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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

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Title of the project activity: China Niaoerchao Hydropower Project
Document version: 6
Date of completion: 05/05/2010

Revision History

Version number	Date	Reason
Version 01	December, 2005	Draft PDD
Version 02	December, 2006	Revised according to the update of the methodology.
Version 03	August, 2007	Global Stakeholder Process (GSP) at Tuv Rheinland website for validation
Version 04	February, 2010	GSP for the second time at ERM website for validation
Version 05	April, 2010	Revised PDD as per findings from site visit.
Version 06	May, 2010	Revised PDD as per draft validation report

A.2. Description of the project activity:

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The China Niaoerchao Hydropower Project (hereinafter referred to as “the project”) is a newly built storage type hydropower plant with a seasonal pondage reservoir. There are two dams constructed for the project, one is the Niaoerchao dam, and another one is the Liujingtan diversion dam (small dam with 12 m in height). The Liujingtan diversion dam is used to divert the water resources through a tunnel to the Niaoerchao reservoir. The distance between these two dams is 8.6 km. The power house is located on the bank of Dongtingxi River, which is a branch of Yuanjiang River located in Yuanling County, Huaihua City, Hunan Province, People’s Republic of China. The total installed capacity of the project is 20 MW and the annual utilization hours are 3,826 h. The corresponding plant load factor is calculated as 43.68% (3826 h/8760 h). The surface of the flooded area at the full reservoir level of the Niaoerchao dam is 1.66 km^2, and the surface of the flooded area at the full reservoir level of Liujingtan diversion dam is 0.143 km^2. The total surface of the flooded area at the full reservoir level of the project is 1.803 km^2, the power density of the project is calculated as installed capacity/submerged area, which is equal to 11.09 W/m^2.

After the project is put into operation, the annual electricity generation is 76,520 MWh with the annual net electricity supply of 72,331 MWh[1]. The electricity generated from the project will be delivered to the Central China Power Grid (CCPG). The electricity generated from the project can displace part of the electricity generated by CCPG, and thus mitigate the global warming potential trend.

The project activity will promote the local and national sustainability powerfully in following aspects:

- The project will reduce the GHG emissions and therefore will mitigate the trend of global warming

[1] Huaihua Institute of Hydroelectric Investigation, Hunan Yuanling Niaoerchao Hydropower Project Supplementary Preliminary Design report, Aug. 2006

by providing clean electricity.
- The project can create job opportunities during the construction period and can provide around 30 job opportunities during the operation period.
- The project can improve the local infrastructure constructions by reinforcing river banks and by building pavements and roads etc.

A.3. Project participants:

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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)
The Peoples' Republic of China (Host)	Hunan Guohong Investment Co., Ltd.	No
Sweden	Carbon Asset Management Sweden AB	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

For detailed information, please refer to Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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People's Republic of China

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

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Hunan Province

A.4.1.3. City/Town/Community etc:

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Qijiaping Town, Yuanling County, Huaihua City

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

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The project is located in Qijiaping Town, Yuanling County, Huaihua City, Hunan Province. The project is 129 km away from the Yuanling County. The project contains two dams, one dam is Niaoerchao dam which is located in Dongtingxi River, and another dam is Liujingtan diversion dam which is located in Wangjiaxi River. The two dames are located 8.6 km from each other. The water resources will be diverted to the Niaoerchao reservior. The co-ordinates of the project are shown below:

Liujingtan diversion dam: 110°48′12″E and 28°52′31″ N

Niaoerchao dam: 110°52′00″E and 28°49′48″ N

Power House: 110°52′15″E and 28°49′50″ N.

The location of the project activity is shown in Chart 1.

Chart 1 The map of the project location

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

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The project falls into:

Sectoral Scope 1: Energy industries (renewable sources)

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

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Prior to the implementation of the project activity, equivalent annual electricity generation is supplied by CCPG. The equivalent annual electricity generation is supplied by CCPG which is also the baseline scenario to the project activity.

1. The main technical parameters

The project is a newly built hydropower project with seasonal pondage reservoir. The layout of the project is shown in Chart 2.

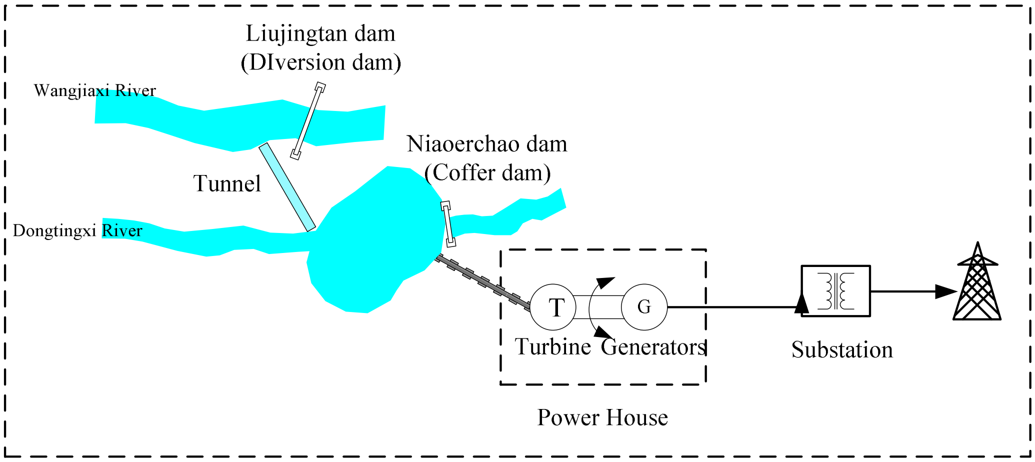

Chart 2　The layout of the project

As shown in the Chart 2, the Liujingtang diversion dam is located in the Wangjiawan River and is a diversion dam. The water will be diverted through the tunnel to the reservoir which was created due to the construction of the Niaoerchao Dam. The Niaoerchao Dam is located in the Dongtingxi River. The powerhouse is located at the bank of river. There are two generators installed in the powerhouse with each single-unit capacity of 10 MW. The total installed capacity of the project is 20 MW. There are two main transformers employed for the project. The lifetime of the project is 20 years. The total annual electricity generation of the project is 76,520 MWh and the annual net electricity supply of the project is 72,331 MWh.

According to SPDR, the net electricity supply of the project is calculated as:

Net electricity supply = electricity generation×coefficient of effective electricity generation– plant internal electricity consumption– electricity transmission line loss = 76,520 MWh×0.95 - 363 MWh = 72,331 MWh

The coefficient of effective electricity generation is adopted as 0.95 in SPDR.

The justifications of difference between electricity generation and net electricity supply are as follows:

<u>Coefficient of effective electricity generation</u>

The coefficient of effective electricity generation are specified in the "Economic Evaluation Code for Small Hydropower Projects (SL16-95)" dated on 1 July 1995, which is currently still valid. The <u>coefficient of effective electricity generation</u> values for hydropower plants are as follows:

Project type	Coefficient of effective electricity generation
1. Grid connected, annual/multi year regulating hydropower plants	0.95-1.00
2. Grid connected, seasonal regulating hydropower plants	0.90-0.95
3. Grid connected, monthly/weekly/daily/no regulating hydropower plants: The grid will accept all electricity generated in rainy season and night The grid will only accept part of the electricity generated in rainy season and night	 0.80-0.90 0.70-0.80
4. Stand alone hydropower plants, daily/no regulating capacity	0.60-0.70

According to FSR, the project is a grid connected seasonal regulating hydropower plant. The "coefficient of effective electricity generation" for the project is falling into category 2 of above table. The applied value for the project is ranged from 0.90 to 0.95. The coefficient of effective electricity generation of 0.95 is used for the project in the FSR and PDD, which is conservative since it adopts the upper limit of the corresponding range in the SL 16-95.

Plant internal electricity consumption and electricity transmission line loss

According to the "Hydroenergy Design Code for Small Hydropower Projects (SL76-94)" issued by Ministry of Water Resources of People's Republic of China, the plant internal electricity consumption is shown as 0.5%-1%. Also, according to the article "The relationship between house service system and power generation output in hydraulic power plant issued in 2007, the internal consumption for hydropower plants is shown as 0.3%-2%.

According to "Hydroenergy Design Code for Small Hydropower Projects (SL76-94)", the transmission line loss for hydropower plants should not be more than 11%.

Combining above 2 points, the total sum of 0.47% (363 MWh/76,520 MWh) for plant internal consumption and transmission line loss of the project is conservative.

Therefore, the difference between electricity generation and net electricity supply is reasonable and conservative.

The detailed features of the project are shown in table 1 the main constructions and facilities parameters as below:

Table 1 Technical parameters on main constructions and facilities of the project[2]

Parameters		Unit	Value	Comment
Turbine	Model	----	HLN255-LJ-150	
	Quantity	unit	2	
	Rated output	MW	10.309	
	Rated rotation	r/min	428.6	
	Rated water head	m	57.0	
	Rated flow	m^3/s	20.04	
	Manufacturer	Fujian Nanping Hydropower Equipment Manufacture Co., Ltd.		
Generator	Model	----	SF10000-14/3250	Mixed flow set
	Quantity	unit	2	
	Rated Capacity	MW	10	
	Rated rotation	r/min	428.6	
	Capacity factor	----	0.8	
	Rated Voltage	kV	6.3	
	Manufacturer	Fujian Nanping Hydropower Equipment Manufacture Co., Ltd.		
Transformer	Model	----	SF9-25000/110	
	Quantity	unit	2	
	Rated Capacity	kVA	25000	
	Manufacturer	Sanbian Technology Co., Ltd.		

2. Environmentally Safe Technology:

It can be found from Environmental Impact Assessment (EIA) of the project that the project has little impact on the local environment. The project does not lead to pollution, so the project is safe to the environment.

3. Technology Transfer:

The main equipments, such as the turbines and other equipments are made in China. There is no international technology transfer for the project activity. The Chinese domestic manufacturers have the ability to produce the turbines and relevant facilities.

[2] The nameplates of Turbine, Generator and Transformer.

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

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The fixed crediting period of 10 years is chosen for the project. The amount of annual and total emission reductions is shown in the following Table 2:

Table 2 Estimated amounts of emission reductions over the chosen crediting period

Year	Annual estimation of emission reductions in tonnes of CO2e
2011	61,687
2012	61,687
2013	61,687
2014	61,687
2015	61,687
2016	61,687
2017	61,687
2018	61,687
2019	61,687
2020	61,687
Total estimated reductions (tonnes of CO_2e)	616,870
number of the crediting period	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	61,687

A.4.5. Public funding of the project activity:

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No public funding from parties included in Annex I is involved for the 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 project activity:

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Title of the approved consolidated baseline and monitoring methodology: ACM0002-Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 11)

Reference: Tool for the demonstration and assessment of additionality (Version 05.2)
Tool to calculate the emission factor for an electricity system (Version 02)

More information on the methodologies listed above is available at the following website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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The project is a grid-connected renewable power generation project activity which meets all the applicable criteria stated in the methodology ACM0002:

1. The project is a newly built hydropower power plant; the submerged area is 1.803 km^2, so its power density is 11.09[3] W/m^2 which is greater than $4W/m^2$;

2. The project activity doesn't involve switching from fossil fuels to renewable energy at the site of the project activity.

3. It can be found from the Grid Connection Agreement of the project that the generated electricity is delivered to Huaihua Power Grid, which is part of CCPG[4]. The geographic and system boundaries for CCPG which the project is connected to can be clearly identified and information on the characteristics of the grid is available.

