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:

>>
Hubei Xiakou Hydropower Project of Nanzhang County, Xiangfan City, Hubei Province, P.R. China.
Version 5
Date: 13 May, 2008

A.2. Description of the project activity:

>>
The Hubei Xiakou Hydropower Project (HXKHP) is located on the Juhe River in Nanzhang County of Hubei Province, China. The installed capacity of HXKHP is 31.6 MW, which consists of a 30MW power house and a 1.6MW small power house. It is a new hydro electric power project with a reservoir (the power density is 7.02 W/ m^2, which is greater than 4 W/ m^2). Its output to the interconnected Central China Power Grid (through the Hubei Power Grid) per year in long-term average terms is 84.23 GWh. The Hubei Power Grid is a part of the Central China Power Grid, which consists of the Hubei, Hunan, Jiangxi, Henan, Sichuan and Chongqing provincial grids.

The purpose of the project activity is to generate electricity by using the renewable hydro resources and reduce 66,208 ton CO_2 emissions per year by displacing certain amount of electricity produced by the Central China Power Grid, which is dominated by thermal power plants.

Moreover, this project is supported by World Bank loans under the name of 'Hydropower Projects in Poor Areas of Hubei Province.' It has significant contributions to local sustainable development.

The specific sustainable development benefits of the project include:
1. Relieving the power shortage problem in the local area and facilitating the economic development of local area.
2. Supplying renewable and zero-emitting energy to the provincial and regional grids, reducing reliance on exhaustible fossil fuel based power sources and CO_2 emissions.
3. Providing job opportunities (many positions during the construction period and 50 permanent positions during operation). A related training program will increase income and education level in the local area.
4. Improving access roads, increasing the efficiency of local transportation.

Overall, this project will contribute to the sustainable development of the local area.

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)
People's Republic of China (Host Country)	Hubei Province Nanzhang Xiakou Power Company, Ltd. (HNXPC)	No
Netherlands	Arreon Carbon UK, Ltd.	No

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):
>>
China, People's Republic

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

A.4.1.3. City/Town/Community etc:
>>
Nanzhang County, Xiangfan City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):
>>
The project is located on the Juhe River. The power plant area is located at 31^{o} 21'2 N; 111^{o} 29'23 E. HXKHP is geographically located at Xiangfan City, Nanzhang County in Hubei Province, as detailed on the map below.

Location of the HXKHP Project

Figure A1. Location of the HXKHP Project in Hubei Province

Location of the HXKHP Project on the map of China
Figure A2. Location of the HXKHP Project in China

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

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The project activity is a large-scale potential CDM project, which fits under the Category 1: Energy Industries (renewable - / non-renewable sources) as per 'List of Sectoral Scopes', Version 04.

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

>>
The project is consists of a dam on the Juhe River, a 333 meter head race tunnel (HRT), intake structures that divert dam water into the HRT, a surface power house to accommodate two 15 MW units and a switchyard downstream from the powerhouse. Voltage of the generated electricity is increased to 110 kV through the Huazhuang substation and the electricity is supplied to the Central China Power Grid.

According to the World Bank and environment impact assessment requirements, the minimum water flow needed to protect the ecological environment is 3m^3/s. The project owner built an ecological diversion channel and installed a 1.6MW generator on the channel. The bypass pipe of the channel will be opened when the small generator is not in use. The water flow of the ecological diversion channel will be monitored to ensure it satisfies the 3m^3/s requirement. A sketch of the Xiakou power plant and its components are shown in Figure A3.

The main design features and characteristics of the two power houses are illustrated below.

	30MW Power House	1.6MW Power House
Gross head	70.6 m to 54.6 m	50 m to 70 m
Turbine Type	HLSK3059-LJ-168	HLA286-WJ-60
Generator Type	SF15-16/3900	SFW1600-6/1430
Manufacturer	Sichuan Dongfeng Electrical Engine Manufacturer	Zhuzhou Shidai Electrical Technology Ltd.
Amount of Generators	2	1
Installed capacity	30MW(2×15MW)	1.6MW
Operation Hour	2667	3672
Annual supplement of generation to the Grid	78.82GWh/year	5.414GWh/year

The project owner started the construction in November 2002. The project construction was stopped in September 2005 due to financial problem, and the reconstruction was started in November 2005. The construction time table is listed bellow:

1. November 2002: river closure
2. March 2004: contract was signed with the manufacturers of the main machines
3. September - October 2005: Construction stopped
4. November 2005: reconstruction was started.
5. December 2005: the dam was built to the designed height and water is retained
6. March 2007: operation begun

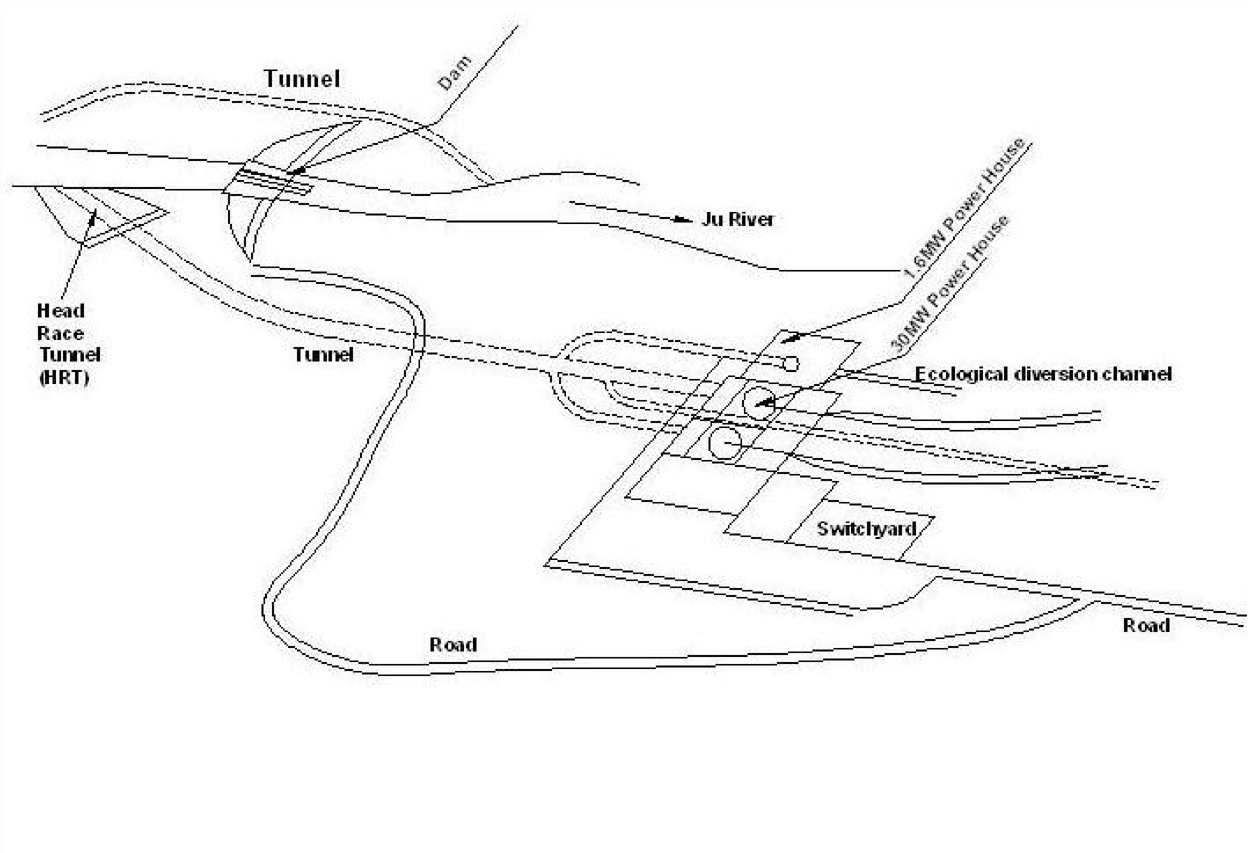

Figure A3. Sketch map of Xiakou Hydropower plant

The generator systems are supplied by a local manufacturer. The technology is local and well established. There is thus no transfer of technology to the host country.

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

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Total estimated emission reduction of 463,456 tons of CO_2 by the project activity is expected over the first crediting period of 7 years.

