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

CONTENTS

A. General description of the small scale project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the proposed small scale project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring Information

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:

Yunnan Dehong Longchuan Bienaihe 1st and 2nd Level Hydropower Stations
Version: 0.3
Date: 04/05/2008

Revision history of the PDD:

Version	Date	Comments
Version 0.1	27 September 2006	First draft, prepared for host country approval
Version 0.2	26 February 2007	Second draft, minor editorial changed, prepared for GSP
Version 0.3	26 December 2007	Revised draft PDD, prepared on the basis of corrective action requests in the Validation protocol from TUV SUD
Version 0.4	04 May 2008	Revised PDD, prepared on the basis of a corrective action request by UNFCCC

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

The proposed project is located in the middle and lower reaches of the Bienai River, which is a secondary branch of the Long River, Longchuan County, Dehong Dai-Jingpo Autonomous Prefecture, Yunnan Province, China. The project involves the construction and operation of two small-scale run-of-river hydropower stations. The total installed capacity of the project is 10.5MW and the average annual electricity supply to the grid is 44,848MWh.

The installed capacity of the Bienaihe 1st level hydropower station is 2.5MW and this hydropower station is expected to operate 4,320 hours per year. The expected annual net electricity supply to the grid is 10,800MWh. The installed capacity of Bienaihe 2nd level hydropower station is 8MW and this hydropower station is expected to operate 4,256 hours per year, and expected annual net electricity supply to the grid is 34,048MWh. The total expected power supplied to the grid by the two projects is 44,848MWh.

The power generation of this project will be transmitted to local transformer substations, then to Yunnan Grid and finally to the South China Grid.

The proposed project activity will provide renewable hydropower to the South China Grid, and displace equivalent electricity from thermal power plants of the South China Grid, thus reducing greenhouse gas emissions. The development of the project is in compliance with the development objective of Chinese energy industry, and it will contribute to the sustainable development in the energy sector, especially in the electricity industry. The main contributions to sustainable development include:

- Reducing reliance on exhaustible fossil fuel based power sources;
- Bridging the gab between power supply and demand on both a regional and national level;
- Reducing the emissions of pollutants resulting from the burning of fossil fuels;
- Reducing global emissions of greenhouse gases resulting from burning fossil fuels;
- Contributing to the province’s economic development by improving the local energy generation infrastructure and increasing employment during both construction and operation of the power plant.

A.3. Project participants:

Name of Party Involved(*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Private Entity: Longchuan Minhong Hydro power Co. Ltd (as the project owner)	No
Germany	RWE Power AG (as the CER buyer)	No

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):

People's Republic of China

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

Yunnan Province

A.4.1.3. City/Town/Community etc:

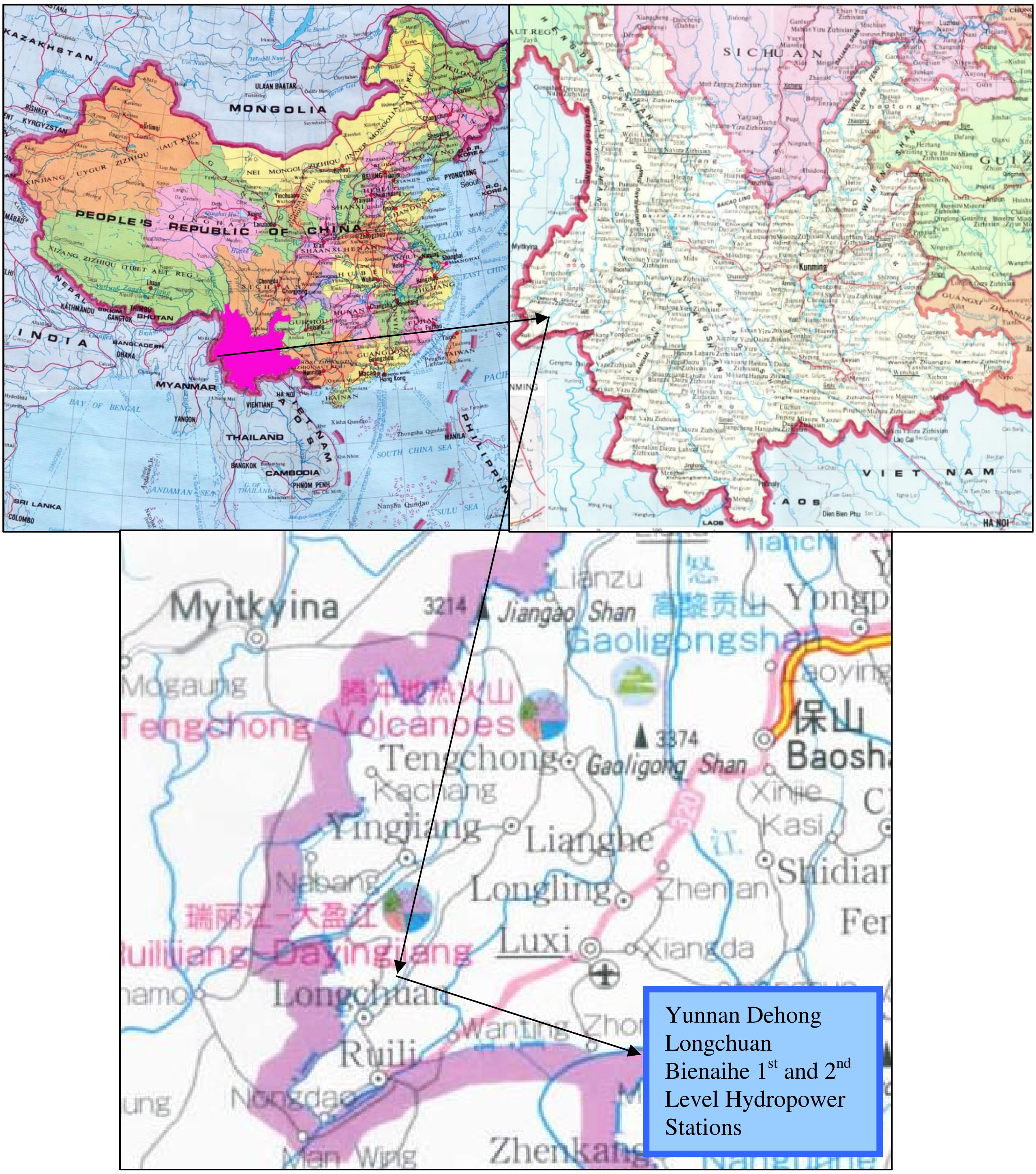
Huguo Town, Longchuan County, Dehong Dai-Jingpo Autonomous Prefecture

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

The project is located in Huguo Town, Longchuan County, Dehong Dai-Jingpo Autonomous Prefecture, Yunnan Province, China.
The 1st level hydropower station is 80km from Longchuan County Seat and 923km from the city of Kunmin. The exact geographic coordinates of the 1st level powerhouse are north latitude of 24°35′41″ and east longitude of 98°05′01″. The exact geographic coordinates of the dam are north latitude of 24°38′07″ and east longitude of 98°04′16″.
The 2nd level hydropower station is 85km from Longchuan County Seat and 925km from the city of Kunmin. The exact geographic coordinates of the 2nd level powerhouse are north latitude of 24°35′16″ and east longitude of 98°06′32″. The exact geographic coordinates of dam are north latitude of 24°35′47″ and east longitude of 98°05′12″.

See the location of the projects in Figure A.1.

Figure A.1: Map of Yunnan Province and the projects' location



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

Type and category(ies) of the small-scale project activity

Type I.D. - Renewable Electricity Generation for a Grid

The project activity utilizes hydropower for electricity generation, which falls into the category of renewable energy. Since the capacity of the proposed project is 10.5MW, not exceeding the threshold qualifying capacity of 15MW, the project activity can be regarded as a small-scale CDM project activity. The power generated is exported to the grid. Therefore, according to small-scale CDM modalities, the project activity falls under Type - I Renewable Energy Projects, and category I-D - Renewable Electricity Generation for a Grid.

Technology of the small-scale project activity

The project consists of the construction and operation of two run-of-river diversion type hydropower stations.

The 1st level hydropower station is a run-of-river diversion type hydropower station with total installed capacity of 2.5MW. The project consists of a masonry gravity dam, diversion system, powerhouse, and switching station.
The maximum height of the masonry gravity dam is 17.5m, the length is 56m and the width is 1.8m.
The diversion system consists of a water intake, a diversion canal and tunnel, and a pressure pipe. The length of diversion canal and tunnel is 1,400m and 1,480m respectively, and the length of the pressure pipe is 106m.
The length of the river that will be impacted (i.e. from dam site to power house) is 7.2km.

The 2nd level hydropower station is a run-of-river diversion type hydropower station with installed capacity of 8MW. The project consists of a masonry gravity dam, diversion system, pressure forebay, powerhouse, and switching station.
The length of the masonry gravity dam is 106m, the maximum height is 21m and the width is 2.0m.
The diversion system consists of a water intake, a diversion tunnel and pressure pipe. The length of the diversion tunnel and pressure pipe is 1,700m and 1,820m respectively.
The length of the river that will be impacted (i.e. from dam site to power house) is 5.1km.

Total installed capacity of the proposed project activity is 10.5MW. The specific technical data are listed in Table A.1

Table A.1 Key technology parameters to be employed for the proposed project

The Main Technical Data		Bienaihe 1st level station	Bienaihe 2nd level station
Turbines	Units	2	2
	Type	XJA-W-63A/1×16	CJA237-W-110/2×10
	Factory	Henan Xixia Hydropower Co., Ltd.	Hunan Lingling Power Equipment Co., Ltd.
	Rated output	1,292kW	4,523kW
	Rated water head	160m	460m
	Rated rotate speed	750r/min	750r/min
	Rated flow rate	0.95m^3/s	1.32m^3/s
Generators	Units	2	2
	Type	SFW1250-8/1430	SFW4000-8/1730
	Factory	Henan Xixia Hydropower Co., Ltd.	Hunan Lingling Power Equipment Co., Ltd.
	Rated power	1.25MW	4MW
	Rated voltage	6.3kV	6.3kV

	Rated rotate speed	750r/min	750r/min
	Rated current	198A	785A

The power generated by the 1st level hydropower station will be transmitted to the 35kV Huguosi transformer substation and the power generated by 2nd level hydropower station will be transmitted to the 110kV Mangdong Dapingzi transformer substation. Both substations are connected to the Yunnan Grid and finally to the South China Grid.

The hydropower technology used is common in China and the project will employ several experts coordinating operations, therefore no special training would be necessary. However, the manufacturer of the technology will provide training on the use of this technology and Beijing Tianqing Power International CDM Consulting, Co., Ltd. will provide training and support regarding monitoring as described in Annex 4.

Tables A.2a and A.2b list the main events in the implementation of the proposed hydropower project.

Table A.2a Implementation schedule for the 1st level station

Date	Main event	Source
10-2004	The project proposal report was finished by the Yunnan Lingyu Water Conservancy and Hydroelectric Power Investigation and Design Co. Ltd.	Project Proposal Report
11-10-2004	The project owner is informed by the Government of Longchuan County who recommended the project owner to apply for CDM project.	The notice from the Government of Longchuan County
18-12-2004	Due to the high investment risk, loan's difficulty and low IRR, the project owner decided to apply for CDM project	Directorate decision for applying CDM
05-01-2005	Approval of project proposal report by the local Development and Reform Commission of Dehong Dai-Jingpo Autonomous Prefecture	Project Proposal Report Approval
10-1-2005	The project owner signed agreement of turbine and generator with the manufacture.	The purchase agreement of turbine and generator.
4-3-2005	The project owner asked the Development and Reform Bureau of Longchuan County to support CDM application	The project owner's request of support CDM application
7-3-2005	The project owner received the support letter from the Development and Reform Bureau of Longchuan County	The support letter from the Development and Reform Bureau of Longchuan County
10-3-2005	When the project owner applied for the project's approvals, the Development and Reform Bureau of Longchuan County approved the project owner to start construction.	Permission for Starting Construction from from the Development and Reform Bureau of Longchuan County
10-2005	The Feasibility Study Report was finished by the Yunnan Lingyu Hydropower Investigation Co. Ltd.	
6-12-2005	EIA approval received	
31-12-2005	Approval received from the Development and Reform Commission of Dehong Dai-Jingpo Autonomous Prefecture	
25-9-2005	The project began to commission	The inspection and check opinion from Yunnan Dehong Power

		Co., Ltd.
Jan. 2006	The Supplement Finance Analysis Report was finished by the Yunnan Lingyu Water Conservancy and Hydroelectric Power Investigation and Design Co. Ltd.	