Therefore, the methodology ACM0002 is applicable to the project activity.

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

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According to ACM0002 (Version 11), the spatial extent of the proposed project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to. The project boundary is schematically illustrated in Figure 2.

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[3] The result of the power density is calculated as following equation: power density = installed capacity / submerged area

[4] According to China's Regional Grid Baseline Emission Factors 2009 issued by Department of Climate Change, National Development and Reform Commission (NDRC), on 2 July 2009, the CCPG covers Huaihua Power Grid.

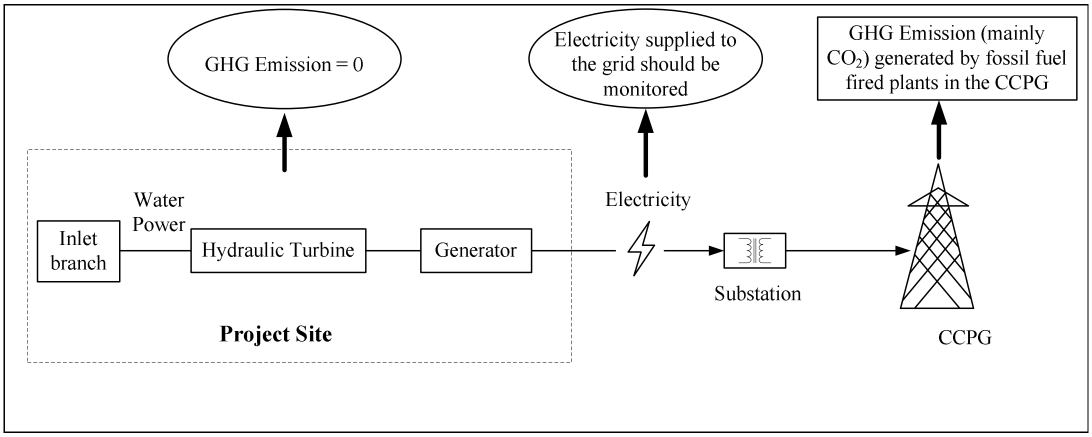

Fig 2 Flow diagram of the project boundary

The project is connected to CCPG; the geographic extent of the grid boundary includes Jiangxi Province, Henan Province, Hubei Province, Hunan Province, Sichuan Province and Chongqing Municipality[5]. The GHG emissions sources and gases in the project boundary are shown in Table 3.

Table 3 Sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	The fuel-fired power plants connected to CCPG	CO_2	Yes	Main emission source according to ACM0002.
		CH_4	No	Minor emission source according to ACM0002.
		N_2O	No	Minor emission source according to ACM0002.
Project Activity	Emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source according to ACM0002.
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source according to ACM0002.

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

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The project is a new grid-connected hydropower plant. According to ACM0002, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an

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[5] China's Regional Grid Baseline Emission Factors 2009, Department of Climate Change, National Development and Reform Commission, 2 July 2009

electricity system".

Thus the baseline scenario of the proposed project is the equivalent annual electricity supplied by CCPG, which is the continued operation of the existing power plants and the addition of new generation sources on the CCPG to meet the electricity demand. The proposed project involves constructing a hydropower plant by using energy water resources for power generation. No project activity emissions are considered since the power density of the proposed project is greater than 10 W/m^2. Thus, the emission reductions of the proposed project are equal to baseline emissions.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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As required by the approved methodology ACM0002 (Version 11), the additionality of the project activity shall be demonstrated and assessed with "Tool for the demonstration and assessment of additionality (version 05.2)" through the following steps:

Step1: Identification of alternatives to the project activity consistent with current laws and regulations

According to methodology ACM0002 (Version 11) and Clean Development Mechanism Validation and Verification Manual (Version 01.1), the Alternative—Equivalent annual electricity generation supplied by the CCPG is the only realistic and credible alternative to the project activity that can be the baseline scenario.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

According to "Tool for the demonstration and assessment of additionality", there are three analysis methods for investment analysis, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

Simple cost analysis (Option I) can be used if the project activity generates no financial or economic benefits other than CDM related income. However, this option is not applicable to the project because the project activity will generate economic benefits from the sale of electricity generation.

Investment comparison analysis (Option II) can only be used if the project and the alternatives to the project activity are all investment projects. However, this option is not applicable to the project because the alternative to the project activity is equivalent annual electricity supplied by CCPG, this alternative is not a new investment project.

Benchmark analysis (Option III). According to Economic Evaluation Code for Small Hydropower Projects[6] (SL16-95) approved by Water Resources Ministry of P. R. China, the financial benchmark internal rate of return (after tax) of total investment for Chinese small hydropower projects (with

[6] http://apps.lib.whu.edu.cn/12/test/gfbz/2/j/xsdpj.html
SL16-95 is still valid according to the "Bulletin of Effective Water Resources Technology Standard", Ministry of Water Resources, 12 January, 2009.
http://www.mwr.gov.cnslzxtzggtzgs200903t20090306_157857.html

installed capacity below 25MW) is 10%[7]. Thus, the benchmark analysis is applicable to the project.

Sub-step 2b. —Option III. Apply benchmark analysis

According to Economic Evaluation Code for Small Hydropower Projects (SL16-95) approved by Ministry of Water Resources of P. R. China, the benchmark Internal Rate of Return (IRR) of total investment for a hydropower project with the installed capacity of below 25MW is 10% (after tax). This benchmark IRR is used extensively in China for investment analysis of small-scale hydropower projects.

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

The CDM was introduced at the Yuanling County government meeting held on 21 June 2005. Then the project owner decided to apply for CDM during the board meeting held on 5 August 2005, which is the investment decision date. The PP signed the Generator and Turbine Purchase Agreement on 16 November 2005. The 1st payment of turbines and generators was made on 8 December 2005, which is marked as project starting date of the project. At the time of investment decision, there was a FSR available with an installed capacity of 12 MW. Therefore, the investment analysis is presented for the 12 MW project. It is in line with paragraph 6 of "Guidelines on the assessment of investment analysis":

6. Guidance: Input values used in all investment analysis should be valid and applicable at the time of the investment decision taken by the project participant…

After the PP received the approval of the FSR, the design proposal was changed to increase the project's economics. The draft Preliminary Design Report (PDR) of the project was completed in November 2005 and then was submitted for panel assessment in December 2005. The main design was changed from three dams to two dams and three tunnels to two tunnels. The draft Supplementary Preliminary Design Report (SPDR) and the final SRDR of the project were completed in January 2006 and August 2006 respectively. The installed capacity designed in SPDR was expanded into 20MW to further maximize the water resources utilization. The actual installed capacity of the project is also 20MW, which can be confirmed through nameplate of generator.

The financial parameters for both 12MW (investment decision) and 20MW (actual installed capacity) are presented in the PDD in order to substantiate that the design change did not change the additionality of the project. The main parameters for the investment analysis of two different designs are shown below respectively.

For the 20 MW design:

Table 4 Main parameters for investment analysis and calculation (20 MW)

No.	Main Parameter	Unit	Value	Source
1	Installed capacity	MW	20	SPDR
2	Total investment	10^4 RMB	15803.83	SPDR
3	Net electricity supply	MWh	72331	SPDR
4	Electricity tariff (with VAT)	RMB/kWh	0.316	SPDR

[7] According to SL16-95, the guidance is also applicable to rural small hydropower with the installed capacity below 50 MW.

5	Value-added Tax	/	6%	SPDR
6	Education surtax	/	3%	SPDR
7	City maintenance & construction surtax	/	5%	SPDR
8	Income tax	/	33%	SPDR
9	Project lifetime	year	20	SL16-95
10	Annual O&M costs	10^4 RMB	253.9	SPDR

The clarification of the project lifetime (20 years) of the project for the investment analysis:

According to the benchmark reference (SL16-95), the investment horizon of the small hydropower project is 20 years. Furthermore, according to the Guidance on the Assessment of Investment Analysis (Version 03.1), a minimum period of 10 years and a maximum of 20 years will be appropriate. So 20years was chosen as the lifetime of the project for IRR calculation.

The IRRs of the project with/without CERs revenue are shown in Table 5.

Table 5 The financial parameters of Niaoerchao Hydropower Project (20 MW)

Item	unit	Without CERs revenue	Benchmark	With CERs revenue
IRR	/	8.51%	10%	11.13%

Without CERs revenue, the project IRR is only 8.51%, which is below the benchmark IRR of 10%. The project is not financially attractive. With CERs revenue, the project IRR is 11.13%. The project is financially attractive.

For the 12 MW design:

Table 6 Main assumptions for investment analysis and calculation (12 MW)

No.	Main Parameter	Unit	Value	Source
1	Installed capacity	MW	12	FSR
2	Total investment	10^4 RMB	8512.00	FSR
3	Net electricity supply	MWh	37161.2	FSR
4	Electricity tariff (with VAT)	RMB/kWh	0.315	FSR
5	Value-added Tax	/	6%	FSR
6	Education surtax	/	3%	FSR
7	City maintenance & construction surtax	/	5%	FSR
8	Income tax	/	33%	FSR
9	Project lifetime	year	20	SL16-95
10	Annual O&M costs	10^4 RMB	160.43	FSR

The IRRs of the project with/without CERs revenue are shown in Table 7.

Table 7 The financial parameters of Niaoerchao Hydropower Project (12 MW)

Item	unit	Without CERs revenue	Benchmark	With CERs revenue
IRR	/	7.55%	10%	10.17%

Without CERs revenue, the project IRR is only 7.55%, which is below the benchmark IRR of 10%. The project is not financially attractive. With CERs revenue, the project IRR is 10.17%. The project is financially attractive.

It can be found from above that the design change (from 12MW to 20MW) improves the financial parameters of the project. However, the project IRRs for both of 12MW and 20MW designs are still far below the benchmark (10%). Therefore, the project is not financially attractive.

Sub-step 2d. Sensitivity analysis

A sensitivity analysis is used to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. For the project, four parameters including total investment, electricity tariff, annual O&M costs and net electricity supply are selected as sensitive factors to check the financial attractiveness; the result of the sensitivity analysis is shown in Table 8 and Table 9.

For the 20MW design:

Table 8 Sensitivity Analysis

Variation rate / FIRR / Factor	-10%	0%	+10%
Total investment	9.81%	8.51%	7.42%
Electricity tariff	7.25%	8.51%	9.74%
O&M costs	8.66%	8.51%	8.36%
Net electricity supply	7.26%	8.51%	9.73%

For the 12MW design:

Table 9 Sensitivity Analysis

Variation rate / FIRR / Factor	-10%	0%	+10%
Total investment	8.79%	7.55%	6.50%
Electricity tariff	6.31%	7.55%	8.75%
O&M costs	7.72%	7.55%	7.37%
Net electricity supply	6.32%	7.55%	8.74%

According to the analysis above, it can be concluded that the financial indicator of the project 20 MW is better than for 12 MW, so the further sensitivity analysis of project 12 MW is skipped.

For the 20 MW design:

(1) Total investment

When total investment of the project decreases by 11.30%, the project IRR will be 10%.

According to official statistic bulletins from Statistics Bureau of Hunan Province, the price of industrial products has increased by 8.0%, 6.0%, 4.3%, 6.1% and 9.3% respectively from 2004 to 2008 in Hunan Province[8]. According to the same statistic bulletins, the price of raw materials has increased by 6.7%,

[8] Natioinal Economy and Social Development Statistic Bulletin for 2004 in Hunan Province, February 2005

Natioinal Economy and Social Development Statistic Bulletin for 2005 in Hunan Province, February 2006

9.4%, 6.5%, 6.1% and 12.0% respectively from 2004 to 2008. Thus, it can be found from statistic bulletins that the construction costs indicate an increasing trend.