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2008 (11st April – 31st December)	48,069
2009	66,208
2010	66,208
2011	66,208
2012	66,208
2013	66,208
2014	66,208
2015 (1st January – 10th April)	18,139
Total estimated reductions (tonnes of CO_2e)	463,456

Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	66,208

Note: Year 2008, in the first crediting period, will start from April 11, 2008.

A.4.5. Public funding of the project activity:

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No public funding from parties included in Annex I is available to 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:

>>
The project activity uses following approved baseline methodology for PDD preparation
Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".
Reference: UNFCCC approved baseline methodology ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006.
Source: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The project activity uses following approved monitoring methodology for PDD preparation
Title: "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources".
Reference: UNFCCC approved baseline methodology ACM0002/ Version 06, Sectoral Scope: 1, 19 May 2006.
Source: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The additionality of the project activity is demonstrated and assessed using the **"Tool for the demonstration and assessment of additionality"** (version 03) agreed by the CDM Executive Board

All the documents are available on the UNFCCC CDM web site:
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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This methodology is applicable to the HXKHP project under the following conditions:

1. The HXKHP Project is a new hydro electric power project with a reservoir, with power density of 7.02 W/m^2, which is greater than 4 W/m^2.

2. The project activity is located in the Juhe River area and does not involve switching from fossil fuels to renewable energy.
3. The geographic and system boundaries for the interconnected Central China Power Grid can be clearly identified and information on grid characteristics is available.

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

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According to the baseline methodology ACM0002 (Version 06), the sources and gases included are shown in the figure blow:

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from Regional Grid thermal Power Plant	CO_2	Yes	Use of fossil fuel in power generation leads to CO_2 emission.
		CH_4	No	Negligible. Exclusion of this is conservative
		N_2O	No	Negligible. Exclusion of this is conservative
Project Activity	Emissions from HXKHP project	CO_2	Yes	Negligible. $4W/m^2$<Power densities <$10W/m^2$
		CH_4	Yes	Negligible. $4W/m^2$<Power densities <$10W/m^2$
		N_2O	No	Negligible
	Leakage emissions	CO_2	No	Negligible
		CH_4	No	Negligible
		N_2O	No	Negligible

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

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1. Define alternatives to the project activity

HNXPC identified plausible project options, which include all possible courses of actions that could be adopted in order to produce electricity for the Hubei Province end-users.

There are four plausible options available to meet the power requirement equivalent to 84.23 GWh.

Project Option 1 – The HXKHP project is not undertaken as a CDM project activity.

Project Option 2 – The China Central Power Grid continues to supply electricity to end-users.

Project Option 3 – A coal (fossil fuel) based power plant supplies the equivalent amount of power to the present grid mix.

Project Option 4 – A power plant from other renewable energy sources, such as biomass, wind power, supplies power to the present grid mix.

2. Determine alternatives to the project activity

Among the above four options, from the technological point of view, There are no other renewable energy sources except water resource in the local area, and thus Project Option 4 is not available.

If a coal (fossil fuel) based power plant were to be built and supply the equivalent power to the present grid mix, its installed capacity would be less than 31.6 MW. According to the most recent power industry policies, however, construction of a coal-fired power plant with a single capacity less than 135 MW is forbidden*. Hence, Project Option 3 is not an option available to HNXPC, a developer of small size independent power projects.

As illustrated Step 2 and Sub-step 3a of section B.5, if the proposed project activity not undertaken as a CDM project activity (Project Option 1), associated barriers arise, such as low IRR, hinder the successful implementation of the project activity.

Therefore, Project Option 2 is determined as the baseline scenario of this project, in other words, the Central China Power Grid continues to supply energy to end users.

3. Description of the identified baseline scenario

As described above, the baseline scenario of this project is Project Option 2 where the Central China Power Grid supplies energy to end users. Central China Power Grid includes Hubei, Hunan, Jiangxi, Henan, Sichuan and Chongqing provincial grids. According to the China Electric Power Yearbooks published from 2001 to 2005, averagely, 35.2% of Central China power was supplied by hydroelectric generation and the remaining 64.8% was supplied by thermal generation.

According to the selected methodology ACM0002, baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) calculated in B.6 and the electricity supplied by the project activity to the grid (EG_y in MWh), as follows

$$BE_y = EG_y \times EF_y$$

The baseline emissions factor applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

The electricity supplied by the project activity to the grid is calculated using the installed capacity of the HXKHP project and the average generating hours of similar projects. It will be monitored after registration.

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

The project started planning in the 1950s, but the construction was not started due to low generating capacity and economic gain until it received grant promise from provincial and county governments and loans from the World Bank under the name of “Hydropower Projects in Poor Areas of Hubei Province”.

* Source: http://www.gov.cn/gongbao/content/2002/content_61480.htm

Prior to the very beginning of construction period, the Hubei Water Resources Bureau and local county government promised the project owner HNXPC a 51.819 million RMB grant because the project improved area irrigation and flood prevention. This grant was first mentioned in July 2001. However, the promised money from this grant had never been deposited into the project owner's construction account.

On June 25, 2002, considering the Xiakou financial attraction increasing because of the government grant, the World Bank approved and promised the loan to the project under the name of "Hydropower Projects in Poor Areas of Hubei Province".

In November 2002, the initial construction started.

After more than 2 years of construction, before mid 2005, only less than 40% of the overall construction was finished, due to insufficient investment, which is caused by the delay of payment from government grant. Facing the high pressure of tight cash flow, the project developer began exploring the possibility of selling of carbon credits generated by project activity in April 2005, right after they learned the concept of CDM from an official document issued by the by Ministry of Science and Technology (MOST) of China on March 23, 2005. The project developer also tried to apply for more loan support from Nanzhang County Rural Credit Cooperation (NCRCC). But it was not approved by NCRCC due to the project's low financial revenue.

After policy adjustment and the local government's financial difficulties, the above mentioned grant from Hubei Water Resources Bureau was cancelled in July 2005. It made the project owner's turnover of capital more difficult than before. Moreover, the expected grant from local county government had not been paid either, until it was cancelled in September 2006.

At this time, the project developer urgently started to actively scout CDM consultants to prepare for the CDM application. On August 22, 2005, the project owner signed a CDM contract with a professional CDM consultant "Beijing Arreon Consulting Company".

In September 2005, the project owner's cash flow broke. The construction work was stopped on September 18, 2005**.** The shut-down period lasted for 2 months because of the delay of payment to the contractors for project construction. The project owner applied an urgent loan from Nanzhang County Rural Credit Cooperation (NCRCC) to start the project re-construction. As a requirement of NCRCC for loan application, a financial risk-analysis for the project, with consideration of the CDM revenue, was made by NCRCC on September 27, 2005. The project owner, Hubei Provincial Power Company, Hubei Institute of Water Conversation and Hydroelectric Exploration & Design (HIWCHED) and Beijing Arreon Consulting Company were also asked to help in the progress of this financial risk-analysis. The funds expected to be generated by the sale of CERs were taken into consideration in this risk-analysis. Considering the CDM support would made the project's total revenue meet NCRCC's loan application standard, the financial risk-analysis was adopted by the NCRCC to approve the loan application from the project owner. The loan application was approved by NCRCC on September 29, 2005, and the project owner got a 10 million Yuan urgent Loan from NCRCC.

On November 20, 2005, re-construction of the project started, with the loan help from CDM incentive. Therefore, the project owner considered CDM impact seriously prior to start of re-construction. The CDM support had, actually made significant positive effect on project's development, prior to start of the project activities.

The additionality of the project is analyzed.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

As described in section B4, there are four plausible options available to meet the power requirement equivalent to 84.23 GWh.

Project Option 1 – The HXKHP project is not undertaken as a CDM project activity.

Project Option 2 – The Central China Power Grid continues to supply electricity to end-users.

Project Option 3 – A coal (fossil fuel) based power plant supplies the equivalent amount of power to the present grid mix.

Project Option 4 – A power plant from other renewable energy sources, such as biomass, wind power, supplies power to the present grid mix.

Sub-step 1b. Consistency with mandatory laws and regulations:

Except Option 3, the other credible options available to HNXPC are in compliance with applicable laws and regulation requirements of the host country.

Step 2: Investment analysis

The step 2 is not applied to the project.