Table A.2b Implementation schedule for the 2nd level station

Date	Main event	Source
10-2004	The project proposal report was finished by the Yunnan Lingyu Water Conservancy and Hydroelectric Power Investigation and Design Co. Ltd.	Project Proposal Report
11-10-2004	The project owner was informed from the Government of Longchuan County who recommended the project owner to apply for CDM project.	The notice from the Government of Longchuan County
18-12-2004	Due to the high investment risk, loan's difficulty and low IRR, the project owner decided to apply for CDM project	Directorate decision for applying CDM
05-01-2005	Approval of project proposal report by the local Development and Reform Commission of Dehong Dai-Jingpo Autonomous Prefecture	Project Proposal Report Approval
9-8-2005	The project owner signed purchase agreement of turbine and generator with the manufacture.	The purchase agreement of turbine and generator.
4-3-2005	The project owner asked the Development and Reform Bureau of Longchuan County to support CDM application	The project owner's request of support CDM application
7-3-2005	The project owner received the support letter from the Development and Reform Bureau of Longchuan County	The support letter from the Development and Reform Bureau of Longchuan County
10-3-2005	When the project owner applied for the project's approvals, the Development and Reform Bureau of Longchuan County approved the project owner to start the construction.	Permission for Starting Construction from the Development and Reform Bureau of Longchuan County
Oct. 2005	The Feasibility Study Report was finished by the Yunnan Lingyu Water Conservancy and Hydroelectric Power Investigation and Design Co. Ltd.	
6-12-2005	EIA approval receive	
31-12-2005	Approval received from the Development and Reform Commission of Dehong Dai-Jingpo Autonomous Prefecture	
Jan. 2006	The Supplement Finance Analysis Report was finished by the Yunnan Lingyu Water Conservancy and Hydroelectric Power Investigation and Design Co. Ltd.	
29-4-2007	The project began to commissioning.	The inspection and checking opinion from Yunnan Dehong Power Co., Ltd.

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

The project activity employs the renewable crediting period, and the estimation of the emission reductions during the first crediting period is provided in Table A.3. The total estimated emission reductions in the first crediting period are 244,349tCO_2e.

Table A.3 Estimation of the Emission Reductions in the First Crediting Period

Years	Annual estimation of emission reductions (tCO_2e)
1 March 2008 – 28 February 2009	34,907
1 March 2009 –28 February 2010	34,907
1 March 2010 –28 February 2011	34,907
1 March 2011 –28 February 2012	34,907
1 March 2012 –28 February 2013	34,907
1 March 2013 –28 February 2014	34,907
1 March 2014 –28 February2015	34,907
Total estimated reductions (tCO_2e) of the first crediting period	**244,349**
Total number of the first crediting period years	7
Annual average reductions over the first crediting period (tCO_2e)	34,907

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

There is no public funding from Annex I countries available for the project.

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

According to Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a 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 2 years; And
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

A proposed small-scale project activity shall not be deemed to be a debundled component of a large project activity if one of the criteria mentioned does not apply to the project.

Except the proposed project, the project owner of the project has not developed other small scale projects within a distance of 1km from the proposed project. So the proposed project is not a debundled component of a large 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:

"AMS-I.D "Grid conected renewable electricity generation", version 10, was employed for the project.

The approved baseline methodology ACM0002/Version 06 will be employed, which is consolidated methodology for grid-connected electricity generation from renewable sources.
The methodology can be found from:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

The AMS-I.D. methodology is applicable to small-scale project activities, under the following restrictions (see version 10 of AMS.I.D):

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.
2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.
3. Biomass combined heat and power (co-generation) systems that supply electricity to and/or displace electricity from a grid are included in this category. To qualify under this category, the sum of all forms of energy output shall not exceed 45 $MW_{thermal}$ e.g. for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 $MW_{thermal}$.
4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[1] from the existing units.
5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

The proposed project activity satisfies these applicability criteria:

- The project is a small-scale project activity; see Section A of this PDD. The project has an installed capacity of 10.5 MW. Therefore, the project will not surpass the threshold of 15 MW for the applicability of the AMS.I.D methodology. (Satisfying the general precondition for the use of an AMS methodology)
- The project involves hydro energy resources, one of the renewable energy generation technologies listed (see restriction 1 above).

[1] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

- The project provides power to the power grid. The existing power grid partially utilizes fossil fuels as power source, as described in Section A.2 and Section B.6 (see restriction 1 above).
- The project does not have a non-renewable component, meaning that the restrictions mentioned under point 2 above are not applicable.
- The project does not involve biomass-based combined heat and power systems, meaning that the restrictions mentioned under point 3 above are not applicable.
- The project does not involve the addition of renewable energy generation units at an existing renewable power generation facility, meaning that the restrictions mentioned under point 4 above are not applicable.
- The project does not seek to retrofit or modify an existing facility for renewable energy generation, meaning that the restrictions mentioned under point 5 above are not applicable.

We therefore conclude that the project satisfies all conditions for the application of small-scale methodology AMS.I.D.

B.3. Description of the project boundary:

The project boundary, as stated in Appendix B of the simplified modalities and procedures for small scale CDM project activities, is limited to the physical project activity. Project activities that displace energy supplied by external sources shall earn certified emission reductions (CERs) for the emission reductions associated with the reduced supply of energy by those external sources.

The physical project boundary of the project includes the area occupied by the components of the two levels of hydropower stations until the connection with the grid, which includes for each level:

- Dam structure
- Water diversion structure including water intake, water diversion tunnel and penstocks
- Power house including turbines/generators and auxiliary equipment
- On-site switching / transformer station (owned by the project entity)
- Transmission lines to the grid

The AMS.I.D methodology does not provide guidance on how the system boundary of the project is to be determined. We therefore have applied the guidance available for the ACM0002 methodology. According to the ACM0002 (version 6) methodology, the relevant grid definition should be based on the following considerations:

1. Use the delineation of grid boundaries as provided by the DNA of the host country if available; or
2. Use, where DNA guidance is not available, the following definition of boundary:
   in large countries with layered dispatch system (e.g. state/provincial/regional/national) the regional grid definition should be used.

According to above requirements, the regional grid (South China Grid) is selected as the project boundary.

As mentioned above, the boundary of the project is marked by the point where the project connects to the grid. The project is connected to the Yunnan Grid, which is part of the South China Grid, which includes the grids of Guangdong, Guangxi, Yunnan and Guizhou[2]. The geographical boundaries for the determination of the baseline emissions are therefore defined as the South China Grid and direct emissions from all generation sources serving the grid. The South China Grid imports electricity from the Central China Grid. Accordingly, we have selected the Central China Grid as the connected electricity

2 http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2006/20061215144550669.pdf

system. For ease of reference, when we refer throughout this PDD to the South China Grid, this will take account of the emissions associated with the imports of power from the connected electricity system (i.e. Central China Grid).

B.4. Description of baseline and its development:

There are only a few scenarios that are prima facie realistic and credible in the context of the South China Grid:

1. Scenario 1. The electricity is supplied by the proposed project activity without the support of CDM;
2. Scenario 2. The electricity is supplied by the thermal power plant with equivalent installed capacity or equivalent annual power generation;
3. Scenario 3. The electricity is supplied by a other renewable energy power plant with equivalent installed capacity or equivalent annual power generation;
4. Scenario 4. The electricity is supplied by South China Grid.

Scenario 1

The first scenario is in compliance with Chinese relevant laws and regulations, but as we will argue in Section B.5 step 1 (Investment barrier analysis), Scenario 1 is not feasible as baseline scenario because of insurmountable economic barriers.

Scenario 2

Scenario 2 is not consistent with Chinese laws and regulations. According to Chinese regulations, coal-fired power plants of less than 135MW are prohibited for construction in the areas covered by the large grids such as provincial grids[3], while construction of thermal power units under 100MW[4] is strictly controlled. As the proposed project's capacity is 10.5MW, we conclude that the second scenario is not in accordance with Chinese laws and regulations and therefore is not a feasible alternative to the propose project activity.

Scenario 3

The third scenario is not feasible as there are no credible renewable energy alternatives is the region. The project area is poor in wind energy resources[5], so it is not provided with conditions for constructing wind power plant with the equivalent installed capacity. At present, there are no wind farms in this area. Therefore, the third scenario is not feasible.

Scenario 4

Scenario 4 is in compliance with relevant Chinese laws and regulations and does not meet insurmountable economic barriers.

From the above analysis we can conclude that the fourth scenario is the only feasible and credible baseline scenario. Therefore, the baseline scenario of this project is: electricity delivered to South China Grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

---

3 Notice on Strictly Prohibiting the Installation of Fuel fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Decree No. 6 (2002).

4 The Temporary Stipulation of the Construction Management of Small Scale Units of Fuel-fired Power Generation (August, 1997)

5 The China new energy net: http://www.newenergy.org.cn/html/2006-2/2006217_7650.html

The project activity involves a construction of a zero-emission power source. Thus, the emission reductions are equal to the baseline emissions.

In accordance with the ACM0002 methodology, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. The baseline emission factor is equal to the combined margin: a weighted average of the operating margin emission factor and the build margin emission factor. See Section B.6 for details.

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 Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities the following categories of barriers are recognized as a basis for the additionality argument:

1. Investment barriers
2. Technological barriers
3. Barriers due to prevailing practice
4. Other barriers

The additionality argument below will be based on a combination of an investment barrier with other barriers.

1. Investment Barrier Analysis

This PDD states that the project is not economically attractive without the revenues from the sale of CERs. There are, in principle, three analysis methods that can be used to demonstrate this:

- Option I: Simple cost analysis.
- Option II: Investment comparison analysis.
- Option III: Benchmark analysis.

Option I is not applicable as the project results in revenues from the sale of power to the grid. Option II is not applicable, because the only alternative to the proposed project activity conducted without CDM is the supply of power from the grid (see Section B.4). Therefore, the benchmark analysis is appropriate.

As financial parameter for the benchmark analysis we use the IRR. The choice of the IRR is appropriate, because this parameter is generally used for project approval decisions in the Chinese power sector. According to Chinese *Economic evaluation code for small hydropower projects*, the IRR of an electric power project's total investment should not be lower than the threshold of 10%.[6] Therefore, the benchmark analysis will use the IRR as the prime financial indicator, and the benchmark rate of the IRR is 10%.

The basic parameters for the calculation and calculation method of annual operating cost of the IRR are provided in Table B.1 and Table B.2 respectively. The IRR of the proposed project (i.e. both levels combined and for both levels separately) is provided in Table B.2 and B.3. All data used as input values

6 The Revision of Economic Evaluation Code for Small Hydropower Project (SL16-95). A "small hydropower project" is a hydropower station with installed capacity lower than 25MW.

for the calculation of the IRRs are from the Project Proposal Reports (PPR), which are an appropriate and reliable source.