According to the Financial Audit Report of Niaoerchao Hydropower Project completed by independent Hunan Xianghua Public Accounting Co., Ltd., the actual fixed assets investment of the project are 199,847,571.37 RMB until the end of 2008. The actual investment is already higher than the total investment budget in SPDR (158,038,300 RMB). So the investment in the SPDR was conservative.

Thus, as the recent published statistics and actual investment made by the project, it is unlikely that the total investment of the project decreases 11.30%.

(2) Electricity tariff

When the electricity tariff of the project increases by 12.20%, the project IRR will be 10%.

The electricity tariff in Hunan Province is guided by Hunan Price Bureau. According to public available electricity tariff guideline documents issued by Hunan Price Bureau, the guideline of electricity tariff for newly built Hunan hydropower plants is as follow from 2002 until now:

Item	Installed capacity	Guidance tariff (incl. VAT) (RMB/kWh)						
		2002-2004	2004	2005	2006	2007	2008[9]	2009
1	Below 1 MW	0.278	0.24	0.24	0.24	0.24	0.25	0.25
2	1 – 6 MW		0.28	0.28	0.28	0.28	0.29	0.29
3	6 – 15 MW		0.30	0.30	0.30	0.30	0.305	0.305
4	Above 15 MW		0.315	0.316	0.316	0.316	0.316	0.316
5	Above 25 MW		Included in item 4 until 2008				0.326	0.326

The sources of electricity tariff from 2002 until now are as follows:

<u>Year 2002-2004</u>

Reply Letter about Electricity Tariff of Yuanmushan Hydropower Plant (Xiangjiahan [2004] No. 55), Hunan Price Bureau, 30 April 2004:

http://wjj.yueyang.gov.cn/newCenterView.do?id=543

Reply Letter about Electricity Tariff of Helv Hydropower Plant (Xiangjiahan [2004] No. 81), Hunan Price Bureau, 11 June 2004:

Natioinal Economy and Social Development Statistic Bulletin for 2006 in Hunan Province, January 2007

Natioinal Economy and Social Development Statistic Bulletin for 2007 in Hunan Province, March 2008

Natioinal Economy and Social Development Statistic Bulletin for 2008 in Hunan Province, March 2009

http://www.hntj.gov.cn/tjgb/hntjgb/

[9] From 2008, the VAT of electricity tariff for hydropower plants with installed capacity above 25 MW is 17% in accordance with Notice about Further Adjustment of Electricity Tariff in Hunan Province (Xiangjiadian [2008] No.158) issued by Hunan Price Bureau on 22 October 2008

http://wjj.yueyang.gov.cn/newCenterView.do?id=946

Year 2004

Notice about Adjustment of Electricity Tariff of Power Plants in Hunan Province (Xiangjiachong [2004] No. 114), Hunan Price Bureau, 4 August 2004:
http://wjj.yueyang.gov.cn/newCenterView.do?id=985

Year 2005

Notice about Electricity Tariff of Power Plants in Hunan Province (Xiangjiachong [2005] No. 129), Hunan Price Bureau, 23 August 2005:
http://wjj.yueyang.gov.cn/newCenterView.do?id=999

Year 2006

Notice about Electricity Tariff of Power Plants in Hunan Province (Xiangjiachong [2006] No. 111), Hunan Price Bureau, 28 July 2006:

http://www.xxpi.com/Article/ShowArticle.asp?ArticleID=3820

Notice about Electricity Tariff of Power Plants in Hunan Province (Xiangjiachong [2006] No. 148), Hunan Price Bureau, 27 October 2006:

http://wjj.yueyang.gov.cn/newCenterView.do?id=990

Year 2007

Approval about Electricity Tariff of Newly Built and Retrofit Power Plants in Hunan Province (Xiangjiachong [2007] No. 85), Hunan Price Bureau, 2 July 2007:

http://wjj.yueyang.gov.cn/newCenterView.do?id=981

Year 2008 until now

Notice about Further Adjustment of Electricity Tariff in Hunan Province (Xiangjiadian [2008] No. 158), Hunan Price Bureau, 22 October 2008:

http://www.changde.gov.cn/art/2008/11/4/art_494_189713.html

It can be found from above that the electricity tariff for similar hydropower plants (with installed capacity between 15 MW – 25 MW) in Hunan Province is very stable but slightly increasing trend, the electricity tariff increased only by 0.32% from 2004 until now.

According to the Notice about Further Adjustment of Electricity Tariff in Hunan Province (Xiangjiadian [2008] No. 158), the actual specific electricity tariff for the project is listed as 0.316 RMB/kWh in the document. The highest ever approved tariff is 0.316 RMB/kWh (0.298 RMB/kWh excluding VAT) for projects of similar size i.e. what this project itself received. Projects above 25 MW received as a maximum 0.326 RMB/kWh (0.279 RMB/kWh excluding VAT), which would return a lower IRR because the VAT is 17% whereas for this project the VAT is only 6%. So, in conclusion, this project

would not cross the benchmark with the highest-ever approved tariff as it would need 0.3544 RMB/kWh including VAT (an increase of 12.20%) in order to do so.

(3) Net electricity supply

When the net electricity supply of the project increases by 12.28%, the project IRR will be 10%.

According to EB 48, Annex 11, paragraph 3:

The plant load factor shall be defined ex-ante in the CDM-PDD according to one of the following three options:

(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval;

(b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company).

According to SPDR, the annual operational hours are calculated through hydrological data for 45 years (1959-2003). The project SPDR was developed by independent Huaihua Institute of Hydroelectric Investigation. The SPDR was approved by Water conservation bureau of Huaihua City in May 2005.

Thus the paragraph 3 (a) of Annex 11 of EB 48 - the PLF is PLF is officially approved while applying the project activity for implementation approval - and 3 (b) - the PLF is determined by a third party contracted by the project participant - are both complied with.

The net electricity generation is mainly subject to water resources availability, which is stable in long term average. Thus, the increase of 12.28% of the net electricity generation is unrealistic to occur.

(4) O&M costs

The project IRR is only 9.96% even if O&M costs are 0. Thus, the O&M costs have little impact on project IRR.

To sum up, IRR of the project is lower than the benchmark (10%) within the reasonable variation scope of the total investment, electricity tariff, net electricity supply and O&M costs, thus the project activity is unlikely to be financially attractive.

Step 3. Barrier analysis

Skipped.

Step 4. Common practice analysis

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

According to the Additionality Tool (Version 05.2), "Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis."

The common practice analysis is limited to the provincial level as the investment environment for each province differs (e.g. electricity tariffs). The selected geographical area for the project, i.e. Hunan Province, is relatively large. Hunan Province is considerably larger than several countries. The policies and regulations in Chinese provinces are different with each other.

In China, hydropower projects with installed capacity below 50 MW are defined as small hydropower projects[10]. According to the regulation of UNFCCC, hydropower plants with the installed capacity of equal or below 15 MW are defined as small scale project. Furthermore, no projects below 15 MW are listed in China Water Resources Yearbooks. The installed capacity of the project activity is 20 MW which means that the project is not a small scale project in CDM concept. So the range of 15-50 MW was selected towards the common practice analysis.

The significant reform of the Chinese electric power sector took place in 2002. The reform involved establishing State Grid Corporation of China and China Southern Power Grid Corporation[11]. The former State Power Corporation was restructured and separated into 5 national power generation companies[12]. Before the power industry restructure in year 2002[13], the hydropower plants were mainly developed by the state owned enterprises, provincial governments ensured that project entity of power plants can obtain sufficient return by providing guaranteed electricity tariffs. Power plants were constructed with the national or the local governmental funds, or the government provided the loan guarantee for the companies, the developers did not have financing difficulties. Thus, the electricity tariff for each power plant was determined with the principle of full-cost recovery[14]. However, the national policy changed after 2002, the electricity tariff will be determined on the basis of average costs of power generation using the same advanced technology and built within the same period under the provincial power grids. Thus projects operated after 2002 are considered as similar projects to the proposed project since they were operated under a same policy scheme.

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[10] Classification & Design Safety Standard of Hydropower Projects (DL5180-2003).

[11] Notice of the State Council on Printing and Distributing the Plans Regarding the Restructuring of the Power Industry(Guofa [2002] No.5), issued by State Council on 10 February 2002

http://www.china5e.com/laws/index2.htm?id=200608080001

[12] Approval from State Development Planning Commission about Power Generation Asset Restructuring and Division Scheme of State Power Corporation, Guodianban (2002) No.952, 26 December 2002

http://www.365dq.com/Research/Info_View.asp?ContentID=1793

[13] Notice of the State Council on Printing and Distributing the Plans Regarding the Restructuring of the Power Industry (Guofa [2002] No.5), issued by State Council, 10 February 2002

[14] Ministry of Water Resources and Electric Power, State Economic Committee and State Price Bureau, Note on Implement methods of Various Power Tariff (No. 101 Shuidiancaizi[1987])

http://www.scicpa.org.cn/html/hyfw/default.asp?id=46&vid=4795

So the hydropower plants with the installed capacity between 15 MW and 50 MW (not including 15MW) operated after 2002 in Hunan Province were chosen to conduct the common practice. The similar projects are listed in Table 10 below; CDM project activities are not included in the table.

Table 10 Hydropower plants constructed since 2002 in Hunan (15-50MW)[15]

No.	The project name	Installed capacity (MW)	Operation time (year)	Investment per kWh (RMB /kWh)	Essential distinction with Niaoerchao	IRR[16]	Type of the project owner
1	Yongxing II	20.0	2005	1.85	The submerged area is small.	Above 10%	State owned enterprise
2	Chengjiangkou	25.0	2006	1.96	The submerged area is small.	Above 10%	Private company
3	Yangmingshan II	25.0	2004	1.21	The submerged area is small.	Above 10%	State owned enterprise
4	Leizhong	40.5	2004	1.80	The submerged area is small.	Above 10%	State owned enterprise

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

In general, investors will develop the hydropower plants with good technical and economic indicators; the hydropower plants in above table were developed earlier with excellent natural conditions such as high water head and low construction costs, so these plants had excellent technical and economic indicators. For our 20 MW project, the investment per unit power generation is 2.18 RMB/kWh. But the investment per unit power generation of these projects shown in the Table 10 is 1.21~1.96 RMB/kWh. And the IRR for all these projects are above 10%. Thus these projects listed in Table above were financially attractive and had no investment risks. But the proposed project has poorer financial indicators and is not financially attractive; it would be very difficult for the developer of the proposed project to obtain a bank's loan without CDM support.

The detailed description of the distinctions of the identified similar projects:

1. Yongxing II hydropower plant: There is a Dongjiang reservoir with multi-year pondage capacity in the upriver of the project. Yongxing II project leads to few submergence of lands due to Dongjiang reservoir thus the investment for Yongxing II project is much less than for the Niaoerchao project. Furthermore, the annual operation period of the project is much higher than for the Niaoerchao project. Yongxing II project is owned by state-owned enterprise while Niaoerchao project is owned by private company. The

[15] China Water Resources Yearbook 2006; Hunan Hydro & Power Design Institute, Investigation Report on Hydropower Plants with Installed Capacity above 15MW in Operation since 2002 in Hunan Province.
[16] The exact IRRs are not disclosed as it is confidential information. The evidence Investigation Report on Hydropower Plants with Installed Capacity of over 15MW in Operation since 2002 in Hunan Province was verified by DOE.

financing difficulty for private company is much higher than state-owned enterprise since state-owned enterprise has more assets that can be used as collateral by the bank.