Step 3. Barrier analysis

HNXPC further establishes project additionality by proceeding to this step. HNXPC is required to determine whether the project activity faces barriers that:

(a) Prevent the implementation of the project activity; and

(b) Do not prevent the implementation of at least one of the alternatives through the following sub steps:

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project

Investment Barriers (Long-term funding)

Government Grant

Prior to the very beginning of construction period, the Hubei Water Resources Bureau and local county government promised the project owner HNXPC a 51.819 million RMB grant because the project improved area irrigation and flood prevention. This grant was first mentioned in July 2001. However, the promised money from this grant had never been deposited into the project owner's construction account.

After more than 2 years of initial construction, before mid 2005, only less than 40% of the overall construction was finished, due to insufficient investment, which is caused by the delay of payment from government grants. After policy adjustment and the local government's financial difficulties, the above mentioned grant from Hubei Water Resources Bureau was cancelled in July 2005. Moreover, the expected grant from local county government had not been paid either, until it was cancelled in September 2006.

The payment delay of government grant had significant negative impact on the project construction, leading to only less than 40% of the overall construction finished before mid 2005. The cancellation of the grant from Hubei Water Resources Bureau in July 2005 made the project owner's turnover of capital more difficult than before. Therefore the project owner's cash flow broke in September 2005. The construction work stopped because of the delay of payment to the contractors for project construction from September 18, 2005.

Loan from Bank

In early 2005, the project owner tried to apply for more loan support from Nanzhang County Rural Credit Cooperation (NCRCC). But it was not approved due to the project's low financial revenue. Facing the high pressure of tight cash flow, the project developer began exploring the possibility of selling of carbon credits generated by project activity in April 2005, right after they learned the concept of CDM from an official document.

After the cancellation of the grant from Hubei Water Resources Bureau in July 2005, the project's financial revenue was even worse than before. The project developer explored the possibility of selling of carbon credits generated by project activity and signed a CDM contract with a professional CDM consultant "Beijing Arreon Consulting Company" in August 2005.

The project construction work stopped from September 18, 2005. The project owner applied an urgent loan of from NCRCC to start the project re-construction. As a requirement of NCRCC for loan application, a financial risk-analysis for the project, with consideration of the CDM revenue, was made by NCRCC on September 27, 2005. The project owner, Hubei Provincial Power Company, Hubei Institute of Water Conversation and Hydroelectric Exploration & Design (HIWCHED) and Beijing Arreon Consulting Company were also asked to help in the progress of this financial risk-analysis. The funds expected to be generated by the sale of CERs were taken into consideration in this risk-analysis. Considering the CDM support would made the project's total revenue meet NCRCC's loan application standard, the financial risk-analysis was adopted by the NCRCC to approve the loan application from the project owner. The loan application was approved by NCRCC on September 29, 2005, and the project owner got a 10 million Yuan urgent Loan from NCRCC.

Technological barriers

The developer discovered the F4 crack layer in the right shoulder of the dam, which can affect dam stability. According to the data achieved through drill sampling, the solution is as follows: drill a hole, angled between 82° and 83°, 24 meters deep, then airproof it with grout. The construction of this task has not yet been completed. It is estimated that this task should cost 5.5 million RMB, which accounts for 6.3% of the total investment of this project.

In addition, the Head Race Tunnel (HRT) of the project has an F6 crack layer and a geological limestone cave, both of which affect the security of the HRT. The developer solved this problem through grouting and backfilling with concrete. This construction used up 1.99 million RMB of project investment.

Sub-step 3b. Show that the identified barriers would not prevent a wide spread implementation of at least one of the alternatives (except the proposed project activity):

It has been observed in Sub-step 3a that the project activity has its associated barriers to successful implementation. The barriers mentioned above are directly related to venturing into a new business of export of power to grid through construction of hydro power project and do not inhibit option 2 discussed above.

Step 4. Common Practice Analysis

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

For the purpose of analyzing common practice, the proposed project is compared to other recent investments in hydropower which have taken place in Hubei Province.

The hydropower projects that have an installed capacity less than 15 MW are excluded because they are small scale projects under CDM standards. The hydropower projects with an installed capacity larger than 50 MW are also not included because they have a substantially different profile and are evaluated differently under Chinese electric power standards.

Hydropower projects that began operation before 2000 are not comparable to the proposed project because of a different economic environment.

The projects which are also seeking for CDM support are not included in the compare.

Table B4 illustrates comparable key indicators for 9 Hubei hydropower projects, all of which have installed capacities is ranging from 15MW to 50MW without seeking for CDM support, as reported by the China Investigation Result of Water Resource (2003).

Table B1 Hydro power plants installed or under construction in Hubei Province since Year 2000[1]

Name	Installed capacity (MW)	Total Investment (million RMB)	Annual power Generation (GWh)	Investment per unit Generation (RMB/kWh)	Electricity sale price (RMB/kWh, excluding VAT)
Dalongtan	30	382	130	2.94	0.308
Xiaoxikou	30	283	101	2.80	0.334
Zhaolaihe	36	338	112.4	3.01	0.308
Bajiaohe I	30	274.06	90.1	3.04	0.330

[1] Source: China Investigation Result of Water Resource (2003). The project list includes the projects start construction or feasibility research before 2003.

Gudongkou	45	323.3	122	2.65	
Xiakou	31.6	283	85.88	3.30	0.308
Zhoujiayuan	36	121	146	0.83	0.294
Pingqian	30	224.96	94.8	2.37	0.295
Guanyintang	18	117	63.4	1.84	

For the projects, which have installed capacities is ranging from 15MW to 50MW, started feasibility research and construction after 2003, are all seeking for CDM support.[2]

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

Without comparing with projects seeking for CDM support, the other 8 hydropower projects all have similar install capacities and, are comparable to the proposed project. The proposed project with total investment of 283 million and annual power generation of 85.88GWh has the highest investment per unit of generation, which is 3.30 RMB/kWh. The other projects which have similar unit investment, including Dalongtan, Xiaoxikou, Zhaolaihe and Bajiaohe I, have same or even higher electricity sale price than the proposed project. Therefore, the project that has the highest investment per unit of generation is the most financially unattractive one due to lowest "unit price to unit investment" ratio. Hence, the proposed project faces higher investment barriers than the other similar projects.

In conclusion, the project is not considered to be common practice.

Therefore, the HXKHP project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Emission Reductions

The emission reductions of this project are determined by the following formula:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER_y	Emissions reductions of the project activity during the year *y* (tCO_2/yr)
BE_y	The baseline emissions during the year *y* (tCO_2/yr)
PE_y	Project emissions during the year *y* (tCO_2/yr)
L_y	Leakage emissions during the year *y* (tCO_2/yr)

I. Baseline emissions

$$BE_y = EG_y \times EF_y$$

Where:

EF_y	The baseline emissions factor, which is equal to emissions factor of the Central China Power Grid $EF_{Central,y}$ (tCO_2/yr)
EG_y	The electricity supplied by the project activity to the grid (MWh)

[2] Source: http://cdm.ccchina.gov.cn/web/index.asp, http://cdm.unfccc.int/index.html

The Central China Power Grid includes Hubei, Hunan, Jiangxi, Henan, Sichuan and Chongqing provincial grids.

Calculation of electricity baseline emission factor

Firstly, the emission factors of Operating Margin ($EF_{OM,y}$) and Build Margin ($EF_{BM,y}$) were calculated, then, the baseline emission factor (EF_y) was calculated as the weighted average of the previous two factors. All the calculation is in compliance with requirement of baseline methodology ACM0002 (Ver. 6). The details are demonstrated below in the following steps.

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

As per Step 1, the Operating Margin emission factor(s) ($EF_{OM,y}$) is calculated based on one of the four following methods:

1. Simple OM, or
2. Simple adjusted OM, or
3. Dispatch Data Analysis OM, or
4. Average OM.

'Simple OM' (1) method is applicable to this project activity because of the following reasons:

(1) In China, the State Grid Corporation runs the inter-regional dispatch system and each regional grid corporation runs the intra-regional dispatch system. The dispatch information is regarded as a business secret and is not available to the public.
(2) The electricity dispatch of the Three-Gorge hydropower plants is independent from the Central China Power Grid; therefore the Three-Gorge hydropower plants' power generation is not included in the total Central China generation.
(3) Over the last five years, in the project electricity system, the Central China Power Grid, the low-cost/must run resources constituted less than 50% of generation. The data in the following table illustrates this.