Table B.1 Basic financial parameters

Parameters	Bienaihe 1st level station	Source	Bienaihe 2nd level station	Source
Installed capacity (MW)	2.5	Project Proposal Report for Bienaihe 1st level station (Section 1.2: Financial Evaluation, Page No. 49-53)	8	Project Proposal Report for Bienaihe 2nd level station (Section 1.2: Financial Evaluation, Page No. 63-67)
Annual Power supplied to Grid (MWh)	10,800		34,048	
Static Total Investment (Ten Thousand Yuan RMB)	1,208.73		3,892.30	
Estimated grid price (Yuan RMB / kWh, with VAT)	0.17		0.17	
Operational period (years)	25		25	
VAT	6%		6%	
Corporate Income Tax	33%		33%	
Annual operating cost (Ten Thousand Yuan RMB)	35,48		100.09	

Table B.2. IRRs of the two separate levels of the propose project activity

Scenario	IRR
Bienaihe 1st level station without CDM revenues	7.59%
Bienaihe 1st level station with CDM revenues	10.99%
Bienaihe 2nd level station without CDM revenues	7.68%
Bienaihe 2nd level station with CDM revenues	11%

Table B.3. IRR of total investment

Scenario	IRR
Without CDM revenue	7.66%
With CDM revenue	11%

Without CDM revenues, the IRR of the project is 7.66%, which is below the benchmark of 10%. Based on a CERs price of 8 EUR/tCO_2, the IRR with CDM revenues will increase to 11%, surpassing the benchmark of 10%.[5] This is also true for the two levels of the proposed project activity separately. Therefore, the CDM revenues can improve the economic attractiveness of the project.

We have also conducted a sensitivity analysis to assess whether under reasonable variations in the critical

5 The Chinese DNA has set a minimum price necessary to obtain host country approval for CDM projects. Although the minimum price has not been published, commonly 8 EUR/tCO_2 is regarded as the minimum price the NDRC will accept. The CER price agreed for this project is either equal to or above 8 EUR/tCO_2, but is considered a commercial secret. Using the minimal CER price is conservative, as a higher CER price would increase the IRR with CDM revenues even higher above the benchmark. For instance, with a CER price of 10 EUR/tCO_2, we calculate a IRR with CDM revenues of 11.85%

assumptions, the results of the analysis remain unaltered. We have used as critical assumptions:

- Power sales revenues [6]
- Static total investment
- Annual operational cost

Variations of 10% have been considered in the critical assumptions. Table B.4 summarizes the results of the sensitivity analysis, while Figure B.1 provides a graphic depiction.

Table B.4a Results of the sensitivity analysis for Bienaihe 1st level station

	-10%	-5%	0%	5%	10%
Power sales revenues	6.33%	7.01%	7.59%	8.24%	8.80%
Static total investment	8.87%	8.20%	7.59%	7.03%	6.51%
Annual operational cost	7.97%	7.78%	7.59%	7.40%	7.21%

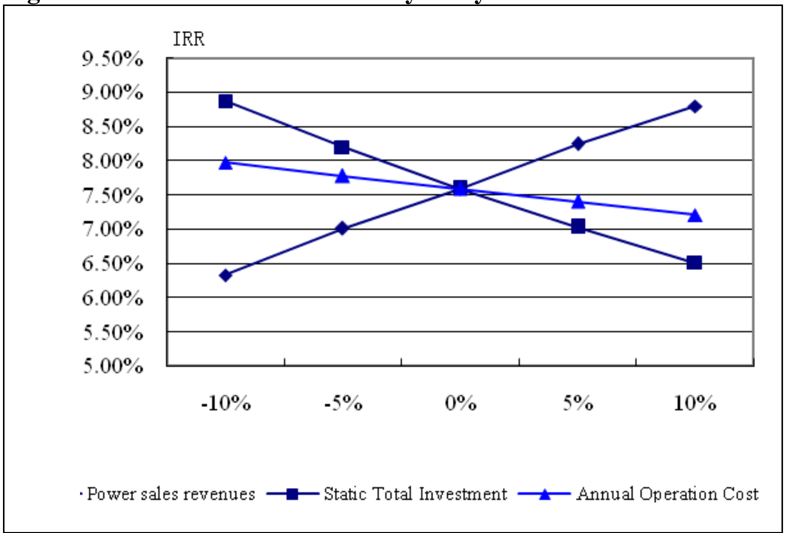
Table B.4b Results of the sensitivity analysis for Bienaihe 2nd level station

	-10%	-5%	0%	5%	10%
Power sales revenues	6.45%	7.11%	7.68%	8.31%	8.86%
Static total investment	8.96%	8.29%	7.68%	7.12%	6.59%
Annual operational cost	8.01%	7.85%	7.68%	7.52%	7.35%

Table B.4c Results of the sensitivity analysis for the proposed project activity

	-10%	-5%	0%	5%	10%
Power sales revenues	6.43%	7.09%	7.66%	8.29%	8.84%
Static total investment	8.94%	8.27%	7.66%	7.10%	6.58%
Annual operational cost	8.00%	7.83%	7.66%	7.49%	7.32%

Figure B.1a Results of the sensitivity analysis for Bienaihe 1st level station



6 The impact of a variation in power sale revenues is equivalent to a variation of either the grid price or the annual operation hours and therefore only the product of these parameters (i.e. power sale revenues) has been included in the sensitivity analysis.

Figure B.1b Results of the sensitivity analysis for Bienaihe 2nd level station

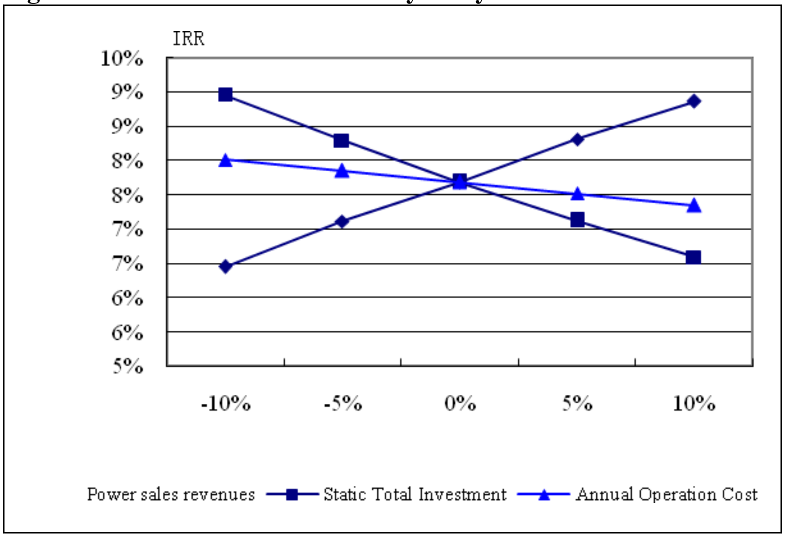
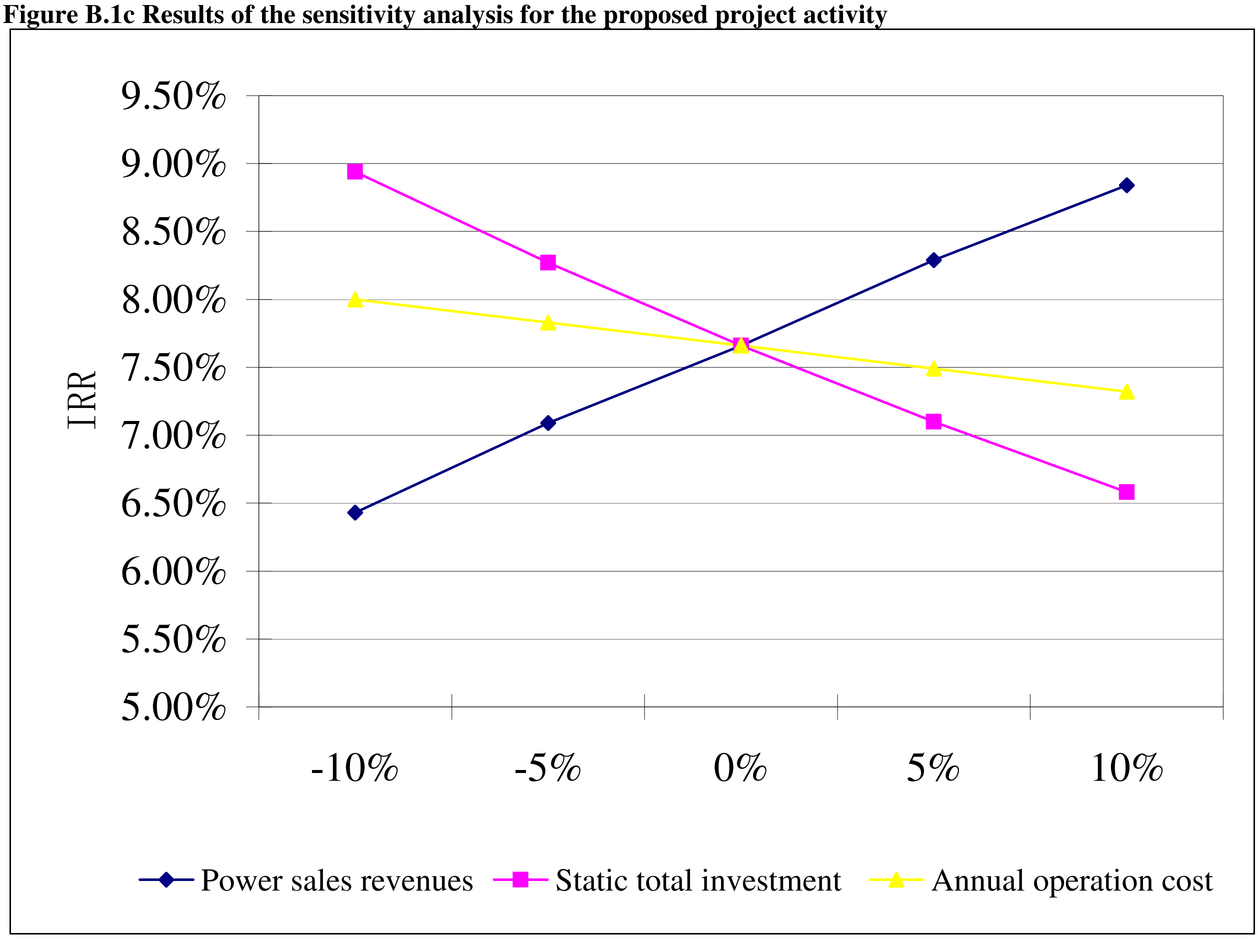


Figure B.1c Results of the sensitivity analysis for the proposed project activity



The conclusion may be clear that with reasonable modifications in the critical assumptions, the main results remain unaltered: the project (including the two sub-projects separately) remains economically and financially unattractive without the revenues from the sale of CERs through CDM, as evidence by an IRR that is substantially below the threshold of 10%.

2 Other Barriers

Uncertainty of electricity sale
Hydropower is strongly affected by hydrological conditions, and local rainfall is unequally distributed throughout the whole year (i.e. the rainfall concentrates in the period Jun.-Sep.). The project consist of two run-of-river hydropower stations without regulating capacity, so the hydropower station can not utilize the abundant water resources during the flood season. This makes it difficult to achieve the estimated annual operating hours. On the contrary, the station will not operate at its full potential during the dry season. The uncertainty of electricity sales reduces the commercial attractiveness of the proposed project.

We therefore conclude that without CDM, the project faces several barriers, which would prevent the construction and implementation of the proposed project activity. CDM helps to overcome these barriers. If the project is not implemented, electrical power will be supplied by the South China Grid, which partly depends on thermal power as its energy source. Thermal power has GHG emissions associated with it.

The proposed project activity will not be implemented without the registration as a CDM project and will reduce GHG emissions below the baseline. Therefore, the proposed project activity is additional.