2. Chengjiangkou hydropower plant: There is a Dongjiang reservoir with multi-year pondage capacity in the upriver of the project. Chengjiangkou project leads to few submergence of lands due to Dongjiang reservoir thus the investment for Chengjiangkou project is much less than for the Niaoerchao project.

3. Yangmingshan II hydropower plant: Due to few submergence of lands of Yangmingshan II project, the investment for the project is nearly half of Niaoerchao project since Yangmingshan II was constructed much earlier than Niaoerchao. Furthermore, Yangmingshan II project is owned by state-owned enterprise while Niaoerchao project is owned by private company. The financing difficulty for private company is much higher than state-owned enterprise since state-owned enterprise has more assets can be used as collateral by the bank.

4. Leizhong hydropower plant: There is a Dongjiang reservoir with multi-year pondage capacity in the upriver of the project. Leizhong project leads to few submergence of lands due to Dongjiang reservoir thus the investment for Leizhong project is much less than Niaoerchao project. Furthermore, the annual operation period of the project is much higher than Niaoerchao project. Furthermore, Leizhong project is owned by state-owned enterprise while Niaoerchao project is owned by private company. The financing difficulty for private company is much higher than state-owned enterprise since state-owned enterprise has more assets can be used as collateral by bank.

In conclusion, the submergences of above 4 similar projects are much less than Niaoerchao project thus the investment for these 4 similar projects are much less than for the Niaoerchao project. Most of above projects are using the big reservoir in upriver. These 4 similar projects were constructed earlier than Niaoerchao project. There is a reservoir with seasonal pondage capacity involved in the construction of Niaoerchao project and the project involves constructing TWO dams. Thus the reservoir causes the high investment due to submergence of lands and resettlers.

It can be concluded from above analysis that the project activity is not common practice in Hunan Province.

The time schedule of the project is show in Table 11 below.

Table 11 Timeline of the project

Date	Schedule
04/2005	Feasibility Study Report (12 MW)[17]
26/05/2005	Approval of Feasibility Study Report[18]
21/06/2005	The minutes of Yuanling County government meeting[19]

[17] Huaihua Institute of Hydroelectric Investigation, the Feasibility Study Report of Yuanling County Dongting River Niaoerchao Hydropower Project, April 2005.
[18] Development and Reform Commission of Huaihua City, the Approval of Feasibility Study Report of Yuanling County Dongting River Niaoerchao Hydropower Project (Huaifagaineng[2005] No.10), 26 May 2005.
[19] Meeting Minutes of Yuanling County Government (No. 9), 21 June 2005.

05/08/2005	Director meeting for decision of CDM consideration (investment decision)[20]
30/09/2005	1st Bank Loan Agreement signed with China Construction Bank (CCB) Changsha Huaxing Branch due to CDM incentives[21]
11/2005	First draft of Preliminary Design Report (16 MW)[22]
07/11/2005	Received *Notice about Application CDM Project from Development and Reform Commission* from Development and Reform Commission of Hunan Province & Science and Technology Department of Hunan Province[23]
16/11/2005	Generator and Turbine Purchase Agreement (16 MW)[24]
08/12/2005	First payment for Generator and Turbine Purchase Agreement (starting date of the project, please refer to below for explanation)[25]
09/12/2005	Attend the training course held by Science & Technology Department of Hunan Province[26]
05/01/2006	2nd Bank Loan Agreement signed with CCB Changsha Huaxing Branch
02/2006	Draft Supplementary Preliminary Design Report (20 MW)[27]
04/2006	Final version of Preliminary Design Report (16 MW)[28]
15/05/2006	Approval of Preliminary Design Report[29]
17/06/2006	Supplementary Generator and Turbine Purchase Agreement (20MW)[30]
23/06/2006	Letter of Intent of Emission Reductions signed with Carbon Asset Management Sweden AB
08/2006	Final version of Supplementary Preliminary Design Report (20 MW)[31]

[20] Minutes of Director Meeting of Hunan Guohong Investment Co., Ltd., 5 August 2005.

[21] Due to there is no written document about CDM incentives for bank loan approval then, CCB Changsha Huaxing Branch issued a statement to describe the bank loan approval situation on 23 March 2010. It is clearly stated by CCB that the CDM is a decisive factor to approve the bank loan.

[22] Huaihua Institute of Hydroelectric Investigation, Draft Preliminary Design Report of Hunan Province Yuanling County Niaoerchao Hydropower Project, November 2005.

[23] Notice of Applying CDM Project in Hunan Province, Hunan Development and Reform Committee and Hunan S&T Department, Nov. 07 2005.

[24] The Agreement of Equipment Purchase of Hunan Yuanling Niaoerchao Hydropower Project, Nov. 16 2005.

[25] 1st payment receipt for Generator and Turbine Agreement from China Construction Bank (CCB), CCB, 8 December 2005

[26] Meeting Guideline of First CDM Training Course in Hunan Province, 9 December 2005.

[27] Huaihua Institute of Hydroelectric Investigation, Draft Supplementary Preliminary Design Report of Hunan Province Yuanling County Niaoerchao Hydropower Project, February 2006.

[28] Huaihua Institute of Hydroelectric Investigation, the final version of Preliminary Design Report of Hunan Province Yuanling County Niaoerchao Hydropower Project, April 2006.

[29] Water Resources Bureau of Huaihua City, Approval Letter of Preliminary Design Report of Yuanling County Niaoerchao Hydropower Project (Huaishuidian [2006] No.50), May 15 2005.

[30] The Supplementary Generator and Turbine Agreement, 17 June 2006.

[31] Huaihua Institute of Hydroelectric Investigation, the final version of Supplementary Preliminary Design Report of Hunan Province Yuanling County Niaoerchao Hydropower Project, August 2006.

29/09/2006	Emission Reductions Purchase Agreement signed with Carbon Asset Management Sweden AB[32]
22/11/2006	Approval of Supplementary Preliminary Design Report[33]
10/12/2006	Construction starting date[34]
16/04/2007-20/04/2007	Training of monitoring[35]
05/06/2007	3rd Bank Loan Agreement signed with CCB Changsha Huaxing Branch
03/09/2007	Global Stakeholder Process (GSP) at Tuv Rheinland website for validation[36]
20/11/2007	CDM Letter of Approval issued by Swedish DNA[37]
17/12/2007	CDM Letter of Approval issued by Chinese DNA[38]
21/08/2008	Operation of 1st generator
27/08/2008	Operation of 2nd generator
13/10/2008	4th Bank Loan Agreement signed with China Construction Bank
15/12/2009	Bank Loan Reply Letter from Agricultural Bank of China (ABC)
20/01/2010	Bank Loan Agreement signed with ABC
09/02/2010	Water Diversion Tunnel Construction Contract of Liujingtan Dam signed
11/03/2010	Global Stakeholder Process (GSP) at ERM website for validation

Determination of project starting date:

According to Page 28 of Glossary of CDM terms (version 5):

The starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. Project activities starting between 1 January 2000 and the date of the registration of a first clean development mechanism project have to provide documentation, at the time of registration, showing that the starting date fell within this period, if the project activity is submitted for registration before 31 December 2005.

In light of the above definition, the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. This, for example, can be the date on which contracts have been signed for equipment or

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[32] Emission Reductions Purchase Agreement between Hunan Guohong Investment Co., Ltd. and Carbon Asset Management Sweden AB, 29 September, 2006.
[33] Water Resources Bureau of Huaihua City, Approval Letter of Supplementary Preliminary Design Report (Huaihuidian [2006] No.139), 22 November 2006
[34] Construction Order issued by Engineering Supervision Department, 10 December 2006.
[35] Monitoring Training Record, Hunan Guohong Investment Co., Ltd., from April 16 2007 to April 20 2007.
[36] http://cdm.unfccc.int/Projects/Validation/DB/IL94TAA2ISL9GR2L4UJFSVLGBLJG0I/view.html
[37] CDM Letter of Approval, Swedish DNA, 20 November 2007.
[38] CDM Letter of Approval for China Niaoerchao Hydropower Project as a Clean Development Mechanism issued by National Development and Reform Commission of the People's Republic of China, 17 December 2007.

construction/operation services required for the project activity.

It can be found from above definition that signing date of Generator and Turbine Purchase Agreement cannot be regarded as project starting date since it is clearly indicated in the agreement that:

The agreement will be effective after receipt of the 1st payment.

The date of 1st payment for Generator and Turbine Purchase Agreement made by project owner is defined as starting date of the project since the agreement will not be effective without 1st payment made. The 1st payment of the agreement indicated that the project owner has committed to expenditures related to the implementation or related to the construction of the project activity.

The designed installed capacity of the project in FSR is 12 MW. According to the FSR, it was found that the IRR of the project was much lower than the benchmark 10%. The implementation of this proposed project would face a financing barrier due to the bad financial index in the FSR. The project IRR can be improved to be over 10% considering the support from CDM. The project owner held the Board Meeting on 5 August 2005. The board of directors decided to apply for CDM support for the proposed project in order to improve the financial indicator of the project. Therefore, the incentives from the CDM have been seriously considered in the decision to proceed with the project activity. The 1st bank loan was signed with CCB on 30 September 2005 due to CDM incentives, which can be confirmed in the statement from CCB.

In order to further utilize the water resources, the PDR adjusted the installed capacity from 12 MW to 16 MW through comparing the technical and economic parameters. The first draft Preliminary Design Report was finished in November 2005. Development and Reform Commission of Hunan Province and Science and Technology Bureau of Hunan Province jointly published the Notice about Application CDM Project on 7 November 2005. The project owner signed the equipment purchase agreement (installed capacity is 16 MW) with Fujian Nanping Nandian Hydropower Equipment Manufacture Co., Ltd. on 16 November 2005. The project owner later attended the CDM training meeting on 9 December 2005. Because the upstream hydropower plant was affected by the flood, the experts of Huaihua Institute of Hydroelectric Investigation conducted a further detailed site investigation. The installed capacity of the project is expanded from 16 MW to 20 MW. The draft SPDR (20 MW) was finished in January 2006. In order to not affect the approval of the PDR, the SPDR was not made publicly until the PDR was approved in April 2006. After the PP got the approval of the PDR, the PP signed the Supplementary Equipment Purchase Agreement (20 MW) with Fujian Nanping Nandian Hydropower Equipment Manufacture Co., Ltd. on 17 June 2006. Then the formal SPDR was finished in August 2006. The Letter of Intent of Emission Reductions and Emission Reductions Purchase Agreement were signed in June 2006 and September 2006 respectively. The project finally started construction in December 2006.

The PDD of the project was published for validation on 3 September 2007, then the DOE conducted the site visit in October 2007. At the same time, the project owner submitted the materials of applying for the proposed project as a CDM project to Chinese DNA. The Chinese DNA issued the CDM LoA of the project on 17 December 2007. The Swedish CDM LoA was issued on 20 November 2007.

Due to the actual investment of the project was increased, a bigger loan is needed. So the project owner applied to ABC for loan on 22 October 2009. According to the reply letter, it can be concluded that the economic benefits of the project (20 MW) are poor, but considering that the revenue of the CERs will increase the repayment ability, the ABC decided to sign the loan contract with the project owner. The new bank loan contract was signed with ABC on 20 January 2010. The new bank loan obtained from

ABC is used to repay all the original bank loans and interests from CCB and to proceed with project construction. After signing of bank loan contract with ABC on 20 January 2010, the project owner signed the Water Diversion Tunnel Construction Contract of Liujingtan Dam on 9 February. The whole construction of the project is expected to be finished in year 2010.