Table B2. Power generation mix of Central China Power Grid for five years (Exclude Three Gorge Hydropower Plant)

Energy Source	2000	2001	2002	2003	2004
Total Power Generation (GWh)	255520	281710	312817	358680	400785
Total Low-cost/must run resources (Hydro)	96590	103554	112470	117840	129939
Total Low-cost/must run resources (Others)	0	0	0	0	0
Low-cost/must run resources % of total grid generation	37.80	36.76	35.95	32.85	32.42

Data Source:

2005 China Electric Power Yearbook, p.474
2004 China Electric Power Yearbook, p.671
2003 China Electric Power Yearbook, p.585
2002 China Electric Power Yearbook, p.617
2001 China Electric Power Yearbook, p.667

According to the result, the Simple OM method is applicable to this project activity.

As defined by methodology ACM 0002, Simple OM emission factor ($EF_{OM\ Simple,y}$) is the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. The formula to calculate simple OM is:

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

Where:

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

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

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by power sources *j* in year(s) *y*.

The following formula can be used to calculate the CO_2 emission coefficient of fuels consumed by thermal power plants:

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad (2)$$

Where:

NCV_i is the Net Calorific Value (energy content) per mass of volume unit of fuel *i*, nation specific value.

$OXID_i$ - is oxidation factor of the fuel *i*, IPCC default value.

$EF_{CO2,i}$ - is the CO_2 emission factor per TJ of fuel *i* (tC/TJ), IPCC default value.

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

As per Step 2 the Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants.

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m,y}}{\sum_{m} GEN_{m,y}}$$

Where:

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

$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *m* and the percent oxidation of the fuel in year(s) *y*,

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

The methodology suggests the project proponent to choose one of the two options available to calculate the Build Margin emission factor $EF_{BM,y}$

This project adopted the Option 1, which requires the project proponent to calculate the Build Margin emission factor $EF_{BM,y}$ ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group *m* consists of either:

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

Project participants should use one from these two sample groups that comprises the larger annual generation.

According to the latest CDM EB clarification and the detailed explanation by Chinese DNA[3], the BM of the Central China Power Grid is calculated as follows:

(1) Since no data available at power plant level, the above samples are composed by the installed capacity increment by fuel type. For the proposed project, the samples include the installed capacity increment of thermal power, hydro power and others.

(2) Find the start year t_0 which meets the following equation:

$$\sum_i CAP_{i,t-t0} \geq 20\% \times \sum_i CAP_{i,t}$$

Where:
t is the most recent year in which data are available;
$CAP_{i,t-t0}$ is the installed capacity increment of type i during the starting year t_0 to the current year t;
$CAP_{i,t}$ is the installed capacity of type i in the current year t.

STEP 3: Calculate the baseline emission factor (EF_y)

As per Step 3 the baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$

II. Project Emissions

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

As per ACM0002 (Version 06), the project is a new hydro electric power projects with reservoirs having power density ω of 7.02 W/m2, 4W/m2<ω≤10W/m2.

$$PE_y = \frac{EF_{res} \times EG_y}{1000}$$

III. Leakage

As per the methodology, $L_y = 0$.

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

(Copy this table for each data and parameter)

Data / Parameter:	EF_{CM}
Data unit:	tCO_2/MWh
Description:	baseline emission factor
Source of data used:	calculated
Value applied:	0.876tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF_{OM}
Data unit:	tCO_2/MWh
Description:	Operating Margin (OM) emission factor of Central China Power Grid
Source of data used:	calculated
Value applied:	1.134 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	tCO_2/MWh
Description:	Build Margin (OM) emission factor of Central China Power Grid
Source of data used:	calculated
Value applied:	0.618 tCO_2/MWh
Justification of the choice of data or description of measurement methods	

and procedures actually applied :	
Any comment:	

Data / Parameter:	NCV_{coal}
Data unit:	GJ/ton
Description:	Net Calorific Value (energy content) per ton of coal
Source of data used:	China Energy Statistics Yearbook
Value applied:	29.27 GJ/ton
Justification of the choice of data or description of measurement methods and procedures actually applied :	The NCV_{coal} data is reported on China Energy Statistics Yearbook 2004, p 535
Any comment:	

Data / Parameter:	COEF
Data unit:	tCO_2/ton of coal
Description:	the CO_2 emission coefficient of coal
Source of data used:	calculated
Value applied:	2.769 tCO_2/ton of coal
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	
Data unit:	km^2
Description:	Surface area of full reservoir level
Source of data used:	Feasibility report
Value applied:	4.5km^2
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{CO2,coal}$
Data unit:	tCO_2/GJ
Description:	the CO_2 emission factor per unit of energy of coal in Central China Power Grid
Source of data used:	IPCC 2006

Value applied:	0.0946 tCO_2/GJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are reported on *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 2, Table 1.4, p. 1.23.
Any comment:	

Data / Parameter:	OXID
Data unit:	unitless
Description:	Oxidation factor of coal
Source of data used:	IPCC 2006
Value applied:	1.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data are reported on *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 2, Table 1.4, p. 1.23.
Any comment:	

Data / Parameter:	EF_{res}
Data unit:	tCO_2/MWh
Description:	Default emission factor for emissions from reservoirs
Source of data used:	ACM0002 (version 06)
Value applied:	90kgCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

Calculation of electricity baseline emission factor

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

As explained before in section B6.1, the Simple OM method is applied here. Either of the following data vintages for year(s) can be used in the calculation of the Simple OM emission factor according to the provision of the methodology.

(i) (ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of the PDD submission, if or

(ii) The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex post monitoring.

Based on the most recent statistics available of the project activity at the time of PDD submission, the first data vintages (ex-ante) for the calculation of the OM emission factor was chosen for this project. The generation data for various power generating sources for the most recent three years are presented in the Annex 3 attached. All key information and data used to acquire the Simple OM emission factor have been listed in table B6 and table B7.

In China, the power plant efficiency indicator is the Power Generation Coal Consumption (PGCC), the amount of standard coal that needs to be consumed to generate one kWh (g/kWh).

The CO_2 emission coefficient of fuel is calculated as

$$COEF_{i,j\,y} = NCV_i * EF_{CO2,i} * OXID_i$$

Where:
$COEF_{i,j\,y}$ - is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel) in year y
NCV_i - is Net Calorific Value (energy content) per mass or volume unit of a fuel I
$EF_{CO2,i}$ - is the CO_2 emission factor per TJ of fuel i (tC/TJ)
$OXID_i$ - is oxidation factor of the fuel i

Because there was no large scale oil-fired and gas-fired power plant in Central China in most recent three years and the impact on OM_{EF} by the electricity generated from thermal power plants combusting other fuels is negligibly small, so it is reasonable to assume all thermal plants are coal-fired plants and the PGCC is applied to all thermal electricity net generation.

Table B3. Basic Data used for Simple OM emission factor calculation

Parameters	**2002**	**2003**	**2004**
Fuel type	**Coal**	**Coal**	**Coal**
NCV_i (GJ/ton)	29.27	29.27	29.27
$EF_{CO2,i}$ (tC/TJ)	25.8	25.8	25.8
$OXID_i$	1.00	1.00	1.00
***$COEF_{i,j\,y}$*(tCO_2/ton of fuel)**	2.7690	2.7690	2.7690

Data sources:
NCV: China Energy Statistics Yearbook 2004, p 535.
EF_{CO2}: IPCC 2006, Volume 2, p. 1.23,
OXID: IPCC 2006, Volume 2, p. 1.23,

The mass of the standard coal burned to supply the Central China Power Grid in year y is calculated as:

$$F_{CPGC,coal,y} = \sum_i GEN_{i,coal,y} \times PGCC_{i,coal,y}$$

Where:

$GEN_{i,coal,y}$ is the net thermal power generation of province i in year y;
$PGCC_{i,coal,y}$ is the PGCC of province i in year y,

The Central China Power Grid exports hydroelectricity to other grids and only imports electricity from the East China Power Grid (information from China Electric Power Yearbooks, see Table in Annex 3). Because the import was negligibly small and the net import from the East China Power Grid was minus, there is no need to take into account electricity imported from other grids to Central China Power Grid in calculating the OM factor.