The project entity first heard about CDM from the Notice from the Government of Longchuan County who recommended the project owner to apply for CDM project on the 11th of October 2004. The project proposal report was finished by the Yunnan Lingyu Water Conservancy and Hydroelectric Power Investigation and Design Co. Ltd. in October 2004. The IRR of Bienaihe 1st level station was 7.59% and The IRR of Bienaihe 2nd level station was 7.68% in the project proposal report. The project's returns on investment are below the benchmark of 10%, so the project faces a barrier to implementing due to the poor returns on investment. Due to the high investment risk, loan's difficulty and low IRR, the project owner decided to apply for CDM project on December 18, 2004. Because the NDRC was in charge of CDM application work, project owner asked the Development and Reform Bureau of Longchuan County to support CDM application on March 4, 2005. The project owner received the CDM support letter from the Development and Reform Bureau of Longchuan County on March 7, 2005. Although the project owner was applying for the project's approvals at that time, the Development and Reform Bureau of Longchuan County approved the project owner to start construction on March 10, 2005. So before the start of the main construction activities, the project owner was very knowledgeable about the opportunities offered by CDM. Although Bienaihe 1st level hydropower station has operated for two years, this project couldn't operation normally and it's benefit was very poor. So the Bienaihe 1st level hydropower station still needed the support of CDM to operate normally. An overview of key events is given in Table A.2a and Table A.2b.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The project is connected to the Yunnan Grid, which is part of the South China Power Grid, which includes the grids of Guangdong, Guangxi, Yunnan and Guizhou. Therefore, the project selects for the South China Power Grid for the calculation of Operating Margin emission factor.

According to methodology AMS-Ⅰ.D., offers the following choices for preparing the baseline calculation for the project activity:

(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. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered;

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The project has been chosen for baseline analysis using method (a) for the baseline calculations because the data of the year in which project generation occurs can not acquire.

Baseline

According to methodology ACM0002, Baseline emissions are equal to the power delivered to the grid, multiplied by the baseline emission factor EF_y. The baseline emission factor is equal to the combined margins: the equally weighted average of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$).

According to the *Bulletin on Baseline Emission Factor of China Region Grid* which was published by the Office of National Coordination Committee on Climate Change on Dec. 15, 2006[7], the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$) calculation for the South China Grid is as follows:

STEP 1 Calculate the Operating Margin emission factor ($EF_{OM,y}$)

ACM0002 (version 06) offers four options for the calculation of the Operating Margin emission factor(s) ($EF_{OM,y}$):

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

As per ACM0002, "Dispatch Data Analysis" should be the first methodological choice. However, the method is not selected herein, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, the simple adjusted OM methodology cannot be used.

7 Bulletin on confirming of the baseline emission factor for China Grid is promulgated by Office of National Coordination Committee on Climate Change, Dec. 15. 2006.

The Simple OM method has been chosen instead. This is possible because low cost/ must run resources account for less than 50% of the power generation in the grid in most recent years. Specifically, from 2000 to 2005, in the composition of gross annual generation power for Southern China Power Grid, the ratio of power generated by hydro-power and other low cost/compulsory resources was: 32.96% in 2000, 32.39% in 2001, 31.60% in 2002, 31.06% in 2003, 29.72% in 2004, obviously lower than 50%.Finally, the "ex-ante vintage" will be employed for OM calculation of the project.

According to the ACM0002 (version 06), the Simple OM has been employed to calculate the OM. The calculation equation is as follows:

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{j} GEN_{j,y}}$$ Equation (B.1)

Where

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

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2e/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by provinces j and the percent oxidation of the fuel(coal, oil and gas) in year(s) y; and

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

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i$$ Equation (B.2)

Where:

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

$OXID_i$ is the oxidation factor of the fuel ,1996 Revised IPCC Guidelines for default values;

$EF_{CO_2,i}$ is the CO_2 emission factor per unit of energy of the fuel i ,1996 Revised IPCC Guidelines for default values.

In addition, there is net imported power to the South China Grid from the Central China Grid. Since it is not possible to identify the specific power plants exporting electricity from the Central China Grid to the South China Grid, the average emission factor of the Central China Grid will be taken into account.

The Operating Margin emission factors for 2002, 2003 and 2004 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we can find in the bulletin mentioned above. The published Operation Margin Emission Factor as 0.9853tCO_2e/MWh.

The operating margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period of the project activity.

STEP 2 Calculate the Build Margin emission factor ($EF_{BM,y}$)

According to ACM0002, the Build Margin Emission Factor is calculated as the generation weighted average emission factor (measured in tCO_2e/MWh) of a sample of *m* power plants. The calculation equation is as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}}$$ Equation (B.3)

Where

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

$COEF_{i,j,m}$ is the CO_2 emission coefficient of fuel i (tCO_2e/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power plants m and the percent oxidation of the fuel(coal, oil and gas) in year(s) y; and

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

The methodology supplied the following two options:

Option 1: Calculate the Build Margin emission factor $EF_{BM,y}$ *ex-ante based on the most recent three years information available on plants already built for sample group m at the time of PDD submission.*

Option 2: For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ *must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods,* $EF_{BM,y}$ *should be calculated ex-ante, as described in option 1 above.*

Project participants have chosen Option 1. However, in China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts[8] the following deviation in methodology application:

1) Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1 - 3 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.

2) Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. 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.

The build margin calculations featured below is derived from the "Bulletin on the baseline emission factor of the Chinese Electricity Grid", which has been published by the Chinese DNA (Office of National Coordination Committee on Climate Change) on Dec. 15. 2006.

Since there is no way to separate the different generation technology capacities as coal, oil or gas fuel etc from thermal power based on the present statistical data, the following calculation measures will be taken: First, according to the energy balance sheet of the most recent year, we should calculate the ratio of

8 This is in accordance with the „Request for guidance: Application of AM0005 and AMS-I.D in China", a letter from DNV to the Executive Board, dated 07/10/2005, available online at:
http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM.
This approach has been applied by several registered CDM projects using methodology ACM0002 so far.

different emissions of CO_2 produced by solid, liquid, and gas fuels for power generation which is part of the total CO_2 emissions; then take this ratio as the weight, take the emission factor based on the commercial optimal efficiency technology level as the base and calculate the emission factor of the thermal power for the grids; finally, multiply this emission factor for thermal power with the ratio of thermal power which is part of the 20% installed capacity addition for the grid, the result is the BM emission factor for the grid.

Sub-step 1

Calculate the proportion of CO_2 emissions of the solid, liquid and gas fuels used to generate power in the total CO_2 emissions of three fuels.

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

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

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

Where,

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

$COEF_{i,j,m}$ is the CO_2 emission coefficient of fuel i (tCO_2e/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power plants m and the oxidation percentage of the fuel(coal, oil and gas) in year(s) y,

Coal, Oil and *Gas* is solid, liquid and gas fuels respectively.

Sub-step 2: Calculate the operating margin emission factor of fuel-based generation:

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

Where,

$EF_{Coal,Adv}, EF_{Oil,Adv}, EF_{Gas,Adv}$ are the operating margin emission factors respectively consumed by coal-fired, oil-fired and gas-fired generation technology in the commercial optimization efficiency.

A coal-fired power plant with a total installed capacity of 600MW is assumed to be the commercially available best practice technology in terms of efficiency, The estimated coal consumption of such a National Sub-critical Power Station with a capacity of 600MW is 336.66gce/kWh, which corresponds to an efficiency of 36.53% for electricity generation.

For gas and oil power plants a 200MW power plant with a specific fuel consumption of 268.13gce/kWh, which corresponds to an efficiency of 45.87% for electricity generation, is selected as commercially available best practice technology in terms of efficiency.

The main parameters used for calculation of the thermal power plant emission factors $EF_{Coal,Adv}$, $EF_{Oil,Adv}$, $EF_{Gas,Adv}$ are provided in the table13 of Annex3.

Sub-step 3: Calculate the Build Margin emission factor

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

Where,

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

For details we can find in the bulletin mentioned above. The published Build Margin emission factor is 0.5714tCO_2e/MWh.

As mentioned above, the build margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period.

The data resources for calculating OM and BM are:
1. Installed capacity, power generation and the rate of internal electricity consumption of thermal power plants
2. Source: *China Electric Power Yearbook* (2003-2005)
3. Fuel consumption and the net caloric value of thermal power plants
4. Source: *China Energy Statistical Yearbook* (figures are for 2000-2005)
5. Carbon emission factor and carbon oxidation factor of each fuel
6. Source: *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*, Table 1-2 of Page 1.6 and Table 1-4 of Page 1.8 in Chapter one.

STEP 3 Calculate the Electricity Baseline Emission Factor (EF_y **)**

The Baseline Emission Factor is calculated as a Combined Margin, using the weighted average of the Operating Margin and Build Margin.

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$ Equation (B.9)

According to the *Bulletin on Baseline Emission Factor of China Region Grid* which was published by the Office of National Coordination Committee on Climate Change on Dec. 15, 2006, the operating margin emission factor (EF_{OM}) of South China Grid is 0.9853tCO_2e/MWh and the build margin emission factor (EF_{BM}) is 0.5714tCO_2e/MWh,. The defaults weights for hydroelectric power projects are used as specified in the ACM0002 (version 06).

$$w_{OM} = 0.5 ; w_{BM} = 0.5$$

We calculate a Baseline Emission Factor of 0.77835tCO_2e/MWh.

Step 4. Calculation of Baseline Emissions

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - L_y \qquad \text{Equation (B.10)}$$

where the baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) calculated in Step 3, times the electricity supplied by the project activity to the grid (EG_y in MWh), as follows:

$$BE_y = EG_y \times EF_y \qquad \text{Equation (B.11)}$$

Where,

EG_y is the electricity supplied to the grid in y year, it is calculated by:

$$EG_y = EG_{s,y} - PR_{g,y} \qquad \text{Equation (B.12)}$$

Of which: $EG_{s,y}$ is the power supplied to the grid.

$PR_{g,y}$ is the electricity use of power plant supplied by the grid.

EF_y is baseline emissions factor, in tCO_2e/MWh.

Based on AMS-I.D, project participant does not need to consider leakage in applying AMS-I.D methodology, i.e. $L_y = 0$.

Therefore, the emission reductions of this specific project are equal to the baseline emissions, i.e.

$$ER_y = BE_y = EG_y \times EF_y \qquad \text{Equation (B.13)}$$

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

Data / Parameter:	$EGP_{m,y,j}$
Data unit:	MWh
Description:	The Generation of Power Sources j of Province m in (years) y (2002-2004, including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Electric Power Yearbook 2003-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate the power delivered to the grid

Data / Parameter:	$GEN_{import,y}$
Data unit:	MWh
Description:	The Power Transmitted from the Central China Grid to the South China Grid in (years) y

	(2002-2004,)
Source of data used:	*China Electric Power Yearbook 2003-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate the OM

Data / Parameter:	$PR_{m,y}$
Data unit:	%
Description:	The rate of electricity consumption of thermal power plants of Province m in year (s) y (2002-2004 including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Electric Power Yearbook 2003-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate the power delivered to the grid

Data / Parameter:	$F_{i,,j,y,m}$
Data unit:	10^4t/10^8m^3
Description:	The Fuel Consumption of Power Sources j of Province m in (years) y (2002-2004, including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Energy Statistical Yearbook 2000-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate OM and BM

Data / Parameter:	NCV_i
Data unit:	TJ/ fuel in a mass or volume unit
Description:	The NCV_i *of* Fuel i in a mass or volume unit
Source of data used:	*China Energy Statistical Yearbook 2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate OM and BM

Data / Parameter:	$EF_{CO_2,i}$
Data unit:	tC/TJ
Description:	The Emission Factor of Fuel i in a mass or volume unit
Source of data used:	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC Default Value
Any comment:	To calculate OM and BM

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	The Oxidation Rate of Fuel i
Source of data used:	*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC Default Value
Any comment:	To calculate OM and BM

Data / Parameter:	$GENE_{best,coal}$
Data unit:	%
Description:	The optimum commercial, coal-fired power supply efficiency
Source of data used:	*Clean Development Mechanism in China: Bulletin on Baseline Emission Factor of China Region Grid-the calculation of baseline Build Margin emission factor for China Grid*
Value applied:	36.53%
Justification of the choice of data or description of measurement methods and procedures actually applied :	National Fixed Value
Any comment:	To calculate OM

Data / Parameter:	$GENE_{best,oil/gas}$
Data unit:	%
Description:	The optimum commercial, oil and gas power supply efficiency
Source of data used:	*Clean Development Mechanism in China: Bulletin on Baseline Emission Factor of China Region Grid-the calculation of baseline Build Margin emission factor for China Grid*
Value applied:	45.87%
Justification of the choice	National Fixed Value

of data or description of measurement methods and procedures actually applied :	
Any comment:	To calculate OM

Data / Parameter:	$CAP_{m,y,i}$
Data unit:	MW
Description:	The Install Capacity of Power Sources j of Province m in (years) y (2000-2004, including Guangdong, Guangxi, Yunnan and Guizhou)
Source of data used:	*China Electric Power Yearbook 2001-2005*
Value applied:	Provided in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official Statistical Data
Any comment:	To calculate BM

B.6.3 Ex-ante calculation of emission reductions:

Based on the Supplement Financial Analysis Report, the net annual electric power supplied to the grid by the project is 44,848 MWh.