From the timeline and corresponding description above, it can be concluded that the continuing and real actions have been taken to secure CDM status for the project in parallel with its implementation.

Thus, the project is additional.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

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Baseline Emissions

According to baseline methodology ACM0002, the baseline emissions are the CO_2 emissions from the equivalent electricity generation in CCPG that are displaced by the project activity. So the baseline emissions by the project activity during a given year *y* is obtained as follows:

According to ACM0002, the project emission should be calculated as:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (1)$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2e/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO_2/MWh)

The project activity is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity, so:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where:

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr);For the project $EG_{facility,y} = EG_y$;

The emission coefficient (measured in kg CO_2e/kWh) should be calculated in a transparent and conservative manner as: a combined margin (CM), consisting of the combination of operating margin(OM) and build margin (BM) according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system (Version 02)”.

The data used for calculation are from an official source (where available) and publicly available. The calculation processes are as follows:

STEP 1: Identify the relevant electricity system.

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).

STEP 3: Select a method to determine the operating margin (OM).
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Identify the group of power units to be included in the build margin (BM).
STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

STEP 1: Identify the relevant electricity system

According to 'Tool to calculate the emission factor for an electricity system' (Version 02), as the generated electricity of the proposed project will be delivered to CCPG, relevant electricity system is defined as all power plants connected to CCPG[39], which includes Jiangxi Province, Henan Province, Hubei Province, Hunan Province, Sichuan Province and Chongqing Municipality.

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)

According to 'Tool to calculate the emission factor for an electricity system' (Version 02), there are two options to calculate the operating margin and build margin emission factor:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.
For the proposed project, Option I is chosen.

STEP 3: Select a method to determine the operating margin (OM)

According to "Tool to calculate the emission factor for an electricity system (Version 02)", there are four methods for calculating the $EF_{grid,OM,y}$:

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

Method (a) can be used if low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages data for hydroelectricity production. It can be found from Table 12 that the low-cost/must run resources including hydro, geothermal, wind, low-cost biomass constitute less than 50% of CCPG during year 2003 to 2007. Thus, method (a) is applicable to calculate $EF_{grid,OM,y}$.

Table 12 Percentage of low-cost/must run resources in CCPG during year 2003 ~ 2007[40]

Year	2003	2004	2005	2006	2007
Percentage (%)	34.43	38.54	38.18	36.57	35.46

[39] Department of Climate Change of National Department and Reform Commission, China's Regional Grid Baseline Emission Factor 2009, 2 July 2009

[40] China Electric Power Yearbook 2004 ~ 2008

For the project, $EF_{grid,OMsimple,y}$ is calculated using ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

STEP 4: Calculate the operating margin emission factor according to the selected method
According to "Tool to calculate the emission factor for an electricity system (Version 02)", there are two options based on different data for calculating $EF_{grid,OMsimple,y}$:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.
For the project, the necessary data for Option A is not available, so Option A can't be used, Option B can be used if only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known and off-grid power plants are not included in the calculation. There isn't any nuclear power in CCPG at present[41] and renewable power generation are considered as low-cost / must-run power sources in CCPG, and the quantity of electricity supplied to CCPG by these sources is known and off-grid power plants are not included in the calculation, so Option B is used for calculating $EF_{grid,OMsimple,y}$, the formula is as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y})}{EG_y} \qquad (3)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh)
i = All fossil fuel types combusted in power sources in project electricity system in year *y*
y = The relevant year as per the data vintage chosen in step 3.

The calculation method of $EF_{grid,OMsimple,y}$ issued by National Development and Reform Commission is referred to for the project[42], to see A1 ~ A7 in Annex 3 for details.

STEP 5: Identify the group of power units to be included in the build margin (BM)

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[41] China Electric Power Yearbook 2008, Page 732

[42] National Development and Reform Commission, China's Regional Grid Baseline Emission Factors 2009, 2 July 2009.

According to 'Tool to calculate the emission factor for an electricity system' (Version 02), the sample group of power units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The set of power units that comprises the larger annual generation should be used.

According to "China's Regional Grid Baseline Emission Factor 2009" issued by National Development and Reform Commission on 2 July 2009, because of the unavailability of the data at the power plant level in China, a deviation method is used to calculate the build margin emission factor, to see Step 6 for details.

STEP 6: Calculate the build margin emission factor

Build Margin emission factor ($EF_{grid,\ BM,\ y}$) is calculated by utilizing an *ex-ante* 3 years data vintage for CCPG, the formulae as follow:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \quad (4)$$

Where :

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

'Tool to calculate the emission factor for an electricity system' (Version 02) provides two options (Option 1 and Option 2) to calculate the build margin emission factor in terms of vintage of data.

Option 1 is chosen to calculate the build margin emission factor. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Because of the data unavailability at the power plant level in China, the 22nd CDM EB meeting agreed the following deviation[43] approaches for $EF_{grid,BM,y}$ calculation:

1) Use the efficiency level of the most advanced commercialized technologies of provincial/regional or national grid of China, as a conservative proxy, for fuel *i* consumption estimation to estimate the $EF_{grid,BM,y}$;

2) Use of capacity additions during last several years for estimating the $EF_{grid,BM,y}$ i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity;

3) Use of installed capacity to replace annual power generation to estimate weights.

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total thermal installed capacity, the $EF_{grid,BM,y}$ will be calculated as:

1) Based on the most recent years energy balance of the CCPG, calculating the proportions of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total CO_2 emissions of thermal power plants and taking them as weights of each type of plants in the following calculations;

2) Based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the emission factor of thermal power plants in CCPG. This approach is more conservative as it assumes all recently built plants have the fuel efficiency as that of the most advanced commercialized technologies;

3) Calculating the $EF_{grid,BM,y}$ through multiplying the emission factor of thermal power plants by the percentage share of thermal power plants installed capacity addition within all recently built installed capacity. The proper year is selected so that it is the closest time when the last 20% of installed capacity was built.

The BM in this PDD is calculated as the following sub-steps.

SUB-STEP 6a: Calculating the percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in CO_2 emissions from total thermal power plants

$$\lambda_{Coal,y} = \frac{\sum_{i \in Coal,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{5}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in Oil,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{6}$$

[43] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

$$\lambda_{Gas,y} = \frac{\sum_{i \in Gas,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (7)$$

Where:

$\lambda_{Gas,y}$ = Percentage of CO_2 emissions from the gas-fired power plants in CO_2 emissions from total thermal power plants in year *y*;

$\lambda_{Oil,y}$ = Percentage of CO_2 emissions from the oil-fired power plants in CO_2 emissions from total thermal power plants in year *y*;

$\lambda_{Coal,y}$ = Percentage of CO_2 emissions from the coal-fired power plants in CO_2 emissions from total thermal power plants in year *y*;

$F_{i,j,y}$ = Amount of fuel i (mass or volume unit, t for solid and liquid fuel, m^3 for gas fuel) consumed by the power sources of province j in year y;

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/t for solid and liquid fuel, GJ/ m^3 for gas fuel);

$EF_{CO_2,i,j,y}$ = CO_2 emission factor of fossil fuel type i in year *y* (tCO_2/MWh).

SUB-STEP 6b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (8)$$

Where:

$EF_{Thermal,y}$ = Emission factor of thermal power plants;

$EF_{Coal,Adv,y}$ = Emission factor of coal-fired power plants applying the most advanced commercialized technologies;

$EF_{Oil,Adv,y}$ = Emission factor of oil-fired power plants applying the most advanced commercialized technologies;

$EF_{Gas,Adv,y}$ = Emission factor of gas-fired power plants applying the most advanced commercialized technologies.

SUB-STEP 6c: Calculating the Build Margin (BM) emission factor ($EF_{grid,BM,y}$)

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (9)$$

Where:

$EF_{grid,BM,y}$ = Build Margin (BM) emission factor with advanced commercialized technologies for year y of CCPG;

$CAP_{Total,y}$ = Incremental installed capacity of recently built power plants, which constitutes near and greater than 20% of the total installed capacity;

$CAP_{Thermal,y}$ = Newly installed capacity of recently built thermal power plants;

$EF_{Thermal,y}$ = Emission factor of thermal power plants.

$EF_{grid,BM,y}$ is calculated according to the latest available data at the submission time of this PDD, the detailed data for the calculations is shown in Table A8-Table A10 of Annex 3.

STEP 7: Calculate the combined margin (CM) emissions factor

According to 'Tool to calculate the emission factor for an electricity system' (Version 02), baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$):

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (10)$$

Where:
w_{OM} = Weighting of operating margin emission factor (%);
w_{BM} = Weighting of build margin emission factor (%).

The weighs w_{OM} and w_{BM}, by default, are 50% (i.e., w_{OM}= w_{BM}= 0.5) for the first crediting period , and w_{OM}= 0.25,w_{BM}= 0.75 for the second and third crediting period.

Project Emissions

According to the baseline methodology ACM0002, for new hydroelectric power projects with reservoirs, if the power density of the project is greater than 10W/m^2, then project emissions PE_y = 0. For the proposed project, the power density is 11.09 W/m^2, greater than 10 W/m^2, thus PE_y=0.

Leakage

According to ACM0002, no leakage emissions are considered, so LE_y = 0.

Emission Reductions

The annual emission reductions (ER_y) of the project are calculated as follows:

$$ER_y \text{ (tCO}_2\text{e/yr)} = BE_y - PE_y - LE_y \quad (11)$$

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

>>

Data / Parameter:	*$NCV_{i,y}$*
Data unit:	kJ/kg or kJ/m^3
Description:	The net calorific value (energy content) per mass or volume unit of fuel *i* in year *y*
Source of data used:	*China Energy Statistical Yearbook 2008.*
Value applied:	See Annex 3 for details.
Justification of the choice of data or	Data used are from Chinese authorities.

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

Data / Parameter:	$EG_{Thermal,j,y}$
Data unit:	MWh
Description:	The electricity generated by fuel-fired power plants in province *j* in CCPG in year *y*
Source of data used:	*China Electric Power Yearbook 2006-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$IPCR_{j,y}$
Data unit:	%
Description:	The internal power consumption rate of power plants in province *j* in CCPG in year *y*.
Source of data used:	*China Electric Power Yearbook 2006-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$EF_{CO2,\ i,y}$
Data unit:	tCO_2/TJ
Description:	The CO_2 emission factor per unit of fuel i in year y
Source of data used:	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	No specific Chinese value available; adopt the lower limit of the 95% confidence intervals in IPCC.
Any comment:	

Data / Parameter:	$FC_{i,y}$
Data unit:	10^4 t, 10^8 m^3
Description:	The quantity of fuel *i* (in a mass or volume unit) consumed by CCPG in year *y*
Source of data used:	*China Energy Statistical Yearbook 2006-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	Installed capacities of province *j* in CCPG in years *y*.
Source of data used:	*China Electric Power Yearbook 2003-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$GENE_{Coal,Adv}$
Data unit:	/
Description:	The power supply efficiency of coal-fired power plants with best technology commercially available
Source of data used:	China's Regional Grid Baseline Emission Factors 2009
Value applied:	38.10%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Calculated based on most recent available data of 2007.

