,528,695
Total			208,725,800

Data source: China Electric Power Yearbook 2004

Table 3.2 Electricity generation of the China Southern Power Grid in 2004

Province	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Guangdong	169389000	5.42	160,208,116
Guangxi	20143000	8.33	18,465,088
Guizhou	49720000	7.06	46,209,768
Yunnan	24322000	7.56	22,483,257
Total			247,366,229

Data source: China Electric Power Yearbook 2005

Table 3.3 Electricity generation of the China Southern Power Grid in 2005

Province	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (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 3.4 Calculation of simple OM emission factor of the China Southern Power Grid in 2003

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Toal fuel	Default carbon content (tC/TJ)	Oxidation Rate (%)	NCV (MJ/t or 1000m^3)	Emission[7] (tCO_2e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10^2
coal	10^4t	4491.79	831.84	2169.11	1405.27	**8898.01**	25.8	100	20908	175993455.05
Cleaned coal	10^4t	0.05				**0.05**	25.8	100	26344	1246.07
Other washed coal	10^4t			36.38	20.37	**56.75**	25.8	100	8363	448971.84
Coke	10^4t				0.5	**0.5**	25.8	100	28435	13449.76
Coke oven gas	10^8m^3				0.04	**0.04**	12.1	100	16726	2968.31
Other gas	10^8m^3	3.21			11.27	**14.48**	12.1	100	5227	335797.81
Crude oil	10^4t	6.85				**6.85**	20	100	41816	210055.71
Gasoline	10^4t	0.02				**0.02**	18.9	100	43070	596.95
Diesel oil	10^4t	31.9			0.76	**32.66**	20.2	100	42652	1031759.27
Fuel oil	10^4t	627.22	0.3			**627.52**	21.1	100	41816	20301304.48
LPG	10^4t					**0**	17.2	100	50179	0.00
Refinery gas	10^4t	2.85				**2.85**	18.2	100	46055	87592.00
Nature gas	10^8m^3					**0**	15.3	100	38931	0.00
Other oil products	10^4t	11.35				**11.35**	20	100	38369	319357.98
Other coking products	10^4t					**0**	25.8	100	28435	0.00
Other energy	10^4tCe	93.21			22.35	**115.56**	0	100	0	0.00
Total emission of the China Southern Power Grid (tCO_2e) J						198746555.23				
Fossil power supply of the China Southern Power Grid (MWh) K						208,725,800				
Imported electricity from the Central China Grid (MWh) L						11,100				
Emission factor of Central China Grid (tCO_2e/MWh) M						0.797442				
Total emission (tCO_2e) N=J+L*M						198,755,407				
Total electricity delivered to the grid (MWh) O=K+L						208,736,900				

Data sources: China Energy Statistical Yearbook (2004)

7 If the unit is 10^4t, I=G*H*F*E*44/12/10^2; if the unit is 10^8m^3, I=G*H*F*E*44/12/10. The same calculations used in Table 3.5 and Table 3.6.

Table 3.5 Calculation of simple OM emission factor of the China Southern Power Grid in 2004

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Toal fuel	Default carbon content (tC/TJ)	Oxidation Rate (%)	NCV (MJ/t or 1000m^3)	Emission (tCO$_2$e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10^2
coal	10^4t	6017.7	1305	2643.9	1751.28	**11717.88**	25.8	100	20908	231767573.55
Cleaned coal	10^4t	0.21				**0.21**	25.8	100	26344	5233.50
Other washed coal	10^4t					**0**	25.8	100	8363	0.00
Coke	10^4t					**0**	25.8	100	28435	0.00
Coke oven gas	10^8m^3					**0**	12.1	100	16726	0.00
Other gas	10^8m^3	2.58				**2.58**	12.1	100	5227	59831.38
Crude oil	10^4t	16.89				**16.89**	20	100	41816	517932.98
Gasoline	10^4t					**0**	18.9	100	43070	0.00
Diesel oil	10^4t	48.88			1.83	**50.71**	20.2	100	42652	1601975.28
Fuel oil	10^4t	957.71				**957.71**	21.1	100	41816	30983494.25
LPG	10^4t					**0**	17.2	100	50179	0.00
Refinery gas	10^4t	2.86				**2.86**	18.2	100	46055	87899.34
Nature gas	10^8m^3	0.48				**0.48**	15.3	100	38931	104833.40
Other oil products	10^4t	1.66				**1.66**	20	100	38369	46707.86
Other coking products	10^4t					**0**	25.8	100	28435	0.00
Other energy	10^4tCe	79.42				**79.42**	0	100	0	0.00
Total emission of the China Southern Power Grid (tCO$_2$e) J						265175481.54				
Fossil power supply of the China Southern Power Grid (MWh) K						247,366,229				
Imported electricity from the Central China Grid (MWh) L						10,951,240				
Emission factor of Central China Grid (tCO$_2$e/MWh) M						0.826448				
Total emission (tCO$_2$e) N=J+L*M						274,226,117				
Total electricity delivered to the grid (MWh) O=K+L						258,317,469				