In a given year, the emission reductions realized by the project activity (ER_y) is equal to baseline GHG emissions (BE_y) minus project direct emissions and leakages during the same year:

$$ER_y = BE_y - PE_y - L_y$$
$$= BE_y - 0 - 0$$
$$= BE_y$$

Thus the annual emission reductions are 34,907tCO_2e.

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

Table B.5 provides the annual emission reductions in tabular form.

Table B.5 Estimate of emission reductions due to the project in the first crediting period

Year	**Estimation of project activity emissions (tCO_2e)**	**Estimation of baseline emissions (tCO_2e)**	**Estimation of leakage (tCO_2e)**	**Estimation of overall emission reductions (tCO_2e)**
01/03/2008 – 28/02/2009	0	34,907	0	34,907
01/03/2009 –28/02/2010	0	34,907	0	34,907
01/03/2010 –28/02/2011	0	34,907	0	34,907
01/03/2011 –28/02/2012	0	34,907	0	34,907
01/03/2012 –28/02/2013	0	34,907	0	34,907
01/03/2013 –28/02/2014	0	34,907	0	34,907

01/03/2014 –28/02/2015	0	34,907	0	34,907
Total (tonnes of CO_2e)	**0**	**244,349**	**0**	**244,349**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{y,1st\ level}$**
Data unit:	MWh
Description:	Electricity supplied to the grid by the 1st level hydropower station of the proposed project activity
Source of data to be used:	Directly measured by meter M1, see figure B.2
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10,800 MWh
Description of measurement methods and procedures to be applied:	The net supply of power to the grid by the Yunnan Dehong Longchuan Bienaihe 1st Level Hydropower Station Project is measured through national standard electricity metering instruments. The metering instruments will be calibrated annually in accordance with the *"Technical administrative code of electric energy metering (DL/T448 —2000)"*. The net amount of power supplied is measured continuously and recorded monthly.
QA/QC procedures to be applied:	These data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to ensure the consistency.
Any comment:	The measured gross electricity supply will be double checked by receipts of sales to the grid and billing invoices for electricity provided by the grid to the proposed project. (see also Section B.7.2 for more details)

Data / Parameter:	**$EG_{y,2nd\ level}$**
Data unit:	MWh
Description:	Electricity supplied to the grid by the 2nd level hydropower station of the proposed project activity
Source of data to be used:	Directly measured by Meter M3, see figure B.2.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	34,048 MWh
Description of measurement methods and procedures to be applied:	The net supply of power to the grid by the Yunnan Dehong Longchuan Bienaihe 2nd Level Hydropower Station Project is measured through national standard electricity metering instruments. The metering instruments will be calibrated annually in accordance with the *"Technical administrative code of electric energy metering (DL/T448 —2000)"*. The net amount of power supplied is measured continuously and recorded

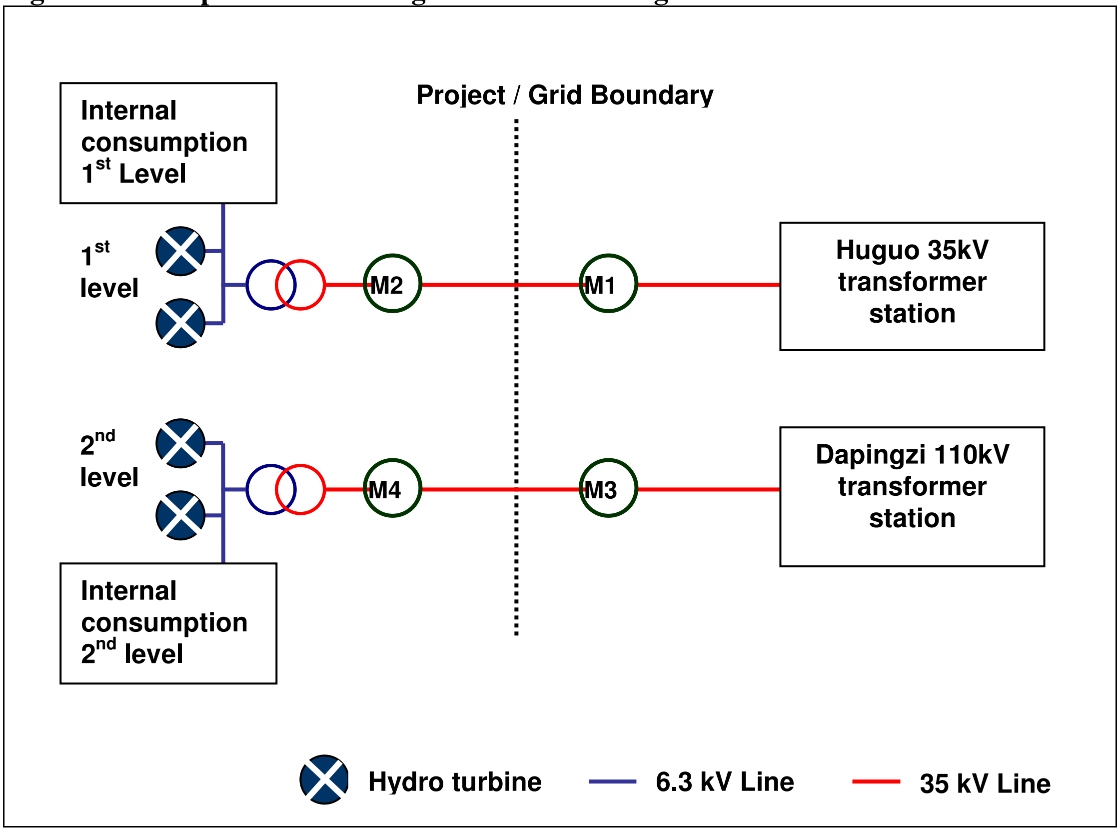
	monthly.
QA/QC procedures to be applied:	These data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to ensure the consistency.
Any comment:	The measured gross electricity supply will be double checked by receipts of sales to the grid and billing invoices for electricity provided by the grid to the proposed project. (see also Section B.7.2 for more details)

B.7.2 Description of the monitoring plan:

The objective of the monitoring plan is to insure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The project owner is mainly responsible for the implementation of the monitoring plan, and the Grid Company will cooperate with the project owner.

The project is connected to the grid through two on-site booster transformer stations (one for each level of the proposed project activity) that increase the voltage to from 6.3 kV to 35 kV. The project is then connected through two 35 kV power lines to the Huguo 35 kV transformer station (connects to the 1st level of the project) and the Dapingzi110 kV transformer station (connects to the 2nd level station) which connect the project to the grid. The power supplied to the grid is metered by the project entity at a point after power has been transformed to 35 kV (see figure B.2).

Figure B.2. Simplified electrical grid connection diagram



In emergencies, the project can also receive power from the grid transformer stations which is used for internal power consumption. Power supplied by the grid to the project activity will be metered and deducted from gross power supply.

The power supply of the project to the grid will be metered by the project entity with the meter M2 and M4, which are located at the high-voltage side of the step-up transformer stations that will be constructed at the project site. Metering instrument M2 and M4 will both record two readings, i.e. power delivered to the grid and power received from the grid. The project entity will log both readings for both levels of the project and the difference, i.e. power delivered minus power received, will be used for the calculation of net power supply per level of the project. Total net power supply by the project to the gird is the sum of the two levels' individual net power supply.

The grid company will meter power supply also at the high voltage side of the on-site transformer stations with its own metering equipment, i.e. bi-directional meters M1 and M3. The grid company will issue on the basis of the readings of M1 and M3 sales receipts for power received from the 1st and 2nd level of the project and billing invoices for power supplied to the 1st and 2nd level of the project.

Calibration of the meters will be carried out annually by the grid company and the results will be submitted to the project entity. After calibration, the meters will be sealed.

Meters M2 and M4 will produce hourly metering results, which will be reported monthly. The project entity will collect the sales receipts for power supplied to the grid and billing receipts for power received from the grid as evidence for the readings of meters M1 and M3. The net supply (i.e. gross supply minus supply by the grid to the project) will be used in the calculations. If there are substantial discrepancies between the readings of the metering instruments throughout the year, the instruments will be recalibrated. In case of discrepancies between the metering instruments of the grid company and the project entity, the readings of the grid company will prevail. All records as listed in table B.7 and the results of calibration will be collected in a central place by the project entity. The project entity will in principle report the monitoring data annually but may deviate to report at intervals corresponding to agreed verification periods and will ensure that these intervals are in accordance with CDM requirements. Data record will be archived for a period of 2 years after the crediting period to which the records pertain.

An overview of the recording frequency, calibration procedures and available documentation is provided in Table B.7. The numbering of the metering equipment refers to Figure B.2 which shows the location of each meter.

Table B.7 Details of metering instruments

Project level	Meter	Operated by	Electronic measurement	Manual measurement	Recording	Calibration	Accuracy	Documentation
1st level	M1	Grid Company	-	-	Hourly measurement and Monthly recording	Grid Company (Annually)	Accuracy Class 1.0 or more accurate	Monthly sales receipts (for power delivered to grid) and billing invoices (for power received from the grid) [9]

[9] Alternatively, the grid company might offer net sales receipts for the readings of meters M1 and M3 (i.e. electricity received from the project entity minus electricity delivered to the project entity).

	M2	Project entity	hourly	Daily (optional)[10]	Hourly measurement and Monthly recording	Grid Company (Annually)	Accuracy Class 2.0 or more accurate	Print out of electronic record and optional paper log. Data will consist of two readings, i.e. power delivered to the grid and power received from the grid.
2nd level	M3	Grid Company	-	-	Hourly measurement and Monthly recording	Grid Company (Annually)	Accuracy Class 0.5 or more accurate	Monthly sales receipts (for power delivered to grid) and billing invoices (for power received from the grid)
	M4	Project entity	hourly	Daily (optional)	Hourly measurement and Monthly recording	Grid Company (Annually)	Accuracy Class 2.0 or more accurate	Print out of electronic record and optional paper log. Data will consist of two readings, i.e. power delivered to the grid and power received from the grid.