Data / Parameter:	$GENE_{Oil,Adv,y}$
Data unit:	/
Description:	The power supply efficiency of oil/gas-fired power plants with best technologies commercially available
Source of data used:	China's Regional Grid Baseline Emission Factors 2009
Value applied:	49.99%

Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Calculated based on most recent available data of 2007.

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2e/MWh
Description:	Operating margin emission coefficient of CCPG
Source of data used:	China's Regional Grid Baseline Emission Factor 2009
Value applied:	1.1255
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build margin emission coefficient of CCPG
Source of data used:	China's Regional Grid Baseline Emission Factor 2009
Value applied:	0.5802
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2e/MWh
Description:	Combined margin emission coefficient of CCPG
Source of data used:	China's Regional Grid Baseline Emission Factor 2009
Value applied:	0.85285
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	

B.6.3. Ex-ante calculation of emission reductions:

>>

Baseline Emissions

According to the formula (3)-(9) in section B.6.1, the results of $EF_{grid,OM,y}$, $EF_{grid,BM,y}$ and $EF_{grid,CM,y}$ are listed in following Table 13 , the detailed calculation is shown in Annex 3.

Table 13 Calculating result of baseline emission factor of CCPG

$EF_{grid,OM,y}$ **(tCO_2e/MWh)**	$EF_{grid,BM,y}$ **(tCO_2e/MWh)**	$EF_{grid,CM,y}$ **(tCO_2e/MWh)**
1.1255	0.5802	0.85285

According to the formula (1) in section B.6.1, the baseline emissions (BE_y) of the project in a typical year are calculated as follow:

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y} = 72{,}331\ MWh^{44} \times 0.85285\ tCO_2e\ /MWh = 61{,}687\ tCO_2\ e\ /yr$$

Project Emissions

The surface area of the project at full reservoir level of the project is $1.803km^2$; the installed capacity of the project is 20MW, so the power density is 11.09 W/m^2 which is greater than $10W/m^2$, the project emissions can be neglected according to the methodology ACM0002 (version 11), e.g. PE_y=0.

Leakage

According to the baseline methodology ACM0002, $LE_y = 0$

Emission Reductions

According to the formula (9) in section B.6.1, the emission reductions (ER_y) of the project in a typical year are calculated as follow:

$$ER_y\ (tCO_2e/yr) = 61{,}687 - 0 - 0 = 61{,}687\ t\ CO_2\ e/yr$$

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

>>

The estimated project emission reductions in the crediting period are listed in Table 14:

Table 14 The ex-ante estimation of emission reductions

Year	**Estimation of project activity emissions (tonnes of CO_2e)**	**Estimation of baseline emissions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of overall emission reductions (tonnes of CO_2e)**
2011	0	61,687	0	61,687
2012	0	61,687	0	61,687

[44] The actual total installed capacity of the project is 20MW, so the net electricity of 72,331MWh was chosen for calculation of emission reduction.

2013	0	61,687	0	61,687
2014	0	61,687	0	61,687
2015	0	61,687	0	61,687
2016	0	61,687	0	61,687
2017	0	61,687	0	61,687
2018	0	61,687	0	61,687
2019	0	61,687	0	61,687
2020	0	61,687	0	61,687
Total estimated reduction (tonnes of CO_2e)	0	616,870	0	616,870
Number of crediting years		10 years		
Annual average emission reduction (t CO_2e)		61,687		

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

>>

B.7.1 Data and parameters monitored:

>>

Data Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The surface area of flooded area at the full reservoir level of Niaoerchao dam is 1660000 m^2, and the surface area of flooded area at the full reservoir level of Liujingtan diversion dam is 143000 m^2. The total surface area of flooded area at the full reservoir level of the project is 1803000 m^2. The actual value will be monitored *ex-post* yearly.
Description of measurement methods and procedures to be applied:	The data for Niaoerchao dam and Liujingtan diversion dam will be yearly measured from topographical surveys, maps, satellite pictures, etc.
QA/QC procedures to be applied:	/

Any comment:	/

Data Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project to the CCPG in year *y*
Source of data to be used:	Meters installed at Wuqiangxi Substation and Qijiaping Substation (used in emergency situation, such as maintenance of power transmission line connected to Wuqiangxi Substation) respectively (M1 for Wuqiangxia Substation and M2 for Qijiaping Substation).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	72,331 MWh/yr is only used for calculation of emission reduction in PDD. The actual value will be monitored by meters *ex-post*. The data is the difference between power exported to grid and power imported from grid.
Description of measurement methods and procedures to be applied:	Continuous measurement and monthly recording.
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity.
Any comment:	

Data Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	20,000,000. The actual value will be monitored *ex-post*.
Description of measurement methods and procedures to be applied:	Determine the installed capacity based on recognized standards. The data will be monitored yearly.

QA/QC procedures to be applied:	/
Any comment:	

B.7.2. Description of the monitoring plan:

>>
The aim of our monitoring plan is to make sure that the emission reduction quantity monitored and evaluated during the project activities' vintage is completed, consistent, clear and precise. In order to insure the project's operation, the project owner compiled *the Handbook of Monitoring and Management for Niaoerchao Hydropower Project*. It has identified the duties of the related positions. The details are summarized as follows:

1. Monitoring subject

The primary data monitored are installed capacity, surface area of the reservoirs and the net electricity generation supplied to grids by the project activity.

2. Processing and managing structure

In order to insure the monitor plan work effectively and efficiently, the project owner established the monitoring management structure as shown in Chart 3.

The commissioner will receive technical supports from the Hunan CDM project service centre.

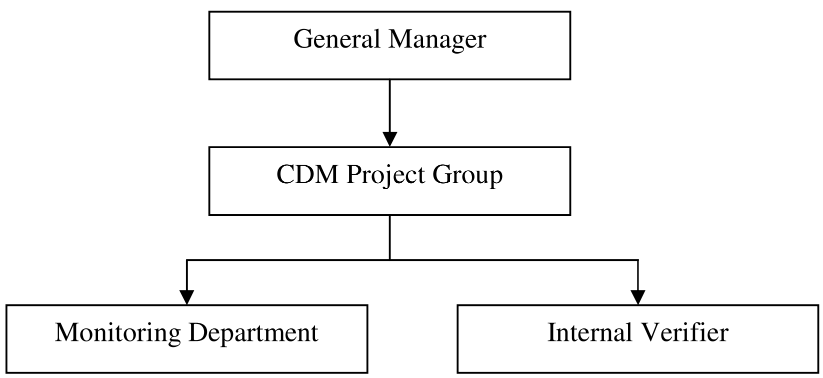

Chart 3 Monitoring Management Structure

The roles and responsibilities for each department/person are as follows:

General Manager is responsible for general management of the project. He/she is final approval of internal monitoring report.

The CDM Project Group is consisted of Monitoring Personnel and Internal Verifier. The group is leaded by the General Manager.

Monitoring Department is responsible for data monitoring, recording and reporting. The department is also responsible for regular operation of the project and maintenance of equipments.

Internal Verifier is responsible for checking the monitoring data and financial settlement with gridcompany plus CERs calculation.

3. Monitoring apparatus and instalment:

The electricity generated by the project will be supplied to Wuqiangxi Substation and Qijiaping Substation (used in emergency situation, such as maintenance of power transmission line connected to Wuqiangxi Substation). The M1 and M2 will be installed at Wuqiangxi Substation and Qijiaping Substation respectively as per the technology requirements of "Management Regulations for Power Energy Metered Device Technology" (DL/T448-2000). According to DL/T448-2000, the accuracy of meters for power plants below 100 MW should be 1.0. Therefore, the accuracy of M1 and M2 installed at Wuqiangxi Substation and Qijiaping Substaion is 1.0 or more accurate. According to Verification Regulation of Electrical Energy Meters with Electronics (JJG596-1999), the M1 and M2 will be calibrated once every 5 years by qualified calibration entity.

4. Data monitoring

The monitoring will be as follows if the M1 and M2 are in normal operation:

(1) The electricity imported from power grid and exported to power grid will be measured through bidirectional meters M1 and M2 installed at each substation. The data will be measured continuously and recorded monthly. The net power supply is the difference of the electricity imported from power grid and exported to power grid.
(2) The sales receipts and other monitoring records are used for cross check for the monitored data.
(3) The project owner provides DOE with the sales receipts and monitoring records during verification.

The principle of the processes is to guarantee the validation officers could obtain the actual meter readings.

The surface area of reservoirs and installed capacity will be yearly measured.

5. Quality control

According to Verification Regulation of Electrical Energy Meters with Electronics (JJG596-1999), the M1 and M2 will be calibrated once every 5 years by qualified calibration entity. After the calibration, the meters should be sealed. The project owner and the power grid are not allowed to break the seal independently.

When the error of M1 and/or M2 is identified beyond the maximum permissible error, the M1 and/or M2 should be displaced or calibrated:

All monitoring data and records will be archived electronically and be kept at least for 2 years after the end of the last crediting period.

6. Disposing process of urgency and abnormity

When the monitoring data is abnormal, the on-grid electricity quantity should be confirmed by the processes stated as below:

(1) When the M1 and/or M2 are beyond allowable error, the net electricity supplied to the grid will be calculated with a conservative method after the negotiation of the project owner and the grid company.
(2) If it is unable to reach an agreement between the project owner and the grid company, the emission reduction during the emergency period will not be claimed by project participants.

After handling of the emergency, the project owner must prepare a report regarding the emergency to explain to DOE that the handling method is reasonable.

7. Training program

Firstly, the project owner should train all the relative officers. The whole training program contains the CDM knowledge, the operational regulations, the quality control (QC) standard flows, the data recording requirements and the management rules.

For further information on our monitoring plan, please refer to *the Handbook of Monitoring and Management for Niaoerchao Hydropower Project*.

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

>>
Date of completion:
05/05/2010

Name of person/entity:
Ms. Dong Nanya

Unit: Hunan CDM project service centre
Address: No. 59, Bayi Road, Changsha, Hunan Province, China 410001
Tel: +86-731-84586782-812 15974290459
E-mail: csudny@yahoo.com.cn

The people or entity above are not the 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:

>>

08/12/2005 (The 1st payment of the Equipment Purchase Agreement, which is the earliest starting date of the activity)

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

>>

20 years and 0 month

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

C.2.1. Renewable crediting period

>>

Not applicable

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

01/01/2011 (or registration date if earlier)

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

>>

The Environmental Impact Assessment (EIA) Report was compiled by Huaihua Environment Protection Science Institute in May 2006[45]. And then the project owner obtained the approval[46] (Huaihuanhan [2006] No.57) from Huaihua Environmental Protection Bureau on 6 June 2006.

Due to the change of the total installed capacity, the PP applied to Huaihua Environmental Protection Bureau for supplementary approval of EIA. Then the PP obtained the supplementary approval [47](Huaihuanhan [2006] No.68) form Huaihua Environmental Protection Bureau on 12 October 2006.
The main comments on EIA report are as follows: On the condition that the owner takes the measures of pollution prevention and ecological protection presented in the EIA report, the Bureau approves the construction of the project at the angle of environmental protection.

The main contents of EIA report are as follows:

1. **Water quality**

The main waste water include: waste water from sand process and concrete mixer system; oil wastewater from construction machinery and living sewage. The oil waster water have little impact on the water quality, and the water from sewage treatment system will have no impact on the water quality. The waste water should be discharged by related standards during the operation of the proposed project.

2. **Air quality**

The construction will produce some waste gas and powder, but this won' affect the air quality; the air pollution will only affect the neighboring inhabitants and workers possibly in the partial area.
The dust will be reduced through sprinkling water in the construction area, the individual protection measures such as wearing masks will be taken by the influenced workers.