Data sources: China Energy Statistical Yearbook 2005

Table 3.6 Calculation of simple OM emission factor of the China Southern Power Grid in 2005

Fuel	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Toal fuel	Default carbon content (tC/TJ)	Oxidation Rate (%)	NCV (MJ/t or 1000m^3)	Emission (tCO_2e)
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/12/10^2
coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	25.8	100	20908	263442601.85
Cleaned coal	10^4t				0.15	**0.15**	25.8	100	26344	3738.21
Other washed coal	10^4t			10.39	33.88	**44.27**	25.8	100	8363	350237.59
Coke	10^4t	4.79			8.05	**12.84**	25.8	100	28435	345389.71
Coke oven gas	10^8m^3				0.79	**0.79**	12.1	100	16726	58624.07
Other gas	10^8m^3	1.87			15.96	**17.83**	12.1	100	5227	413485.84
Crude oil	10^4t	10.91				**10.91**	20	100	41816	334555.88
Gasoline	10^4t	0.68				**0.68**	18.9	100	43070	20296.31
Diesel oil	10^4t	31.96	2.02		1.81	**35.79**	20.2	100	42652	1130638.84
Fuel oil	10^4t	887.21				**887.21**	21.1	100	41816	28702703.26
LPG	10^4t					**0**	17.2	100	50179	0.00
Refinery gas	10^4t	4.92				**4.92**	18.2	100	46055	151211.46
Nature gas	10^8m^3	0.93				**0.93**	15.3	100	38931	203114.71
Other oil products	10^4t	1.7				**1.7**	20	100	38369	47833.35
Other coking products	10^4t					**0**	25.8	100	28435	0.00
Other energy	10^4tCe	104.66	133.15		59.72	**297.53**	0	100	0	0.00
Total emission of the China Southern Power Grid (tCO_2e) J						295204431.07				
Fossil power supply of the China Southern Power Grid (MWh) K						269,169,531				
Imported electricity from the Central China Grid (MWh) L						96,363,000				
Emission factor of Central China Grid (tCO_2e/MWh) M						0.771225				
Total emission (tCO_2e) N=J+L*M						369,521,975				
Total electricity delivered to the grid (MWh) O=K+L						365,532,531				

Data sources: China Energy Statistical Yearbook 2006

$EF_{OM,y}=(N_{2003}+N_{2004}+N_{2005}) / (O_{2003}+O_{2004}+O_{2005}) = 1.0119\ tCO_2e/MWh$

Table 3.7 Data and result of Step (1)

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Total fuel E=A+B+C+D	NCV (MJ/t 或 1000m^3) F	Default carbon content (tC/TJ) G	Oxidation Rate H	Emission (tCO_2e) I
Coal	10^4t	6696.47	1435	3212.31	1975.55	**13319.33**	20908	25.8	1	263442601.85
Cleaned coal	10^4t				0.15	**0.15**	26344	25.8	1	3738.21
Other washed coal	10^4t			10.39	33.88	**44.27**	8363	25.8	1	350237.59
coke	10^4t	4.79			8.05	**12.84**	28435	25.8	1	345389.71
Total solid fuel										**264141967**
Oil	10^4t	10.91				**10.91**	41816	20	1	334555.88
Gasoline	10^4t	0.68				0.68	43070	18.9	1	20296.3068
Kerosene	10^4t					0	43070	19.6	1	0
Diesel oil	10^4t	31.96	2.02		1.81	35.79	42652	20.2	1	1130638.836
Fuel oil	10^4t	887.21				887.21	41816	21.1	1	28702703.26
Other oil products	10^4t	1.7				1.7	38369	20	1	47833.35333
Total liquid fuel										**30239028**
Nature gas	10^7m^3	0.93				0.93	38931	15.3	1	203114.7063
Coke oven gas	10^7m^3				0.79	0.79	16726	12.1	1	58624.07247
Other coal gas	10^7m^3	1.87			15.96	17.83	5227	12.1	1	413485.8424
LPG	10^4t					0	50179	17.2	1	0
Finery gas	10^4t	4.92				4.92	46055	18.2	1	151211.46
Total gas fuel										**826436**
Total										**295204431**