PROCEDURES IN CASE OF DAMAGED METERING EQUIPMENT / EMERGENCIES

Damages to metering equipment:

In case metering equipment is damaged and no reliable readings can be recorded the project entity will estimate net supply by the proposed project activity according to the following procedure:

1. **In case metering equipment operated by project entity is damaged only:**
   The metering data logged by the grid company, evidenced by sales receipts will be used as record of net power supplied to the grid for the days for which no record could be recorded.
2. **In case both metering equipment operated by project entity and grid company is damaged:**
   The project entity and the grid company will jointly calculate a conservative estimate of power supplied to the grid. A statement will be prepared indicating
   ► the background to the damage to metering equipment
   ► the assumptions used to estimate net supply to the grid for the days for which no record could be recorded
   ► the estimation of power supplied to the grid
   The statement will be signed by both a representative of the project entity as well as a representative of the grid company.

The project entity will furthermore document all efforts taken to restore normal monitoring procedures.

Emergencies:

In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the following procedure for declaring the emergency period to be over:

1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.

[10] The project entity intends to log the readings of meters M2 and M4 manually in daily logs, but these logs will not form a formal requirement during verification. The ACM0002 methodology only requires hourly electronic measurement and these manual log records will only be maintained for back-up purposes. The project entity may deviate from this procedure during actual operation of the project.

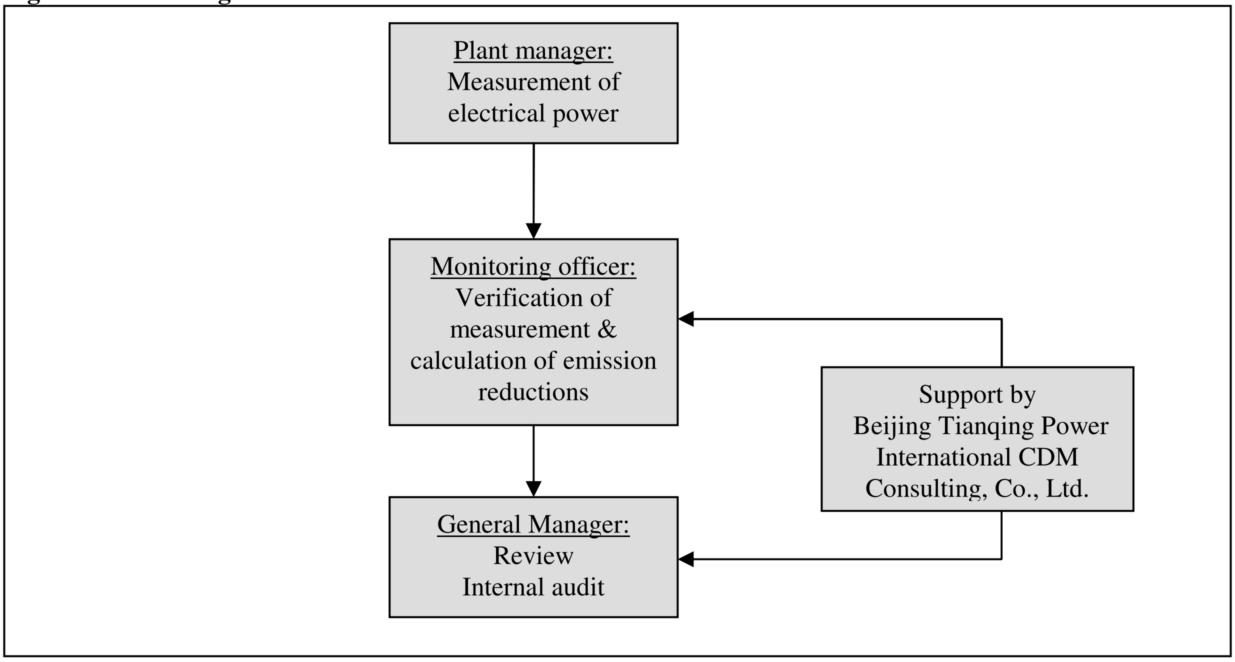
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure B.4. The General Manager of Longchuan Minhong Hydro Power Co. Ltd. will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the electrical energy supplied to the grid and reporting of daily operations, which will be carried out by the plant manager.

The project entity will appoint a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the grid to the hydropower plant and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the hydropower station including operating periods; power delivered to the grid, equipment defects, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Annex 4. Finally, the monitoring reports will be reviewed by the General Manager of Longchuan Minhong Hydro Power Co. Ltd.

Figure B.3. Management structure in order to monitor emission reductions



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

Date of completion: 26/12/2007

Name of persons determining the baseline:

Aimin Yang, General Manager, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68297768; 68297648
Fax: +86-10-68173473; 68166196
Email: aiminyang820@yahoo.com.cn

Jingqiu Yang, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68297768; 68297648
Fax: +86-10-68173473; 68166196
Email: jingqiuyang@yahoo.com.cn

Dongkui Jiang, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68297768; 68297648
Fax: +86-10-68173473; 68166196
Email: jiang_dongkuai@yahoo.com.cn

Xuemei Tang, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68297768; 68297648
Fax: +86-10-68173473; 68166196
Email: jasmine1982616@yahoo.com.cn

XiujuanYuan, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-68297768; 68297648
Fax: +86-10-68173473; 68166196
Email: abeautytracy@yahoo.com.cn

Casper Meeuwis van der Tak, General Director, Caspervandertak Consulting
Tel: +86-10-84505756
Fax: +86-10-84505758
Email: info@caspervandertakconsulting.com

Meskes Ywe Berkouwer, Consultant, Caspervandertak Consulting
Tel: +86-10-84505756
Fax: +86-10-84505758
Email: meskes@caspervandertakconsulting.com

Beijing Tianqing Power International CDM Consulting, Co., Ltd. and Caspervandertak Consulting are not project participants.

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:

10/01/2005

(On this day the equipment purchase contract for the Bienaihe 1st level station has been signed which is the earliest starting date of the proposed project activity)

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

25 years 0 months

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

C.2.1. Renewable crediting period

A renewable crediting period will be used.

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

01/03/2008 or the date after registration whichever is later

C.2.1.2. Length of the first crediting period:

7 years 0 months

C.2.2. Fixed crediting period:

Not applicable, a renewable crediting period will be applied.

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:

According to the relevant environmental laws and regulations, an environmental impact assessment (EIA) of the two stations has been carried out. The EIA has been approved by the Environment Protection Bureau of Dehong Dai-Jingpo Autonomous Prefecture Yunnan Province on December 6th, 2005. The main conclusions are provided as follows:

1. Impact on Atmosphere Environment
The main pollutant is dust caused by construction and transportation. The construction site will be equipped with watering devices, and there will be watering vehicles for the road. . The concrete milling device will be equipped with a dust removal device. Additionally, workers will be equipped with masks.

2. Impact on Ambient Environment
The noise mainly comes from digging, demolition, concrete milling, crushing and vehicles. There will be a speed limit for vehicles in the living area, and it is forbidden to use the althorn during the night. Additionally, the project will pay more attention to virescence along the road to mitigate the noise influence.

3. Impact on Aquatic Environment
The wastewater mainly consists of industrial wastewater and domestic wastewater. The industrial wastewater will be discharged after treatment in a simplified sedimentation tank which will reduce the quantity of sand and make the water meet the standards. The main contents of domestic wastewater are suspended particles, COD, nitrogen, and phosphorus, which will be led through an oil separator and discharged into Bienai River.

4. Impact of Solid Waste
The construction waste soil and slag will be transported to a designated waste disposal site. The waste will be covered by waste soil. Since the quantity of domestic waste during operation period is comparatively small, the project owner will build a special waste storage to reserve the waste, and the local sanitary department will clean them time to time.

5. The Impact on Soil and Water Loss
For the prevention of water and soil loss during the construction and operation period, some measures will be taken such as building a preventing slag wall and discharging water tunnel, taking plant measure, protecting road, and virescence in the dam area. It is expected that these practical measures effectively regulate the soil and water loss.

6. Impact of Land Requisition on Land Utilization and Immigration
The total occupied land of the 1st level station is 2.33ha (of which, permanent occupied land is 1.89ha and temporary occupied land is 0.44ha). The total occupied land of the 2nd level station is 3.93ha (of which, permanent occupied land is 2.86hm^2 and temporary occupied land is 1.07hm^2). The occupied tilled land is comparatively small, involving little farmland. The project has not involved immigration.

7. Impact on Ecosystem

There is no provincial protected vegetation or migrating fish or special fish. After the construction, the living habitat of tylototriton verrucosus and paa yunnanensis will be improved. Since the construction area is limited, the construction and operation will not cause much influence on this plant.

8. Impact on the Environmental Flow

The operation of Beinai river 1st station will lead to the reduction of riverway water from dam to power plant with the length about 7.2km, in dry season, there are streams in the two banks in the lower reaches of the dam site. Since the power station has already considered to requirement of ecological water needs, there is a discharge flow of about $0.1m^3/s$. Therefore, the power plant has little impact on eco-environment of the river. The operation of Beinai river 2nd station will lead to the reduction of riverway water from dam to power plant with the length about 5.1km, in dry season, there are streams in the two banks in the lower reaches of the dam site. Since the power station has already considered to requirement of ecological water needs, there is the water flow is about $0.1m^3/s$. Therefore, the power plant has little impact on eco-environment of the river.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the project are not considered significant by the Chinese government and the project participants. The Environmental Impact Assessment Form (EIA) was approved by the Environment Protection Bureau of Dehong Dai-Jingpo Autonomous Prefecture Yunnan Province on December 6th, 2005.

SECTION E. Stakeholders' comments

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

A special stakeholder consultation meeting for this project relating to CDM was hold from 10.00 to 12.00 on December 10th 2006 in Hongyun Hotel, Longchuan County, to collect opinions of all potential stakeholders, such as local residents and so on. The aim of this meeting was to collect opinions concerning the influence of the project on the local society, economy, and daily life.

To ensure that the information concerning this meeting is available to all potential stakeholders, Longchuan Minhong Hydro Power Co., Ltd. posted bulletins in the *Dehong United Newspaper* (2006-12-09), and on the website of Beijing Tianqing Power International CDM Consulting Co.,Ltd www.tqcdmchina.com. Furthermore, questionnaires were distributed to residents who may be impacted by the project and 16 investigation questionnaires have been returned. At the meeting, the project owner and consultant invited the participants to comment and express their concerns on the project and CDM. The representatives asked the following questions:

1. Will the noise during construction affects people's life?
2. Is there submergence caused by the project? If yes, will this influence the local residents?
3. Is there immigration caused by the project? If yes, is immigration voluntary? Are migrants satisfied with their new living conditions?
4. How do local residents earn a living?
5. What is the impact of the project on the local environment?
6. What is the impact of the construction of this project on the local industry?
7. Has the project impacted local residents' incomes?
8. Will the cost increase due to the implementation of the CDM project?
9. Do you know CDM before the project? What is the attitude of local residents and the government towards CDM projects? Do they support this CDM project?
10. Do all stakeholders agree with the construction of the hydropower stations?

E.2. Summary of the comments received:

We investigated some residents who might be impacted by the project by distributing investigation questionnaires. Of all the 16 investigated residents, all of them is older than 20, 19% of them are female, and 81% of them are senior high school graduates or higher. The following are the results:

- 100% of the investigated residents use firewood for heating and cooking.
- 100% of the investigated residents think the hydropower station will bring benefits to their lives and will not have a negative impact on their lives.
- 100% of the investigated residents think the construction of the project will not have a negative impact on the local environment.
- 100% of the investigated residents agree with the construction of this project.

From the questionnaires and stakeholders' meeting, we find that all residents and the local government agree with the construction of the project.

The land occupation of the construction is small, and affected residents will be properly compensated. The implementation of the proposed project will provide electricity power for both household consumption and industrial production. This project will accelerate the development of village enterprises, and will increase employment opportunities, incomes and the quality of life for local residents. The project owner has contributed to the local education and economy by donating money to the construction of bridge, road, grain yard, and school. In a word, the influence of the proposed project is positive, and all stakeholders agree with the construction of the proposed project.