Based on the data of the most recent three years (Attached in Annex III) published on China Electric Power Yearbooks, Simple OM $EF_{OM,y}$ can be calculated as the table below shows. $GEN_{Coal\ thermal,y}$ is the net thermal generation (coal-fired) delivered to the Central China Power Grid in year *y*.

Table B4. Data of coal-fired power plants in the Central China Power Grid used for OM calculation

		Year 2002	Year 2003	Year 2004
A	$GEN_{Coal\ thermal,y}$ for Central China (GWh)	183733	225988	249074
B	$F_{coal,y}$ for Central China (ton)	2083683	2587025	2800129
C	COEF	2.7690	2.7690	2.7690
D=B*C/A	Simple OM (tCO_2/MWh)	1.134	1.145	1.124

Data Source:
China Electric Power Yearbook
See Annex III

As per methodology ACM0002, the EF_{OM} Average is the generation-weighted average for the most recent three years for which data are available at the time of PDD submission, thus the EF_{OM} Average for the Central China Power Grid is **1.134** (ton of CO_2/MWh)

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

As per Step 2 the Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants.

For the project activity under discussion the sample group '*m*' consists of (b) the capacity additions that comprise 20% of the system generation (in MWh) and that have been built most recently, because it comprises the larger annual generation than option (a). None of the power plant capacity additions in the sample group have been registered as CDM project activities.

According to EB's approved deviation for Methodologies AM0005 and AMS-I.D. and the detailed explanation by Chinese DNA , the BM of Central China Power Grid is calculated.

Based on recently obtained official statistics on the Central China Power Grid, the increase in capacity from 2001 to 2004 comprised less than 20% (17.4%) of 2004 whole system capacity. The difference from 2000 to 2004 comprised 22.5% of 2004 system capacity, over 20%. Therefore, system capacity in 2000 was chosen to compare with that in 2004 to determine the newly added amount as the sample group m.

Since 99.5% of emissions in the Central China Power Grid come from coal from 2002-2004 (see annex 3 for details), other emissions are mostly insignificant due to start up fuels. It is thus reasonable to count all thermal power plants as coal-fired plants in this calculation.

The following tables show the composition of new capacity addition by fuel types, and the calculation results.

Table B5. Composition of new capacity addition by fuel types in the Central China Power Grid

	System Capacity 2000 (MW)	System Capacity 2001 (MW)	System Capacity 2004 (MW)	Newly added System Capacity in 2004 (MW)
Thermal power plants	39864.6	42569.2	53744.7	13880.1
Hydropower plants	28637.8	30397.0	34642.1	6004.3
Other plants	0	0	0	0
Total	68502.4	72966.2	88386.8	19884.4
Capacity fraction of system capacity in 2004	77.5%	82.55%	100%	22.5%

The most advanced and commercially available coal power technology in the Central China Power Grid, is a 600MW sub-critical unit with ASCC (Assumed Standard Coal Consumption) value of 320 gce/kWh.. Thus, the BM EF_{Bmy} (tCO_2/MWh) is calculated as shown in the following table.

Table B6. Calculation of the weighted average BM EF_{Bmy} (tCO_2/MWh)

A	B	C	D	E=C/D	F=A*B*E/1000
Assumed Standard Coal Consumption (kg/MWh)	COEF(tCO_2/ ton coal)	Newly Added Thermal Capacity(MW)	Newly Added System Capacity(MW)	Fraction of New Thermal Addition (%)	EF_{BMy} (tCO_2/MWh)
320	2.769	13879.3	19884.4	69.8	0.618

EF_{BM},y (ton of CO_2/MWh) is **0.618** (see Annex 3 for details).

STEP 3: Calculate the baseline emission factor *EF_y*

The most recent 3-years weighted average of the Simple OM and the BM of the base year i.e. 2005 are considered. The Baseline Emission Factor was calculated as a combined margin (CM), consisting of the simple average of both the resulting OM and BM.

CM=0.5*OM + 0.5*BM = 0.5*(1.134+0.618) =0.876 tCO_2e/MWh

The Baseline Emission Factor, $EF_{electricity,y}$ is **0.876**tCO_2e/MWh

Calculation of baseline emissions due to displacement of electricity

As determined in B.4, the baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) calculated in B.6 and the electricity supplied by the project activity to the grid (EG_y in MWh), as follows

$$BE_y = EG_y \times EF_y = 0.876 \times 84234 = 73{,}789 tCO_2/year$$

Project Activity

As per ACM0002 (Version 06), the project is a new hydro electric power projects with reservoirs having power density ω of 7.02 W/m2, 4W/m2<ω≤10W/m2.

$$PE_y = \frac{EF_{res} \times EG_y}{1000} = \frac{90 \times 84234}{1000}$$
$$=7{,}581 CO_2/year$$

Leakage

As per ACM0002 (Version 06), LEy = 0.

Emission Reductions

The total net emission reductions are calculated as below.

$$ER_y = BE_y - PE_y - L_y = 73789 - 7581 = 66{,}208 CO_2/year$$

B.6.4 Summary of 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)
2008	5,504	53,573	0	48,069
2009	7,581	73,789	0	66,208
2010	7,581	73,789	0	66,208
2011	7,581	73,789	0	66,208
2012	7,581	73,789	0	66,208
2013	7,581	73,789	0	66,208
2014	7,581	73,789	0	66,208
2015	2,077	20,216	0	18,139
Total (tonnes of CO_2e)	53,067	516,523	0	463,456

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	Electricity quantity supplied to the Grid
Data unit:	MWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	Feasibility Report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	85,885MWh
Description of measurement methods and procedures to be applied:	The electricity quantity is directly measured with measuring instruments and verified with invoices or receipts from the grid company.
QA/QC procedures to be applied:	Electricity meters would be properly maintained with regular testing and calibration schedules developed as per the technical specification requirements to ensure accuracy.
Any comment:	

Data / Parameter:	Electricity quantity input from the Grid
Data unit:	MWh
Description:	Electricity export to the proposed project from the power grid
Source of data to be used:	Feasibility Report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,651MWh
Description of measurement methods and procedures to be applied:	The electricity quantity is directly measured with measuring instruments and verified with invoices or receipts from the grid company.
QA/QC procedures to be applied:	Electricity meters would be properly maintained with regular testing and calibration schedules developed as per the technical specification requirements to ensure accuracy.
Any comment:	

B.7.2 Description of the monitoring plan:

>>
According to the methodology, the electricity quantity supplied to the Grid from the project plant minus the electricity quantity import the project plant from the Grid is EG_y. The data to be monitored are the electricity delivered to the power grid by project plants and the electricity export to the proposed project from the power grid. The electricity is directly measured with measuring instruments and verified with invoices or receipts from the grid company.

1. Outline of the monitoring plan of the project activity

The general manager is responsible for the overall monitoring process. In the first step of the process, the project's total generation and electrical energy utilized by the power generating equipment in the project boundary should be measured and reported daily. This will be organized and checked by the plant manager. He or she should appoint monitoring officers whose are responsible for measuring the two data points and collecting sale receipts or invoices. This measurement should then be checked weekly by the plant manager. The monitoring officer should calculate the net electricity supplied to the facility and the subsequent emission reductions. The monitoring officer will prepare operational reports on the project activity and record the daily operation of the plant; including operational periods, power generation, equipment defects, etc. Finally, the monitoring reports will be reviewed by the general manager. The operational and management structure for the project's monitoring plan has been outlined below:

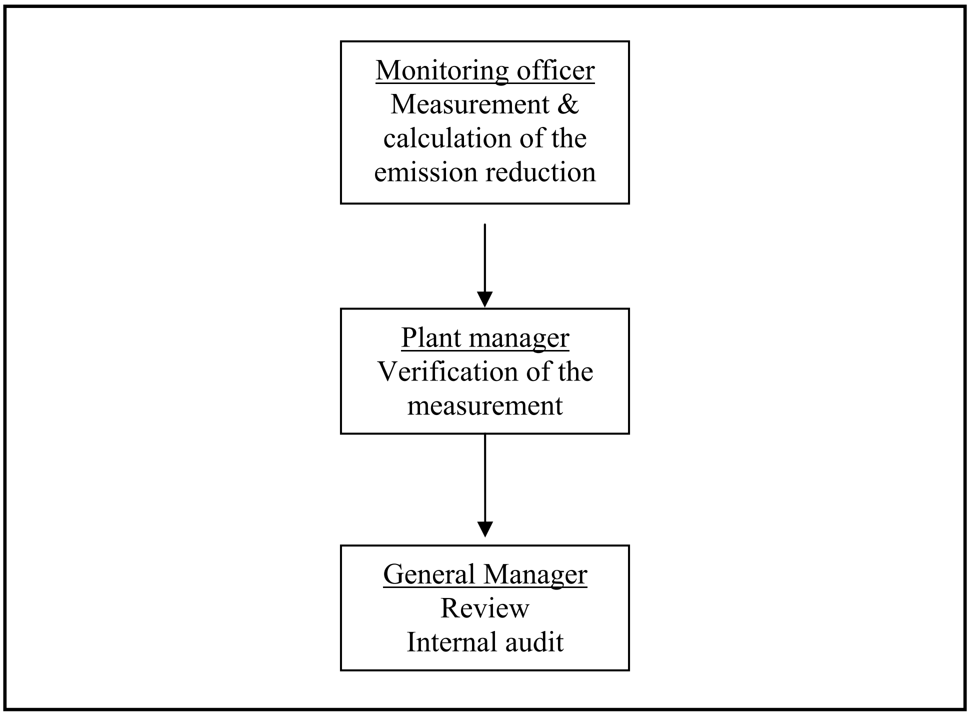

Figure B1. Management structure for monitoring the emission reduction

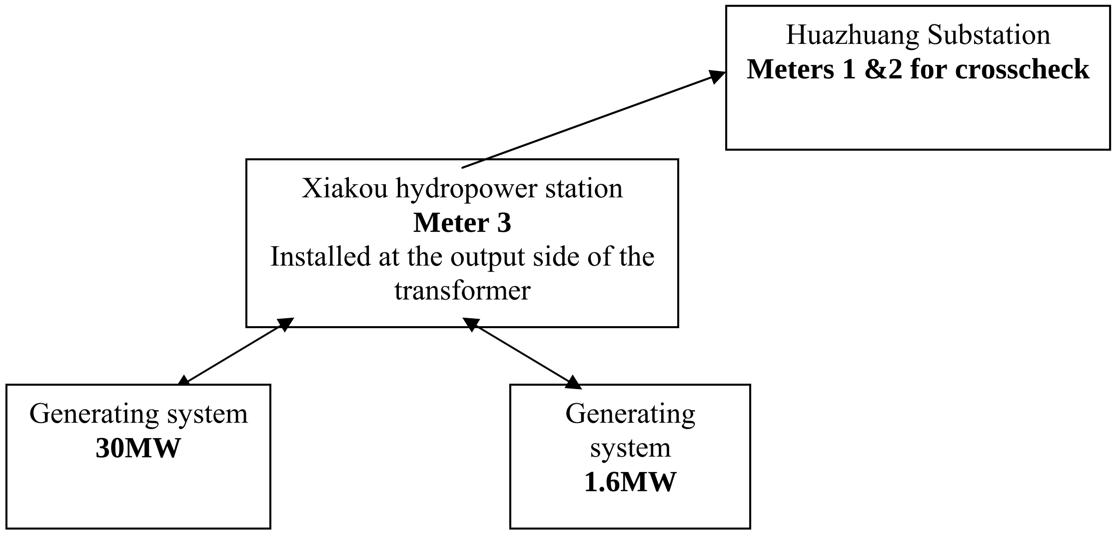

Figure2. Bus bar structure in Xiakou hydropower station

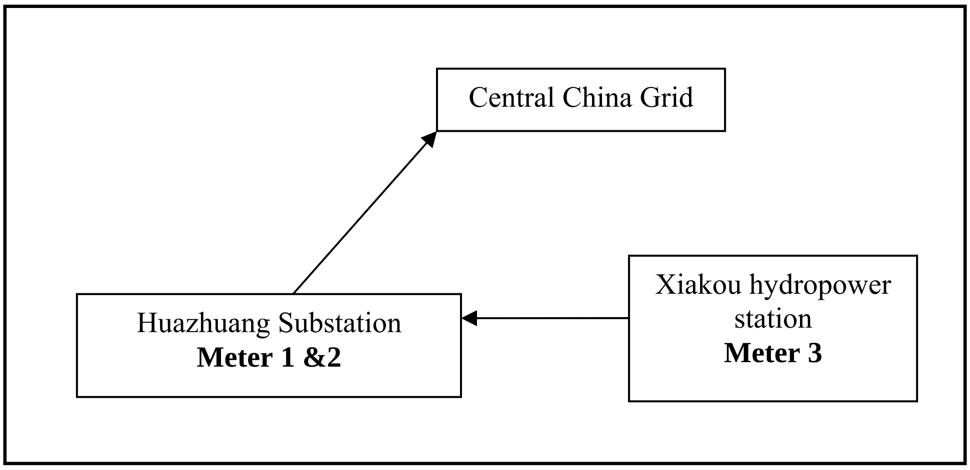

Figure B3. Location of the meters

Meter 1: Hongxiang BDMI**; Meter 2:** Siemens ZFB405**; Meter 3:** Siemens ZFB405

2. The installation and operation of monitoring instruments

In order to precisely measure the data, electricity should be measured both at the connection point to the grid and the output side of the transformer of project plants. The grid company must install measuring instruments to meter the power supply at the Huazhuang substation. The primary electricity meter is a type Hongxiang BDMI, which is a two-way meter with a 0.5s margin of error. The auxiliary meter is a Siemens ZFB405, also with a 0.5s margin of error. The Xiakou hydropower station meter is a Siemens ZFB405, with a 0.5s margin of error. The metering instruments at both locations should be calibrated annually according to regulations.

3. Data record

The plant manager and monitoring officer should be trained on implementing the monitoring process before the hydro plants begin operation to assure that they have fully understood their responsibilities and the requirements of the monitoring plan. During the monitoring process, the monitoring officer should record the meter once an hour and record the data on to the electricity statistic sheet on site. Records cannot be altered and all original data must be conserved. If the monitoring officer cannot reach the site in time to record, the plant manager should assign other employee to take over this duty. The record should be handed over to the monitoring officer without any delay when he or she arrives on site and both people should sign it. The plant manager should check and verify the electricity statistic sheet every week and report results to the general manager after doing so.

4. QA & QC and procedures in case of emergency

The electricity quantity supplied to the Grid and electricity quantity input from the Grid by the two systems (30MW and 1.6MW) was measured by the only meter in Xiakou hydropower station (Meter 3, which is a two-way meter). The total net electricity supplied to the Central China Power Grid equal to electricity quantity supplied to the Grid minus electricity quantity input from the Grid. The meter 3 is located at output side of the transformer of the xiakou hydropower project plant. Meters 1 and 2 installed at Huazhuang Substation are used for crosscheck of meter 3. The value metered by the backup meter at Huazhuang substation will be used when the main meter is fault. If meter 3 at Xiakou hydropower station need to be repaired or calibrated, the value metered by the meters at Huangzhuang substation will be used.

Data record will be archived for a period of 2 years after the credit period to which the records pertain.

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 of baseline and monitoring study

12/06/2007

Name of persons/entityies determining the baseline and monitoring methodology

Ms. LU Na, Dr. GUO Jun
Arreon Carbon UK Ltd. (Project participant)
Suite 1208, West Tower, Twin Towers
B12 Jianguomenwai Avenue, Beijing 100022
P.R. China

Mr. XU Hongbo
Hubei Province Nanzhang Xiakou Power Co. Ltd. (Project participant)
Shuijing Road Chengguan Town Xiangfan City Hubei Province
Xiangfan City, Hubei 441500, P.R., China

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:

>>

20/11/2005

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

>>
30MW power house: 25 years
1.6MW power house: 20 years

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

C.2.1. Renewable crediting period

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

>>
11/4/2008 or the date after registration

C.2.1.2. Length of the first crediting period:

>>
7 years and 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

SECTION D. Environmental impacts

>>

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

>>
An environmental impact assessment (EIA) was performed on the project to ensure that it complied with national, regional and local environmental regulations. The EIA for this project was carried out by the Hubei Research Academy of Environmental Science (HRAES). HRAES is an official Environmental Assessment Institute certified by the State Environmental Protection Agency (SEPA). It is independent from the project owner, HNXPC, both financially and administratively. The following is a brief summery of the EIA report (Report No.Guo Huan Ping Zheng Jia Zi No. 0946).