3. **Noise**

The Noise is mainly from the construction, the blast and the transportation. It will have some impacts on the neighboring inhabitants and workers.
In order to reduce the impact, following measures should be carried out: reinforce the management of the noise, avoid construction at night, setup warning board to remind the passing people and passing vehicle; provide the influenced workers with the security and protection equipment such as earplug, earflap and helm.

4. Ecological environment

---

[45] Huaihua Environment Protection Science Institute, Environmental Impact Assessment of Hunan Province Yuanling County Niaoerchao Hydropower Project, May, 2006

[46] Huaihua Environmental Protection Bureau, Approval of Environmental Impact Assessment of Hunan Province Yuanling County Niaoerchao Hydropower Project(Huaihuanhan[2006] No.57), 6 June, 2006

[47] Huaihua Environmental Protection Bureau, Supplementary approval of Environmental Impact Assessment of Hunan Province Yuanling County Niaoerchao Hydropower Project(Huaihuanhan[2006] No.68), 12 October, 2006

The project won't cause impact on the rare animals and plants in the neighboring area. And the construction and inundation won't have big impacts on the terrestrial vegetation. In order to reduce the impact, many trees will be planted in the construction area after operation. And the ecological flux of the project is no less than $0.42m^3/s$.

5. Inundation and resettlement
The inundation and resettlement will result in some impacts on the local agriculture and environment. The total surface area of flooded area at the full reservoir level of the project is $1.803km^2$. The total number of the re-settlers is 244. The resettlers will received the compensate according to the Compensation Standards, and the local government will supervise each payment.

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 host Party and the project participants both regard that the proposed project will not bring significant impacts on the environment.

SECTION E. Stakeholders' comments

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

>>
The project owner put up the bulletins all around the project site and held a meeting for stakeholders consultation on December 3, 2006[48]. Participants of the meeting included public personnel of different age, different sex, different occupations and different educational background. The total amount of the participants was 46 persons. All participants of the meeting made comments on the construction of the proposed project. More details are shown in section E.2.

E.2. Summary of the comments received:

>>
The meeting indicates that all the stakeholders support the construction of the project which is a favourable guarantee to the successful implementation of the project.

The people presented the following issues and suggestions:
1. The compensation of the project is the most important issue. The compensation should be paid on time according the related Compensation Standards. The living standard of the resettlers should be improved in the allocation area.
2. Although the impacts on water, air and noise during the construction are in a small scope and slight degree, PP should carry out the environmental protection stated in the EIA report seriously to ensure that the production and living of the local people isn't affected obviously.
3. The water and soil conservation should be conducted well; the vegetation should be recovered after the completion of the construction.

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

>>
According to the comments of the local villagers in section E.2., the project owners will take the following measures:

1. The PP pay the compensation on time and make sure that the living standard of the resettlers will be improved.
2. The environmental protection measures presented in the EIA report will be taken strictly to minimize the adverse impacts from the project and bring the positive impacts on the environment into full play.
3. The water & soil conservation measures presented in the Water and Soil Conservation Scheme will be taken strictly.
4. The construction of the project will be accelerates.

[48] Stakeholders Consultation Meeting Minutes of China Niaoerchao Hydropower Project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY
PROJECT OWNER

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from parties included in Annex I is available to the project activity.

Annex 3

BASELINE INFORMATION[49]

The installed capacity and the fuel consumption data used for OM and BM calculations are derived from <China Energy Statistical Yearbook>, <China Electric Power Yearbook>.

The low calorific value, CO_2 emission factor and oxidation factor of fuels are listed in Table A1 below.

Table A1 Low calorific values, CO_2 emission factors and oxidation factors of fuels

Fuel	Low Calorific Value	Emission Factor ($kgCO_2/TJ$)	Oxidation Factor
Raw Coal	20908 kJ/kg	87,300	1
Cleaned Coal	26344 kJ/kg	87,300	1
Other Washed Coal	8363 kJ/kg	87,300	1
Moulded coal	20908 kJ/kg	87,300	1
Coke	28435 kJ/kg	95,700	1
Crude Oil	41816 kJ/kg	71,100	1
Gasoline	43070 kJ/kg	67,500	1
Diesel Oil	42652 kJ/kg	72,600	1
Fuel Oil	41816 kJ/kg	75,500	1
Other oil production	41816 kJ/kg	75,500	1
Natural Gas	38931 kJ/m^3	54,300	1
Coke Oven Gas	16726 kJ/m^3	37,300	1
Other Gas	5227 kJ/m^3	37,300	1
LPG	50179 kJ/kg	61,600	1
Refinery Dry Gas	46055 kJ/kg	48,200	1

Data Source: The net calorific values are quoted from <China Energy Statistical Yearbook 2008>, Page 287.

[49] Department of Climate Change, National Development and Reform Commission, China's Regional Grid Baseline Emission Factors 2009, 2 July 2009

The emission factors are quoted from <2006 IPCC Guidelines for National Greenhouse Gas Inventories >, Table 1.3 and Table 1.4, Page 1.21-1.24, Chapter 1, Volume 2 Energy. The lower limit of the 95% confidence intervals is adopted.

Step 1: Calculating the Operating Margin emission factor ($EF_{grid,OM,y}$)

Table A2 Simple OM Emission Factors Calculation of CCPG for Year 2005

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Emission Factor	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	($kgCO_2/TJ$)	($MJ/t,km^3$)	L=G×J×K/ 100000 (for mass unit)
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K	L=G×J×K/ 10000 (for volume unit)
Raw Coal	10^4 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	**17827.75**	25.8	100	87,300	20908	325,404,287
Cleaned Coal	10^4 t	0.02						**0.02**	25.8	100	87,300	26344	460
Other Washed Coal	10^4 t		138.12			89.99		**228.11**	25.8	100	87,300	8363	1,665,408
Coke	10^4 t		25.95		105			**130.95**	29.2	100	95,700	28435	3,563,450
Coke Oven Gas	10^8 m^3			1.15		0.36		**1.51**	12.1	100	37,300	16726	94,206
Other Gas	10^8 m^3		10.2			3.12		**13.32**	12.1	100	37,300	5227	259,696
Crude Oil	10^4 t		0.82	0.36				**1.18**	20	100	71,100	41816	35,083
Gasoline	10^4 t		0.02			0.02		**0.04**	18.9	100	67,500	43070	1,163
Diesel Oil	10^4 t	1.3	3.03	2.39	1.39	1.38		**9.49**	20.2	100	72,600	42652	293,861
Fuel Oil	10^4 t	0.64	0.29	3.15	1.68	0.89	2.22	**8.87**	21.1	100	75,500	41816	280,035
LPG	10^4 t							**0**	17.2	100	61,600	50179	0
Refinery Dry Gas	10^4 t	0.71	3.41	1.76	0.78			**6.66**	15.7	100	48,200	46055	147,842
Natural Gas	10^8 m^3						3	**3**	15.3	100	54,300	38931	634,186
Other Petroleum Products	10^4 t							**0**	20	100	75,500	38369	0
Other Coking Products	10^4 t				1.5			**1.5**	25.8	100	95,700	28435	40,818
Other Energy	10^4tce		2.88		1.74	32.8		**37.42**	0	100	0	0	0
Total													**332,420,496**

Data Source: <China Energy Statistical Yearbook 2006>

Table A3 Fuel-fired Electricity Generation of CCPG for Year 2005

Province	Electricity Generation	Electricity Generation	Auxiliary Power Ratio	Supplied Electricity
	(10^8 kWh)	(MWh)	(%)	(MWh)
Jiangxi	300	30,000,000	6.48	28,056,000
Henan	1,315.9	131,590,000	7.32	121,957,612
Hubei	477	47,700,000	2.51	46,502,730
Hunan	399	39,900,000	5.00	37,905,000
Chongqing	175.84	17,584,000	8.05	16,168,488
Sichuan	372.02	37,202,000	4.27	35,613,475
Total				**286,203,305**

Data Source: <China Electric Power Yearbook 2006>

According to Table A2, the total CO_2 emission of CCPG is 332,420,496 t CO_2e in year 2005. According to Table A3, the total supplied electricity of CCPG is 286,203,305MWh. According to formula (3) in section B.6.1, the $EF_{grid,OM,2005}$ is 1.16148 tCO_2e/MWh.

Table A4 Simple OM Emission Factors Calculation of CCPG for Year 2006

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Emission Factor	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	($kgCO_2$/TJ)	(MJ/t,km^3)	L=G×J×K/ 100000 (for mass unit)
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K	L=G×J×K/ 10000 (for volume unit)
Raw Coal	10^4 t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	**20127.82**	25.8	100	87,300	20908	367,386,738
Cleaned Coal	10^4 t					5.79		**5.79**	25.8	100	87,300	26344	133,160
Other Washed Coal	10^4 t	4.51	104.12		8.59	79.21		**196.43**	25.8	100	87,300	8363	1,434,116
Briquette	10^4 t						0.01	**0.01**	26.6	100	87,300	20908	183
Coke	10^4 t		17.23		0.32			**17.55**	29.2	100	95,700	28435	477,576
Coke Oven Gas	10^8 m^3		0.52	1.07	4.24	0.38	0.01	**6.22**	12.1	100	37,300	16726	388,053
Other Gas	10^8 m^3	12.69	3.95		1.7	4.36	0.01	**22.71**	12.1	100	37,300	5227	442,770
Crude Oil	10^4 t		0.49					**0.49**	20	100	71,100	41816	14,568
Gasoline	10^4 t		0.01					**0.01**	18.9		67,500	43070	291
Diesel Oil	10^4 t	0.91	2.23	1.41	1.78	0.96		**7.29**	20.2	100	72,600	42652	225,737
Fuel Oil	10^4 t	0.51	1.26	1.31	0.8	0.57	3.49	**7.94**	21.1	100	75,500	41816	250,674
LPG	10^4 t							**0**	17.2	100	61,600	50179	0
Refinery Dry Gas	10^4 t	0.86	8.1	1	0.97			**10.93**	15.7	100	48,200	46055	242,630
Natural Gas	10^8 m^3			0.28		0.16	18.63	**19.07**	15.3	100	54,300	38931	4,031,309
Other Petroleum Products	10^4 t							**0**	20	100	75,500	38369	0
Other Coking Products	10^4 t						0.01	**0.01**	25.8	100	95,700	28435	272
Other Energy	10^4tce	17.45	37.36	31.55	18.29	29.35		**134**	0	100	0	0	0
Total													**375,028,077**

Data Source: <China Energy Statistical Yearbook 2007>

Table A5 Fuel-fired Electricity Generation of CCPG for Year 2006

Province	Electricity Generation	Electricity Generation	Auxiliary Power Ratio	Supplied Electricity
	(10^8 kWh)	(MWh)	(%)	(MWh)
Jiangxi	344.49	34,449,000	6.17	32,323,497
Henan	1,512.35	151,235,000	7.06	140,557,809
Hubei	548.41	54,841,000	2.75	53,332,873
Hunan	464.08	46,408,000	4.95	44,110,804
Chongqing	234.87	23,487,000	8.45	21,502,349
Sichuan	441.93	44,193,000	4.51	42,199,896
Total				**334,027,226**

Data Source: <China Energy Statistical Yearbook 2007> and <China Electric Power Yearbook 2007>

The electricity import to the CCPG from NWPG was 3,028,950MWh for year 2006. The Operating Margin emission factor of NWPG was 0.99148 According to Table A4, the total CO_2 emission of CCPG is378,031,235 t CO_2e in year 2006. According to Table A5, the total supplied electricity of CCPG is 337,056,176MWh. According to formula (3) in section B.6.1, the $EF_{grid,OM,2006}$ is 1.12157 tCO_2e/MWh.