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

Given the generally positive (or neutral) nature of the comments received, no action will been taken to solve the comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

The Project Entity:

Organization:	Longchuan Minhong Hydro power Co. Ltd
Street/P.O.Box:	South of Mengwan Road, Zhangfeng Town, Longchuan County
Building:	/
City:	Dehong Dai-Jingpo Autonomous Prefecture
State/Region:	Yunnan Province
Postfix/ZIP:	678700
Country:	China
Telephone:	+86-692-7172588
FAX:	+86-692-7177193
E-Mail:	/
URL:	/
Represented by:	Wenyao Lin
Title:	General Manager
Salutation:	Mr.
Last Name:	Lin
Middle Name:	/
First Name:	Wenyao
Department:	/
Mobile:	+86-13759202697
Direct FAX:	+86-692-7177193
Direct tel:	+86-692-7172588
Personal E-Mail:	lwy7750@sina.com

The Purchasing Party:

Organization:	RWE Power AG
Street/P.O.Box:	Rellinghauser Straβe 37
Building:	/
City:	Essen
State/Region:	/
Postfix/ZIP:	45128
Country:	Germany
Telephone:	+49-201-12-20226
FAX:	+49-201-12-24132
E-Mail:	michael.fuebi@rwe.com
URL:	www.rwe.com
Represented by:	Michael Fübi
Title:	Principal of Climate Protection
Salutation:	Dr.
Last Name:	Fübi
Middle Name:	/
First Name:	Michael
Department:	/
Mobile:	/
Direct FAX:	+49-201-12-24132
Direct tel:	+49-201-12-20226
Personal E-Mail:	michael.fuebi@rwe.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project does not receive any public funding from Annex I countries.

Annex 3

BASELINE INFORMATION

Table 1 –Power Supply data for the South China Grid, 2002 (not including low operating cost and must-run power plants)

	Guangdong	Guangxi	Guizhou	Yunnan
Thermal Power Generation (MWh)	123,081,000	13,069,000	33,231,000	15,787,000
Rate of Electricity Consumption of the Power Plant (%)	5.58	8.31	7.90	8.21
Power Supplied to the Grid(MWh)	116,213,080.20	11,982,966.10	30,605,751.00	14,490,887.30
Total Supplied to Grid of the Thermal Power (MWh)		173,292,684.60		
Net import Power from the Central China Power (MWh)		0.00		
The total Power for the South China Grid (MWh)		173,292,684.60		

Data Source: China Electric Power Yearbook 2003.

Table 2 –Power Supply data for the South China Grid, 2003 (not including low operating cost and must-run power plants)

	Guangdong	Guangxi	Guizhou	Yunnan
Thermal Power Generation (MWh)	143,351,000	17,079,000	43,295,000	19,055,000
Rate of Electricity Consumption of the Power Plant (%)	4.99	4.09	6.57	3.77
Power Supplied to the Grid(MWh)	136,197,785.10	16,380,468.90	40,450,518.50	18,336,626.50
Total Supplied to Grid of the Thermal Power (MWh)		211,365,399.00		
Net import Power from the Central China Power (MWh)		11,100.00		
The total Power for the South China Grid (MWh)		211,376,499.00		

Data Source: China Electric Power Yearbook 2004.

Table 3 –Power Supply data for the South China Grid, 2004 (not including low operating cost and must-run power plants)

	Guangdong	Guangxi	Guizhou	Yunnan
Thermal Power Generation (MWh)	169,389,000	20,143,000	49,720,000	24,322,000
Rate of Electricity Consumption of the Power Plant (%)	5.42	8.33	7.06	7.56
Power Supplied to the Grid(MWh)	160,208,116.20	18,465,088.10	46,209,768.00	22,483,256.80
Total Supplied to Grid of the Thermal Power (MWh)		247,366,229.10		
Net import Power from the Central China Power (MWh)		10,951,240.00		
The total Power for the South China Grid (MWh)		258,317,469.10		

Data Source: China Electric Power Yearbook 2005.

Table 4. Calculation of average emission factor for the Central China Grid in 2003 and 2004

	2003	2004
Total CO_2 emission of the Central China Grid (tCO_2e)	270,902,649.98	339,209,149.89
The total power supplied to the Central China Grid (MWh)	352,435,719.20	418,261,666.30
Average emission factor (tCO_2e/ MWh)	0.76866	0.81100

Table 5–2002 data for primary fuel input for thermal power supply to the South China Grid

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Subtotal =A+B+C+D
Raw coal	Ten thousand Tons	4,121.06	711.35	1,430.68	1,144.39	7,407.48
Clean coal	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other washed coal	Ten thousand Tons	0.00	0.00	35.26	13.58	48.84
Coke	Ten thousand Tons	0.00	0.00	0.00	6.44	6.44
Coke oven gas	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other gas	10^8 Cubic meter	0.63	0.00	0.00	0.00	0.63
Crude oil	10^8 Cubic meter	5.80	0.00	0.00	0.00	5.80
Gasoline	Ten thousand Tons	0.01	0.00	0.00	0.00	0.01
Diesel oil	Ten thousand Tons	73.07	0.67	0.00	0.50	74.24
Fuel oil	Ten thousand Tons	701.41	0.20	0.00	0.00	701.61
LPG	Ten thousand Tons	0.09	0.00	0.00	0.00	0.09
Refinery gas	10^8Cubic meter	1.42	0.00	0.00	0.00	1.42
Natural gas	10^8Cubic meter	0.00	0.00	0.00	0.00	0.00
Other petroleum products	10^8Cubic meter	7.91	0.00	0.00	0.00	7.91
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other E (standard coal)	Ten thousand Tons	79.28	0.00	0.00	0.00	79.28

Data Source: China Energy Statistical Yearbook 2000-2002.

Table 6- Calculation of the OM Emission Factor for the South China Grid in 2002

Fuel	Unit	Fuel Consumption in the SCPG (E)	Emission Factor （tC/TJ） (F)	Oxidation Rate (%) G	Average NCV (MJ/t,km^3) H	CO_2Emission (tCO_2e) I=G*H*F*E*44/12/10000（in mass） I=G*H*F*E*44/12/1000 (in volume)
Raw coal	Ten thousand Tons	7,407.48	25.80	98.0	20,908	143,582,063.68
Clean coal	Ten thousand Tons	0.00	25.80	98.0	26,344	0.00
Other washed coal	Ten thousand Tons	48.84	25.80	98.0	8,363	378,664.82
Coke	Ten thousand Tons	6.44	29.50	98.0	28,435	194,114.79
Coke oven gas	10^8 Cubic meter	0.00	13.00	99.5	16,726	0.00
Other gas	10^8 Cubic meter	0.63	13.00	99.5	5,227	15,618.20
Crude oil	Ten thousand Tons	5.80	20.00	99.0	41,816	176,078.81
Gasoline	Ten thousand Tons	0.01	18.90	99.0	43,070	295.49
Diesel oil	Ten thousand Tons	74.24	20.20	99.0	42,652	2,321,856.41
Fuel oil	Ten thousand Tons	701.61	21.10	99.0	41,816	22,471,255.50
LPG	10^8Cubic meter	0.09	17.20	99.5	50,179	2,833.92
Refinery gas	10^8Cubic meter	1.42	18.20	99.5	46,055	43,424.12
Natural gas	10^8Cubic meter	0.00	15.30	99.5	38,931	0.00
Other petroleum products	Ten thousand Tons	7.91	20.00	99.0	38,369	220,340.12
Other coking products	Ten thousand Tons	0.00	25.80	98.0	28,435	0.00
Other E (standard coal)	Ten thousand Tce	79.28	0.00	0.00	0.00	0.00
Total emission Q		169,406,545.87 tCO_2e				
Total supply to SCPG P		173,292,684.60 MWh				
OM Emission Factor (=Q/P)		0.9776 tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2000-2002； Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; p. 1.6.

Table 7–2003 data for primary fuel input for thermal power supply to the South China Grid

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Subtotal =A+B+C+D
Raw coal	Ten thousand Tons	4,491.79	831.84	2,169.11	1,405.27	8,898.01
Clean coal	Ten thousand Tons	0.05	0.00	0.00	0.00	0.05
Other washed coal	Ten thousand Tons	0.00	0.00	36.38	20.37	56.75
Coke	Ten thousand Tons	0.00	0.00	0.00	0.50	0.50
Coke oven gas	Ten thousand Tons	0.00	0.00	0.00	0.04	0.04
Other gas	10^8 Cubic meter	3.21	0.00	0.00	11.27	14.48
Crude oil	10^8 Cubic meter	6.85	0.00	0.00	0.00	6.85
Gasoline	Ten thousand Tons	0.02	0.00	0.00	0.00	0.02
Diesel oil	Ten thousand Tons	31.90	0.00	0.00	0.76	32.66
Fuel oil	Ten thousand Tons	627.22	0.30	0.00	0.00	627.52
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Refinery gas	10^8Cubic meter	2.85	0.00	0.00	0.00	2.85
Natural gas	10^8Cubic meter	0.00	0.00	0.00	0.00	0.00
Other petroleum products	10^8Cubic meter	11.35	0.00	0.00	0.00	11.35
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other E (standard coal)	Ten thousand Tons	93.21	0.00	0.00	22.35	115.56

Data Source: China Energy Statistical Yearbook 2004.

Table 8- Calculation of the OM Emission Factor for the South China Grid in 2003

Fuel	Unit	Fuel Consumption in the SCPG (E)	Emission Factor （tC/TJ） (F)	Oxidation Rate (%) G	Average NCV (MJ/t,km^3) H	CO_2Emission (tCO_2e) I=G*H*F*E*44/12/10000（in mass） I=G*H*F*E*44/12/1000 (in volume)
Raw coal	Ten thousand Tons	8,898.01	25.80	98.0	20,908	172,473,585.95
Clean coal	Ten thousand Tons	0.05	25.80	98.0	26,344	1,221.15
Other washed coal	Ten thousand Tons	56.75	25.80	98.0	8,363	439,992.40
Coke	Ten thousand Tons	0.50	29.50	98.0	28,435	15,071.02
Coke oven gas	10^8 Cubic meter	0.04	13.00	99.5	16,726	3,173.15
Other gas	10^8 Cubic meter	14.48	13.00	99.5	5,227	358,970.64
Crude oil	Ten thousand Tons	6.85	20.00	99.0	41,816	207,955.15
Gasoline	Ten thousand Tons	0.02	18.90	99.0	43,070	590.98
Diesel oil	Ten thousand Tons	32.66	20.20	99.0	42,652	1,021,441.68
Fuel oil	Ten thousand Tons	627.52	21.10	99.0	41,816	20,098,291.43
LPG	10^8Cubic meter	0.00	17.20	99.5	50,179	0.00
Refinery gas	10^8Cubic meter	2.85	18.20	99.5	46,055	87,154.04
Natural gas	10^8Cubic meter	0.00	15.30	99.5	38,931	0.00
Other petroleum products	Ten thousand Tons	11.35	20.00	99.0	38,369	316,164.40
Other coking products	Ten thousand Tons	0.00	25.80	98.0	28,435	0.00
Other E (standard coal)	Ten thousand Tce	115.56	0.00	0.00	0.00	0.00
CO_2 emission of power import from CCPG		0.76866×11,100= 8,532.11tCO_2e				
Total emission (Q)		195,032,144.10 tCO_2e				
Supply to SCPG (P)		211,376,499.00 MWh				
OM Emission Factor (=Q/P)		0.92268 tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2004； Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; p. 1.6.