1. Ecological environment

The vegetation in the project area is all common species. After project completion, the vegetation will be replanted. Therefore, the project will not have a significant impact on the local vegetative environment.

In addition, the number of fish groups, birds and amphibious animals will increase after the construction period. After the project is completed, the improved environment will make it possible for the giant salamander, an endangered species, to recolonize the area.

Water creatures:
The number of fish will increase significantly after the construction period.

2. Water
Before being drained into the Juhe River, all waste water will be treated by simple treatment system. The project therefore does not have any negative effects on quality of water in nearby area.

3. Solid waste
The solid waste during the construction period will be collected and reused as much as possible. The rest will be carried into waste residue pits. The project will not have negative impacts on the local environment.

4. Climate
The project will also help to improve the local climate. It will increase water supply in winter while decrease the rate of temperature increase in the summer, thereby has positively impacting the growth of local vegetation.

5. Recommendations
Irrigation and flood prevention plans must be optimally managed
The vegetation re-establishment plan must be finished and strictly implemented.
A plan for crop development must be finished and strictly implemented.
The environment protection guide should be strictly followed.

The EIA study for the HXKHP project indicates that the project would not have an overall significant impact on the local environment.

Due to the installation of the project, about 900 residents were relocated to nearby counties. The relocation scheme was developed in August 2001 by the local government and then approved by the World Bank. World Bank also dispatched specialists to inspect the migration progress over a fixed period. An independent organization authorized by the World Bank is responsible for monitoring the migration and releases a monitoring report of migration every year. The latest report has been finished by East China Investigation and Design Institute (ECIDI) under the GHECC in 2005. The brief summery is given below.

The relocation work is nearly completed. Relocation compensation meets pre-set standards and the program has been implemented well. Residents are satisfied with the relocation. Moreover, the county migration office will compensate local villagers both monetarily and with tillable land.

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 EIA study for the HXKHP project indicated that the project would not significantly impacts the local environment.

The EIA report was approved by the Hubei Province Environmental Protection Administration (HPEPA) on January 7, 2000. HPEPA agrees with the conclusion of the EIA (Approval file: E Huan Zi No.[2000]3).

SECTION E. Stakeholders' comments

>>

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

>>

Stakeholders of this project include the government and NGOs, local population, regional social organisations whose level of involvement with the project activity varies at different stages. All the necessary clearances from the government parties have been obtained.

As a project supported by loan from World Bank, the project's stakeholder comments collection is implemented under requirements from World Bank, including a series of meetings, discussions and surveys. World Bank also has independent observer team, who in charge of the annual emigration assessment report. The observer team examines the emigration work from the design period of the project till the operation period, insuring that all the comments can be collected and the corresponding work must be done to deal with the problem. The annual emigration assessment reports have been provided.

The project owner had 2 surveys for comments collection.

The EIA study group conducted a written survey of local residents on their opinions of the project. 50 questionnaires were randomly distributed to reflect public opinion and concern.39 valid questionnaires were returned after the survey. The survey questions were as follows:

1. How much do you know about the HXKHP project?
2. What is your attitude towards the project?
3. What do you think of the impact of the HXKHP project?
4. Do you think the HXKHP project has any negative impacts? If so, what are they?
5. What do you think about the relocation of local residents?
6. What do you think of the environmental impact of the relocation?
7. Will you support the construction of the HXKHP project?
8. Are there any endangered species in Nanzhang?
9. What do you think is the main environmental problem in Nanzhang?

The project was supported by 36 of the 39 local residents. The brief summary of the survey was circulated to all the stakeholders and is available in the project's EIA report. The opinions expressed by the stakeholders were recorded and are available upon request.

Another survey was carried out to address CDM issues. A total of 103 questionnaires were randomly distributed and 100 valid questionnaires were returned. The survey questions were as follows:

1. What is your attitude towards the project?
2. How do you think the project contributes to sustainable development?
3. What do you think could be the project's negative impacts?
4. Are you satisfied with the project owner's relocation scheme?
5. Do you think the migrants' living standard was affected by the migration?
6. Do you think any environmental problems result from the project?

7. Are you satisfied with the project owner's work in terms of environmental protection?
8. What is your attitude towards this project's CDM application?
9. How do you think CDM registration would affect the project?

E.2. Summary of the comments received:

>>
The following is the summary of public survey conducted by the EIA study group:

77.7% of the 39 local residents were aware of the project's basic information. 94.9% of the respondents approved of the immediate launch of the project. 71.8% believed that the project had a positive impact on the local economy, improving the job market as well as irrigation, transportation and flood prevention systems. 89.7% of respondents were willing to contribute to the project. The relocation was also welcomed by 92.3% of local inhabitants. The opinions of local residents should be taken into account when implementing the relocation scheme.

Below is the summary of the survey carried out to address CDM issues:

100% of the 100 local inhabitants supported the project. 48% of the respondents thought that it would positively impact the local economy. 43% of respondents believed that the project would provide more job opportunities. 56% of the residents thought the project may affect the local people's life. 100% of the 100 local inhabitants were satisfied with the relocation scheme and its implementation. 45% of the respondents believed that the standard of living of the relocated residents would improve as a result of the project. 58% of respondents were concerned about post-construction irrigation. 99% of respondents were satisfied with the environmental protection work. All of the respondents supported the project's CDM application. CDM registration was believed to have a positive impact on the project.

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

>>
Relocation was completed before project construction began. Three residents originally resisted relocation, but consented to the move after receiving compensation. All related documents are available upon request.

The project will provide many job opportunities. Many positions will be available during the construction period and fifty permanent staff positions will be available during project operation. A training program will also be implemented to increase the education level of local residents. In addition, the project will increase income level of the local people and local government.

Addressing the local residents concern on the construction's impact on irrigation, the project owner built an ecological diversion channel to meet downstream irrigation and satisfy resident's daily water supply needs.

As a project achieved loan from the World Bank (WB), the location work of HXKHP project also need to be checked by WB. The check report can be provided by the project owners.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Hubei Province Nanzhang Xiakou Power Co. Ltd.
Street/P.O.Box:	Shuijing Road Chengguan Town Xiangfan City Hubei Province
Building:	
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<u>Annex 2</u>

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

BASELINE INFORMATION

Province	Generation 2004(MWh)		Generation 2003(MWh)		Generation 2002(MWh)		Generation 2001(MWh)		Generation 2000(MWh)	
	Hydro	Thermal	Hydro	Thermal	Hydro	Thermal	Hydro	Thermal	Hydro	Thermal
Hubei	69512	43034	38775	39532	27854	34301	27026	32045	28140	27773
Hunan	24236	37186	24401	29501	25359	20058	21339	19403	21063	16574
Jiangxi	3890	30127	3864	27165	6151	18648	5425	16191	5225	14881
Henan	6884	109352	5457	95518	4859	84734	3572	76022	2274	67998
Sichuan	58902	34627	50000	32782	44499	27879	42838	20808	36904	18732
Chongqing	5670	16520	3951	16341	3748	14727	3354	13687	2988	12969
total	129939	270846	117841	240839	112470	200347	103554	178156	96590	158930

Data source:
Generation 2004: 2005 China Electric Power Yearbook, p.474
Generation 2003: 2004 China Electric Power Yearbook, p.671
Generation 2002: 2003 China Electric Power Yearbook, p.585
Generation 2001: 2002 China Electric Power Yearbook, p.617
Generation 2000: 2001 China Electric Power Yearbook, p.667

Thermal Generation and Net Thermal Generation in Central China over the last three years (GWh)

Province	Gen. 2004	Aux. rate 2004	Net Gen. 2004	Gen. 2003	Aux. rate 2003	Net Gen. 2003	Gen. 2002	Aux. rate 2002	Net Gen. 2002
Jiangxi	30127	7.04	28006	27165	6.43	25418	18648	7.67	17218
Henan	109352	8.19	100396	95518	7.68	88182	84734	8.03	77930
Hubei	43034	6.58	40202	39532	3.81	38026	34301	7.73	31650
Hunan	37186	7.47	34408	29501	4.58	28150	20058	7.73	18507
Chongqing	16520	11.06	14693	16341	8.97	14875	14727	10.21	13223
Sichuan	34627	9.41	31369	32782	4.41	31336	27879	9.59	25205
Total	270846		249074	240839		225988	200347		183733

All data of the provincial level grids for each year in the above table can be found from China Electric Power Yearbook 2003 P585, China Electric Power Yearbook 2004 P709, China Electric Power Yearbook 2005 P474 respectively.