Data sources: China Energy Statistical Yearbook 2006

Table 3.8 Emission factor of best technology

	Variable	Electricity supply efficiency	Carbon content of fuel* (tC/TJ)	Oxidation rate*	Emission factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1000*B*C44/12
Coal-based power plants	$EF_{Coal,Adv}$	35.82%	25.8	1	0.9508
Gas-based power plants	$EF_{Gas,Adv}$	47.67%	15.3	1	0.4237
Oil-based power plants	$EF_{Oil,Adv}$	47.67%	21.1	1	0.5843

Calculate with formula (4), (5) and (6), the value for λ_{Coal} is 89.48%, the value for λ_{Oil} is 10.24% and the value for λ_{Gas} is 0.28%. Therefore $EF_{Thermal} = \lambda_{Coal} \cdot EF_{Coal.Adv} + \lambda_{Oil} \cdot EF_{Oil,Adv} + \lambda_{Gas} \cdot EF_{Gas,Adv}$=0.9117 tCO_2e/MWh.

Table 3.9 Installed capacity of the China Southern Power Grid in 2005

	Guangdong	Guangxi	Guizhou	Yunnan	Total
Thermal power (MW)	35182.6	4931.2	9634.8	4758.4	54507
Hydro power (MW)	9035.7	6085.3	7233	7993.1	30347.1
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	83.4
Total (MW)	48081.7	11016.5.	16867.8	12751.5	88717.5

Data source: China Electric Power Yearbook 2006

Table 3.10. Installed capacity of the China Southern Power Grid in 2004

	Guangdong	Guangxi	Guizhou	Yunnan	Total
Thermal power (MW)	30172.9	4378.1	7801.8	4306.9	46659.7
Hydro power (MW)	8584.6	5040.4	6896.5	7058.6	25220.8
Nuclear power (MW)	3780	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	2483.4
Total (MW)	42621	9418.5	14698.3	11365.5	78103.3

Data source: China Electric Power Yearbook 2005.

Table 3.11. Installed capacity of the China Southern Power Grid in 2003

	Guangdong	Guangxi	Guizhou	Yunnan	Tianshengqiao Hydro	Total

					Power Station	
Thermal power (MW)	27231.4	3190.1	6465.8	3556.8	0	40444.1
Hydro power (MW)	8107.2	4525.2	3713.7	6543.2	2520	23009.3
Nuclear power (MW)	3780	0	0	0	0	3780
Wind power and Other (MW)	83.4	0	0	0	0	2483.4
Total (MW)	39202	7715.3	10179.5	10100	2520	69716.8

Data source: China Electric Power Yearbook 2004

Table 3.12 Calculation of BM emission factor of the China Southern Power Grid

	Installed capacity in 2003 (MW) A	**Installed capacity in 2004 (MW) B**	**Installed capacity in 2005 (MW) C**	**Capacity additions from 2003 to 2005 (MW) D=C-A**	**Share in total capacity additions**
Thermal power	40444.1	46659.7	54507	14062.9	74.01%
Hydro power	23009.3	25220.8	27947.1	4937.8	25.99%
Nuclear power	3780	3780	3780	0	0.00%
Wind power and other	2483.4	2483.4	2483.4	0	0.00%
Total	69716.8	78143.9	88717.5	19000.7	100.00
Share in 2005	78.58%	88.04%	100%		

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

Annex 4

MONITORING INFORMATION

The calibration of meters & metering, the QA/QC procedure and others of the monitoring plan should be carried out with reference to the Power Purchase Agreement of the Project, the Parallel Operation Agreement of the Project and the checking and testing standard and the specification of the monitoring equipments. No other additional information.

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