Table A6 Simple OM Emission Factors Calculation of CCPG for Year 2007

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Emission Factor	Average Low Calorific Value	CO_2 Emission (tCO_2e)
									(tC/TJ)	(%)	($kgCO_2/TJ$)	($MJ/t,km^3$)	L=G×J×K/ 100000 (for mass unit)
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K	L=G×J×K/ 10000 (for volume unit)
Raw Coal	10^4 t	2200.57	9357	3479.8 1	2683.81	1547.7	3239	**22507.89**	25.8	100	87,300	20,908	410,829,404
Cleaned Coal	10^4 t		3.07			3.8		**6.87**	25.8	100	87,300	26,344	157,998
Other Washed Coal	10^4 t	0.04	87.16		2.06	96.42		**185.68**	25.8	100	87,300	8,363	1,355,631
Briquette	10^4 t						0.01	**0.01**	26.6	100	87,300	20,908	183
Coke	10^4 t							**0**	29.2	100	95,700	28,435	0
Coke Oven Gas	10^8 m^3	0.08	2.61	0.25	0.31	0.91		**4.16**	12.1	100	37,300	16,726	259,534
Other Gas	10^8 m^3	29.17	25.79		24.69		23.98	**103.63**	12.1	100	37,300	5,227	2,020,444
Crude Oil	10^4 t		0.43					**0.43**	20	100	71,100	41,816	12,784
Gasoline	10^4 t				0.04	0.01		**0.05**	18.9	100	67,500	43,070	1,454
Diesel Oil	10^4 t	0.98	3.21	2.51	2.83	1.93		**11.46**	20.2	100	72,600	42,652	354,863
Fuel Oil	10^4 t	0.42	1.25	1.33	0.63	0.64	1.74	**6.01**	21.1	100	75,500	41,816	189,742
LPG	10^4 t							**0**	17.2	100	61,600	50,179	0
Refinery Dry Gas	10^4 t	1.43	10.01	0.97	0.7			**13.11**	15.7	100	48,200	46,055	291,022
Natural Gas	10^8 m^3		0.12	0.18		0.2	1.87	**2.37**	15.3	100	54,300	38,931	501,007
Other Petroleum Products	10^4 t							**0**	20	100	75,500	41,816	0
Other Coking Products	10^4 t							**0**	25.8	100	95,700	28,435	0
Other Energy	10^4tce	23.43	63.65	35.95	29.46	23.21		**175.7**	0	0	0	0	0
Total													**415,974,066**

Data Source: <China Energy Statistical Yearbook 2008>

Table A7 Fuel-fired Electricity Generation of CCPG for Year 2007

Province	Electricity Generation	Electricity Generation	Auxiliary Power Ratio	Supplied Electricity
	(10^8 kWh)	(MWh)	(%)	(MWh)
Jiangxi	421	42,100,000	7.72	38,849,880
Henan	1773	177,300,000	7.55	163,913,850
Hubei	609	60,900,000	6.69	56,825,790
Hunan	542	54,200,000	7.18	50,308,440
Chongqing	288	28,800,000	9.2	26,150,400
Sichuan	451	45,100,000	8.68	41,185,320
Total				**377,233,680**

Data Source: <China Electric Power Yearbook 2008>

The electricity import to the CCPG from NWPG was 3,005,400MWh for year 2007. The Operating Margin emission factor of NWPG was 1.01129 According to Table A6, the total CO_2 emission of CCPG is 419,013,395 t CO_2e in year 2007. According to Table A7, the total supplied electricity of CCPG is 380,239,080MWh. According to formula (3) in section B.6.1, the $EF_{grid,OM,2007}$ is 1.10197 tCO_2e/MWh.

The Operating Margin (OM) emission factor is the weighted average emission factors of year 2005-2007, and is expressed as follows:

$$EF_{grid,OM,y} = 1.1255\ tCO_2e/MWh.$$

Step 2: Calculating the Build Margin emission factor ($EF_{grid,BM,y}$)

Sub-Step 2a: Calculation of percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

Table A8 Percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

		Jiangxi	Henan	Hubei	Hunan	Chong qing	Sichuan	Total	Average Low Calorific Value	Emission Factor (tC/TJ)	Oxid ation	CO_2 Emission (tCO_2e)
Fuel	**Unit**	**A**	**B**	**C**	**D**	**E**	**F**	**G=A+…+F**	**H**	**I**	**J**	**K=G×H×I×J/ 100,000**
Raw Coal	10^4 t	2,200.57	9,357	3,479.81	2,683.81	1,547.7	3,239	22,507.89	20,908	87,300	100	410,829,404
Cleaned Coal	10^4 t	0	3.07	0	0	3.8	0	6.87	26,344	87,300	100	157,998
Other Washed Coal	10^4 t	0.04	87.16	0	2.06	96.42	0	185.68	8,363	87,300	100	1,355,631
Briquette	10^4 t	0	0	0	0	0	0.01	0.01	20,908	87,300	100	183
Coke	10^4 t	0	0	0	0	0	0	0	28,435	95,700	100	0
Subtotal												**412,343,216**
Crude Oil	10^4 t	0	0.43	0	0	0	0	0.43	41,816	71,100	100	12,784
Gasoline	10^4 t	0	0	0	0.04	0.01	0	0.05	43,070	67,500	100	1,454
Diesel Oil	10^4 t	0.98	3.21	2.51	2.83	1.93	0	11.46	42,652	72,600	100	354,863
Fuel Oil	10^4 t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	41,816	75,500	100	189,742
Other Petroleum Products	10^4 t	0	0	0	0	0	0	0	41,816	75,500	100	0
Subtotal												**558,843**
Natural Gas	10^7m^3	0	1.2	1.8	0	2	18.7	23.7	38,931	54,300	100	501,007
Coke Oven Gas	10^7m^3	0.8	26.1	2.5	3.1	9.1	0	41.6	16,726	37,300	100	259,534
Other Gas	10^7m^3	291.7	257.9	0	246.9	0	239.8	1,036.3	5,227	37,300	100	2,020,444
LPG	10^4 t	0	0	0	0	0	0	0	50,179	61,600	100	0
Refinery Dry Gas	10^4 t	1.43	10.01	0.97	0.7	0	0	13.11	46,055	48,200	100	291,022
Subtotal												**3,072,007**
Total												**415,974,066**

Data Source: <China Energy Statistical Yearbook 2008>

According to Table A8 and formula (5), (6), (7) in section B.6.1, the percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions are calculated as:

$$\lambda_{Coal,y} = 99.13\% \ , \ \lambda_{Oil,y} = 0.13\% \ , \ \lambda_{Gas,y} = 0.74\%$$

Sub-Step 2b: Calculation of the fuel-fired emission factor ($EF_{Thermal,y}$)

The most advanced commercialized technologies for coal-fired power plants in China are generators of 600MW and above. The calculation uses the top 30 of the lowest coal consumption generators built in 2007. The estimated average standard coal consumption of them is322.5 gce/kWh, corresponding to the power supply efficiency of 38.10%. For gas-fired and oil-fired power plants in China, the most advanced commercialized technologies are 200MW combined cycle generators. The standard coal consumption (equivalent) for power supply of oil-fired and gas-fired power plants is 246gce/kWh, corresponding to the power supply efficiency of 49.99%.

Parameters used for calculating fuel-fired emission factor are shown in Table A9 below:

Table A9 Emission factors of coal/gas/oil-fired power plants applying the most advanced commercialized technologies

	Parameter	Efficiency of Power Supply	Emission Factor of Fuel kgCO_2/TJ)	Oxidation Factor	Emission Factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1,000,000×B×C
Coal-fired Power Plant	$EF_{Coal,Adv,y}$	38.10%	87,300	100%	0.8249
Gas-fired Power Plant	$EF_{Gas,Adv,y}$	49.99%	75,500	100%	0.5437
Oil-fired Power Plant	$EF_{Oil,Adv,y}$	49.99%	54,300	100%	0.3910

According to Table A9 and formula (8) in section B.6.1, the $EF_{Thermal,y}$ is calculated as follows.

$$EF_{Thermal,y} = EF_{Coal,Adv,y} \cdot \lambda_{Coal,y} + EF_{Oil,Adv\,y} \cdot \lambda_{Oil,y} + EF_{Gas\,Adv\,y} \cdot \lambda_{Gas,y}$$

$$= 0.8213 \text{ t}CO_2\text{/MWh}$$

Sub-Step 2c: Calculation of the Build Margin (BM) emission factor ($EF_{grid,BM,y}$)

A10 Installed Capacity of CCPG in 2007

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Fuel-fired	MW	9,270	38,540	13,040	13,360	6,370	12,000	92,580
Hydro	MW	3,570	2,740	24,020	9,220	2,240	19,860	61,650
Nuclear	MW	0	0	0	0	0	0	0
Wind	MW	0	0	10	17	24	0	51
Total	MW	12,840	41,280	37,070	22,597	8,634	31,860	154,281

Data Source: <China Electric Power Yearbook 2008>

A11 Installed Capacity of CCPG in 2006

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Fuel-fired	MW	6,568	32,603	11,623	10,715	5,594	9,555	76,658
Hydro	MW	3,288	2,553	18,320	8,648	1,979	17,730	52,518
Nuclear	MW	0	0	0	0	0	0	0
Wind	MW	0	0	0	17	24	0	41
Total	MW	9,856	35,156	29,943	19,380	7,597	27,285	129,217

Data Source: <China Electric Power Yearbook 2007>

A12 Installed Capacity of CCPG in 2005

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Fuel-fired	MW	5,906	26,267.8	9,526.3	7,211.6	3,759.5	7,496	60,167.2
Hydro	MW	3,019	2,539.9	17,888.9	7,905.1	1,892.7	14,959.6	48,205.2
Nuclear	MW	0	0	0	0	0	0	0
Wind	MW	0	0	0	0	24	0	24
Total	MW	8,925	28,807.7	27,415.2	15,116.7	5,676.2	22,455.6	108,396.4

Data Source: <China Electric Power Yearbook 2006>

Table A13 Newly Added Installed Capacity from Year 2005-2007

Installed capacity	2005	2006	2007	Increase from 2005 to 2007	Percentage
	A	B	C	D=C-A	
Fuel-fired (MW)	60,167.2	76,658	92,580	32,412.8	70.64%
Hydro (MW)	48,205.2	52,518	61,650	13,444.8	29.30%
Nuclear (MW)	0	0	0	0	0.00%
Wind (MW)	24	41	51	27	0.06%
Total(MW)	**108,396.4**	**129,217**	**154,281**	**458,84.6**	**100.00%**

Percentage of year 2006	70.26%	83.75%	100%		

Data Source: <China Electric Power Yearbook 2006-2008>

According to Table A10 and formula (9) in section B.6.1, the $EF_{grid,BM,y}$ is calculated as:

$$EF_{grid,BM,y} = 0.8213 \times 70.64\% = 0.5802 \text{ tCO}_2\text{/MWh}$$

Step 3: Calculating the baseline emission factor ($EF_{grid,CM,y}$)

According to formula (10) in section B.6.1, the baseline emission factor of CCPG is calculated as:

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} = 0.85285 \text{ tCO}_2\text{e/MWh}$$

Annex 4

MONITORING PLAN

No additional information.