PGCC and Coal Consumption of the Central China Power Grid in Year 2002

	A	B	C=A*B
Province	PGCC(ton/GWh)	NET $GEN_{thermal,y}$(GWh)	$F_{coal,\ y}$ (ton)
Hubei	395	31650	346168
Hunan	404	18507	207039
Jiangxi	390	17218	185936
Henan	408	77930	880414
Sichuan	452	25205	315468
Chongqing	406	13223	148659
Total		183733	2083684

Note: PGCC of each province can be found from China Electric Power Yearbook 2003 P592. PGCC of the Central China Power Grid in year 2002 is calculated as the total standard coal consumed by the four provinces ($F_{coal,\ y}$) divided by the total thermal power generation ($GEN_{thermal,\ y}$).

$$EF_{OM,\ Central\ China,\ 2002} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} = \frac{2083684 \times 2.7690}{183733 \times 1000} = 1.134\ tCO_2/MWh$$

PGCC and Coal Consumption of the Central China Power Grid in Year 2003

	A	B	C=A*B
Province	PGCC(ton/GWh)	$GEN_{thermal,y}$(GWh)	$F_{coal,\ y}$ (ton)
Hubei	391	38026	411698
Hunan	404	28150	314906
Jiangxi	382	25418	268864
Henan	409	88182	998682
Sichuan	482	31336	418233
Chongqing	424	14875	174643
Total		225987	2587025

Note: PGCC of each province can be found from China Electric Power Yearbook 2004 P670.

$$EF_{OM,\ Central\ China,\ 2003} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} = \frac{2587025 \times 2.7690}{225988 \times 1000} = 1.145\ tCO_2/MWh$$

PGCC and Coal Consumption of the Central China Power Grid in Year 2004

	A	B	C=A*B
Province	PGCC(ton/GWh)	$GEN_{thermal,y}$(GWh)	$F_{coal,\ y}$ (ton)
Hubei	376	40202	418564
Hunan	391	34408	372530
Jiangxi	380	28006	294685
Henan	411	100396	1142567
Sichuan	455	31369	395211
Chongqing	434	14693	176571
Total		249074	2800129

Note: PGCC of each province can be found from China Electric Power Yearbook 2005 P472.

$$EF_{OM,\ Central\ China,\ 2004} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} = \frac{2800129 \times 2.7690}{249074 \times 1000} = 1.124\ tCO_2/MWh$$

Installed Capacity and generation of the Central China Power Grid in 2000

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
	A	B	C	D	E	F	G=A+B+C+D+E +F
Thermal Capacity (MW)	4474.3	13789.0	8038.8	4477.4	2995.0	6090.1	39864.60
Hydro Capacity (MW)	1846.0	1528.0	7070.5	5858.0	1327.0	11008.3	28637.80
Total Capacity (MW)	6320.3	15317.0	15109.3	10335.4	4322.0	17098.4	68502.40
Generation from thermal plants (GWh)	14881	67999	27773	16574	12968	18733	158928
Generation from hydro plants (GWh)	5225	2274	28140	21063	3822	36905	97428
Total generation (GWh)	20106	70273	55912	37637	16790	55638	256356
Average generation hours of thermal plants							3987
Average generation hours of hydro plants							3402
Data Source: China Electric Power Yearbook 2001, China Electric Power Press, 2001							

Installed Capacity and generation of the Central China Power Grid in 2001

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
	A	**B**	**C**	**D**	**E**	**F**	**G=A+B+C+D+E +F**
Thermal Capacity (MW)	4869.8	15349.0	8077.3	4997.8	2898.3	6377.0	42569.20
Hydro Capacity (MW)	2067.8	2438.0	7125.6	5966.1	1268.0	11531.5	30397.00
Total Capacity (MW)	6937.6	17787.0	15202.9	10963.9	4166.3	17908.5	72966.20
Generation from thermal plants (GWh)	16191	76022	32045	19403	13687	20808	178156
Generation from hydro plants (GWh)	5425	3572	27025	21340	3354	42839	103555
Total generation (GWh)	21616	79594	59070	40743	17041	63647	281711
Average generation hours of thermal_plants							4185
Average generation hours of hydro plants							3407
Data Source: China Electric Power Yearbook 2002, China Electric Power Press, 2002							

Installed Capacity and generation of the Central China Power Grid in 2002

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
	A	B	C	D	E	F	G=A+B+C+D+E +F
Thermal Capacity (MW)	5128.8	15904.5	8147.8	4975.6	3004.5	6142.0	43303.20
Hydro Capacity (MW)	2197.4	2438.0	7213.9	6135.3	1195.5	11854.6	31034.70
Total Capacity (MW)	7326.2	18342.5	15361.7	11110.9	4200.0	17996.6	74337.90
Generation from thermal plants (GWh)	18648	84734	34301	20058	14727	27879	200347
Generation from hydro plants (GWh)	6151	4859	27854	25329	3748	44500	112441
Total generation (GWh)	24799	89593	62155	45387	18475	72379	312788
Average generation hours of thermal_plants							4627
Average generation hours of hydro plants							3623
Data Source: China Electric Power Yearbook 2003, China Electric Power Press, 2003							

Installed Capacity and generation of the Central China Power Grid in 2003

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
	A	**B**	**C**	**D**	**E**	**F**	**G=A+B+C+D+E +F**
Thermal Capacity (MW)	5407.80	17635.50	8173.30	6446.70	3126.20	6104.00	46893.50
Hydro Capacity (MW)	2304.70	2438.00	7337.20	6603.20	1329.80	12341.40	30549.30
Total Capacity (MW)	7712.50	20073.50	15510.50	13049.90	4456.00	18445.40	79247.8
Generation from thermal plants_(GWh)	27165	95518	39532	29501	16341	32783	240840
Generation from hydro plants_(GWh)	3864	5457	30169	24402	3951	50000	117843
Total generation (GWh)	31029	100975	69701	53903	20292	82783	358683
Average generation hours of thermal_plants							5136
Average generation hours of hydro plants							3857
Data Source: China Electric Power Yearbook 2004, China Electric Power Press, 2004 http://www.3g.gov.cn/news/sxkd/2006o2l30003.htm http: *//w.s1.com.cn/zgdl/s1w/12y/kpsdl.htm*							

Installed Capacity and generation of the Central China Power Grid in 2004

	Jiangxi	Henan	Hubei	Hunan	Chongqin g	Sichuan	Total
	A	B	C	D	E	F	H=A+B+C+D+E+ F
Thermal Capacity (MW)	5496.00	21788.50	9509.30	6779.50	3271.10	6900.30	53744.70
Hydro Capacity (MW)	2549.90	2438.00	7415.10	7448.30	1407.90	13382.90	34642.10
Total Capacity (MW)	8045.90	24226.50	16924.40	14227.80	4679.00	20283.20	88386.80
Generation from thermal plants (GWh)	30127	109352	43034	37186	16520	34627	270846
Generation from hydro plants (GWh)	3890	6884	30357	24237	5670	58902	129940
Total generation (GWh)	34017	116236	73391	61423	22914	93529	401510
Average generation hours of thermal plants							5039
Average generation hours of hydro plants							3750

Data Source:
China Electric Power Yearbook 2005, China Electric Power Press, 2005
htt://www.3g.gov.cn/news/sxkd/2oo6o213ooo3.htm *http://wwv.s1.com.cn/zgdl/s1w/o4* 12y/04 12 kpsdl.htm

Electricity import and export of Central China Power Grid (2002-2004)

Year	**2002**	**2003**	**2004**
A. Central China Power Grid to East China Power Grid (GWh)	4375	8310	26934
B. East China Power Grid to Central China Power Grid	657	4807	0.22
Net +import/-export of CCPG: D=B-A	**-3718**	**-3503**	**-26934**
Data sources: http://www.ica.gov.cn/new/hybd/yydl/yydl2002/01/yydl012901.htm http://www.cec.org.cn/news/content.asp?NewsID=19795 http://www.sp.com.cn/zgdl/spw/12y/kqsdl.htm China Electric Power Yearbook 2005, China Electric Power Press, 2006			

Annex 4

MONITORING INFORMATION

Refer to Section B

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