Table 9–2004 data for primary fuel input for thermal power supply to the South China Grid

Fuel	Unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	Subtotal =A+B+C+D
Raw coal	Ten thousand Tons	6,017.70	1,305.00	2,643.90	1,751.28	11,717.88
Clean coal	Ten thousand Tons	0.21	0.00	0.00	0.00	0.21
Other washed coal	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Coke	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Coke oven gas	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other gas	10^8 Cubic meter	2.58	0.00	0.00	0.00	2.58
Crude oil	10^8 Cubic meter	16.89	0.00	0.00	0.00	16.89
Gasoline	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Diesel oil	Ten thousand Tons	48.88	0.00	0.00	1.83	50.71
Fuel oil	Ten thousand Tons	957.71	0.00	0.00	0.00	957.71
LPG	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Refinery gas	10^8Cubic meter	2.86	0.00	0.00	0.00	2.86
Natural gas	10^8Cubic meter	0.48	0.00	0.00	0.00	0.48
Other petroleum products	10^8Cubic meter	1.66	0.00	0.00	0.00	1.66
Other coking products	Ten thousand Tons	0.00	0.00	0.00	0.00	0.00
Other E (standard coal)	Ten thousand Tons	79.42	0.00	0.00	0.00	79.42

Data Source: China Energy Statistical Yearbook 2005.

Table 10- Calculation of the OM Emission Factor for the South China Grid in 2004

Fuel	Unit	Fuel Consumption in the SCPG (E)	Emission Factor （tC/TJ） (F)	Oxidation Rate (%) G	Average NCV (MJ/t,km^3) H	CO_2Emission (tCO_2e) I=G*H*F*E*44/12/10000（in mass） I=G*H*F*E*44/12/1000 (in volume)
Raw coal	Ten thousand Tons	11,717.88	25.80	98.0	20,908	227,132,222.08
Clean coal	Ten thousand Tons	0.21	25.80	98.0	26,344	5,128.83
Other washed coal	Ten thousand Tons	0.00	25.80	98.0	8,363	0.00
Coke	Ten thousand Tons	0.00	29.50	98.0	28,435	0.00
Coke oven gas	10^8 Cubic meter	0.00	13.00	99.5	16,726	0.00
Other gas	10^8 Cubic meter	2.58	13.00	99.5	5,227	63,960.24
Crude oil	Ten thousand Tons	16.89	20.00	99.0	41,816	512,753.65
Gasoline	Ten thousand Tons	0.00	18.90	99.0	43,070	0.00
Diesel oil	Ten thousand Tons	50.71	20.20	99.0	42,652	1,585,955.53
Fuel oil	Ten thousand Tons	957.71	21.10	99.0	41,816	30,673,659.31
LPG	10^8Cubic meter	0.00	17.20	99.5	50,179	0.00
Refinery gas	10^8Cubic meter	2.86	18.20	99.5	46,055	87,459.85
Natural gas	10^8Cubic meter	0.48	15.30	99.5	38,931	104,309.23
Other petroleum products	Ten thousand Tons	1.66	20.00	99.0	38,369	46,240.78
Other coking products	Ten thousand Tons	0.00	25.80	98.0	28,435	0.00
Other E (standard coal)	Ten thousand Tce	79.42	0.00	0.00	0.00	0.00
CO_2 emission of power import from CCPG		0.81100×10,951,240=8,881,427.85 tCO_2e				
Total emission (Q)		269,093,117.34 tCO_2e				
Supply to SCPG (P)		258,317,469.10 MWh				
OM Emission Factor (=Q/P)		1.04171 tCO_2e/MWh				

Data sources: China Energy Statistical Yearbook 2005；Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Workbook, p. 1.8; p. 1.6.

Table 11-Full-wighted Ave. OM 3 years of the South China Grid

years	2002	2003	2004
Total CO_2 Emission (tCO_2e)	169,406,545.87	195,032,144.10	269,093,117.34
Total supply （MWh）	173,292,684.60	211,376,499.00	258,317,469.10
Full-weighted average OM	= (169,406,545.87 +195,032,144.10+269,093,117.34) / (173,292,684.60 +211,376,499.00 +258,317,469.10) = 0.9853 tCO_2e/MWh		

Table12. Calculation of Ratio of Solid, Liquid and Gas fuel in total CO_2 Emission

Fuel		Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	Average NCV (MJ/t,km^3)	Emission Factor （tC/TJ）	Oxidation Rate (%)	CO_2 Emission (tCO_2e)	Ratio
Coal	Raw coal	10^4tons	6,017.70	1,305.00	2,643.9	1,751.28	11,717.88	20,908	25.80	98.0	227,132,222	-
	Clean coal	10^4tons	0.21	0.00	0.00	0.00	0.21	26,344	25.80	98.0	5,129	-
	Other washed coal	10^4tons	0.00	0.00	0.00	0.00	0.00	8,363	25.80	98.0	0	-
	Coke	10^4tons	0.00	0.00	0.00	0.00	0.00	28,435	29.50	98.0	0	-
	Total	-	-	-	-	-	-	-	-	-	227,137,351	87.29%
Oil	Crude oil	10^4tons	16.89	0.00	0.00	0.00	16.89	41,816	20.00	99.0	512,754	-
	Gasoline	10^4tons	0.00	0.00	0.00	0.00	0.00	43,070	18.90	99.0	0	-
	Diesel oil	10^4tons	0.00	0.00	0.00	0.00	0.00	43,070	19.60	99.0	0	-
	Fuel oil	10^4tons	48.88	0.00	0.00	1.83	50.71	42,652	20.20	99.0	1,585,956	-
	LPG	10^4tons	957.71	0.00	0.00	0.00	957.71	41,816	21.10	99.0	30,673,659	-
	Other petroleum products	10^4tons	1.66	0.00	0.00	0.00	1.66	38,369	20.00	99.0	46,241	-
	Total	-	-	-	-	-	-	-	-	-	32,818,610	12.61%
Gas	Natural gas	10^7m^3	4.80	0.00	0.00	0.00	4.8	38,931	15.30	0.995	104,309	-
	Coke oven gas	10^7m^3	0.00	0.00	0.00	0.00	0.00	16,726	13.00	0.995	0	-
	Other gas	10^7m^3	25.80	0.00	0.00	0.00	25.8	5,227	13.00	0.995	63,960	-
	LPG	10^4tons	0.00	0.00	0.00	0.00	0.00	50,179	17.20	0.995	0	-
	Refinery gas	10^4tons	2.86	0.00	0.00	0.00	2.86	46,055	18.20	0.995	87,460	-
	Total	-	-	-	-	-	-	-	-	-	255,729	0.10%
Total		-	-	-	-	-	-	-	-	-	260,211,690	100%

Table13. Calculation of the Emission Factor for Coal-fired, oil-fired and Gas-fired Power

	Variable	Supply Efficiency J	Emission Factor of fuel F (tc/TJ)	Oxidation Rate G (%)	Emission Factor (tCO_2e/MWh) =3.6/J/1000*F*G*44/12
Coal-fired	$EF_{Coal,Adv}$	36.53%	25.8	98.0	0.9136
Gas-fired	$EF_{Gas,Adv}$	45.87%	15.3	99.5	0.4381
Oil-fired	$EF_{Oil,Adv}$	45.87%	21.1	99.0	0.6011

The emission factor of thermal power is：

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.8737 \text{ tCO}_2\text{e/MWh}.$$

Table14. The Installed Capacity of the South China Grid 2002

Installed Capacity	Guangdong	Guangxi	Guizhou	Yunnan	Tianshengqiao	Total
Thermal power(MW)	25,237.8	3,156.2	2,932.7	4,642.5	0.0	35,969.2
Hydro power(MW)	7,775.3	4,363.3	5,836.3	2,426.1	2,520.0	22,921
Nuclear power(MW)	2,790.0	0.0	0.0	0.0	0.0	2,790
Wind power and other(MW)	76.8	0.0	0.0	0.0	0.0	76.8
Total (MW)	35,879.9	7,519.5	8,769.1	7,068.6	2,520.0	61,757.1

Data Source: China Energy Statistical Yearbook 2003.

Table15. The Installed Capacity of the South China Grid 2003

Installed Capacity	Guangdong	Guangxi	Guizhou	Yunnan	Tianshengqiao	Total
Thermal power(MW)	27,231.4	3,190.1	3,556.8	6,465.8	0.0	40,444.1
Hydro power(MW)	8,107.2	4,525.2	6,543.2	3,713.7	2,520.0	25,409.3
Nuclear power(MW)	3,780.0	0.0	0.0	0.0	0.0	3,780
Wind power and other(MW)	83.4	0.0	0.0	0.0	0.0	83.4
Total (MW)	39,202.0	7,715.3	10,100.0	10,179.5	2,520.0	69,716.8

Data Source: China Energy Statistical Yearbook 2004.

Table16. The Installed Capacity of the South China Grid 2004

Installed Capacity	Guangdong	Guangxi	Guizhou	Yunnan	Total

Thermal power(MW)	30,172.9	4,378.1	4,306.9	7,801.8	46,659.7
Hydro power(MW)	8,584.6	5,040.4	7,058.6	6,896.5	27,580.1
Nuclear power(MW)	3,780.0	0.0	0.0	0.0	3,780.0
Wind power and other(MW)	83.4	0.0	0.0	0.0	83.4
Total (MW)	42,620.9	9,418.5	11,365.5	14,698.3	78,103.3

Data Source: China Energy Statistical Yearbook 2005, Tianshenqiao power station is included in Guizhou.

Table17. The Calculation of BM Emission Factor for the South China Grid

	2002	2003	2004	New addition 2002-2004	The Ratio in new addition
Thermal power(MW)	35,969.2	40,444.1	46,659.7	10,690.5	65.40%
Hydro power(MW)	22,921.0	25,409.3	27,580.1	4,659.1	28.50%
Nuclear power(MW)	2,790.0	3,780.0	3,780.0	990.0	6.06%
Wind power (MW)	76.8	83.4	83.4	6.6	0.04%
Total(MW)	61,757.0	69,716.8	78,103.2	16,346.2	100.00%
Ratio of installed capacity in 2004	79.07%	89.26%	100%		

Data Source: China Energy Statistical Yearbook

$EF_{BM,y} = 0.8737 \times 65.40\% = 0.5714\ tCO_2e/MWh$.

The OM is calculated as 0.9853tCO_2e/MWh, the BM is calculated as 0.5714tCO_2e/MWh. And the baseline emission factor equal to the combined margin with equally weighted average of the operating margin emission factor and the build margin emission factor.

According to ACM0002 (version 6), the default weight of hydropower is:

$$w_{OM} = 0.5 \qquad w_{BM} = 0.5$$

So the Baseline Emissions Factor (EF_y in tCO_2e/MWh) is 0.77835tCO_2e/MWh.

Annex 4

MONITORING INFORMATION

Selection procedure:
The monitoring officer will be appointed by the general manager of Longchuan Minhong Hydro power Co. Ltd. The monitoring officer will be selected from among the senior technical or managerial staff. Before he/she commences monitoring duties, he/she will receive training on monitoring requirements and procedures by Beijing Tianqing Power International CDM Consulting, Co., Ltd.

The selection of the initial monitoring officer has taken place and the following person was appointed:
Name: Xufeng Chen
Position: Manager of Production and Operation Department

Tasks and responsibilities:
The monitoring officer will be responsible for carrying out the following tasks

- **Supervise and verify metering and recording:**
  The monitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.
- **Collection of additional data, sales / billing receipts:**
  The monitoring officer will collect sales receipts for power delivered to the grid, billing receipts for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the hydropower station.
- **Calculation of emission reductions:**
  The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.
- **Preparation of monitoring report:**
  The monitoring officer will annually prepare a monitoring report which will include among others a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration and a calculation of emission reductions.

Support:
The monitoring officer will receive support from Beijing Tianqing Power International CDM Consulting, Co., Ltd. in his/her responsibilities through the following actions:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving
- Provide the monitoring officer with a calculation template in electronic form for calculation of annual emission reductions
- Continuous advice to the monitoring officer on a need basis
- Review of monitoring report